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Foundational Assumptions and Associated Observables

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Abstract

The Institute for Defense Analyses worked with the Office of the Secretary of Defense (OSD) to invent Foundational Assumptions and Associated Observables (FAAOs). FAAOs are a tool to help oversight organizations monitor progress in acquisition programs between milestones. FAAOs are similar to the Framing Assumptions required in the 2015 version of the DoD's acquisition regulations, but they are created by and for oversight organizations, not those executing the programs. In addition to inventing the process, we also delivered five sets of FAAOs to the OSD for use in oversight, which was an essential step in creating the process.

Introduction

It may be apocryphal, but some say that if you drop a frog into a pot full of hot water, it will jump out without injury. But if you drop it into a pot of water at a comfortable temperature and heat it up gradually, you can boil it.[1] Acquisition programs seem to be similar. In this metaphor, when a program goes through a milestone review, its temperature is measured and actions are taken to make sure all is well. Between milestones, programs can quietly morph into something quite different, and the metaphorical temperature can rise as the program experiences unanticipated challenges. The purpose of Foundational Assumptions and Associated Observables, or FAAOs, is to note the temperature at the milestone review and to create a process for the oversight community to measure it regularly.

[1] While frogs may not behave this way, we do not want to discourage you from catching a frog and testing it out, if you are so inclined.

History of Framing Assumptions

The Weapon Systems Acquisition Reform Act of 2009 (WSARA) mandated the appointment of a Director of Performance Assessment and Root Cause Analysis (PARCA) within the Office of the Secretary of Defense (OSD), who, under certain circumstances, must perform root cause analyses (RCAs) on major defense acquisition programs (MDAPs), most often when too much cost growth has triggered a Nunn-McCurdy (NM) breach.[2] Immediately upon the director's appointment, he and his first staff members conducted five RCAs simultaneously: the Advanced Threat Infrared Countermeasure and Common Missile Warning System (ATIRCM/CMWS), the Apache Longbow Block III, the DDG-1000, the F-35, and the Remote Minehunting System (RMS). This was a period of unusually intense effort. In the years since, they have conducted 17 more RCAs.

Early on, PARCA noticed a pattern in these results. MDAPs do not generally suffer cost growth leading to NM breaches because of small errors. Rather, it was often the case that programs suffered from invalid major assumptions starting early in each MDAP's life cycle. Often the problems grew out of management errors or unrealistic baselines. These incorrect assumptions later caused major difficulties for the program.

PARCA's staff termed these incorrect assumptions in the troubled programs *framing assumptions*, or FAs. They realized that all acquisition programs must depend on such assumptions, most of which are accurate and therefore cause no problems. They also figured that if these assumptions were made explicit early on in an MDAP's life cycle and then monitored, programs that experienced problems because of failed FAs would be identified sooner and dealt with more easily.

PARCA disseminated information about FAs. In January 2015, the Under Secretary of Defense for Acquisition, Technology and Logistics (USD[AT&L]) signed a new instruction, DoD Instruction (DoDI) 5000.02, *Operation of the Defense Acquisition System*, which mandated that program managers report their FAs at the Milestone A review, again at the Request for Proposal (RFP) release decision point, and again at Milestone B Defense Acquisition Board (DAB) meetings.

DAB briefings given after DoDI 5000.02 was signed included discussions of FAs, but the FAs presented varied significantly in both quality and follow-through. Some MDAPs built elaborate checklists, while others seem to have had no more than a single PowerPoint slide with a few bullet points. Some MDAP program offices worked with PARCA staff to help develop their FAs while others did not. Some MDAPs presented inconsistent lists of FAs in their DAB charts and other documents, such as their acquisition strategies (ASs).

In December 2014, just before the instruction was signed, the Armored Multipurpose Vehicle (AMPV) program came up for a Milestone B review. AMPV's DAB charts had these FAs:

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[2] NM breaches are triggered by growth in average unit cost, which is the quotient of total dollars in the program divided by the number of units. Both the numerator and denominator include the past and the projected future. The details of the triggers are too complex for a footnote and not directly relevant to this paper. A succinct description can be found in Appendix A of Arnold et al. (2010).

- Vendors will offer military derivative solutions similar to what the Army used for cost estimating purposes.
- Vendors offer mature designs and deliver prototypes 24 months after contract award
- Mission Equipment Package (MEP) Configuration locked at Preliminary Design Review (PDR) for Engineering and Manufacturing Development (EMD), Critical Design Review (CDR) for Low Rate Initial Production (LRIP)

The AMPV AS contains the following paragraph:

> Framing assumptions for the development of this AS include: A Bradley-based solution is an adequate analogy for representing the cost and schedule estimates for the offeror selected for the EMD program (the Request for Proposal [RFP] was built to allow any military vehicle or derivative that meets performance requirements); vendors will offer mature designs and are able to deliver prototypes 24 months after contract award; AMPV will remain in the fleet for 50+ years, similar to the M113; and six months is sufficient time to execute source selection.

None of these reported FAs look like big bets upon which AMPV's success is highly dependent. If the first prototype arrives in 30 months instead of 24 months or source selection takes a year, neither implies that the program is fundamentally different. The procurement is expected to run for 18 years. These delays might indicate deeper problems with other assumptions, but they are not overly important by themselves. In fact, AMPV has missed many deadlines, but there is no discussion of cancellation or of an NM breach. The assumption about remaining in the fleet for 50+ years is noteworthy. Such an assumption should have an influence on the vehicle's designers, but a 50-year life span cannot be verified, so it is unclear how stating it as an FA matters for monitoring the health of the program. Our foundational assumptions for this program are presented in a later section, Final Deliverable.

While each MDAP generates FAs for itself, resulting in considerable variation, the assumptions in the AMPV program were not atypical. PARCA wanted to use FAs to monitor program health, but few of them were suitable. They had tried to train program managers to do a better job, but instead developed an alternative internal approach that became FAAOs.

The Origin of FAAOs

FAAOs were created by the Institute for Defense Analyses (IDA) as tools to help PARCA conduct its regular work assessing the performance of MDAPs. Philosophically, foundational assumptions are the same as FAs; both are attempts to identify the big bets in an acquisition program and to track how well that the program is doing between the milestones of the program's life cycle relative to those assumptions. The associated observables enable PARCA to ascertain whether or not the foundational assumptions remain true. However, instead of being the responsibility of the program manager, FAAOs reside at PARCA and may have been written in-house or by external contractors.

If foundational assumptions are philosophically the same as FAs, why do both exist? The motivations of a program office and an oversight organization do not always align. The FAs are generated and owned by the program office, whereas FAAOs belong to PARCA. However, PARCA's FAAOs have no legal or regulatory power. PARCA may seek comments or help from anybody they like, but there is no obligation for the program office to respond. There is no statutory requirement that FAAOs exist.

Because PARCA has no authority, no coordination with external offices is necessary, although PARCA can offer recommendations. FAAOs are brand new and have not yet proven their utility, but we expect them to be useful because PARCA will monitor them, and if they find something alarming, they can take their finding to a senior official in OSD and recommend some extra investigation. The senior official would then decide whether it is worth making a deep dive on the program. It is worth noting that in 2016, the official to notify and convince was the USD(AT&L). Today, that office no longer exists, and it is unclear who in OSD would be the most appropriate official to notify. PARCA could notify the Secretary of Defense or his deputy; if either of those officials decided to act, they could investigate the program and mandate changes, even if there is no relevant lower-level official in OSD.

This Project

This paper is part of PARCA's first endeavor into FAAOs. PARCA contracted with IDA to generate several sets of FAAOs and report on the process, which we did, making us the *writer* of the first FAAOs. We expect PARCA to use these FAAOs by reading them quarterly and comparing what they say to the current status of the programs. The action officer (AO) who performs that role is the *reader*.

We generated FAAOs for five programs. The first was on the AMPV program, for which the FAAOs were in the form of a memo that was revised twice during coordination between our team and PARCA before it achieved consensus. Upon reflection, the disagreements between our team and the sponsor over AMPV were partly about style but also about content. The 2013 definition of an FA, which we adhered to in the AMPV case, is not sufficient. We will discuss this matter further in the following section, Framing Assumptions. The problem with the definition of an FA may have been clearest in the AMPV case not just because it was the first program we examined, but also because—of all the programs we looked at—it was by far the furthest along.

After AMPV, we delivered FAAOs on four more programs as briefing charts:

- Three-Dimensional Expeditionary Long-Range Radar (3DELRR)
- Columbia Class submarine
- Global Positioning System (GPS) IIIF satellites
- DDG-51 flight III ships with their new Air and Missile Defense Radar (AMDR)

The final set of FAAOs should be thought of as one "program," although it spans two MDAPs: the DDG-51 MDAP, which has produced 64 currently active ships with more on the way, and the AMDR, which achieved Milestone B in 2013 but has yet to have its hardware taken to sea for testing.

Framing Assumptions

FAAOs grew out of FAs. Relatively rapidly, the DoD moved to instantiate the idea of requiring certain acquisition programs to identify potential assumptions that, if they were violated, could significantly affect cost, schedule, or performance outcomes. The short time

between the report on the theorized benefits of FAs by PARCA analysts in 2013 (Husband, 2013) and the promulgation of FAs in DoDI 5000.02[3] just 16 months later is remarkable.

FAs are defined broadly as "any explicit or implicit assumption that is central to shaping the cost, schedule, and/or performance expectations of a program." The PARCA office in 2013, and, later, Arena and Mayer (2014, p. 2), attempted to more precisely define the attributes of an FA:[4]

- *Critical: Significantly affects program expectations*. This criterion means that FAs, when they fail or are incorrect, will have significant cost, schedule, and/or performance effects on the program. One possible consequence is a formal program breach. Another—arguably appropriate—possible consequence is that the program is cancelled. The criterion is meant to exclude the many smaller assumptions made for a program that do not result in significant consequences.
- *No workarounds: Consequences cannot be easily mitigated*. This criterion implies that valid FAs have no obvious workarounds or potential fixes if they are wrong. When an FA is wrong, there is a very high probability of significant cost and/or schedule implications.
- *Foundational: Not derivative of other assumptions*. This criterion is, perhaps, the hardest to understand and define. An FA is foundational if it is a high-level and encompassing assumption. An FA might have derivative assumptions associated with it, but a proper FA will not be derivative or subordinate to other major assumptions.
- *Program-specific: Not generally applicable to all programs.* This criterion implies that FAs should reflect some unique aspects of the program. For example, an FA is not, "The contractor will perform well." However, an FA might be, "The key technologies are sufficiently mature such that no component development or prototyping is necessary."

This last constraint on the definition of FAs solves one problem, that of bounding the set of applicable FAs, but leads to others by omitting many relevant questions for the health of a program. Bailey and Frazier (2018) discuss the fact that many of the problems in acquisition programs are about general best practices, not program-specific issues. Another problem with this definition is that problems in a program can be at a level where they will not cause an NM breach or cancellation, but still rise to the interest of oversight because of short-term issues.

The FAAOs for AMPV suffered both kinds of issues. Individuals within the Pentagon expressed concerns that the first AMPVs would not be delivered in time to satisfy operational demands because there was insufficient manufacturing capacity for the vehicles. Some felt that for the FAAOs to be useful, they would need to touch on this point, especially because the Under Secretary was worried about them at the time; however, others resisted

[3]No definition is provided, however, which is why research to help operationalize the selection of FAs is needed.
[4]Italicized text is from the PARCA original. RAND also published a slightly earlier treatment (Arena et al., 2013).

because the FAAOs did not satisfy the described criteria in two ways. First, the need for sufficient manufacturing capability was not program-specific, and second, the funding required to fix the manufacturing deficit was very small compared to the total cost of the program. It is possible that we should rethink whether these are the best criteria for FAAOs, but at this point, they have been adopted.

Writing FAAOs

In most instances, a set of FAAOs ought to be associated with a baseline for schedule and cost. The fundamental question the FAAO writer is answering is, "What are the big bets associated with this baseline?"

Data Sources

To answer this question, we started by reading every program-related document we could find. The following list should not be thought of as either necessary or sufficient, but it is suggestive, and for each set of FAAOs, we at least sought out these documents:

1. Requirements Documents (usually a Capability Development Document, or CDD, but not necessarily)
2. Selected Acquisition Reports (SARs)
3. Defense Acquisition Executive Summaries (DAES) reports
4. Approved Program Baseline (APB)
5. Acquisition Strategy (AS)
6. Defense Acquisition Board (DAB) briefing charts
7. Test and Evaluation Master Plan (TEMP)
8. Budget displays in the lead service's Procurement and RDT&E budget justification books
9. Reports from congressional agencies, typically the Congressional Budget Office (CBO), the Congressional Research Service (CRS), and the Government Accountability Office (GAO).[5]

Availability of these documents varies considerably. They may not all yet exist, depending on the phase of the acquisition program in question. IDA has contacts within the office of the Director of Operational Test and Evaluation (DOT&E), which allows us to access many of them. IDA's testing experts have also provided numerous briefings from either the program office or the lead service's testing community. Those briefings often highlight technical or programmatic issues that have been identified, along with proposed mitigation strategies. The progression from one briefing to another is often informative as well—for example, revealing slips in scheduled testing events, operational dates, or the like.

In addition to reading documents, the IDA research team interviewed our testing experts on the programs, PARCA's AOs who are following the programs and any other

[5] The GAO produces a useful annual summary, most recently GAO (2017).

experts we could find: some from government oversight organizations and others from within IDA. We interviewed at least two experts for each program.

It is critical to capture Key Performance Parameters (KPPs) and Key System Attributes (KSAs), which can be numerous but quite revealing. For example, the 3DELRR program had requirements for interoperability with radars and command systems from all of the other services, but the latter systems were themselves evolving into new versions, so in effect 3DELRR was chasing a moving target. In turn, monitoring the progress of an acquisition program might require PARCA AOs to query the program offices for related programs, perhaps residing in other services.

Thinking

After collecting information, we applied two approaches to developing FAAOs: a *direct approach* and a *data-driven approach*.

The direct approach evaluates the assumptions and their implications directly. Can we design a system that meets these requirements? Is the threat environment stable enough to warrant this investment? What would go wrong if the assumptions aren't met, and how might OSD monitor the status of these assumptions? The direct approach has been written about in one way or another in all of our references on FAs.

While the foundational assumption comes first in a direct approach, in the data-driven approach, the associated observable is the starting point of the analysis. In this approach, we think about what data are available on the program, what issues those data are revealing (or perhaps concealing), and what data the writer would like to have to obtain clear resolution. The AMPV program provides a good example. Like all program offices, AMPV reports regularly on how many units they plan to build each year. The annual totals are reported in quarterly DAES reports and annual SARs, as well as in the APB and AS. However, although the AMPV has five variants, only the AS said how many of each variant of those planned vehicles would be built each year.[6] The DAES reports and the SARs, which are continually updated, track the total number of vehicles, but not separately by variant. Having continuous data on variants would tell analysts a great deal about whether the program is sticking to plan or some variants are being delayed. If, for example, the mortar carriers were delayed, the program could report that it is in good health when, in fact, there is a serious unresolved problem the program office could be choosing not to reveal.

Final Deliverable

For the five programs, one of our deliverables was a memo and the other four were sets of briefing charts.[7] Each document contains a table like Table 1 from AMPV with simple instructions for the AO who would follow the program quarterly, along with general information to back up the chart and provide context on the program.

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[6] The year-by-year totals for each variant didn't sum to the full program totals for all variants in the AS's table. Therefore, the only document we found that touched on this question beyond what is currently under contract had two contradictory answers for what the Army plans to buy.

[7] As some of the FAAOs were marked For Official Use Only (FOUO), we did not attach them to this paper to allow it to circulate more easily. All five can be found by contacting the authors of this paper.

Table 1. FAAO Table for the AMPV

Foundational Assumptions	Associated Observables
The AMPV program takes currently used mission equipment and mounts it onto a proven chassis that is larger and more capable than the original. The design process is low-risk and easily understood.	[The observable in this box was For Official Use Only and has been removed.]
	Monitoring technical measurements can show trends, and three important ones for any ground vehicle are weight, horsepower, and electrical power. For each variant, find the current value and target for each variable and plot them as a function of time. (Note: 5 variants × 3 technical parameters × (actual + goal) = 30 numbers each quarter.)
	The number of each variant produced and projected by year should be tracked. If the plan shifts some variants earlier and others later, this suggests a problem in the variant with the delayed production. The mix has presumably been set so each brigade can replace all M113s with AMPVs at once, preventing the need to support both simultaneously; a delay in any variant would change this.
AMPVs are one-for-one replacements of existing M113s currently in the ABCTs.	The total number of each type of vehicle in the program's plan should be monitored. Changes here indicate this is no longer a one-for-one replacement program.

Each quarter, the PARCA AO assessing a program should read the FAAOs for that program (which should reflect the status of the program the last time OSD examined it) and follow up their reading in two ways. First, they should attempt to collect the data that the FAAOs call for and add them to the data that have been collected in past quarters to see how they are trending. Second, they should reflect on the program described in the FAAOs and consider if the essence of the program has changed. If either the data or the reflection suggest that major changes in the program have occurred, PARCA should notify management and encourage a deep dive into the state of the program.

The reflection step is important. It is likely that the last time OSD leadership thought about this program was at a milestone that could have been several years in the past.[8] The last review may have corresponded to a requirements document, an AS, a TEMP, a set of briefing charts, a set of FAs, or more. To know if the program has changed, the obvious method would be to read all of those documents and see if they are still correct, but this is too much effort to perform quarterly. The author of the FAAO memo should capture the understanding of the program at the time of this review and report it all in a short document. For example, if everything in the FAAO memo is about aerodynamic challenges that have remained under control while the AO is now hearing about major challenges in software development, it is time for senior managers to investigate the program again, as the challenges they are facing today were not anticipated when it was last reviewed. The reflection stage calls for the AO's judgment, and the writer of the FAAOs must make sure they have given the AO enough information to allow them to exercise that judgment.

Lessons Learned From Our Five Sets of FAAOs

Our five sets of FAAOs were about programs that varied in many ways, including technical difficulty, phase of development, interoperability requirements, level of

[8] It is possible that no political appointees in OSD were in their jobs at the last milestone and that none have ever thought about this program, for which they are now responsible.

classification, and service. All of these differences matter, and the purpose of this section is to discuss them.

Table 2 contains data on each of our programs. Research, Development, Test and Evaluation (RDT&E) Funding Fraction is a variable we designed. Using the data source in the right-hand column, it takes the RDT&E appropriations in base year dollars and reports what fraction of those dollars were appropriated before fiscal year (FY) 2018.[9]

Table 2. FAAO Program List

Program	Service	Milestone B Date	Milestone C Date	RDT&E Funding Fraction before FY 2018	Source
AMPV	Army	December 2014	February 2019	53%	Dec 2017 SAR
3DELRR	Air Force	September 2014	June 2022	66%	Apr 2018 APB
Columbia	Navy	November 2016	NA	64%	Dec 2017 SAR
GPS IIIF	Air Force	NA	March 2020	0%	PB 2019 AF RDT&E *J Book* Volume 2 PE 1203269F (page 889)
DDG Flight III & AMDR	Navy	September 2013	April 2017	87%	Dec 2017 SAR (AMDR Only)

In the rest of this section, we discuss our learning process and sum up the lessons at the end.

Program Stage

Conceptually, FAAOs are connected to a baseline because the question we are asking is what assumptions must be made to meet that baseline. The different programs, with their different stages, made that question more or less complicated.

AMPV

Our first set of FAAOs was completed in December 2017. AMPV has not yet been fielded, but it received its first procurement funding in 2018 to begin LRIP. Our research showed two different things, one that is comforting to oversight and another that is not.

Overall, everything seems to be in order. These vehicles are mostly derivative designs that are relatively simple. The total RDT&E funding is about $1 billion, but that funding will design five different vehicles.

In the short term, however, things are not comfortable at all because of production difficulties. Because these vehicles are supposed to be simple, the Army believes they can deploy them to Eastern Europe quickly, but the facility where BAE is planning to manufacture them is not currently capable of the notional production rate. This delay and the

[9] Normally a budget justification book wouldn't be sufficient for calculating RDT&E budget fraction because it reports only then-year dollars and doesn't break out year-by-year to allow conversion to a base year. However, since our source showed no funds were appropriated to GPS IIIF before FY2019, the fraction is exactly zero.

expenditure required to eliminate it are not significant on the scale of the program as a whole, but it is a serious issue for the program today. Whether or not that should be considered in the FAAOs is still an open question. To date, all guidance on FAs has been at the level of NM breaches, and they have been required to be program-specific. The assumption here is that there is sufficient capacity to build the required hardware, which is an essential condition for success for every program that produces hardware.

3DELRR

Our second set of FAAOs was for 3DELRR; it was presented to PARCA in February 2018. Table 2 shows that 3DELLR had its Milestone B review in 2014, but this is misleading. Then-USD(AT&L) Frank Kendall approved entry into EMD with a Milestone B decision in September 2014, apparently before an APB was finished. However, that initial development contract award to Raytheon was held up for 2.5 years because of bid protests by two competitors (Lockheed Martin and Northrop Grumman) and a lawsuit filed by Raytheon. The EMD phase began in earnest in May 2017, when the contract was again awarded to Raytheon.

This program was effectively initiated too early for FAAO development. A typical program would have released at least four SARs by the time we conducted this analysis, dated December 2014 through December 2017; 3DELRR had produced zero. 3DELRR was selected for our study because it was re-emerging. When we worked on our FAAOs, the program had no baseline, although one would later be approved by the Air Force's acquisition executive in April 2018. Still, the data source and thinking processes enabled us to produce a set of briefing charts that could help inform future AOs by highlighting some potential difficulties in the program.

Columbia

The FAAOs on Columbia were completed in April 2018. Milestone B took place in November 2016, and lead ship construction is scheduled to begin in October 2020. Long-lead items are already being built. Like AMPV, Columbia was well positioned for this analysis. The program's mission and requirements are clear, as is the budget.

GPS IIIF

We delivered FAAOs on GPS IIIF in July 2018, but this program is premature. We did have a requirements document, but all the documents we read, with one exception, suggested that this program is not a major change from the GPS III program that precedes it. The sole exception was the set of cost numbers we found in the Defense Acquisition Management Information Retrieval (DAMIR) system's "PB" section, which is not an official report. However, these numbers were high enough to give us pause because they predicted that each GPS IIIF satellite would cost about 1.5 times the cost of a GPS III satellite, and the total RDT&E costs were projected to be similar to the costs on GPS III. At this stage in the program, it was difficult for us to understand the reason for all of those extra costs. We were able to identify the assumptions that were being discussed, but there is a mystery in this program that we could not uncover at this stage.

DDG-51 Flight III and AMDR

This program consists of two MDAPs: DDG-51, an established system that has produced many of the Navy's current ships, and AMDR, a new radar that has not been fielded yet. The DDG-51 flight III ships are variants of the older ships in the *Arleigh Burke*

class.[10] The AMDR program will produce the new SPY-6 radar system, which should make these new ships more capable than their predecessors. We delivered our FAAOs in July 2018. While this combination of MDAPs is not technically a program, we adopted the word *program* to describe it because that seems appropriate; the Navy is planning to buy 22 ships that are unlike any previous ships.

While AMDR has already passed Milestone C, it is worth noting that the radar has not yet been tested at sea, nor has it been tested with multiple arrays, even though the operational configuration is to consist of four arrays working together. With all of the requirements and costs laid out but the system not yet in production, this was a good time to identify the program's FAAOs.

Interoperability Requirements

The programs we studied varied considerably in how interoperable they need to be. At one extreme is the Columbia class submarine, and at the other is 3DELRR. Interoperability is difficult and needs to be considered when identifying FAAOs. A system that must be interoperable may perform the same way in two separate instances and be useful the first time but not the second, because of how other systems interact.

Columbia class boats are expected to remain hidden while waiting for an order to strike, orders that can only come via a limited number of channels. From an interoperability standpoint, this is about as isolated as a system can be.

At the other extreme is 3DELRR, which is envisioned to provide data that contribute to a picture of everything in the air over a theater. Other data will come from other services, and possibly also civilian agencies and international partners. The picture generated will include aircraft from all of our services as well as allies and rivals. Similarly, that picture may be used by joint headquarters and operators from every service and our allies. To understand whether this system will be useful requires looking at how it interacts with all those other systems, and our FAAOs for 3DELRR call for monitoring the progress of its interfaces with two other systems.

Classification

Our FAAOs on the Columbia class submarines were made more difficult because of classification issues, and we have some concern that because of the classification, we may have missed something that is relevant. There was a lot written about the "coordinated stern," but in the unclassified world, it was rarely more than concern. We found a document classified at the SECRET level that illuminated this conversation considerably, although it was still difficult to incorporate that information into the unclassified final product PARCA requested.

We also began the process of working on FAAOs for the Air Force's Long Range Stand-off Weapon (LRSO), which is a new nuclear-armed cruise missile. While the existence of the program is not only public but has been advertised, once we dug below the surface we found that everything was classified beyond SECRET. We agreed along with PARCA that even if we could get read-in to learn about the program, PARCA's analysts

[10] Previous ships in the class are already subdivided into three flights called I, II, and IIa.

would not be able to take advantage of a document that was classified beyond SECRET, so we went no further.

None of the other programs we studied seemed to have significant problems with classification issues. For every one of them, we reviewed some documents that were classified at the SECRET level, but we were able to produce unclassified final products.

Deliverable Format

As stated earlier, IDA delivered the first set of FAAOs in a memo and the others in briefing charts. The sponsor was happier with the briefing chart of our second set than the memo of the first. We suspect there were more differences than the format, but we decided to continue with the format that was well received. If we are asked to deliver additional sets of FAAOs, we may revisit this decision, as we expect that a written document is more useful than a set of charts. We will also consult with the AOs and see how they were used.

Resources Required to Write FAAOs

The first two sets of FAAOs, for AMPV and 3DELRR, each required about 200 hours of researchers' time to put together. Once we had a better feel for the process, the number of hours dropped to between 80 and 100 per set.

There were disagreements among the PARCA and IDA staff members about which sets of FAAOs were best. Some of the disagreements stemmed from the requirement that FAs be program-specific, some from the format of the IDA deliverables, and others over program-specific issues.

Summary of Lessons Learned

It is never too late in a program's life cycle to attempt to identify FAAOs, as long as the government is planning to spend more money on the program; however, the reverse is not true. Writing FAAOs only makes sense once there is a record of what the program is supposed to deliver. 3DELRR had a Milestone B review, but the program stalled so soon after that it never even had an APB. An FAAO writer is not going to do a more complete job than a DAB, so the FAAOs should wait until after that review. GPS IIIF seemed to be much too early.

It only makes sense to generate FAAOs at a level of classification that is high enough to know what is going on in the program. There is no reason that highly classified FAAOs could not exist, but they would also require both an audience and storage containers (i.e., safes) that are cleared at that level, and that is not how PARCA has operated.

Conclusion

Time will tell if any of these sets of FAAOs turn out to be useful. If AOs read the FAAOs quarterly and track the observables we recommended, that is one form of success. If the data are consistent with program health, then we will have done better still. Our first hope is that the five programs we studied will match their baselines in cost, schedule, and performance. If any one of them slips, we hope that the FAAOs will allow the OSD to detect those problems early.

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