ROOT CAUSE ANALYSIS OF VTUAV FIRE SCOUT'S NUNN-McCURDY BREACH

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The Problem

The root cause of the VTUAV Fire Scout Program's Nunn-McCurdy breach needs to be determined.

IDA's methodology for conducting a Root Cause Analysis of Nunn-McCurdy breaches is a four-step process centered on the Root Cause Narrative described by PARCA.

A Nunn-McCurdy breach occurs when a program experiences cost or schedule growth exceeding any of the established Nunn-McCurdy thresholds. The Weapon Systems Acquisition Reform Act (WSARA) of 2009 mandates that a Root Cause Analysis (RCA)—defined in WSARA as an assessment of the underlying cause or causes of growth in cost, schedule slips, or poor performance of a program—be conducted when such a breach occurs. The Director, Performance Assessments and Root Cause Analyses (PARCA) is responsible for conducting the required RCA.

At PARCA's request, IDA has conducted eleven RCAs over the past few years, in support of PARCA memoranda to the Under Secretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)) describing the root causes of cost growth in programs that have experienced a critical Nunn-McCurdy breach. When the Congress requires the Department to recertify a program because it has experienced a Nunn-McCurdy breach, PARCA's memos are submitted in support of the Department's recertification decision for that program.

METHODOLOGY FOR PARCA RCAs

IDA's methodology for conducting a Root Cause Analysis of Nunn-McCurdy breaches is a four-step process centered on the Root Cause Narrative described by PARCA. This methodology repeatedly produces compelling arguments for the conclusions of the root cause:

1. **Official Statement of the Breach.** We take this from the Program Deviation Report to the Defense Acquisition Executive.
2. **Timeline of Events Leading up to the Breach.** We construct the initial version of the timeline from the program's historical Selected Acquisition Reports (SARs) and add to it as discovery proceeds.
3. **Root Cause Narrative.** Starting with the statement of the breach, we work backward linking the contributing factors and classifying them as symptoms; proximate causes; bad things that happened that do not have anything to do with the cost growth; and root causes. WSARA provides seven categories of root causes to consider, but permits others.

WSARA Categories of Root Causes

- Unrealistic performance expectations
- Unrealistic baseline estimates for cost or schedule
- Immature technologies or accepting excessive manufacturing or integration risk
- Unanticipated design, engineering, manufacturing, or technology integration issues arising during program performance
- Changes in procurement quantities
- Inadequate program funding or funding instability
- Poor performance by government or contractor personnel responsible for program management.

To the extent possible, we apportion the cost growth to the contributing factors, providing graphs and data as evidence without comment or conclusion.

"The purpose of the Narrative is to simply and even-handedly display the relevant facts and circumstances by which a program ended up in a ditch."(Gary Bliss)

4. **Root Cause Analysis.** We tell the story of the breach starting at the root of the problem, and allocate the contributing factors and their cost to each root cause. We discuss problems of inception and execution, and identify exogenous causes.

The RCA on the Vertical Takeoff and Landing Unmanned Aerial Vehicle (VTUAV) Fire Scout program (system shown in Figure 1) exemplifies the process.

Figure 1. MQ-8A VTUAV Fire Scout

ROOT CAUSE ANALYSIS OF VTUAV FIRE SCOUT PROGRAM

On March 10, 2014, the Program Manager for the Navy and Marine Corps Multi-Mission Tactical Unmanned Air Systems Program Office (PMA-266) submitted a Program Deviation Report that announced the VTUAV program would breach the Nunn-McCurdy critical cost thresholds of 25 percent for the Average Procurement Unit Cost (APUC) and Program Acquisition Unit Cost (PAUC) in the approved VTUAV Acquisition Program Baseline (APB).

The initial concept in 1999 for the Fire Scout was to make unmanned a Schweitzer 330 helicopter. After initial tests on the MQ-8A, the Schweitzer aircraft selected was found to have inadequate lift capacity and endurance to satisfy the Navy's desired operational needs. To address this, the Navy and Northrop Grumman

further modified the aircraft to increase its performance by adding a rotor blade, extending the tail boom, and adding sponsons for additional carrying capacity. These changes to the helicopter, now designated the MQ-8B, increased the maximum gross weight and provided nearly three hours more time on station. As developmental tests proceeded, however, restrictions surfaced that limited its use.

Meanwhile, U.S. Africa Command put out an urgent request for the Rapid Deployment Capability (RDC), whose performance needs necessitated not additional purchases of MQ-8B, but the development of a third variant outside the Program of Record (POR). This new aircraft, the MQ-8C, uses a far more capable helicopter (the Bell 407), which has room and power to be a versatile weapon system. The Navy has since adopted the MQ-8C as the POR aircraft for all future procurements on the VTUAV program. According to the Navy, the more capable aircraft meant they could deploy two MQ-8Cs in place of three MQ-8Bs and reduce the total number needed to meet the Littoral Combat Ship (LCS) requirement.

Figure 2 shows major events in the evolution of the Fire Scout program from its original configuration (RQ-8A), to the configuration developed in the POR (MQ-8B), to the third configuration, developed under an RDC Joint Urgent Operational Needs (JUON) program outside the POR (MQ-8C)[1].

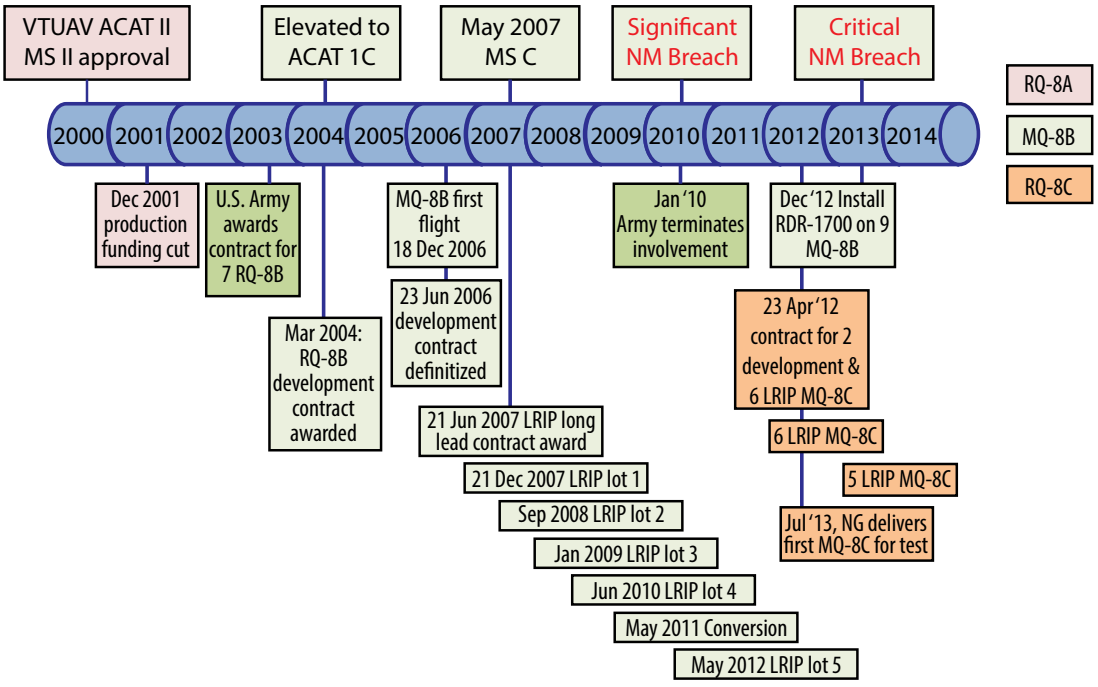

Figure 2. VTUAV Fire Scout Timeline

[1] The non-POR status means that not all costs incurred for development and procurement (of the new requirements) are included in the program baseline.

This article discusses only the critical Nunn-McCurdy breach in APUC over the original 2006 baseline, calculated to be 71.5 percent. The Navy offered that the change in aircraft purchase quantity was the sole reason for increased APUC values for VTUAV. Since quantity change rarely occurs alone, we believe that determination of other factors must precede the quantity change calculation.

The VTUAV SARs reveal that the Navy added $327 million (FY06 dollars) to the procurement program and stretched the procurement schedule by 17 years before they decided not to procure any more MQ-8Bs. Figure 3 shows the VTUAV Fire Scout planned procurement profiles from the annual SARs.

A fixed cost analysis of annual procurement cost by quantity yields an annual fixed cost estimate of approximately $20 million, which translates into a $340 million increase in the procurement cost estimate over the course of the program. The major contributors to the schedule delays were a replan of the initial, unrealistic acquisition profile; better alignment of aircraft procurement with LCS procurement; a five-year delay in the scheduled date for operational evaluation (OPEVAL); and allowance for more time for the development of the MQ-8C.

Cost experience on procurement of the VTUAV provided by the Navy revealed that recurring costs for the MQ-8B had increased by 7 percent and that the more capable MQ-8C would cost about $1 million more than the MQ-8B's current estimated cost (another 11 percent).

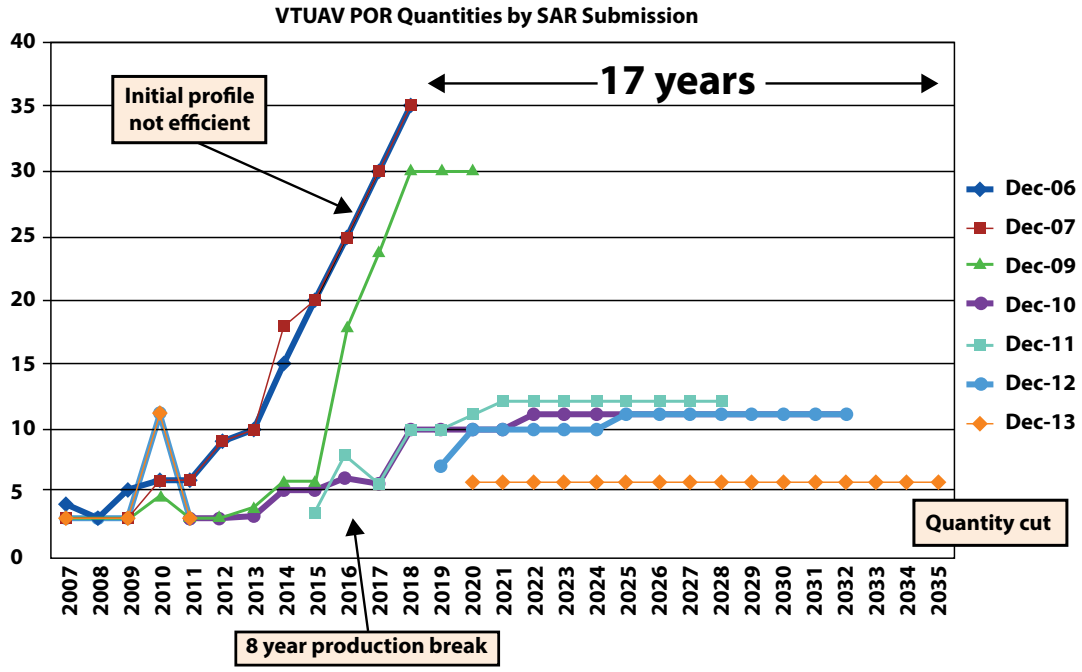

Figure 3. VTUAV POR Quantities by SAR Submission

Figure 4 shows IDA's estimates of the relative contributions for each of the reasons. There remain 32 percentage points of APUC growth for which the quantity change is accountable.

With 32 percent of the APUC increase associated with a reduced number of aircraft systems to be bought, the question is why the Navy decided to stop buying MQ-8Bs, an aircraft the Navy had reported met operational requirements. In reviewing test reports and performing analyses of demonstrated performance, we found that, during developmental testing and through experience in the field, the MQ-8B had restricted wind envelopes and reliability issues, and required greater engine maintenance costs than anticipated.

Figure 5 shows the aggregate Wind Over Deck envelopes[2] allowed for the MQ-8B on board LCS-1 superimposed on the objective and threshold requirement.[3] The white areas within the threshold "fan" are

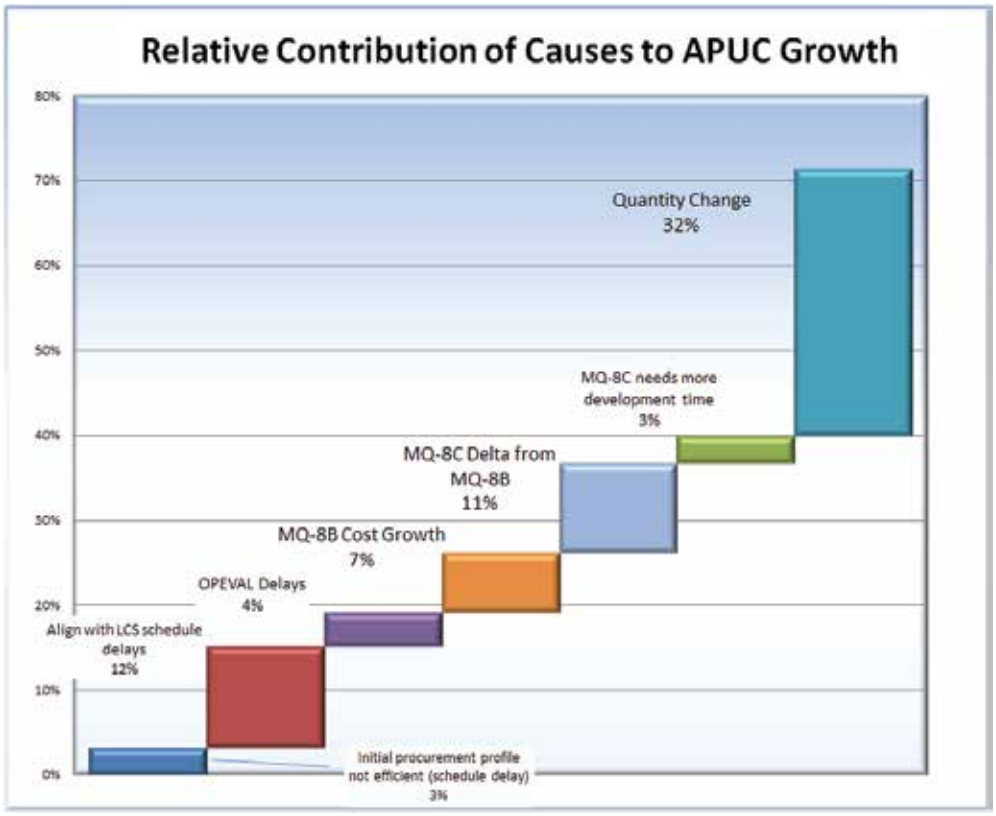

Figure 4. Relative Contributions of Causes of APUC Growth

[2] *Naval Air Training and Operating Procedures Standardization (NATOPS) Flight Manual,* Navy Model MQ—8B, Unmanned Aerial Vehicle, November 1, 2013 Change 1—March 1, 2014, Document Number A1—MQ8BA—NFM—000.

[3] Capabilities Production Document, Vertical Takeoff and Landing Tactical Unmanned Aerial Vehicle (VTUAV) System, Prepared for Milestone C Decision, Version 4.3, December 20, 2006.

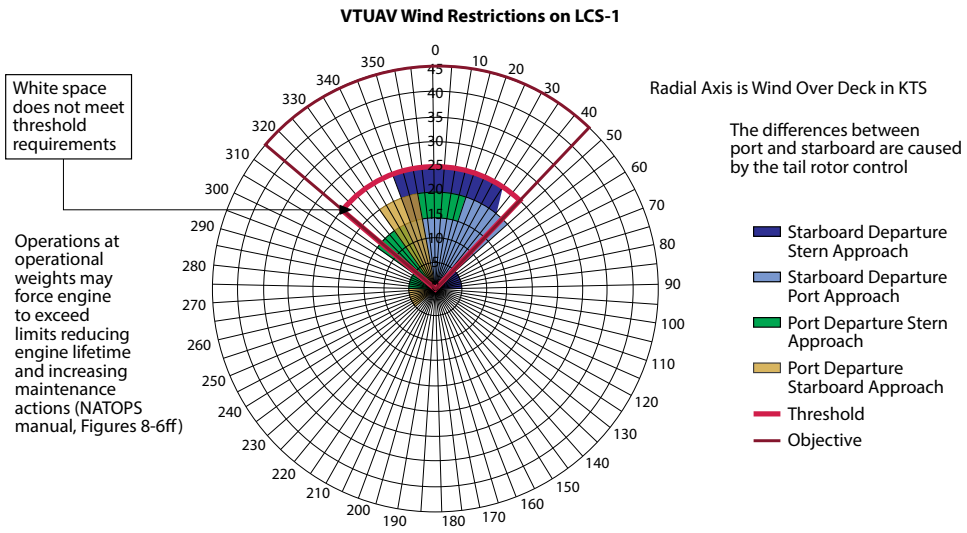

Figure 5. Aggregate Wind Over Deck Envelopes Allowed for MQ-8B On Board LCS-1

conditions in which the system does not meet the threshold requirement. The shortfalls seen in Figure 5 are due primarily to inadequacies in tail rotor authority at nominal power settings and aircraft weights.[4]

In addition, operational assessments revealed that the aircraft needed to operate at near maximum gross weight to meet time on station requirements. The engine operations at high power settings needed to meet these requirements reduced the mean time between failures, increased mean time to repair, and required additional spare parts.[5] Furthermore, the aircraft could not be operated at standard military hot temperatures due to engine overheating issues.[6] Cooling air scoops[7] are being added to the current MQ-8Bs so they can safely operate at temperatures above 30˚C.

IDA assesses that the Navy abandoned the MQ-8B because it did not meet their performance expectations. Because of this, we find that the increases in recurring cost, the OPEVAL delays, the development time for the MQ-8C, and the change in quantity are all consequences of the MQ-8B design not meeting performance expectations.

Furthermore, we assess that even with the modifications made

[4] CDR Van Patrick McLawhorn, USN, and Mr. Richard Paletta, "Status of MQ-8B Developmental Testing, Inclusive of Software Increment 9.1.3.1," Report No: NAWCADPAX/ISR-2012/62, May 24, 2012.

[5] Quick Reaction Assessment of VTUAV, COMOPTEVFOR, September 12, 2012.

[6] McLawhorn and Paletta, "Status of MQ-8B Development Testing," May 24, 2012.

[7] MQ-8 AIRFRAME CHANGE NO. 16. To provide modification instructions for Engine Bay Access Panels to add cooling air scoops to reduce operating oil temperature levels.

from the MQ-8A to the MQ-8B (increasing vehicle weight, improving rotor performance, and increasing engine horsepower), the Schweitzer 330 aircraft and engine were limited in overall capability and were not going to be able to meet the payload and endurance expectations across the range of intended operational conditions. Because of this, we allocate 56 percentage points of the 71.5 percentage points in APUC growth to the WSARA Root Cause Category "poor performance by government personnel responsible for program management." The remaining APUC growth we attribute to a faulty initial procurement plan and LCS schedule delays.

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