ACQUISITION INNOVATION RESEARCH CENTER

# Case Studies of Technology Transition

EXECUTIVE SUMMARY AND REPORT

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**SPONSOR**

**Commission on Planning, Programming, Budgeting, and Execution (PPBE) Reform**
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# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| **ACD&P** | Advanced Component Development and Prototypes |
| **ACE** | Air Combat Evolution |
| **AFC** | Army Future Command |
| **AFRL** | Air Force Research Laboratory |
| **AI** | Artificial Intelligence |
| **ASA ALT** | Assistant Secretary of the Army for Acquisitions, Logistics, and Technology |
| **ATR** | Above Threshold Reprogramming |
| **BA** | Budget Authority |
| **BES** | Budget Estimate Submissions |
| **BTR** | Below Threshold Reprogramming |
| **CAPE** | Cost Assessment and Program Evaluation |
| **CCA** | Collaborative Combat Aircraft |
| **CCMD(s)** | Combatant Command(s) |
| **COTS** | Commercial-off-the-Shelf |
| **DARPA** | Defense Advanced Research Projects Agency |
| **DCGS** | Distributed Common Ground System |
| **DCGS-A** | Distributed Common Ground System-Army |
| **DoD** | Department of Defense |
| **DOTMLPF** | Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Facilities |
| **DOTMLPF-P** | Doctrine, Organization, Training, Materiel, Leadership, Personnel, Facilities, and Policy |
| **DPG** | Defense Planning Guidance |
| **EMD** | Engineering & Manufacturing Development |
| **EOU** | Experimental Operations Unit |
| **EW** | Electronic Warfare |
| **FAR** | Federal Acquisition Regulation |
| **FCB** | Functional Capabilities Board |
| **FSC** | Future Surface Combatant |
| **FSP** | Full System Prototypes |
| **FY** | Fiscal Year |
| **FYDP** | Future Years Defense Program |

| | |
|---|---|
| **GAO** | Government Accountability Office |
| **GMU** | George Mason University |
| **GVSC** | Ground Vehicle Systems Center |
| **HASC** | House Armed Services Committee |
| **IRB** | Institutional Review Board |
| **ISR** | Intelligence Surveillance and Reconnaissance |
| **IWN** | Immediate Warfighter Need |
| **JEON** | Joint Emergent Operational Need |
| **JCIDS** | Joint Capabilities Integration and Development System |
| **JRAC** | Joint Rapid Acquisition Cell |
| **JUON** | Joint Urgent Operational Need |
| **LUSV** | Large Unmanned Surface Vessel |
| **MDUSV** | Medium Displacement Unmanned Surface Vehicle |
| **MOSA** | Modular Open Systems Approach |
| **MTA** | Middle-Tier Acquisition |
| **MUSV** | Medium Unmanned Surface Vehicle |
| **NDAA** | National Defense Authorization Act |
| **NGAD** | Next Generation Air Dominance |
| **NGCV** | Next Generation Combat Vehicles |
| **NSSL** | National Security Space Launch |
| **OCO** | Overseas Contingency Operations |
| **OSD** | Office of the Secretary of Defense |
| **OTA** | Other Transaction Agreement |
| **PE** | Program Element |
| **PEO** | Program Executive Office |
| **POM** | Program Objective Memoranda |
| **PPBE** | Planning, Programming, Budgeting, and Execution |
| **PWSA** | Proliferated Warfighting Space Architecture |
| **R&D** | Research and Development |
| **RAA** | Rapid Acquisition Authority |
| **RCV** | Robotic Combat Vehicle |
| **RDT&E** | Research, Development, Test and Evaluation |

| | |
|---|---|
| **RTK** | Robotic Technology Kernel |
| **S&T** | Science and Technology |
| **SASC** | Senate Armed Services Committee |
| **SBIR** | Small Business Innovation Research |
| **SCO** | Strategic Capabilities Office |
| **SDA** | Space Development Agency |
| **SOW** | Scope of Work |
| **SP** | Surrogate Prototypes |
| **STTR** | Small Business Technology Transfer |
| **SWP** | Software Acquisition Pathway |
| **TENCAP** | Tactical Exploitation of National Capabilities |
| **TITAN** | Tactical Intelligence Targeting Access Node |
| **UON** | Urgent Operational Need |
| **USSF** | United States Space Force |
| **USV** | Unmanned Surface Vessel |
| **VENOM** | Viper Experimentation and Next-gen Operations Model |

# EXECUTIVE SUMMARY

**Through the use of Case Studies, review how the Planning, Programming, Budgeting, and Execution (PPBE) process supports joint efforts, capability and platform lifecycles, and transitioning technologies to production.**

Overall, the project findings highlight challenges associated with rapidly iterating and deploying software and/or commercial technology capabilities to support warfighter requirements. In particular, the PPBE process struggles when:

- Funding the rapid development and deployment of new capabilities to meet operational needs;
- The need for fiscal flexibility is greatest, usually during the year of execution; and
- Adjusting to rapidly evolving programs and needs.

These challenges can be overcome, however. The six case studies demonstrate that successful development and progress can be made when:

- Strong senior leadership drives prioritization;
- The broadness of Program Elements (PEs) enables flexibility in program execution;
- Agile approaches such as Middle Tier of Acquisition (MTA) enable programs to evolve and adapt with the least disruption; and
- Congressional engagements are regular and candid.

**Case Study Findings**

Each of the six case studies is unique and offers some insight into technology transition in the PPBE process. The specific findings are summarized below.

*U.S. Navy Program Executive Office Unmanned and Small Combatants*
*Large Unmanned Surface Vessel (LUSV) and Medium Unmanned Surface Vehicle (MUSV)*

- The PPBE process can be difficult to navigate due to several influencing factors, including:
    - » Congressional marks with prejudice;
    - » Continuing resolutions;
    - » Reprogramming threshold limit;
    - » Lack of management reserve;
- One size-fits-all PPBE process does not work well for new technology programs with no significant cost or development history; and
- J-books are not realistic for projects with many interrelated parts because they appear as an “à la carte” menu.

*U.S. Air Force Program Executive Office Fighters and Advanced Aircraft Directorate*
*Collaborative Combat Aircraft (CCA)*

- Program success requires significant coordination with:
    - » Other government agencies (Navy, DARPA, SCO, cost estimators "living with CAPE");
    - » "Can't overstate their effort" to build working relationships with many vendors to steer capability-driven outcomes;
- PPBE outcomes sometimes conflict with Air Force strategy;
- Budget structure that provides flexibility helps navigate the PPBE process; and
- Leadership prioritization is a critical factor for programmatic success.

*U.S. Army Program Executive Office Ground Combat Systems*
*Robotic Combat Vehicle (RCV)*

- PPBE processes are not optimal, but also not a significant hurdle to operations or strategy;
- More frequent interactions with Congressional staff would help to communicate evolving program status and associated budget;
- There is a need for flexibility in PPBE process to address agile acquisition; and
- Having all lines of effort in a single program element is helpful.

*The Space Development Agency (SDA)*

- SDA's use of the MTA pathway and the agile, iterative incorporation of commercial technologies are central to its rapid product delivery;
- Due to SDA's mandate to rapidly deliver capabilities, budget requests must be made before requirements are finalized—i.e. programming must occur before planning;
- PE consolidation gives SDA flexibility for program success, while external stakeholders who seek to impact the program prefer a divided PE structure; and
- Building and launching SDA tranches can be challenging to manage in existing budgetary categories.

*Tactical Intelligence Targeting Access Node (TITAN)*

- TITAN's use of the Modular Open Systems Approach (MOSA) and MTA pathway have led to rapid prototyping and program success;
- TITAN prototyping efforts have benefited programmatically and technologically from being a continuation of previous Army research efforts and funding lines; and
- The shift of program funding from Procurement to Research, Development, Test, and Evaluation (RDT&E), accomplished with effective stakeholder alignment, ensured appropriate investment was made in prototyping, which has been important to program success.

*Joint Rapid Acquisition Cell (JRAC)*

- JRAC efforts highlight the challenges of developing and deploying urgently needed capabilities to support operational needs via the Services' respective PPBE processes; and
- Phasing out Overseas Contingency Operations funding has made it increasingly difficult to secure funding to fill urgent capability gaps, especially Joint Urgent Operational Needs (JUONs) and Joint Emergent Operational Needs (JEONs).

# INTRODUCTION

## SCOPE OF WORK (SOW) FOR THIS GMU TASK

### *CASE STUDIES OF TECHNOLOGY TRANSITION*

Pursuant to Sec. 1004(f)(2)(C), conduct "a review of how the process supports joint efforts, capability and platform lifecycles, and transitioning technologies to production."

One of the alleged issues with PPBE that has received a lot of attention is that it can cause the failure of technology transition through the "valley of death" between experimental projects and programs of record. For example, the October 2021 Department of Defense (DoD) Prototyping Handbook finds that "DoD's Planning, Programming, Budgeting, and Execution (PPBE) process makes it difficult for prototyping projects to obtain necessary funding when it's needed. The PPBE process takes nearly two years from the time a funding need is identified to the time funding is available. In the fast-paced world of technology development, this lag in funding can prevent the timely development and deployment of a capability needed to address an emerging threat."

While there have been numerous articles decrying the "valley of death" problem in the DoD, there is little empirical evidence or root-cause analyses. Certainly, not every experimental or commercial technology is viable for transition into operational use. The "valley of death" thus provides a useful screening process. In its Fiscal Year (FY) 2022 final report, the Senate Appropriations Subcommittee on Defense recognized that discussions of PPBE reform have been closely linked with the "valley of death" issue but cautioned that the goal of the resourcing process is to "increase military capabilities" rather than measure "how many technologies can be transitioned." This makes it clear that there is an opportunity cost to every potential capability for technology transition.

Crucial questions of technology transition include:

1. Are higher-valued opportunities foregone at the expense of continuing lower-valued programs?

2. Is the PPBE process a significant root cause of failure to reallocate resources to higher-valued uses as distinct from the JCIDS or Small "A" acquisition process?

The study team for this task at the Baroni Center for Government Contracting at George Mason University (GMU) will develop six case study vignettes of roughly 5 to 10 pages to assess the impact of the PPBE process on technology transition. The team will work with the Commission on PPBE Reform and DoD officials to secure the participation of programs or capability areas to provide unclassified and non-proprietary information. The team proposes the following case studies (assuming sufficient program access is granted to the research team):

- **Autonomous systems.** The study team will examine the respective autonomous systems programs in the Services including: (1) Navy Large and Medium Unmanned Surface Vessels (LUSV/MUSV); (2) Air Force Collaborative Combat Aircraft (CCA); and (3) Army Robotic Combat Vehicle (RCV).

- **The Space Development Agency (SDA)**. The study team will examine its development and merger into the Space Force.

- **TBD.** Two additional programs will be identified as case studies during the research program.

These case studies could become potential pilots for implementing Commission recommendations.

During research and discussion with the PPBE Commission, the study team chose the following two programs to round out the case studies:

- **Tactical Intelligence Targeting Access Node (TITAN).** This Army program is heavily focused on software and commercial technology
- **Joint Rapid Acquisition Cell (JRAC).** Specifically, the team is examining two classified programs that had significant challenges with the PPBE process.

## METHODOLOGY

Each of the case studies was conducted using the following methodology:

- **Literature review**. The study team examined key publicly available information including: government documents (principally budget justification books and Congressional bill and report language); government reports; think tank reports; newspaper/trade articles; and other sources. Many of these sources were available through the literature review conducted by other AIRC researchers.
- **Identify key PPBE-related issues.** For each case, the study team developed hypotheses from the literature review. These hypotheses became the source of many of the subsequent interview questions, focused around issues such as MTA, BA8 or the Software Pathway, reprogramming, execution flexibility, etc.
- **Conduct interviews**. The study team conducted interviews with program personnel, industry, and outside experts on each case study subject and topic. Please note, the GMU Institutional Review Board (IRB) Office determined on June 16, 2023 that this project is exempt from IRB review according to federal regulations.
- **Compile case study.** The lead case author developed a draft 8-to-10-page case based on the interviews, analysis, and literature review that was then reviewed by the study team before submission to the Commission.

# CASE STUDY 1: NAVY LARGE AND MEDIUM UNMANNED SURFACE VESSELS (LUSV/MUSV)

## 1.0 EXECUTIVE SUMMARY

The following case study was designed to provide insight into the potential impact of the PPBE process on technology transition. This case study focuses on the LUSV and MUSV programs of U.S. Navy Program Executive Office Unmanned and Small Combatants.

Navy LUSV and MUSV are unique programs in several ways and therefore ideal for highlighting potential areas of concern concerning technology transition in the PPBE process. Each program, as well as the associated Enabling Capabilities program, is contained in separate project and program elements, making them as distinct as possible from a budgeting perspective. Interview subjects felt that this was largely a "forcing function" by Congress to better understand their projects and to possibly exert greater control over them. The Navy's strategy has been impacted directly by the PPBE process several times, including delays in LUSV production possibly over concerns about armed unmanned systems. The Navy also received a one-time Congressional Add of $42 million in 2019 to make an early purchase of a prototype, years earlier than originally planned, resulting in what interview subjects described as an "orphan child" vessel. Finally, interview subjects outlined several ways in which the PPBE process is especially difficult to navigate for new-technology programs, for example, the inability to move money into/out of marked w/prejudice lines is especially onerous. The key findings of the case are outlined in Figure 1.1.

**Key Findings**

1. PPBE process can be difficult to navigate in several ways, including:
   a. Congressional marks with prejudice
   b. continuing resolutions
   c. reprogramming threshold limit
   d. lack of management reserve
2. One size-fits-all PPBE process does not work well for new technology programs with no significant cost or development history.
3. J-books are not realistic for projects with many interrelated parts because they appear as an "à la carte" menu.

**Figure 1.1. LUSV/MUSV Case Study Key Findings**

The following case study contains a history of the program, budget overview, images, and most importantly key findings from interviews with knowledgeable personnel on their experiences navigating the PPBE process. The key findings appear to align with several areas of concern identified in the Commission on PPBE Reform's Interim Report, including: 1) improve PPBE-related relationships between DoD and Congress; 2) promote innovation and adaptability; and 3) improve alignment of budgets to strategy.[1]

## 1.1 PROGRAM OVERVIEW

LUSV and MUSV are U.S. Navy programs for ships that can be optionally manned, remotely operated in semi-autonomous fashion, or with sufficient technological advancement, sent on mission autonomously. The USV program represents a significant portion of the unmanned surface vessel component of Navy's Future Surface Combatant (FSC) strategy.[2] The Navy called for the development and fielding of a range of USVs to be integrated into its existing fleet of vessels in a strategy document titled *Department of the Navy Unmanned Campaign Framework*, released on March 16, 2021 (referenced in a 2023 Congressional Research Service report).[3] Navy has separate programs aimed at developing and procuring two variants of USV: the LUSV and MUSV.[i] Both LUSV and MUSV are described in Navy's FY 2024 budget justification book as "affordable, high endurance, reconfigurable ships able to accommodate various payloads for unmanned missions and augment Navy's manned surface force."[4] The first unmanned fleet exercise involving USVs occurred in April 2021, dubbed "Unmanned Integrated Battle Problem 21."[5] Shortly thereafter in January and February 2022, the U.S. 5th Fleet hosted the International Maritime Exercise 2022 and Cutlass Express 2022 that also involved unmanned vessels.[6] On May 13, 2022, Navy set up a new command for unmanned surface vessel fleet integration, named Unmanned Surface Vessel Division One.[7]

Both current USV programs benefited from earlier development and prototype programs, including Defense Advanced Research Projects Agency's (DARPA) Anti-Submarine Warfare Continuous Trail Unmanned Vessel, Office of Naval Research's Medium Displacement Unmanned Surface Vessel (MDSUV)/Sea Hunter, and Office of the Secretary of Defense Strategic Capabilities Office's Ghost Fleet Overlord Large USV experimentation efforts.[8] Specifically, MUSV benefited from the MDUSV program run by DARPA/Office of Naval Research, which produced the Sea Hunter and Seahawk ships. The LUSV program inherited four ships from Overlord Unmanned Surface Vehicle, an LUSV development effort within a larger Ghost Fleet program, run by DoD's Strategic Capabilities Office (SCO)/Uncrewed Maritime Systems Program Office.[9] SCO began the Ghost Fleet Overlord Program in 2018 to accelerate the integration of LUSVs into the U.S. Navy fleet.[10]

As an exemplar of the utility of the previous development work, Capt. Pete Small, program manager for unmanned maritime systems, was quoted in a January 12, 2022, press report as saying:

> 'What did we gain out of that [Project Overlord]? The first thing we gained is the platforms. We're getting those free of charge… It's something on the order of $370 million' over three years invested by the SCO into unmanned vessels.[11]

[i] Project 1234 titled *Unmanned Surface Vehicle (USV)* is not considered in this report because, according to Navy's FY 2024 budget justification book, that project is specific to the "development of unmanned mine countermeasures systems to provide minehunting, minesweeping, and mine neutralization" (p. 213), which is clearly a distinct project unrelated to autonomous vehicles.

***LUSV***

In September 2020, six conceptual design studies worth $42 million were awarded.[ii] The six LUSV studies, worth roughly $7 million each, were awarded to Austal USA, Huntington Ingalls Industries, Fincantieri Marinette, Bollinger Shipyards, Lockheed Martin, and Gibbs & Cox.[12] The initial FY 2020 budget submission also requested funds to purchase two LUSV prototypes that year and provisioned for ten additional LUSVs (two more every year) over the course of that year's Future Years Defense Program (FYDP) (FY 2021- 2024).[13] The acquisition strategy and timeline were significantly altered, however, due to concerns expressed by congressional defense committees about Navy's acquisition strategies and maturity of prototype development.[14] Legislative provisions were added to FY 2020-2022 budgets to address those concerns and the FY 2021 budget was reconfigured to postpone the LUSV concept design awards to maintain compliance with the legislation.[15] The Government Accountability Office was directed by a provision in House Report 116-442 for FY 2021 to review Navy's USV efforts, resulting in GAO-22-104567 titled *Uncrewed Maritime Systems: Navy Should Improve Its Approach to Maximize Early Investments*.[16]

Navy's FY 2024 budget submission reintroduced the procurement of production LUSVs through Navy's shipbuilding account, at the following rates:

- FY 2025 – One LUSV at $315.0M
- FY 2026 – Two LUSVs at a combined cost of $522.5 million
- FY 2027 – Three LUSVs at a combined cost of $722.7 million
- FY 2028 – Three LUSVs at a combined cost of $737.2 million[17]

***MUSV***

According to Navy's FY 2024 budget justification book, the MUSV program has been designated as a Rapid Prototyping Program designation and follows a MTA approach.[18] A contract awarded to L3 Harris in July 2020 following a full and open competitive procurement process included a prototype and options to procure up to eight additional MUSVs should funding be made available.[19, iii] The delivery of the initial prototype under that contract is planned for Q4 FY 2024.[20] As of May 2022, while there remained a clear operational need for the LUSV variant, there was growing uncertainty about the utility of MUSV. It appeared that the primarily surveillance mission of the MUSV might overlap with smaller and cheaper options, rendering it less useful.[21] However, later that year in August, 2022, two MUSVs participated alongside two LUSV prototypes in the 2022 Rim of the Pacific exercise in Hawaii and the value of the medium-sized variant was reinforced.[22] As of January 2023, Navy was reportedly firming up plans for a more extensive MUSV program even though there is no funding for producing MUSVs in the FY 2024-2028 FYDP.[23]

The LUSV program and Unmanned Surface Vehicle Enabling Capabilities program were both new starts in FY 2020. The MUSV was identified as the Medium Displacement Unmanned Surface Vehicle (MDUSV), which itself was a new start in FY 2019. Navy received a Congressional Add of $42 million in 2019 to the MDUSV project to make an early purchase of a prototype. All three lines of effort are separated into distinct projects and distinct program elements, which was described by interview participants as largely a "forcing function" by Congress to understand projects and possibly exert greater control over the programs.

[ii] This was erroneously reported as September 2019 in GAO-22-104567.

[iii] This was erroneously reported as July 2019 in GAO-22-104567.

## 1.2 IMPACT OF PPBE ON LUSV/MUSV: KEY FINDINGS AND INTERVIEW VIGNETTES

A group interview was conducted with seven personnel from U.S. Navy Program Executive Office Unmanned and Small Combatants. In advance of the discussion, interview subjects were provided with questions prepared by the GMU research team. The questions were designed to guide discussions and assess the potential impact of PPBE on the LUSV and MUSV programs. The interviews abided by the Chatham House Rule whereby all identities of the interview participants and information during the interview are to remain unidentified.

### *1.2.1 PPBE PROCESSES DIFFICULT TO NAVIGATE*

Interview subjects mentioned multiple areas of difficulty with navigating the PPBE process and how it can inhibit operations within their program. They spoke of the difficulty of dealing with Congressional marks with prejudice, the negative impact of continuing resolutions on overall timelines, the too-low reprogramming threshold limit, and the lack of ability to have a management reserve within budgeting constraints.

***Congressional marks with prejudice***

Several interview subjects addressed the difficulty their office experiences when dealing with Congressional marks, specifically that they cannot move monies in or out of a marked-with-prejudice budget line.

> Oftentimes a line that is marked is a line where I'm having to replan and change my strategy because something happened to it. So, my inability to move money in or out of that marked line in the same kind of efficient manner, it's kind of counterintuitive. Those would be the lines that I wanna have some more flexibility on.[24]

> The problem is there's no trust with Congress, right? There's no trust that we're gonna adhere to what they want, and so they restrict our ability to move money in a marked line, right? Congress says, 'Hey, I only want you to buy three units [instead of four units] and I'm gonna cut you $10 million.' But the real answer is it's not $30 million [each], it's $33 million. I would like to have the ability to move $3 million into that line to still execute Congress's intent, which is to buy three instead of four, but because of the rules I cannot do that.[25]

> It makes it hard to fix things that are very small and very fixable, but we can't fix it. And to [his] point, in a $798 billion defense budget you don't think we could fix a $3 million problem ourselves? Hell yeah, we could. But the law says you can't move money into a marked line. So no, we're just gonna leave it broke, so that's frustrating.[26]

This issue was also highlighted with an example provided by an interview subject about the difficulty of managing differing marks made by two committees (House Armed Services Committee (HASC) and Senate Armed Services Committee (SASC)).

> A perfect example is what we're going through right now. We have a line that got marked, and it got marked one amount by one committee and a different amount by the different committee. The lower amount just marked the line but the higher amount marked individual programs within the line. So, the Navy, thinking they're doing a good thing, appealed to the lower mark, but it totally kills one of the programs because it is only that program that's on that mark. Do you want $16 million hitting one of three programs, or do you want $18 million spread across three programs? The Navy went with the lower number, but it's gonna completely make a program inexecutable now, whereas the answer should have been keep three programs limping along rather than losing one completely.[27]

***Continuing resolutions hurt***

Interview subjects spoke about how continuing resolutions especially hurt because they compress an already tight execution schedule further. They talked about how a program cannot access its new funds until typically two months after a continuing resolution ends, which usually results in only half a year of properly funded execution. Interview subjects also mentioned how this additionally fosters a perception of non-performance for future evaluations by Congress.

> In a normal thing, the PPBE should work. Congress passes October 1st, OSD can say, OK, this is impact to the 24 programs. I can adjust 25 to maybe so when we submit to Congress, you know in February things will work. The sponsor can look at that and say, OK, these things have happened. I can adjust 26. We haven't been able to do that in probably a decade. So, any problem where you get a little bit behind it just it continues. And Congress marks you for being behind [even though] they start you six months late.[28]

> In our PPBE planning, as we're budgeting and planning and trying to execute, it's slowly drifting to the right and the decade that I've been here, it's almost a whole six months off the fiscal year. This is what you have to plan for or you're going to run out of money before the money shows up in the execution year.[29]

> So even when we do know what we're doing from the cost estimating side and we do lay out a plan, then the marked budget arrives that doesn't come in on time and we're trying to play catch up. And immediately after the money is awarded then it's, 'How are you doing on your obligations and your expenditures?' and 'Hey, we're gonna come up and sweep up that money.'[30]

***Additional budgetary restrictions***

There was also a brief discussion about two budgeting constraints that do not seem to be a good match for practical concerns: the reprogramming threshold limit and the lack of management reserve. First, the interview subjects said that the reprogramming threshold limit was too low considering the overall size of budgets. They felt that the low limit hamstrings a responsible department from solving smaller issues on their own recognizance. As summarized by one of the interview subjects:

> The $10 million below threshold reprogramming versus the above threshold reprogramming and the need to go talk to all four committees about the moving money means that even if we did have a good idea of something that can happen, the chance that good idea is gonna get from the working level all the way through and be approved is very minimal. The limit on below threshold reprogramming definitely seems like it's out of date. I totally understand the power of the purse, and the limit of a 20% threshold seems like something that could work, but the $10 million limit just doesn't work.[31]

The same interview subject also addressed how the lack of ability to have a management reserve means that the budget is often not an accurate reflection of what should be reasonably expected in a project's evolution.

> Another problem is the lack of management reserve. You know, that we're not supposed to budget in management reserve. As the federal government, we're supposed to budget to target, not budget, to what we think is reality. So regardless of the fact that 0.5% of projects complete on cost schedule and with existing requirements, we're supposed to budget to that existing kind of spot versus being able to budget to that kind of management reserve. So, we're not necessarily allowed to put in those planned unknown rework steps that we know is gonna happen.[32]

**PPBE processes difficult to navigate**

Among the various issues identified by interview subjects as areas of difficulty, continuing resolutions were identified as a factor involving government operations that has to be considered. Although it was not strictly a PPBE issue, continuing resolutions negatively impact the budgeting process and compress the overall timetable for completing work.

> When Congress doesn't pass a bill until February that completely compresses [everything]. I have to defer things during the CR, now I get all my money six months in. They say, "Hey, you're not making benchmark." Well, because I didn't get enough money to, you know, even make any of these benchmarks, and I've had to defer all this work, and I've jammed it all into six months.... I hate to blame Congress, but they have a duty on October 1 to start the fiscal year. Once that's broken, everything gets compressed and once you start compressing these timelines, you can't recover.
>
> *Source: U.S. Navy Unmanned and Small Combatants, Interview Subject #2*

**Figure 1.2. LUSV/MUSV Key Finding #1 - Interview Vignette**

### *1.2.2 ONE-SIZE-FITS-ALL PPBE PROCESS AND NEW TECHNOLOGY PROGRAMS*

Interview subjects spoke about how the PPBE process reflects a one-size-fits-all approach to budgeting, and that this is not particularly advantageous for programs that are based on new technologies. They spoke about how it is difficult to cost estimate or plan for a program based on constantly evolving and new technologies or to adjust the program for quickly evolving needs, especially in the execution year.

> We reformed the acquisition system, but we didn't reform the associated budgeting system. There are things about the PBBE process that do work. I do think [it works] in major capability acquisition where you're buying very large, very slow-moving things like ships. It sets up a nice structure with nice guardrails that allow you to get a highly complex, very large amount of money committed... Now you're using this process that works great for buying billion-dollar things for things that cost hundreds of thousands of dollars or small millions. It's the one-size-fits-all process that quickly becomes onerous to the point of, almost, we work around the system rather than let the system work us.[33]

> The reforms that have happened on the Defense acquisition side, with the Adaptive Acquisition Framework and the introduction of other pathways as alternatives to major capability acquisition, was largely driven by the realization that we're using one specific tool for everything and that it works really well for major capabilities, but it doesn't work for other ones. But PPBE doesn't have that kind of difference.[34]

Interview subjects provided another example of how the PPBE process can interfere with strategic planning for a new technology program. Navy received a one-time Congressional Add of $42M in 2019 to make an early purchase of a prototype, years earlier than serial production was scheduled to begin. The funding was described as not being well aligned with Navy's strategy because the money was a one-time event and it was received too early to fit well into the overall development timeline for the program.

> Suddenly in 2019, there's a Congressional Add to buy a boat. That was at least four years earlier than what we had planned to do. The requirements are not in the right spot, the long-term budget is not ready, the estimate is not in the right spot, the acquisition documentation is not in the right spot, the contracting piece is not in the right spot. Nothing had been prepared for that Congressional Add to go buy a boat. We went and bought a single unit, but then you ended up with this orphan child, right? The Congressional Add sparked a start, but at that point in time the only way to really continue with serial production would have been another Congressional Add due to the budget.[35]

***Difficulty estimating costs – no data points in the past***

Interview subjects spoke of the difficulty of cost-estimating a new technology that has little to no precedence or budgeting history. They also described their challenge of explaining the unique nature of new technology programs to other parties like the Government Accountability Office (GAO) and Congress. Interview subjects characterized those parties as relying on "napkin math" to judge their program primarily from budget books without appreciating the full story of how hard it is to plan and cost estimate such a program.[36]

> In our unmanned system there's so much that's unknown in the software and those new things that we're developing that make it incredibly difficult. In the large capital investments that are in other places, the aircraft carriers or something, so much of that cost is driven by historical knowledge, you know, on the price of steel and those big kind of aspects. You can be off in certain areas on the large capital investments and the PPBE won't eat you alive because the stuff that you're off on represents a smaller chunk in the larger grand scheme of things. But in our stuff, it's flipped, it's inverted. The question marks are in areas that can drive all kinds of craziness.[37]

> Because we don't have any data points, and it's an echo. Whatever cost you shout into it is what you're going to get back for the cost estimate, because for unmanned technology in particular, there is no precedent. If we don't have data points to very clearly tell us how much it costs per unit, then we have almost no ability to predict what it's going to look like going forward.[38]

***Latency issues during execution year***

Along the vein of difficulty to estimate cost, interview subjects also pointed out how evolving requirements during an execution year can be difficult to take into account given the strict budget process. One interview subject compared this to a latency in communication that can be experienced on a ship, and the negative consequences such latency would have in the real world.

> There's so many things that are broken in PPBE, in my opinion, but the year of execution flexibility is something that absolutely would help us with any number of different things. The in-execution-year ability to change, I don't wanna be in a spot where I'm using the over the horizon comms path that has all that latency in it. When I see something is gonna collide and I wanna make a change, I don't have the ability within that small time frame to make that change. So, instead I have to sit and watch that collision happen, knowing that I'm sending a command that isn't really gonna be properly read until like two or three years from now.[39]

> In industry, we often have these rolling planning waves of budget plans where we have a package of funding and the precise planning isn't planned to the specific items I'm gonna do until I get to a certain stage. And then I open up that next budget that was planned and I do that precision planning for it much closer to the execution of it. You know, we're not able to do those kind of things within the execution year because of the rigidness of the way that PPBE is structured.[40]

**One-size-fits-all PPBE process and new technology programs**

Several interview subjects made the point the PPBE is more difficult to navigate because the process assumes the ability to estimate a project's cost based on past cost or historical data. Neither of these are readily available for a program based on new technology that is rapidly evolving through experimentation and prototyping, which limits the ability to accurately predict future costs.

> If it's the first time it's ever been done, we don't know how to scope it. We don't know how to price it. Our ability to predict forward both hours and dollars is immature at best. And it is completely colored by and judged by past performance.
>
> *Source: U.S. Navy Unmanned and Small Combatants, Interview Subject #1*

**Figure 1.3. LUSV/MUSV Key Finding #2 - Interview Vignette**

### *1.2.3 J-BOOKS AS À LA CARTE MENUS DO NOT REFLECT REALITY*

Along the lines of earlier comments about the difficulty of dealing with congressional marks, interview subjects also spoke of the difficulty of how Congressional staffers treat the budget books as if they are an "à la carte menu." Interview subjects expressed how seeing individually segregated budget lines is not a good representation for how projects with multiple interrelated parts exist in reality.

> The budget justification books appear like an à la carte menu, and that's not reality. The budget books, the way that we're supposed to break it down for staffers is, you know, here's how much I'm gonna do towards each of these individual items when actually those items are interrelated. And then they mark a portion of it that they think equates to that exact line item which actually breaks several other areas.... The marks are a huge problem, and the way that they mark it in that à la carte menu is not directly how we're gonna be able to apply it.[41]

Another interview subject provided an illustrative example of how economies of scale are not taken into account by Congressional staffers when considering appropriately priced multiple quantity units and budget cuts. In short, he said that staffers often don't understand economies of scale and will assume the same per-unit price will hold even when fewer quantities are purchased. He gave a hypothetical example, warning that he has seen this scenario play out repeatedly in the past, whereby they were originally going to buy three units at $10 million each, but Congress only permitted the purchase of two units.

> Say there's four units for $40 million and somebody's like, 'Hey, I'm gonna cut one unit, so I cut you $10 million,' [but] that's not how it works. Now, we have to go back and renegotiate with the shipbuilder. 'Hey, I know I told you I was gonna buy four.' So, now the unit cost has gone from $10 million to $13.5 million. They only gave me enough for two. I go buy two at $27 million, but now I've got this asset, right. I spent $27 million, [but] they gave me $30 million. I've got a $3 million asset and that's the way people look at it. Instead of thinking, 'Oh my God, we just bought something for $13.5 million when it should have cost $10 million.' We just throw away $7 million, but everybody's happy because we created a $3 million asset in the process. That would be looked at as a win and it's the most messed up thing I can think of.[42]

The lack of realism dealing with the budgets of programs that have highly evolving needs was also reflected in interviews with contractors for the program. The interview subjects highlighted how it was their impression that Congressional marks made during the evolution of the project appeared to reflect simplistic assumptions and did not fully appreciate the integrated nature of the hardware and software requirements. They made the point that it is also not realistic to expect that there are already existing commercial solutions for many of the requirements, and that unforeseen development costs should be considered inherent to innovative programs.[43, 44]

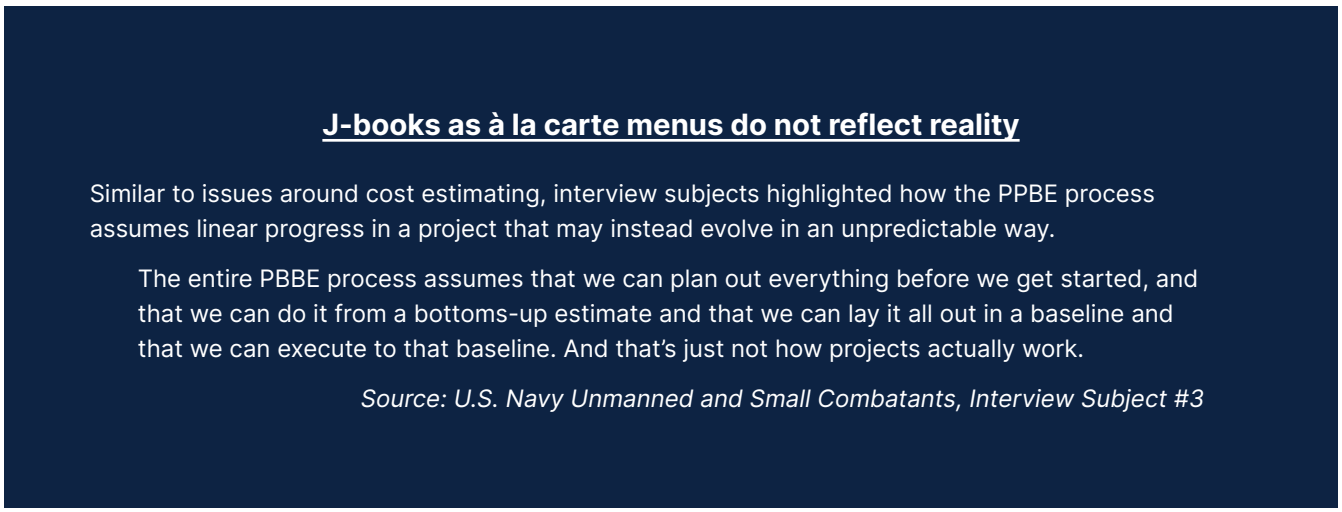


**Figure 1.4. LUSV/MUSV Key Finding #3 - Interview Vignette**

## 1.3 APPENDIX A. HERITAGE OF PROGRAM

**Figure 1.5. Heritage of Navy Large and Medium Unmanned Surface Vessels (LUSV/MUSV)**

| Fiscal Year | Project | Program Element | Budget Activity |
|---|---|---|---|
| 2024 - 2022 | 3066: Large Unmanned Surface Vessel (LUSV) | PE 0603178N / (U)LARGE UNMANNED SURFACE VESSELS (LUSVs) | BA 4 |
| | 3428: Medium Unmanned Surface Vehicle (MUSV) | PE 0605512N / MEDIUM UNMANNED SURFACE VEHICLES (MUSVs) | |
| | 3067: Unmanned Surface Vehicle Enabling Capabilities | PE 0605513N / UNMANNED SURFACE VEHICLE ENABLING CAPABILITIES | |
| 2021 | 3066: Large Unmanned Surface Vessel (LUSV)* | PE 0603178N / Medium and Large Unmanned Surface Vehicles (USVs) | BA 4 |
| | 3428: Medium Unmanned Surface Vehicle (MUSV) | | |
| | 3067: Unmanned Surface Vehicle Enabling Capabilities | | |
| 2020 | 3066: Large Unmanned Surface Vehicle (LUSV) | PE 0603502N / Surface & Shallow Water MCM | BA 4 |
| | 3428: Medium Unmanned Surface Vehicle (MUSV)** | | |
| | 3067: Unmanned Surface Vehicle Enabling Capabilities | | |
| 2019 | 3428: Medium Displacement Unmanned Surface Vehicle (MDUSV) | PE 0603502N / Surface & Shallow Water MCM | BA 4 |

Source: Department of Defense Budget Estimates, Navy Justification Books: Research, Development, Test & Evaluation, Fiscal Year 2019 through 2024.

Notes: Green highlight represents a new start; Orange highlight represents a realignment of funding; BA 4 = BA 4: Advanced Component Development & Prototypes (ACD&P).

* Project retitled from "Large Unmanned Surface Vehicle (LUSV)."

** Project retitled from "3428: Medium Displacement Unmanned Surface Vehicle (MDUSV)"

## 1.4 APPENDIX B. BUDGET HISTORY

**Table 1.1: FY 2024 Budget Request, 3066: Large Unmanned Surface Vessel (LUSV); 3428: Medium Unmanned Surface Vehicle (MUSV); 3067: Unmanned Surface Vehicle Enabling Capabilities**

| | | Request ($M) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Item | Funding Category | FY 2022 | FY 2023 | FY 2024 | FY 2025 | FY 2026 | FY 2027 | FY 2028 | Total Cost |
| 3066: Large Unmanned Surface Vessel (LUSV) | RDT&E | $98.871 | $136.580 | $117.400 | $127.855 | $127.006 | $129.431 | $131.729 | Continuing |
| 3428: Medium Unmanned Surface Vehicle (MUSV) | RDT&E | $57.872 | $85.966 | $85.800 | $99.387 | $98.268 | $99.761 | $101.768 | Continuing |
| 3067: Unmanned Surface Vehicle Enabling Capabilities | RDT&E | $115.436 | $181.534 | $176.261 | $293.493 | $213.290 | $190.510 | $195.165 | Continuing |

Source: Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy, March 2023, pp. 19, 1381, 1395.

Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

**Table 1.2: FY 2024 Program Change Summary, PE 0603178N / (U)LARGE UNMANNED SURFACE VESSELS (LUSVs)**

| | FY 2022 | FY 2023 | FY 2024 Base |
|---|---|---|---|
| Previous President's Budget | $102.493 | $146.840 | $125.501 |
| Current President's Budget | $98.871 | $136.580 | $117.400 |
| Total Adjustments | ($3.622) | ($10.260) | ($8.101) |
| - Congressional General Reductions | - | ($0.260) | - |
| - Congressional Directed Reductions | - | ($10.000) | - |
| - SBIR/STTR Transfer | ($3.622) | - | - |
| - Rate/Misc Adjustments | - | - | ($8.101) |

Source: Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy, March 2023, p. 20.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

**Table 1.3: FY 2024 Program Change Summary, PE 0605512N / MEDIUM UNMANNED SURFACE VEHICLES (MUSVs)**

| | FY 2022 | FY 2023 | FY 2024 Base |
|---|---|---|---|
| Previous President's Budget | $60.020 | $104.000 | $93.809 |
| Current President's Budget | $57.872 | $85.966 | $85.800 |
| Total Adjustments | ($2.148) | ($18.034) | ($8.009) |
| - Congressional General Reductions | - | ($0.477) | - |
| - Congressional Directed Reductions | - | ($17.557) | - |
| - SBIR/STTR Transfer | ($2.148) | - | - |
| - Program Adjustments | - | - | ($8.500) |
| - Rate/Misc Adjustments | - | - | $0.491 |

Source: Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy, March 2023, p. 1382.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

**Table 1.4: FY 2024 Program Change Summary, PE 0605513N / UNMANNED SURFACE VEHICLE ENABLING CAPABILITIES**

| | FY 2022 | FY 2023 | FY 2024 Base |
|---|---|---|---|
| Previous President's Budget | $119.560 | $181.620 | $192.885 |
| Current President's Budget | $115.436 | $181.534 | $176.261 |
| Total Adjustments | ($4.124) | ($0.086) | ($16.624) |
| - Congressional General Reductions | - | ($0.086) | - |
| - SBIR/STTR Transfer | ($4.124) | - | - |
| - Program Adjustments | - | - | ($17.508) |
| - Rate/Misc Adjustments | - | - | $0.884 |

Source: Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy, March 2023, p. 1396.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

**Table 1.5: FY 2023 Budget Request, 3066: Large Unmanned Surface Vessel (LUSV); 3428: Medium Unmanned Surface Vehicle (MUSV); 3067: Unmanned Surface Vehicle Enabling Capabilities**

| | | Request ($M) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Item | Funding Category | FY 2021 | FY 2022 | FY 2023 | FY 2024 | FY 2025 | FY 2026 | FY 2027 | Total Cost |
| 3066: Large Unmanned Surface Vessel (LUSV) | RDT&E | $67.517 | $102.493 | $146.840 | $125.501 | $122.643 | $123.302 | $128.796 | Continuing |
| 3428: Medium Unmanned Surface Vehicle (MUSV) | RDT&E | $53.402 | $60.020 | $104.000 | $93.809 | $98.894 | $97.757 | $99.229 | Continuing |
| 3067: Unmanned Surface Vehicle Enabling Capabilities | RDT&E | $21.681* | $119.560 | $181.620 | $192.885 | $299.182 | $195.298 | $195.827 | Continuing |

Source: Department of Defense Fiscal Year (FY) 2023 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy, April 2022, pp. 11, 1397, 1411.

Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

* Amount shown in PE 0603178N / (U)LARGE UNMANNED SURFACE VESSELS (LUSVs) LUSV because 3067: Unmanned Surface Vehicle Enabling Capabilities realigned to PE 0603178N in FY 2021.

**Table 1.6: FY 2023 Program Change Summary, PE 0603178N / (U)LARGE UNMANNED SURFACE VESSELS (LUSVs)**

| | FY 2021* | FY 2022 | FY 2023 Base |
|---|---|---|---|
| Previous President's Budget | $91.747 | $144.846 | $0.000 |
| Current President's Budget | $89.198 | $102.493 | $146.840 |
| Total Adjustments | ($2.549) | ($42.353) | $146.840 |
| - Congressional General Reductions | - | ($0.353) | - |
| - Congressional Directed Reductions | - | ($42.000) | - |
| - SBIR/STTR Transfer | ($2.549) | - | - |
| - Adjustments to Budget Years | - | - | $146.840 |

**Change Summary Explanation**

FY 2023 funding increase reflects the fact that the FY 2022 President's Budget request did not include out-year funding.

Source: Department of Defense Fiscal Year (FY) 2023 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy, April 2022, p. 12.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

* Contains $21.681 from 3067: Unmanned Surface Vehicle Enabling Capabilities because it realigned to PE 0603178N in FY 2021.

**Table 1.7: FY 2023 Program Change Summary, PE 0605512N / MEDIUM UNMANNED SURFACE VEHICLES (MUSVs)**

| | FY 2021 | FY 2022 | FY 2023 Base |
|---|---|---|---|
| Previous President's Budget | $55.285 | $60.028 | $0.000 |
| Current President's Budget | $53.402 | $60.020 | $104.000 |
| Total Adjustments | ($1.883) | ($0.008) | $104.000 |
| - Congressional General Reductions | - | ($0.008) | - |
| - SBIR/STTR Transfer | ($1.883) | - | - |
| - Adjustments to Budget Years | - | - | $104.000 |

**Change Summary Explanation**

FY 2023 funding increase reflects the fact that the FY 2022 President's Budget request did not include out-year funding.

Source: Department of Defense Fiscal Year (FY) 2023 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy, April 2022, p. 1398.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

**Table 1.8: FY 2023 Program Change Summary, PE 0605513N / UNMANNED SURFACE VEHICLE ENABLING**

| | FY 2021 | FY 2022 | FY 2023 Base |
|---|---|---|---|
| Previous President's Budget | $0.000 | $170.838 | $0.000 |
| Current President's Budget | $0.000 | $119.560 | $181.620 |
| Total Adjustments | $0.000 | ($51.278) | $181.620 |
| - Congressional General Reductions | - | ($0.578) | - |
| - Congressional Directed Reductions | - | ($50.700) | - |
| - Adjustments to Budget Years | - | - | $181.620 |

**Change Summary Explanation**

FY 2023 funding increase reflects the fact that the FY 2022 President's Budget request did not include out-year funding.

Source: Department of Defense Fiscal Year (FY) 2023 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy, April 2022, p. 1412.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

**Table 1.9: FY 2022 Budget Request, 3066: Large Unmanned Surface Vessel (LUSV); 3428: Medium Unmanned Surface Vehicle (MUSV); 3067: Unmanned Surface Vehicle Enabling Capabilities**

| | | Request ($M) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Item | Funding Category | FY 2020 | FY 2021 | FY 2022 | FY 2023 | FY 2024 | FY 2025 | FY 2026 | Total Cost |
| 3066: Large Unmanned Surface Vessel (LUSV) | RDT&E | $0.000 | $69.634 | $144.846 | - | - | - | - | - |
| 3428: Medium Unmanned Surface Vehicle (MUSV) | RDT&E | $0.000 | $55.285 | $60.028 | - | - | - | - | - |
| 3067: Unmanned Surface Vehicle Enabling Capabilities | RDT&E | $0.000 | $22.113* | $170.838 | - | - | - | - | - |

Source: Department of Defense Fiscal Year (FY) 2022 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy, May 2021, pp. 9, 1413, 1425.

Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

* Amount shown in PE 0603178N / (U)LARGE UNMANNED SURFACE VESSELS (LUSVs) LUSV because 3067: Unmanned Surface Vehicle Enabling Capabilities realigned to PE 0603178N in FY 2021.

**Table 1.10: FY 2022 Program Change Summary, PE 0603178N / (U)LARGE UNMANNED SURFACE VESSELS (LUSVs)**

| | FY 2020 | FY 2021* | FY 2022 Base |
|---|---|---|---|
| Previous President's Budget | $0.000 | $464.042 | $530.035 |
| Current President's Budget | $0.000 | $91.747 | $144.846 |
| Total Adjustments | $0.000 | ($372.295) | ($385.189) |
| - Congressional General Reductions | - | ($1.953) | - |
| - Congressional Directed Reductions | - | ($408.640) | - |
| - Congressional Adds | - | $93.700 | - |
| - Congressional Directed Transfers | - | ($55.402) | - |
| - Program Adjustments | $0.000 | $0.000 | ($380.653) |
| - Rate/Misc Adjustments | $0.000 | $0.000 | ($4.536) |

**Change Summary Explanation**

FY21: -$372.295M Total; -$1.953M congressional general reduction, -$408.640M congressional directed reductions for restoring acquisition accountability,

$93.700M congressional adds for restoring acquisition accountability - program restructure, -$55.402M congressional directed transfers to MUSV new PE.

Source: Department of Defense Fiscal Year (FY) 2022 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy, May 2021, p. 10.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

* Contains $22.113 from 3067: Unmanned Surface Vehicle Enabling Capabilities because it realigned to PE 0603178N in FY 2021.

**Table 1.11: FY 2022 Program Change Summary, PE 0605512N / MEDIUM UNMANNED SURFACE VEHICLES (MUSVs)**

| | FY 2020 | FY 2021 | FY 2022 Base |
|---|---|---|---|
| Previous President's Budget | $0.000 | $0.000 | $0.000 |
| Current President's Budget | $0.000 | $55.285 | $60.028 |
| Total Adjustments | $0.000 | $55.285 | $60.028 |
| - Congressional General Reductions | - | ($0.117) | - |
| - Congressional Directed Transfers | - | $55.402 | - |
| - Program Adjustments | $0.000 | $0.000 | $60.028 |

**Change Summary Explanation**

FY21: Congressional transfers $26.302M Medium Unmanned Surface Vehicle from line 27 (project 3428); $14.000M Medium Unmanned Surface Vehicle machinery plant only, per Navy Large Unmanned Surface Vehicle program restructure from line 27; $15.100M Naval Surface Warfare Center land-based engineering site for Medium Unmanned Surface Vehicle testing only, per Navy Large Unmanned Surface Vehicle program restructure from line 27; -$.117M Congressional General Reduction

FY22: Funds transferred from PE 0603178N. The FY 2022 funding request was reduced by $4.500M to account for the availability of prior year execution balances that were realigned from PE 0603178N into 0605512N.

Source: Department of Defense Fiscal Year (FY) 2022 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy, May 2021, p. 1414. Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

**Table 1.12: FY 2022 Program Change Summary, PE 0605513N / UNMANNED SURFACE VEHICLE ENABLING CAPABILITIES**

| | FY 2020 | FY 2021 | FY 2022 Base |
|---|---|---|---|
| Previous President's Budget | $0.000 | $0.000 | $0.000 |
| Current President's Budget | $0.000 | $0.000 | $170.838 |
| Total Adjustments | $0.000 | $0.000 | $170.838 |
| - Program Adjustments | $0.000 | $0.000 | $170.838 |

**Change Summary Explanation**

FY22: +$170.838M realignment of Unmanned Surface Vehicle (USV) Enabling Capabilities (Project 3067) from PE 0603178N to PE 0605513N in FY 2022.

Source: Department of Defense Fiscal Year (FY) 2022 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy, May 2021, p. 1426.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

**Table 1.13: FY 2021 Budget Request, 3066: Large Unmanned Surface Vessel (LUSV); 3428: Medium Unmanned Surface Vehicle (MUSV); 3067: Unmanned Surface Vehicle Enabling Capabilities**

| | | Request ($M) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Item | Funding | FY 2019 | FY 2020 | FY 2021 | FY 2022 | FY 2023 | FY 2024 | FY 2025 | Total Cost |
| 3066: Large Unmanned Surface Vessel (LUSV)* | RDT&E | $0.000 | $0.000 | $238.617 | $377.200 | $144.549 | $198.720 | $134.948 | Continuing |
| 3428: Medium Unmanned Surface Vehicle (MUSV) | RDT&E | $0.000 | $0.000 | $26.302 | $29.998 | $42.994 | $43.853 | $44.730 | Continuing |
| 3067: Unmanned Surface Vehicle Enabling Capabilities | RDT&E | $0.000 | $0.000 | $199.123 | $122.837 | $192.836 | $77.854 | $80.857 | Continuing |

Source: Department of Defense Fiscal Year (FY) 2021 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy, February 2020, p. 1.

Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

* Starting in FY 2021, the project name changed from "Large Unmanned Surface Vehicle (LUSV)" to "Large Unmanned Surface Vessel (LUSV)".

**Table 1.14: FY 2021 Program Change Summary, PE 0603178N / Medium and Large Unmanned Surface Vehicles (USVs)**

| | FY 2019 | FY 2020 | FY 2021 Base |
|---|---|---|---|
| Previous President's Budget | $0.000 | $0.000 | $0.000 |
| Current President's Budget | $0.000 | $0.000 | $464.042 |
| Total Adjustments | $0.000 | $0.000 | $464.042 |
| - Program Adjustments | $0.000 | $0.000 | $464.417 |
| - Rate/Misc Adjustments | $0.000 | $0.000 | ($0.375) |

**Change Summary Explanation**

Program Changes: +$464,042K transfer from PE 0603502N.

Source: Department of Defense Fiscal Year (FY) 2021 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy, February 2020, p. 2.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

**Table 1.15: FY 2020 Budget Request, 3066: Large Unmanned Surface Vessel (LUSV); 3428: Medium Unmanned Surface Vehicle (MUSV); 3067: Unmanned Surface Vehicle Enabling Capabilities**

| Item | Funding Category | Request ($M) FY 2018 | FY 2019 | FY 2020 | FY 2021 | FY 2022 | FY 2023 | FY 2024 | Total Cost |
|---|---|---|---|---|---|---|---|---|---|
| 3066: Large Unmanned Surface Vehicle (LUSV) | RDT&E | $0.000 | $0.000 | $372.527 | $535.364 | $584.323 | $607.616 | $637.984 | Continuing |
| 3428: Medium Unmanned Surface Vehicle (MUSV)* | RDT&E | $0.000 | $2.800 | $23.900 | $26.300 | $30.000 | $43.000 | $43.860 | Continuing |
| 3067: Unmanned Surface Vehicle Enabling Capabilities | RDT&E | $0.000 | $0.000 | $50.413 | $199.277 | $177.280 | $247.458 | $132.039 | Continuing |

Source: Department of Defense Fiscal Year (FY) 2020 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy - Budget Activity 4, March 2019, p. 201.

Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

*Starting in FY 2020, the project name changed from "Medium Displacement Unmanned Surface Vehicle (MDUSV)" to "Medium Unmanned Surface Vehicle (MUSV)".

**Table 1.16: FY 2020 Program Change Summary, PE 0603502N / Surface & Shallow Water MCM**

| | FY 2018 | FY 2019 | FY 2020 Base* |
|---|---|---|---|
| Previous President's Budget | $154.117 | $62.727 | $76.052 |
| Current President's Budget | $69.906 | $120.348 | $507.000 |
| Total Adjustments | ($84.211) | $57.621 | $430.948 |
| - Congressional General Reductions | - | ($0.482) | - |
| - Congressional Directed Reductions | - | ($1.997) | - |
| - Congressional Adds | - | $60.100^ | - |
| - SBIR/STTR Transfer | ($2.025) | 0 | - |
| - Program Adjustments | $0.000 | $0.000 | $432.400 |
| - Rate/Misc Adjustments | $0.000 | $0.000 | ($1.452) |
| - Congressional General Reductions Adjustments | ($0.216) | - | - |
| - Congressional Directed Reductions Adjustments | ($94.970) | - | - |
| - Congressional Adds Adjustments | $13.000 | - | - |

Source: Department of Defense Fiscal Year (FY) 2020 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy - Budget Activity 4, March 2019, p. 203.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

*Amounts shown are a combination of multiple projects contained in the Program Element, including: 1234: Unmanned Surface Vehicle (USV), 2989: Barracuda, 3066: Large Unmanned Surface Vehicle (LUSV), 3067: Unmanned Surface Vehicle Enabling Capabilities, 3123: SMCM UUV, 3428: Medium Unmanned Surface Vehicle (MUSV), and 9999: Congressional Adds.

^ Contains $42.000 directed to the Medium Displacement Unmanned Surface Vehicle project.

**Table 1.17: FY 2019 Budget Request, 3428: Medium Displacement Unmanned Surface Vehicle (MDUSV)**

| Item | Funding Category | Request ($M) FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 | FY 2022 | FY 2023 | Total Cost |
|---|---|---|---|---|---|---|---|---|---|
| 3428: Medium Displacement Unmanned Surface Vehicle (MDUSV) | RDT&E | $0.000 | $0.000 | $2.800 | $23.900 | $26.300 | $30.000 | $43.000 | Continuing |

Source: Department of Defense Fiscal Year (FY) 2019 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy - Budget Activity 4, February 2018, p. 197.

Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

**Table 1.18: FY 2019 Program Change Summary, PE 0603502N / Surface & Shallow Water MCM**

| | FY 2017 | FY 2018 | FY 2019 Base* |
|---|---|---|---|
| Previous President's Budget | $165.775 | $154.117 | $233.873 |
| Current President's Budget | $126.761 | $154.117 | $62.727 |
| Total Adjustments | ($39.014) | $0.000 | ($171.146) |
| - Reprogrammings | $9.680 | $0.000 | - |
| - SBIR/STTR Transfer | ($3.694) | $0.000 | - |
| - Program Adjustments | $0.000 | $0.000 | ($162.501) |
| - Rate/Misc Adjustments | $0.000 | $0.000 | ($8.645) |
| - Congressional General Reduction Adjustments | ($45.000) | - | - |

Source: Department of Defense Fiscal Year (FY) 2019 Budget Estimates, Navy Justification Book Volume 2 of 5: Research, Development, Test & Evaluation, Navy - Budget Activity 4, February 2018,

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

* Amounts shown are a combination of multiple projects contained in the Program Element, including: 0530: Mine Hunt Systems, 1233: Surface MCM Mid-life Upgrade, 1234: Unmanned Surface Vehicle (USV),1235: Mine Warfare Planning and Analysis, 2094: Unmanned Underwater Vehicle, 2131: Assault Breaching System, 2989: Barracuda, 3123: SMCM UUV, and 3428: Medium Displacement Unmanned Surface Vehicle (MDUSV).

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# CASE STUDY 2: AIR FORCE COLLABORATIVE COMBAT AIRCRAFT (CCA)

## 2.0 EXECUTIVE SUMMARY

The following case study was designed to provide insight into the potential impact of the PPBE process on technology transition. This case study focuses on the CCA program of U.S. Air Force Program Executive Office Fighters and Advanced Aircraft Directorate.

Air Force CCA is a unique program in several ways and therefore ideal for highlighting potential areas of concern concerning technology transition in the PPBE process. CCA has never been declared a budgetary "new start," and instead a technology transition program element was used to transition the program from Air Force Research Laboratory's Skyborg program (contained in Air Force Vanguards). Interview subjects spoke about the positives and challenges of significant coordination efforts with other departments, especially Navy, as well as a large contractor base (35+ vendors), to develop CCA capabilities. They also acknowledged the importance of budget structure and how embedding the CCA project within the same program element as the larger NGAD initiative enabled flexibility with monies. Finally, they spoke about how strong leadership support has been critical for programmatic success. The key findings of the case are outlined in the following Figure 2.1.

**Key Findings**

1. Significant coordination with:
    a. other government agencies (Navy, DARPA, SCO, cost estimators "living with CAPE"), and
    b. "can't overstate their effort" to build working relationships with many vendors to steer capability-driven outcomes.
2. PPBE outcomes sometimes conflict with Air Force strategy.
3. Budget structure that provides flexibility helps navigate the PPBE process.
4. Leadership prioritization is a critical factor for programmatic success.

**Figure 2.1. CCA Case Study Key Findings**

The following case study contains a history of the program, budget overview, images, and most importantly key findings from interviews with knowledgeable personnel on their experiences navigating the PPBE process. The key findings appear to align with several areas of concern identified in the Commission on PPBE Reform's Interim Report, including 1) Improve PPBE-related relationships between DoD and Congress, 2) Promote innovation and adaptability, and 3) Improve alignment of budgets to strategy.[1]

## 2.1 PROGRAM OVERVIEW

CCA is a U.S. Air Force program for unmanned combat air vehicle envisioned to operate either in combination (i.e., "tethered") with manned combat aircraft or in more autonomous roles (i.e., "untethered"). CCA are described in the FY 2024 Air Force budget justification book as "un-crewed weapon systems capable of enhancing crewed weapon systems to achieve air superiority."[2] The program is a component of the Next Generation Air Dominance (NGAD) initiative that is broadly aimed at developing sixth-generation jet fighter aircraft more advanced than those currently in service. The FY 2024 Budget Request Overview identified CCA as a key component of the NGAD Family of Systems, stating that by "accelerating development of CCAs, Air Force will be able to augment current and future platforms with lower cost complementary systems that increase lethality and exchange ratios in highly contested environments."[3] Air Force Secretary Frank Kendall has said he wants the CCA program to reach operational capability in a "comparable" timeline with the NGAD program.[4]

The CCA program has benefited greatly from work previously completed under other programs, most notably Air Force Rapid Capabilities Office, Air Force Research Lab's Skyborg program, and the Defense Advanced Research Projects Agency's Air Combat Evolution (ACE) initiative.[5] In fact, the CCA program is a direct transition from the Skyborg Vanguard program, which was itself developed to "integrate artificial intelligence into autonomous unmanned air vehicles to enable future manned-unmanned teaming."[6] The current CCA effort is included in Budget Activity 4, Advanced Component Development and Prototypes (ACD&P), because "efforts are necessary to evaluate integrated technologies, representative modes or prototype systems in a high fidelity and realistic operating environment."[7] Two ancillary programs to the core CCA project were started in FY 2024, called the Experimental Operations Unit (EOU) and the Viper Experimentation and Next-gen Operations Model (VENOM). The former will explore Doctrine, Organization, Training, Materiel, Leadership, Personnel, Facilities, and Policy (DOTMLPF-P) concepts while the latter will serve as a testbed for the autonomous features on a crewed aircraft.[8] Concept exploration, integration studies, technology risk reduction, and prototyping are set to begin in FY 2024. In total, the U.S. Air Force plans to spend over $500 million on CCA programs in FY 2024, and more than $6 billion through FY 2028.[9]

Unlike conventional forms of unmanned combat air vehicles like the MQ-1 Predator[10] and MQ-9 Reaper[11] drones that are still operated remotely by humans,[12] CCA will incorporate an artificial intelligence control system, dubbed an "autonomy package." In addition to artificial intelligence (AI) pilots capable of operating autonomously, CCA will also be designed to serve in perhaps "100 roles" in USAF missions and are meant to be capable of surviving on the battlefield.[13] The three major lines of effort for the CCA program include:

1. CCA platform development,
2. autonomy package development, and
3. an experimental operations unit to figure out organizational aspects of the program (e.g., training, equipping, and supplying the program).[14]

Air Force Secretary Frank Kendall, in an interview in mid-March, 2023, acknowledged that the FY 2024 budget request was a "pretty significant investment in the first year of a competitive new start" and that the number of potential contractors had not been decided yet.[15] However, Andrew Hunter, the service's acquisition chief, has mentioned that Air Force is "already working with on the order of 35 industry vendors on CCA today," so an expansive vendor pool is expected.[16] Hunter has also been quoted as saying that Air Force will regard the program as a continuous competition, even in the R&D phase:

> What often trips us up and gets us to these single points of failure is that it's life or death. You win and that's a 50-year franchise that both sides are essentially locked into and it becomes a death struggle for industry on every contract that if you don't win, you're gone. You no longer exist in some cases. So that's very high stakes.[17]

Although the Autonomous Collaborative Platform program element (0207179F) was new for FY 2023, the CCA platform project (647123) is a continuation of previous work accomplished under the Skyborg Vanguard Program. As noted in the FY 2023 budget justification book, the "creation of this program element represents the transition of the Skyborg Vanguard Program from Advanced Technology Development (BA: 03) to Advanced Component Development and Prototypes (BA: 04)."[18] As such, the genesis of the CCA program was an administrative realignment relying on a technology transfer instead of a new start. Most of the FY 2024 requested budget ($379.776 million) is devoted to research and development efforts, with a relatively minor portion ($12.434 million) dedicated to acquisition support.

## 2.2 IMPACT OF PPBE ON CCA: KEY FINDINGS AND INTERVIEW VIGNETTES

A group interview was conducted with five personnel from U.S. Air Force Program Executive Office Fighters and Advanced Aircraft Directorate. In advance of the discussion, interview subjects were provided with questions prepared by the GMU research team. The questions were designed to guide discussions and assess the potential impact of PPBE on the CCA program. The interviews abided by the Chatham House Rule whereby all identities of the interview participants and information during the interview are to remain unidentified.

### *2.2.1 CLOSE COORDINATION WITH GOVERNMENT PARTNERS AND CONTRACTORS*

A key theme highlighted by several interview subjects was that a high level of coordination with both other government agencies and commercial partners was integral to their effective operation. This coordination involved several other government agencies, including science and technology (S&T) partners from whom technology was inherited, Navy on current platform interoperability concerns, and with Cost Assessment and Program Evaluation (CAPE) in particular when it involved budgeting. This unusually high level of coordination was characterized in short as an "unbelievably close and integrated relationship with the S&T community: Air Force Research Laboratory (AFRL), DARPA, SCO, [and] all those people have unlimited access to this location."[19]

> We're coordinating very closely to the Navy. In fact, they are actually co-located with us here inside this facility in some of our development activity… We have AFCA integrated in here as well as CAPE and so we leverage a lot of their power and expertise, while we have our own estimating team, and they work together in outcomes.[20]

> We have our own cost estimators in our office, and then sitting in queues just on the other side of the door are Air Force cost estimators who have full access to any of our meetings and stay up to date on program information. And then those cost estimators have direct relationships with the CAPE cost estimators. CAPE is very professional and ask what meetings they can attend, when is the right time to dive deep into the program and work with us.[21]

Interview subjects also spoke about the extra effort needed to ensure multiple collaborating agencies were on the same page in areas that were deemed imperative for joint platform and software development. To that end, Air Force was cognizant that they had to carefully develop common standards in areas like communication links and autonomy architecture that would ensure functional integrated technology even if the PPBE process "separated" the various agencies. Although interoperability concerns are undoubtedly not driven solely by budgeting processes, the PPBE process appeared to be an extra factor that had to be considered in strategic planning.

> It's not hard to work with Navy. The problem is once we make our [joint] decisions regarding development activities and decisions as they relate to capability development, they go off and do their budget, we go off and do our budget. If I rate CCA as my #1 priority and they rate it as their #30 priority, obviously that doesn't line up and it's not gonna make the cut on the Navy side, and it will make the cut on the Air Force side… We wanna work together to set up an acquisition strategy that allows them to bring in their funding and to bring in our funding, to work together to get to ultimately a better product. The current process introduces a lot of uncertainty and risk if one of those budget lines doesn't get funded. It actually affects the overall outcomes for both services.[22]

The Air Force anticipates a relatively large contractor base of at least thirty-five companies for CCA-related work, and the department is similarly expending much effort to coordinate vendor relations. Interview subjects talked about various ways in which they have actively tried to responsibly involve vendors in the development process while maintaining executive control and reinforcing competition. For instance:

> One of the things we looked at when we stood up the Agile Development Office was basically dissecting the business case and getting between the primes and the key suppliers and preventing preferred business relationships that would steer the outcome from a capability perspective. And trust me, it was a tremendous multiyear challenge on how we did that. We actually dissected that business case, and we bring in the suppliers and everyone else to help steer the outcome from a capability perspective. Now we've inserted ourselves essentially between primes and suppliers, and we have an independent relationship with the suppliers as well as the primes, even though the primes remain the integrating contractors.[23]

> Big picture it put us in the driver seat to make sure that we have competition throughout the life cycle of a weapon system. So, when the prime contractors or integrators come to us with a weapon system solution, we have enough people that are competitive, that they're not just gonna go to preferred vendors for the key technologies that come within that weapons system.[24]

**Close coordination with government partners and contractors**

The interview subjects spoke about significant coordination efforts with both other departments, especially Navy and CAPE, to develop CCA capabilities. While they acknowledged the difficulties of aligning priorities of multiple stakeholders, they felt this effort was worthwhile.

> We let CAPE go everywhere with us, we give them full access to our vendors. We will bring them to all the major vendors who will tell their story to the CAPE analysts, show them their basis for estimates and any new manufacturing technologies or engineering methodologies that they're using. It gets really exciting when the corporations bring in their cost estimators and we get to sit and watch graduate-level cost estimating methodology and debates. All that leads to a sense of partnership with CAPE and active relationships and better products.

The interview subjects also spoke similarly about the benefits and challenges of involving a large contractor base of 35+ vendors, as exemplified by the following:

> We need industry to be more informed on the progress of what you're doing, the timeline you're executing on, and have the infrastructure for those vendors to be able to contribute when opportunities come. We can't overstate how much effort this office puts into preparing that industry base and managing that we keep our contractor base of 35 vendors informed on progress. But the return on investment is huge because now you feel the momentum of all of industry going after this problem of fielding capability, not just a single platform.

*Source: U.S. Air Force Fighters and Advanced Aircraft Directorate, Interview Subject #3*

**Figure 2.2. CCA Key Finding #1 - Interview Vignette**

### *2.2.2 PPBE OUTCOMES SOMETIMES CONFLICT WITH AIR FORCE STRATEGY*

Several of the interview subjects expressed doubt that the PPBE process was simply an apolitical means for allocating resources, and instead felt that "Congress uses the PPBE process to try to force us to behave in a certain way."[25] One interview subject provided an example where Secretary Kendall and others had at one point tried to consolidate S&T program elements and they were "immediately shut down for one reason and one reason only: it would take away their [Congress's] control."[26] As he further described it,

> I think we're going at trying to solve the process when reality is we're not really trying to solve the problem. And what I mean by that is, is we think PPBE is a process by which we get funding into programs to be able to execute and deliver capability to warfighters. I think that is a completely false pretense. Simply what PPBE process is turned out to be is a tool for Congress to manage the services and the programs so that they can maintain ultimate control.... Everything we do has to be done in such a way that Congress feels like they still maintain ultimate control to steer outcomes.[27]

Furthermore, this interview subject offered another example of how the PPBE process as effected by Congress would sometimes deviate from Air Force's desired strategy:

> As an example, Congress has a great interest in what the Air Force is doing with 4th Generation assets. The Air Force decided that it didn't want to spend a lot of money on 4th Generation capability development and backed away from the program. So, we offered a lot of money up in the omnibus to reallocate those funds somewhere else in the Air Force. Congress came back and denied the source because they want us to go fund 4th Gen and electronic warfare (EW) capability. They use the PPBE process to force us down a path where we don't think strategically we should be going. And then it does have second, third order effects of programs like CCA and NGAD because we're forced to try to figure out how we make it work at the portfolio level.[28]

The importance of regular communication with Congress was also identified as instrumental for successfully using a technology transition process to build the CCA program rather than declaring it a new start. For instance, in response to a question of whether Air Force had received pushback from Congress on using a technology transfer, the response was:

> Zero comments or questions in formal reports or informal discussions during our quarterly engagements. We telegraph to Congress what we're doing, when we're doing it, how we're doing it, and why I'm doing it. I think those are key things, using the tools we have while at the same time messaging what we're gonna do, was critically important.[29]

**PPBE outcomes sometimes conflict with Air Force strategy**

Interview subjects were careful to acknowledge that while Congressional oversight in the PPBE process can be an issue for strategy developments, it was ultimately their responsibility to navigate it to ensure the success of their program.

> So, the question is, 'What are the things we can do to make sure they [Congress] maintains the level of control they want while at the same time we're showing them how we're going to be in a better position to deliver capability faster?' I think it's just an awareness that we need to meet Congress's interests.

*Source: U.S. Air Force Fighters and Advanced Aircraft Directorate, Interview Subject #1*

**Figure 2.3. CCA Key Finding #2 - Interview Vignette**

### 2.2.3 FLEXIBLE BUDGET STRUCTURE HELPS

Interview subjects spoke about the importance of budget structure and how embedding the CCA project within the same program element as the larger NGAD initiative enabled flexibility with monies. As one interview subject noted, "This was done so I have maximum flexibility across the two lines and he [colleague] will come to me and say, 'Hey, I need to shift money here or shift money there' and then we can do it."[30] In a similar vein, concern was expressed by at least one interview subject for the fact that EOU and VENOM are in a separate program element because they are specifically designed to support the larger CCA effort that is "moving out like a freight train."[31] These comments highlighted the interrelated nature of the different lines of effort and how they could not be separated from one another on an operational level even if the PPBE process could potentially treat them as isolated projects.

Two other topics related to the PPBE process and Air Force operations also arose in conversation and are worth noting. Reprogramming thresholds were addressed within the larger conversation of how Congress was perceived to utilize the PPBE process for their own purposes:

> Some of the discussion about the ATR [above threshold reprogramming] and BTR [below threshold reprogramming] processes needs to be revisited. You can still give Congress control, but at the same time, give us a little more flexibility and agility because then I can actually focus on capability delivery versus focus on all the administrative tasks I have to do for anything over $10 million. It's just… that is insane. I mean, it is control at the lowest level. So, we do a lot here and we do it well. We could do more and we could do it faster, but we are limited by that process that we have.[32]

Finally, the consistently evolving nature of the overall program and the potential difficulty of cost estimating new technology within a highly structured budgeting process was briefly mentioned:

> While Venom is a new project, we have a very solid foundation from an estimating standpoint on the F-16 fleet and the aerial target fleet. So while it was a new program, it's not the same complexity of estimating a brand new CCA-type program. We got to a very good place with both EOU and VENOM and we understood what we didn't know at the time. We understood what trades we may have to make to live within the cost estimate that we have. If you let everything shake out and try and get a perfect answer all the time, then you will never field a capability, and that's only reason we have jobs.[33]

### 2.2.4 LEADERSHIP PRIORITIZATION IS IMPORTANT

Leadership prioritization was identified as a critical factor in successfully navigating potential budgeting and political issues:

> CCA, is a little bit of a red herring in this conversation because, frankly, it's Frank Kendall's number one priority coming out of the Operational Imperatives. I think we were the only program that got fully funded as part of the process, so that made it a little easier… So, you give us the flexibility and you give us the access to leadership… we can do things pretty quickly.[34]

> It takes both things. Having priority access at the top level, and then the brute force at all levels: Air Force staff level, CAPE level, comptroller level, on the Hill… to be able to execute effectively within the PPBE process.[35]

## 2.3 APPENDIX A. HERITAGE OF PROGRAM

| Fiscal Year | Project | Program Element | Budget Activity |
|---|---|---|---|
| 2024 | 647123: Collaborative Combat Aircraft (CCA)* | PE 0207110F / Next Generation Air Dominance* | BA 4 |
| | 643721: Experimental Operations Unit (EOU) | PE 0207179F / Autonomous Collaborative Platforms | BA 4 |
| | 645340: Viper Experimentation and Next-gen Operations Model (VENOM) | | |
| 2023 | 647123: Autonomous Collaborative Technologies** | PE 0207179F / Autonomous Collaborative Platforms** | BA 4 |
| 2022 - 2021 | 630320: Air Force Vanguards*** | PE 0603032F / Future AF Integrated Technology Demos | BA 3 |

**Figure 2.4. Heritage of Collaborative Combat Aircraft (CCA)**

Source: Department of Defense Budget Estimates, Air Force Justification Books: Research, Development, Test & Evaluation, Fiscal Year 2021 through 2024.

Notes. Green highlight represents a new start; Orange highlight represents a realignment of funding; BA 3 = BA 3: Advanced Technology Development (ATD); BA 4 = BA 4: Advanced Component Development & Prototypes (ACD&P).

* Project retitled from "647123: Autonomous Collaborative Technologies", and program element transferred from "0207179F / Autonomous Collaborative Platforms".[36]

** "The Autonomous Collaborative Platform program element (0207179F) is new for FY2023.... Funds requested for PE 0207179F, project 647123 in FY23 are an administrative realignment only and do not constitute a new start".[37]

*** In FY 2021, realignment and consolidation of Skyborg Vanguard activities and funding from preexisting projects: (1) PE 0603456F / Human Effectiveness Advanced Technology Development, Project 635327: Warfighter Interfaces; (2) PE 0603211F / Aerospace Technology Dev/Demo, Project 634920: Flight Vehicle Tech Integration; (3) PE 0603211F / Aerospace Technology Dev/Demo, Project 634927: Aerospace Power & Flight Control Integ & Demo; and (4) PE 0603216F / Aerospace Propulsion and Power Technology, Project 634921: Aircraft Propulsion Subsystems Int.[38]

## 2.4 APPENDIX B. BUDGET HISTORY

**Table 2.1: FY 2024 Budget Request, 647123: Collaborative Combat Aircraft (CCA), 643721: Experimental Operations Unit (EOU), and 645340: Viper Experimentation and Next-gen Operations Model (VENOM)**

| Item | Funding Category | Request ($M) FY 2022 | FY 2023 | FY 2024 | FY 2025 | FY 2026 | FY 2027 | FY 2028 | Total Cost |
|---|---|---|---|---|---|---|---|---|---|
| 647123: Collaborative Combat Aircraft (CCA) | RDT&E | $0.000 | $0.000 | $392.210 | $513.752 | $245.967 | $1,643.635 | $3,032.756 | Continuing |
| 643721: Experimental Operations Unit (EOU) | RDT&E | $0.000 | $0.000 | $68.956 | $44.461 | $55.534 | $56.548 | $57.723 | Continuing |
| 645340: Viper Experimentation and Next-gen Operations Model (VENOM) | RDT&E | $0.000 | $0.000 | $49.870 | $16.994 | $17.588 | $17.863 | $18.666 | Continuing |

Source: Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Air Force Justification Book Volume 2 of 4: Research, Development, Test & Evaluation, Air Force, March 2023, p. 415, 427.

Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

**Table 2.2: FY 2024 Program Change Summary, PE 0207110F / Next Generation Air Dominance**

| | FY 2022 | FY 2023 | FY 2024 Base* |
|---|---|---|---|
| Previous President's Budget | $1,524.667 | $1,657.733 | $1,655.166 |
| Current President's Budget | $1,452.934 | $1,657.635 | $2,326.128 |
| Total Adjustments | ($71.733) | ($0.098) | $670.962 |
| - Congressional General Reductions | $0.000 | ($0.098) | - |
| - Reprogrammings | ($17.800) | $0.000 | - |
| - SBIR/STTR Transfer | ($53.933) | $0.000 | - |
| - Other Adjustments | $0.000 | $0.000 | $670.962 |

**Change Summary Explanation**

In FY 2024, PE 0207179F, Project 647123 "Autonomous Collaborative Technologies" was retitled to "Collaborative Combat Aircraft" and transferred from PE 0207179F "Autonomous Collaborative Platforms" to PE 0207110F "Next Generation Air Dominance" in the amount of $392.210.

Source: Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Air Force Justification Book Volume 2 of 4: Research, Development, Test & Evaluation, Air Force, March 2023, p. 416.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

*Amounts shown are a combination of two projects contained in the Program Element: 646007: AS 2030 Air Dominance Technologies (ADT) and 647123: Collaborative Combat Aircraft (CCA).

**Table 2.3: FY 2024 Program Change Summary, PE 0207179F / Autonomous Collaborative Platforms**

| | FY 2022 | FY 2023* | FY 2024 Base^ |
|---|---|---|---|
| Previous President's Budget | $0.000 | $51.747 | $51.895 |
| Current President's Budget | $0.000 | $51.747 | $118.826 |
| Total Adjustments | $0.000 | $0.000 | $66.931 |
| - Other Adjustments | $0.000 | $0.000 | $66.931 |

**Change Summary Explanation**

Funding increased due to two new BPAC's added to this PE (0207179F).

Source: Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Air Force Justification Book Volume 2 of 4: Research, Development, Test & Evaluation, Air Force, March 2023, p. 428.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

*Amount shown is only 647123: Autonomous Collaborative Technologies because it realigned to PE 0207179F in FY 2023.

^ Amount shown is only 643721: Experimental Operations Unit (EOU) and 645340: Viper Experimentation and Next-gen Operations Model (VENOM) because they are new starts in FY 2024 and because 647123: Autonomous Collaborative Technologies transferred to PE 0207110F / Next Generation Air Dominance in FY 2024.

**Table 2.4: FY 2023 Budget Request, 647123: Autonomous Collaborative Technologies**

| | | Request ($M) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Item | Funding Category | FY 2021 | FY 2022 | FY 2023 | FY 2024 | FY 2025 | FY 2026 | FY 2027 | Total Cost |
| 647123: Autonomous Collaborative Technologies | RDT&E | $0.000 | $0.000 | $51.747 | $51.895 | $0.000 | $0.000 | $0.000 | $103.642 |

Source: Department of Defense Fiscal Year (FY) 2023 Budget Estimates, Air Force Justification Book Volume 2 of 4: Research, Development, Test & Evaluation, Air Force - Vol-2, April 2022, p. 365.

Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

**Table 2.5: FY 2023 Program Change Summary, PE 0207179F / Autonomous Collaborative Platforms**

| | FY 2021 | FY 2022 | FY 2023 Base |
|---|---|---|---|
| Previous President's Budget | $0.000 | $0.000 | $0.000 |
| Current President's Budget | $0.000 | $0.000 | $51.747 |
| Total Adjustments | $0.000 | $0.000 | $51.747 |
| - Other Adjustments | $0.000 | $0.000 | $51.747 |

**Change Summary Explanation**

The Autonomous Collaborative Platform program element (0207179F) is new for FY2023. Program element 0207179F, project 647123 is a continuation of previous work accomplished under the Skyborg Vanguard Program. The creation of this program element represents the transition of the Skyborg Vanguard Program from Advanced Technology Development (BA: 03) to Advanced Component Development and Prototypes (BA: 04). Funds requested for PE 0207179F, project 647123 in FY23 are an administrative realignment only and do not constitute a new start.

Source: Department of Defense Fiscal Year (FY) 2023 Budget Estimates, Air Force Justification Book Volume 2 of 4: Research, Development, Test & Evaluation, Air Force - Vol-2, April 2022, p. 366.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

**Table 2.6: FY 2022 Budget Request, 630320: Air Force Vanguards**

| Item | Funding Category | Request ($M) FY 2020 | FY 2021 | FY 2022 | FY 2023 | FY 2024 | FY 2025 | FY 2026 | Total Cost |
|---|---|---|---|---|---|---|---|---|---|
| 630320: Air Force Vanguards | RDT&E | $0.000 | $147.350 | $131.643 | - | - | - | - | - |

Source: Department of Defense Fiscal Year (FY) 2022 Budget Estimates, Air Force Justification Book Volume 1 of 3: Research, Development, Test & Evaluation, Air Force - Vol-1, May 2021, p. 211.

Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

**Table 2.7: FY 2022 Program Change Summary, PE 0603032F / Future AF Integrated Technology Demos**

| | FY 2020 | FY 2021 | FY 2022 Base |
|---|---|---|---|
| Previous President's Budget | $0.000 | $157.619 | $87.812 |
| Current President's Budget | $0.000 | $147.350 | $131.643 |
| Total Adjustments | $0.000 | ($10.269) | $43.831 |
| - Congressional Directed Reductions | $0.000 | ($10.269) | - |
| - Other Adjustments | $0.000 | $0.000 | $43.831 |

**Change Summary Explanation**

FY2021 decrease of 10.269 million Congressional Directed Reduction due to Unjustified request-Future Transformational Capabilities in the amount of 10.000 million and Undistributed Mark in the amount of 0.269 million.

FY2022 increase of 36.528 million to fund Rocket Cargo and provide additional support to the Skyborg and Navigation Technology Satellite 3 (NTS-3) efforts.

Source: Department of Defense Fiscal Year (FY) 2022 Budget Estimates, Air Force Justification Book Volume 1 of 3: Research, Development, Test & Evaluation, Air Force - Vol-1, May 2021, p. 212.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

**Table 2.8: FY 2021 Budget Request, 630320: Air Force Vanguards**

| Item | Funding Category | Request ($M) FY 2019 | FY 2020 | FY 2021 | FY 2022 | FY 2023 | FY 2024 | FY 2025 | Total Cost |
|---|---|---|---|---|---|---|---|---|---|
| 630320: Air Force Vanguards | RDT&E | $0.000 | $0.000 | $157.619 | $87.812 | $59.427 | $30.219 | $28.796 | Continuing |

Source: Department of Defense Fiscal Year (FY) 2021 Budget Estimates, Air Force Justification Book Volume 1 of 3: Research, Development, Test & Evaluation, Air Force - Vol-1, February 2020, p. 257.

Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

**Table 2.9: FY 2021 Program Change Summary, PE 0603032F / Future AF Integrated Technology Demos**

| | FY 2019 | FY 2020 | FY 2021 Base |
|---|---|---|---|
| Previous President's Budget | $0.000 | $0.000 | $0.000 |
| Current President's Budget | $0.000 | $0.000 | $157.619 |
| Total Adjustments | $0.000 | $0.000 | $157.619 |
| - Other Adjustments | $0.000 | $0.000 | $157.619 |

**Change Summary Explanation**

Increase in FY 2021 of $157.619 million is due the following:

1) Realignment and consolidation of Skyborg Vanguard activities and funding from PE 0603456F, Human Effectiveness Advanced Technology Development, Project 635327, Warfighter Interfaces; PE 0603211F, Aerospace Technology Dev/Demo, Project 634920, Flight Vehicle Tech Integration; PE 0603211F, Aerospace Technology Dev/Demo, Project 634927, Aerospace Power & Flight Control Integ & Demo; and PE 0603216F, Aerospace Propulsion and Power Technology, Project 634921, Aircraft Propulsion Subsystems Int.
2) Realignment and consolidation of Golden Horde activities and funding from PE 0603601F, Conventional Weapons Technology, Project 63670B, Weapon Concept Development.
3) Realignment and consolidation of Navigation Technology Satellite 3 activities and funding from PE 0603270F, Electronic Combat Technology, Project 63431G, RF Warning & Countermeasures Tech, and PE 0603401F, Advanced Spacecraft Technology, Project 633834, Integrated Space Technology Demonstrations.
4) Realignment of Future Transformational Capabilities funding from across the various Air Force S&T RDT&E Advanced Technology Development programs. These transfers in FY 2021 are part of the Air Force RDT&E BA 03 PE consolidation in order to realign technology areas to better support the National Defense Strategy, Air Force Future Operating Concept, and the Air Force S&T Strategy, April 2019.

Source: Department of Defense Fiscal Year (FY) 2021 Budget Estimates, Air Force Justification Book Volume 1 of 3: Research, Development, Test & Evaluation, Air Force - Vol-1, February 2020, p. 258.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

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# CASE STUDY 3: ARMY ROBOTIC COMBAT VEHICLE (RCV)

## 3.0 EXECUTIVE SUMMARY

The following case study was designed to provide insight into the potential impact of the PPBE process on technology transition. This case study focuses on the RCV program of U.S. Army Program Executive Office Ground Combat Systems.

Army RCV is a unique program in several ways and therefore ideal for highlighting potential areas of concern concerning technology transition in the PPBE process. All its lines of effort (SP, FSP, SWP) are contained in one project, itself contained in a single program element, making it as consolidated as possible from a budgeting perspective. Interview subjects felt that this budgeting strategy facilitated a significant shift in strategy (Light, Medium, and Heavy variants to a common chassis) within the PPBE process. Interview subjects also felt that having all lines of effort in a single program element generally allows for a more agile response to technology development and evolving knowledge. For instance, the program has progressed in a non-linear fashion, having reached Budget Activity 5 status (Development & Demonstration: SDD) in an earlier stage before regressing to Budget Activity 4 status (Advanced Component Development and Prototypes: ACD&P) and then returning to its now current Budget Activity 5 status, all presumably based on experimentation results and not budgeting concerns. Interview subjects spoke about how the PPBE process is not optimal but also not a great hindrance to operations and strategy, how more frequent interactions with Congress are desired, and how a different mindset is required for handling developmental programs. The key findings of the case are outlined in Figure 3.1.

**Key Findings**

1. PPBE processes are not optimal, but also not a significant hurdle to operations or strategy.
2. More frequent interactions with Congressional staff would help to communicate evolving program status and associated budget.
3. There is a need for flexibility in PPBE process to address agile acquisition.
4. Having all lines of effort in a single program element is helpful.

**Figure 3.1. RCV Case Study Key Findings**

The following case study contains a history of the program, budget overview, images, and most importantly key findings from interviews with knowledgeable personnel on their experiences navigating the PPBE process. The findings appear to align with several key areas identified in the Commission on PPBE Reform's Interim Report, including 1) Improve PPBE-related relationships between DoD and Congress, 2) Promote innovation and adaptability, and 3) Improve alignment of budgets to strategy.[1]

## 3.1 PROGRAM OVERVIEW

RCV is a U.S. Army program for developing a set of autonomous and semiautonomous vehicle platforms to provide a range of capabilities on the battlefield.[2] The program is alternatively referred to in the FY 2024 Budget Request Overview as the Remote Combat Vehicle program.[3] The purpose of the RCV development program as described in the FY 2024 Army budget justification book is to "produce unmanned ground combat vehicle prototypes… [to] integrate and secure advanced autonomy and artificial intelligence algorithms, and inform follow-on production and fielding decisions."[4] Regarding autonomy efforts, the Robotic Combat Vehicles (RCVS) website further notes that "RCVs will offer the options of mission-dictated control and handoff between equipped mounted and dismounted control stations."[5] According to the *Army's Robotic Combat Vehicle Campaign Plan, January 16, 2019*, referenced in a 2023 Congressional Research Service report, Army originally planned to develop three RCV variants: Light, Medium, and Heavy (RCV-L, RCV-M, RCV-H).[6] However, as reported in a Congressional Research Service report, the Assistant Secretary of the Army for Acquisitions, Logistics, and Technology (ASA[ALT]) has recently stated that Army plans to focus on RCV-L development and will defer RCV-M development for the near future.[7]

Army Future Command (AFC) and modernization efforts are guided by the U.S. Army Modernization Strategy, outlined in the 2018 U.S. Army Modernization Strategy Report to Congress in support of the National Defense Strategy.[8] Two previous attempts at modernizing the fleet, the Future Combat Systems program (2000-2009) and the Ground Combat Vehicle program (2010-2014) did not produce working vehicles and were eventually cancelled.[9] The current strategy, further detailed in the 2019 Army Modernization Strategy, outlines six Army modernization priorities, one of which is Next Generation Combat Vehicles (NGCV), of which RCV is one of four signature efforts.[10] Between FY 2020 and FY 2022, Army cancelled funding for 105 procurement programs and reduced funding for 169 additional programs (totaling $23.9 billion), allowing it to internally realign its Research, Development, Test, and Evaluation (RDT&E) and procurement funding towards modernization priorities.[11]

The RCV program is being developed as part of the Next Generation Combat Vehicles (NGCV) family of vehicles meant to replace and extend the existing fleet of ground combat vehicles.[12] According to one of the interview subjects, the RCV project migrated from the Experimentation Army Futures Command Ground Vehicle Systems Center (GVSC) to Program Executive Office Ground Combat Systems as Title 10 authority in mid to late 2022.[13] The RCV effort is included in Budget Activity 5, Development & Demonstration (SDD) and involves three major lines of effort: an RCV(L) MTA Rapid Prototyping program, itself divided into two lines of effort: Surrogate Prototypes: SP and Full System Prototypes: FSP, and a Software Acquisition Pathway (SWP) program.[14] The SP line of effort focuses on further developing prototypes similar to ones used in previous experimentation for gaining soldier feedback, whereas the FSP effort is aimed at developing a long-run prototype that will be used as a model for eventual production.[15] The SWP line of effort will initially rely on autonomous software developed in-house by Ground Vehicle System Center called the Robotic Technology Kernel (RTK), which will be used in the minimum viable capability release.[16] Thereafter a government- contractor hybrid development approach will be used "to mature, integrate, and secure software capabilities from the science and technology base."[17] A key feature of the RCV program is that the three lines of effort are contained within a single project and single program element, making it as consolidated as possible from a budgeting perspective.

According to a GAO report on NGCVs, Army initially relied on two competitively-awarded consortium-based other transaction agreements (OTAs) to "conduct experiments to determine the availability and maturity of technologies and the validity of operating concepts."[18] Subsequently, in 2020, Army awarded additional consortium-based OTAs to two contractors, QinetiQ North America (Virginia-main headquarters in the United Kingdom) and Textron (Rhode Island), to build four RCV-Ls and four RCV-Ms, respectively.[19] On March 29, 2023, Army released a Request for Prototype Proposal that could select up to four contractors (originally five contractors) for the Full System Prototypes effort. In September 2023, four companies were selected to deliver a prototype by August 2024: McQ, Textron Systems, General Dynamics Land Systems, and Oshkosh Defense.[20,21] It is envisioned that the four vendors initially participating will be down selected to a single vendor in Q1 2025 for continued development and eventual FSP builds.[22] The winner will deliver up to nine prototypes the following year, and a production decision is slated for FY 2027 with fielding of the first unit set for FY 2028.[23]

## 3.2 IMPACT OF PPBE ON RCV: KEY FINDINGS AND INTERVIEW VIGNETTES

Interviews were conducted with three personnel from U.S. Army Program Executive Office Ground Combat Systems. In advance of the discussion, interview subjects were provided with questions prepared by the GMU research team. The questions were designed to guide discussions and assess the potential impact of PPBE on the RCV program. The interviews abided by the Chatham House Rule whereby all identities of the interview participants and information during the interview are to remain unidentified.

### *3.2.1 PPBE PROCESS NOT OPTIMAL BUT NOT A HINDRANCE*

Two of the interview subjects (the ones with greater overall experience), felt that there was not a strong relationship between PPBE and how the RCV program had evolved over time. Both stressed in various ways that program requirements and the results of experimentation, not budgeting concerns, were the core driving force behind strategic and funding decisions. As one subject described it, it was "experimentation coming to reality."[24] To that end, neither felt that any important decisions had been made strictly because of the PPBE process:

> Personally, I don't think there's a strong relationship there. Like, PPBE did not impact the decision to focus on a common platform. It was the second phase, what we call soldier operational experiment phase two, that was completed about a year ago and from that came the recommendation to shift the strategy for RCV.[25]

Perhaps the strongest evidence that PPBE did not directly hinder the RCV program is how the program office has been able to execute a core strategic decision to shift focus away from developing specific variants (Light, Medium, Heavy) in favor of developing a common (light) chassis that will be later configured for medium and heavy variants. Soldier operational experiment phase II completed about a year prior to the interview led to the recommendation to shift RCV strategy toward developing a common chassis with lighter armament (the RCV-L) with the idea of leveraging that design for heavier payloads and advanced capabilities in the future (presumably RCV-M). The interview subjects were clear that the decision was prompted by experiment results and that PPBE had not interfered with their ability to shift strategic focus.

> The feedback from the experimentation, that's probably the most significant piece, combined with it being an investment decision on maturing a capability before expanding on it. I think that is more what's driven it rather than, you know, we didn't have enough money, or we were concerned about being able to justify requests.[26]

> When you looked at it holistically, and we saw the gap between the light and the medium, it related back to requirements and not necessarily to budgeting at all. When the requirements community changed and we transitioned to a common platform, because we kept separate lines of effort in the totality of just an RCV program [single budget line], it allowed us that flexible space to not delineate between an 'L' and an 'M' and instead focus on the common chassis-type platform, like in our recent public solicitation. So, it's not that we didn't want to look at it [RCV- M] or that PPBE hindered us from exploring it, it's just the investment at the time and the capabilities that go back to the requirements didn't really warrant it given where the Army wanted to go. Personally, I don't see an issue with it [PPBE] at all.[27]

Another feature of the RCV program that makes it unique is that it has changed budget activity statuses twice in recent years, reaching BA5 status in FY 2023. Both interview subjects again noted that this was driven almost entirely by the natural level of development of the product.

> I don't think it was that difficult of a thing. Some of this was a little bit before my time on some of those activities, but I got to see the transition from [Budget Activity] four to five and I don't think the PPBE process hindered us at all.[28]

> It got to a point where the learning has not necessarily stopped, but the capabilities of most of our industry partners have reached a point where it is able to start transitioning to post-milestone-B-type behavior.... all of it is transition-able technology that we can actually execute to produce prototypes and field. The valley of death is kind of over, in a sense, where we can actually produce and start putting kit into the soldier's hands.[29]

The second interview subject confirmed that the earlier transition from BA5 to BA4 status was also driven by the product development itself, not anything having to do with planning or budgeting.

> [Sometimes] things are ready from the commercial industry that may not necessarily be ready for military application. Everyone initially believed that it was ready to go. But when you apply it to military mission profiles and the additional scope where you need to have it employed in certain contexts, the robots did not meet that portfolio or that capability. So, when it regressed [went back to BA4 status], it went back to essentially the drawing board to apply military acumen. Senior leaders thought and everyone who demonstrated it thought that it was a capability that was there, but when it was applied to military mission profiles, it was not robust, not rugged enough, did not meet a lot of our military standards, so it went back to experimentation. And then obviously now it's gotten back to the point where it actually has the applicability for someone to take it back over and get out of the experimentation.[30]

The single criticism expressed by one of these two interview subjects is that PPBE possibly delayed prototyping a bit, but he noted the delay was not significantly and that good lessons were learned. The added time allowed them to get more information out of experimentation to make larger investment decisions, even if overall it was probably not optimal. The interview subjects highlighted that their true challenge was not with the PPBE process itself, but how to best communicate program plans and relate them to resourcing requirements.

> It's been a challenge to be able to clearly justify those budgets, and we do our best to do that in the budget books. We first say what program it is, then describe the activity, and describe the intent of the request at large... that's just our efforts to try to maintain a degree of clarity.[31]

The third interview subject was harsher in his critique of the PPBE process, even though he was newer on the scene compared to the first two interview subjects:

> I don't understand why PPBE is the way it is, and there's probably a lot of good reasons for the structure in the way that you go about it, but I don't know all those. From my point of view, I think it's archaic. I think it's really challenging to get things done in a fast-paced innovation-based world and I don't think it adapts well to emerging needs.[32]

Although he acknowledged that it was a deliberate, structured approach and appreciated the insights it presumably provided the top-level leadership (e.g., identifying priorities), he found it to be "out of touch with reality in terms of how funds are executed, how emerging needs present themselves, and how we adapt to them".[33] He went on further to explain:

> I couldn't have foreseen two years ago[1] what I need to deal with today, either because it came up through a soldier touch point or experimentation, or, you know, a new technology emerged, or the Army changes perspective or its approach to some new revolutionary technology, a change in strategy.[34]

Despite these criticisms, the third interview subject was still complimentary of the PPBE process for inadvertently prompting higher level resource thinking and strategizing that led to working towards a common chassis rather than RCV-L and RCV-M variants.

> The good news is that we are learning so much. We would be so dumb to try to do two of these programs at the same time. We'd learn the same lessons, would probably fail at both… the best thing we can do is start with the RCV light because it's an easier problem set. We will figure out all the pitfalls, the ways we're gonna fail, and fail, and then hopefully the next program that we do, whether it's RCV medium or something else, it can be better.[35]

**PPBE process not optimal but not a hindrance**

The two more experienced interview subjects concurred that while the PPBE process is not an optimal one, it has not been a great hindrance to RCV program operations and strategy. They reiterated this at several points in their respective interviews while addressing several facets of technology transition, including strategy development, experimentation results, and moving between budget activities. For example:

> When the requirements community changed and we transitioned to a common platform, because we kept separate lines of effort in the totality of just an RCV program [single budget line], it allowed us that flexible space to not delineate between an 'L' and an 'M' and instead focus on the common chassis-type platform, like in our recent public solicitation…. Personally, I don't see an issue with it [PPBE] at all.

*Source: U.S. Army Ground Combat Systems, Interview Subject #2*

**Figure 3.2. RCV Key Finding #1 - Interview Vignette**

[1] The Interim Report of the Commission on Planning, Programming, Budgeting, and Execution Reform identifies the PPBE process as "a rigorous competitive process that takes place more than two years in advance of expenditures" (p. 26).

### *3.2.2 MORE FREQUENT INTERACTIONS WITH CONGRESS*

A key observation made by the senior interview subjects was that while the PPBE process has had a limited negative impact on RCV development, it is still not an optimal process for a rapidly evolving program. Their main desire was for more frequent interaction with Hill staffers to enable the program officers to provide updated context for the evolving project strategy and to explain any rapidly changing requirements. All three interview subjects expressed this desire:

> More frequent and close engagement with professional staffers on those budgets, and maybe a little more training on our end, then we probably could have better articulated the strategy, particularly as it was evolving… that could have probably led to better results overall.[36]

> The level of interaction that we have with the staffers on the Hill is not enough to be able to support this. We have this conversation all the time. We don't do a good enough job within the Army of updating staffers or Congress on our current program activities or statuses…. Two, we don't have the ability to go back to them continuously to update them, nor do they inquire unless something's wrong.[37]

Interview subjects noted that significant changes can occur in the nine months between submission of budget exhibits and staff briefings (typically February or March each year) and the budget being passed into law (typically the following December). One interview subject characterized this as acquisition professionals getting only "get one bite at the apple every year" to deliver their message in March without any meaningful reengagement with Hill staffers thereafter.[38]

> I think with technology programs like the software program for RCV, there is always a possibility that program plans evolve and it creates a gap between the plan and the [acquisition] authorities that we have with our existing funds and thus creates delays. I think it is more risk than a normal program on this one.[39]

> I could have made leaps and bounds with changes in the program, but I'm marked from 6-8 months ago. I should have an ability to go back to the staffers and say, 'Hey, you know, you marked me for ahead of need, well things have changed.' I'm ready to execute, but now that I'm cut, I can't award the contract. I can't do below threshold reprogramming. I can't do above threshold reprogram because of that mark. I should have the ability to access those personnel. The mark stands, that money's gone at the beginning of fiscal year when it's signed. But if the Army is willing to invest and the program is back on track, we should have that ability to go back to staffers. I can't tell you how much it takes to move mountains to actually engage at a two-star level from a PM perspective.[40]

Along with having the opportunity to provide more timely updates and budget justifications, the second interview subject mentioned that another benefit of greater interaction would be to educate Hill staffers on certain nuances of contracting. He felt that there was sometimes a lack of understanding on the part of staffers regarding how acquisition authorities work in practice. At the end of his conversation, he provided an example of how OTAs can go from zero to one hundred percent obligated in a single day, but that there was sometimes a perception on the Hill of program under-execution if the zero-balance remained too long. He also noted certain timing issues with having inherited the RCV program mid-year and getting penalized for under-execution even though a budget had not been laid out in advance of the transition. As he noted in his concluding remarks, "We need to have more than once-a-year engagement with Congress to update them and have a means to do that."[41]

The issue of having budgets marked for not spending enough was also highlighted in an interview conducted with one of the contractors for the program. He mentioned several times the difficulty of dealing with continuing resolutions, especially in the context of new starts, and suggested that having a three-year approved budget would help negate some of the negative effects of continuing resolutions. From his viewpoint, he had also witnessed the dual "penalty" incurred by continuing resolutions, namely the program receiving money late and then being penalized for not executing obligations fast enough.[42]

**More frequent interactions with Congress**

All three interview subjects made the same suggestion for more frequent communication, not only with Congress but also internally within Army. One interview subject stated that he suspected others in the Pentagon did not have the full story of what the program is accomplishing because the RCV program staff have not been able to message their success well enough.

> If my own bosses don't know what we're doing, all the successes we've had, and all the work that we're putting into this and how we're moving the ball forward, then I'm certain Congress doesn't. So, I don't know how we expect to get support if they [Hill staffers] don't know what we're doing. And if we don't communicate or find a way to communicate when requirements change, what we're going after clearly and concisely, then I think we're just shooting ourselves in the foot in terms of trying to get support from the people who enable us to do our mission.
>
> *Source: U.S. Army Ground Combat Systems, Interview Subject #3*

**Figure 3.3. RCV Key Finding #2 - Interview Vignette**

### *3.2.3 NEED FOR FLEXIBILITY IN PPBE PROCESS*

Interview subjects highlighted the need for greater flexibility in the PPBE process to address agile acquisition, specifically when dealing with iterative requirements and different colors of money. As mentioned earlier, Army shifted strategic focus from producing specific RCV variants (Light, Medium, Heavy) to instead developing a common chassis that meets near-term needs with an eye towards the future. While the interview subjects did not see PPBE as a major hindrance, they felt it was sub-optimal when it came to matching a structured process to a program with evolving requirements, which itself requires a different mindset.

> And that's what I really think got us over the hump was to stop focusing on the super hard problems to solve, including all the capabilities, the network, the power to handle the hard problems in the future. We focused the total capability solely on building growth for autonomy, but not necessarily including full autonomous mobility now. We have to get some sort of robot out there to show minimal viable product, the capability to augment soldier capabilities, things that you do as mundane tasks, with a robot from a defense perspective, recon and security. I don't necessarily need a full autonomous robot to do that.... I think over these years being an 80% solution is good enough for the time now, knowing that eventually we'll get to 100%.[43]

The need for flexibility to handle changing requirements also came up when discussing whether the future autonomous package would rely more heavily on the in-house development work or to-be-acquired commercial work. While acknowledging that at the time it was unknown how it would end up, the interview subject was confident that they would be able to navigate the PPBE process in their future desired direction:

> We can't really tell at this point, but right now it's being assessed as a mix of government solution and commercial solutions. I think that whatever the solution ends up being, really doesn't have a significant impact on the purpose of the funds. It is whether we can articulate the plan as it evolves to be able to support the budget that is an open question. And there is always risk there with having a year of execution activities that potentially evolve a strategy, when there's a budget in for the following year and enactment, there's always that risk. If you ask me personally whether that is large risk, I don't think so.[44]

The third interview subject also warned how the PPBE process might be more difficult to navigate in the future when attention shifts to bigger technology issues:

> We have an abbreviated requirements document, but things are changing in there and I don't think that the PPBE process can keep up with it. It has not gotten in our way yet and it has enabled us to be successful because we just have our lump sum of money. But eventually, when we decide to take on the more challenging projects of off-road autonomy and some of these things that we're working on, if you haven't gone through the process to defend that need and allocate money specifically towards it, I think it's gonna make it more challenging to do the big technologies.[45]

Finally, the third interview subject also spoke implicitly about how having more budget authority would be helpful. He described the difficulty of having to "hide" any management reserve within his budget and justify it as a legitimate expense due to the fear that someone will take it away otherwise if left specifically as a reserve. He also suggested something akin to near-colorless money be devoted to emerging technologies or innovative programs, specifying that he thought this should be done at Army-wide level, not the program level:

> At some level the system has to adapt. I appreciate the archaic nature because it's deliberate and structured and it's predictable, but as I look at it, a two-year timeline to develop a budget for emerging technologies doesn't work and there's no way that it can work because the world is starting to move too fast. We really gotta find a way to have different layers. So, maybe 70 percent of the budget is covered through the two-year PPBE process and then 20 percent of it is covered through a year-long PPBE-like process that is still defined, and then maybe the final 10 percent is just a DoD slush fund, for lack of a better term. The DoD has to set aside some money to respond to emergent requirements, and they can reprogram and redirect some stuff at some level, but coming up with something like different layers so that there is a fighting chance for new programs or new technologies or new threats… I'm not sure if that exists today outside of doing reprogramming, but we've got to find a way to make it work better.[46]

**Need for flexibility in PPBE process**

All three interview subjects highlighted that their mindset as a developmental program was to not achieve perfection. Instead, their goal is to produce a working product as soon as possible and perfect it over time through experimentation and testing. As one of them noted:

> Straight up from the program office, we're not going for perfect. We're going for good enough, and good enough is good enough because the soldiers need something and they need it now. So, we can't lose sight of just getting something out as soon as possible, [even] knowing it's gonna be, you know, something short of perfect. And as soon as we're done with this, we should be starting the next program. I guess we'll see if the PPBE process can support starting another program record for robotic systems in the next couple of years.
>
> *Source: U.S. Army Ground Combat Systems, Interview Subject #3*

**Figure 3.4. RCV Key Finding #3 - Interview Vignette**

### *3.2.4 FLEXIBILITY WITHIN A SINGLE PROGRAM ELEMENT*

Flexibility with having all lines of effort in a single program element and moving monies was highlighted in conversations about how the RCV program budget has been purposely designed to achieve greater flexibility. The Army has retained all its lines of efforts (Surrogate Prototypes, Full System Prototypes, and embedded software development and sustainment) within a single Project and single PE. All three of the interview subjects supported the idea of consolidating activities into a single budget line to handle the greater risks of evolving requirements since RCV is a rapidly evolving technology-heavy program. One benefit of the purposeful budgeting was the ability to deal with congressional marks when a "mark that is unspecified or there is a cut to the program line for no specified reason, I then have the ability to move and decide where to take the hit internally."[47]

Another interview subject called out this uniqueness by saying that including autonomous software in the same PE as the prototype efforts was useful for allowing the budget to adapt to the changing project.

> We sort of recognize that there's strengths and weaknesses to that approach, and the strength, which is where we're focusing is on flexibility, especially as we understand more about developing the autonomous software and the related hardware. So, we had made, we had discussions internally about whether that, whether the software program should go on a separate PE and be executed that way or at least a separate project even under PE but ultimately we felt at this point in the program the flexibility was paramount.... [We have] the desire for flexibility, to be able to use resources or to have more expansive budget authority, to move monies, say maybe from the platform itself to the autonomous program or back and forth. This is our way of trying to create as much flexibility as we process as we could at least since they [hardware and software] are so integrated.[48]

> I think it's the best strategy we have. I want to retain all the flexibility I can at the lowest levels so we can just not have anything getting in our way and be able to execute on a daily, monthly, quarterly, basis. I think the approach to having it all lumped together is good…. because it provides flexibility to put money in whichever pathway we need to fulfill the requirements. It's really the mating of hardware with software that gives us useful capability. An unmanned platform without software is nothing; software without a platform is nothing. It's only the mix of the two that gives you something useful, so I really do like that it's under one line and that provides some flexibility.[49]

The second interview subject also suggested greater flexibility with money in the development phase of programs:

> I'm not talking colorless money. [But] I think there should be a way to have money that is nondiscriminatory of the phase that the program is actually in. There is gonna be traceability through, you know, OSD, CAPE and whatever your program level is where we do massive spend plans. But when I transfer into a milestone C, low-rate production decision, that's when you really focus on procurement and then I shouldn't be doing experimentation anymore, I shouldn't be doing live fire, that's when the regulations should happen. I'm not talking colorless money. I think there should be a real consideration that if you're in the developmental phase, whatever the Amy has available or whatever you are commissioned, that money is just your money to execute the program.[50]

**Flexibility within a single program element**

The third interview subject who was most critical of the PPBE processes highlighted the difficulty of a constantly evolving program to navigate the process. The following quote captures the sentiment that while the PPBE process might be useful in many regards, there are limitations for how a fast-evolving program can operate within it.

> It's so challenging to try to adjust on the fly to the need right now or a change in strategy or something within the construct and confines of the program. It's [PPBE] archaic and it seems like an immovable object. I can't do the things I need to do in the time I need to do them to develop a relevant capability to fulfill an operational need.

*Source: U.S. Army Ground Combat Systems, Interview Subject #3*

**Figure 3.5. RCV Key Finding #4 - Interview Vignette**

## 3.3 APPENDIX A. HERITAGE OF PROGRAM

| Fiscal Year | Project | Program Element | Budget Activity |
|---|---|---|---|
| 2024 - 2023 | CF5: Robotic Combat Vehicle (BA5) NGCV-CFT | PE 0604641A / Tactical Unmanned Ground Vehicle (TUGV) | BA 5 |
| 2022 - 2020 | CF4: Robotic Combat Vehicle (RCV) NGCV-CFT | PE 0604017A / Robotics Development | BA 4 |
| 2019 - 2018 | FD9: Robotics Systems* | PE 0604017A / Robotics Development* | BA 4 |
| 2017 - 2015 | DV7: Small Unmanned Ground Vehicle | PE 0604641A / Tactical Unmanned Ground Vehicle** | BA 5 |

**Figure 3.6. Heritage of Robotic Combat Vehicle (RCV)**

Source: Department of Defense Budget Estimates, Army Justification Books: Research, Development, Test & Evaluation, Fiscal Year 2015 through 2024.

Notes. Green highlight represents a new start; Orange highlight represents a realignment of funding; BA 4 = BA 4: Advanced Component Development & Prototypes (ACD&P); BA 5 = BA 5: System Development & Demonstration (SDD).

* In the preamble of the FY 2018 Army budget justification book[51], "0604017A/FD9" is listed as a new start; therefore, both project and program element are listed here as a new start.

** In FY 2015, this program element "capture[s] requirements for Common Robotic System (Individual) (CRS(I)) and a number of other emerging robotic systems development and test requirements."[52] In FY 2017, this program element "captures four efforts to include: the Common Robotic System - Individual (CRS(I)), Robotics Enhancement Program (REP), Robotics Architecture, (RA) and Robotics Development (RD). Beginning in FY 2017, the Robotics Architecture (Interoperability Profile (IOP)) will be under this PE."[53]

## 3.4 APPENDIX B. BUDGET HISTORY

**Table 3.1: FY 2024 Budget Request, CF5: Robotic Combat Vehicle (BA5) NGCV-CFT**

| | | Request ($M) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Item | Funding Category | FY 2022 | FY 2023 | FY 2024 | FY 2025 | FY 2026 | FY 2027 | FY 2028 | Total Cost |
| CF5: Robotic Combat Vehicle (BA5) NGCV-CFT | RDT&E | - | $109.849 | $142.125 | $142.354 | $142.518 | $144.039 | $145.645 | $826.530 |

Source: Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Army Justification Book Volume 3a of 3: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 5A, March 2023, p. 188.
Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

**Table 3.2: FY 2024 Program Change Summary, PE 0604641A / Tactical Unmanned Ground Vehicle (TUGV**

| | FY 2022 | FY 2023 | FY 2024 Base |
|---|---|---|---|
| Previous President's Budget | $0.000 | $115.986 | $145.128 |
| Current President's Budget | $0.000 | $109.849 | $142.125 |
| Total Adjustments | $0.000 | ($6.137) | ($3.003) |
| - Congressional Directed Reductions | - | ($6.137) | - |
| - Adjustments to Budget Years | - | - | ($3.003) |

**Change Summary Explanation**
Decreased funding to support higher Army priorities.

Source: Department of Defense Fiscal Year (FY) 2024 Budget Estimates, Army Justification Book Volume 3a of 3: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 5A, March 2023, p. 189.
Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

**Table 3.3: FY 2023 Budget Request, CF5: Robotic Combat Vehicle (BA5) NGCV-CFT**

| Item | Funding Category | Request ($M) FY 2021 | FY 2022 | FY 2023 | FY 2024 | FY 2025 | FY 2026 | FY 2027 | Total Cost |
|---|---|---|---|---|---|---|---|---|---|
| CF5: Robotic Combat Vehicle (BA5) NGCV-CFT | RDT&E | - | - | $115.986 | $145.128 | $145.188 | $145.228 | $146.641 | $698.171 |

Source: Department of Defense Fiscal Year (FY) 2023 Budget Estimates, Army Justification Book Volume 2b of 2: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 5A, April 2022, p. 187.
Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

**Table 3.4: FY 2023 Program Change Summary, PE 0604641A / Tactical Unmanned Ground Vehicle (TUGV)**

| | FY 2021 | FY 2022 | FY 2023 Base |
|---|---|---|---|
| Previous President's Budget | $0.000 | $0.000 | $0.000 |
| Current President's Budget | $0.000 | $0.000 | $115.986 |
| Total Adjustments | $0.000 | $0.000 | $115.986 |
| - Adjustments to Budget Years | - | - | $115.986 |

**Change Summary Explanation**
FY 2023 funding increase reflects the fact that the FY 2022 President's Budget request did not include out-year funding.

Source: Department of Defense Fiscal Year (FY) 2023 Budget Estimates, Army Justification Book Volume 2b of 2: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 5A, April 2022, p. 188.
Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

**Table 3.5: FY 2022 Budget Request, CF4: Robotic Combat Vehicle (RCV) NGCV-CFT**

| Item | Funding Category | Request ($M) FY 2020 | FY 2021 | FY 2022 | FY 2023 | FY 2024 | FY 2025 | FY 2026 | Total Cost |
|---|---|---|---|---|---|---|---|---|---|
| CF4: Robotic Combat Vehicle (RCV) NGCV-CFT | RDT&E | $75.326 | $89.281 | $84.450 | - | - | - | - | - |

Source: Department of Defense Fiscal Year (FY) 2022 Budget Estimates, Army Justification Book Volume 2a of 2: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 4, May 2021, p. 371.
Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

**Table 3.6: FY 2022 Program Change Summary, PE 0604017A / Robotics Development**

| | FY 2020 | FY 2021 | FY 2022 Base |
|---|---|---|---|
| Previous President's Budget | $84.381 | $121.207 | $144.629 |
| Current President's Budget | $80.909 | $95.367 | $87.198 |
| Total Adjustments | ($3.472) | ($25.840) | ($57.431) |
| - Congressional Directed Reductions | - | ($21.415) | - |
| - SBIR/STTR Transfer | ($3.472) | ($4.425) | - |
| - Adjustments to Budget Years | - | - | ($57.431) |

**Change Summary Explanation**
The decrease in funding from FY 2021 to FY 2022 is due to a realignment of funding and change in strategy.

Source: Department of Defense Fiscal Year (FY) 2022 Budget Estimates, Army Justification Book Volume 2a of 2: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 4, May 2021, p. 368.
Notes: Orange highlight is then-present year's Justification Book year. Amounts shown are a combination of multiple projects contained in the Program Element, including: CF4: Robotic Combat Vehicle (RCV) NGCV-CFT, FD2: Soldier Robotics Systems, and FD9: Robotics Systems. All amounts are U.S. dollars in millions.

**Table 3.7: FY 2021 Budget Request, CF4: Robotic Combat Vehicle (RCV) NGCV-CFT**

| | | Request ($M) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Item | Funding Category | FY 2019 | FY 2020 | FY 2021 | FY 2022 | FY 2023 | FY 2024 | FY 2025 | Total Cost |
| CF4: Robotic Combat Vehicle (RCV) NGCV-CFT | RDT&E | $0.000 | $78.559 | $114.889 | $139.867 | $141.868 | $141.868 | $141.878 | $758.929 |

Source: Department of Defense Fiscal Year (FY) 2021 Budget Estimates, Army Justification Book: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 4, February 2020, p. 396.

Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

**Table 3.8: FY 2021 Program Change Summary, PE 0604017A / Robotics Development**

| | FY 2019 | FY 2020 | FY 2021 Base |
|---|---|---|---|
| Previous President's Budget | $74.368 | $115.222 | $105.332 |
| Current President's Budget | $70.745 | $84.381 | $121.207 |
| Total Adjustments | ($3.623) | ($30.841) | $15.875 |
| - Congressional Directed Reductions | - | ($30.841) | - |
| - Reprogrammings | ($3.623) | - | - |
| - Adjustments to Budget Years | - | - | $15.875 |

**Change Summary Explanation**

FY 2021 increase of $15.992 million aligns program requirements with Army modernization priorities for Project CF4 Robotic Combat Vehicle (RCV) NGCV-CFT.

Source: Department of Defense Fiscal Year (FY) 2021 Budget Estimates, Army Justification Book: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 4, February 2020, p. 395.

Notes: Orange highlight is then-present year's Justification Book year. Amounts shown are a combination of multiple projects contained in the Program Element, including: CF4: Robotic Combat Vehicle (RCV) NGCV-CFT, FD2: Soldier Robotics Systems, FD3: Battery Modernization & Interface Standardization, and FD9: Robotics Systems. All amounts are U.S. dollars in millions.

**Table 3.9: FY 2020 Budget Request, CF4: Robotic Combat Vehicle (RCV) NGCV-CFT**

| Item | Funding Category | Request ($M) FY 2018 | FY 2019 | FY 2020 | FY 2021 | FY 2022 | FY 2023 | FY 2024 | Total Cost |
|---|---|---|---|---|---|---|---|---|---|
| CF4: Robotic Combat Vehicle (RCV) NGCV-CFT | RDT&E | $0.000 | $0.000 | $109.400 | $99.008 | $126.676 | $77.594 | $57.382 | $470.060 |

Source: Department of Defense Fiscal Year (FY) 2020 Budget Estimates, Army Justification Book: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 4, March 2019, p. 394.

Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

**Table 3.10: FY 2020 Program Change Summary, PE 0604017A / Robotics Development**

| | FY 2018 | FY 2019 | FY 2020 Base |
|---|---|---|---|
| Previous President's Budget | $39.608 | $95.660 | $15.677 |
| Current President's Budget | $38.051 | $74.368 | $115.222 |
| Total Adjustments | ($1.557) | ($21.292) | $99.545 |
| - Congressional General Reductions | ($0.031) | ($0.092) | - |
| - Congressional Directed Reductions | - | ($21.200) | - |
| - SBIR/STTR Transfer | ($1.526) | - | - |
| - Adjustments to Budget Years | - | - | $99.545 |

**Change Summary Explanation**

The FY 2020 increase of $73.845 million supports the Army's modernization priorities in support of the National Defense Strategy, to include experimental prototyping.

Source: Department of Defense Fiscal Year (FY) 2020 Budget Estimates, Army Justification Book: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 4, March 2019, p. 393.

Notes: Orange highlight is then-present year's Justification Book year. Amounts shown are a combination of multiple projects contained in the Program Element, including: CF4: Robotic Combat Vehicle (RCV) NGCV-CFT, FD2: Soldier Robotics Systems, FD3: Battery Modernization & Interface Standardization, and FD9: Robotics Systems. All amounts are U.S. dollars in millions.

**Table 3.11: FY 2019 Budget Request, FD9: Robotics Systems**

| Item | Funding Category | Request ($M) FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 | FY 2022 | FY 2023 | Total Cost |
|---|---|---|---|---|---|---|---|---|---|
| FD9: Robotics Systems | RDT&E | $0.000 | $37.249 | $92.704 | $12.851 | $12.849 | $7.412 | $2.964 | $166.029 |

Source: Department of Defense Fiscal Year (FY) 2019 Budget Estimates, Army Justification Book: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 4, February 2018, p. 389.

Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

**Table 3.12: FY 2019 Program Change Summary, PE 0604017A / Robotics Development**

| | FY 2017 | FY 2018 | FY 2019 Base |
|---|---|---|---|
| Previous President's Budget | $0.000 | $39.608 | $69.070 |
| Current President's Budget | $0.000 | $39.608 | $95.660 |
| Total Adjustments | $0.000 | $0.000 | $26.590 |
| - Adjustments to Budget Years | - | - | $26.590 |

**Change Summary Explanation**

FY2019 increase in the amount of $26.6 million supports efforts related to Tactical Wheeled Vehicle - Leader Follower and Robotic Combat Vehicle Experimental Unit Prototypes

Source: Department of Defense Fiscal Year (FY) 2019 Budget Estimates, Army Justification Book: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 4, February 2018, p. 377.

Notes: Orange highlight is then-present year's Justification Book year. Amounts shown are a combination of multiple projects contained in the Program Element, including: FD2: Soldier Robotics Systems, FD3: Battery Modernization & Interface Standardization, and FD9: Robotics Systems. All amounts are U.S. dollars in millions.

**Table 3.13: FY 2018 Budget Request, FD9: Robotics Systems**

| Item | Funding Category | Request ($M) FY 2016 | FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 | FY 2022 | Total Cost |
|---|---|---|---|---|---|---|---|---|---|
| FD9: Robotics Systems | RDT&E | $0.000 | $0.000 | $37.249 | $65.400 | $13.000 | $13.000 | $3.000 | Continuing |

Source: Department of Defense Fiscal Year (FY) 2018 Budget Estimates, Army Justification Book: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 4, May 2017, p. 241.

Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

**Table 3.14: FY 2018 Program Change Summary, PE 0604017A / Robotics Development**

| | FY 2016 | FY 2017 | FY 2018 Base |
|---|---|---|---|
| Previous President's Budget | $0.000 | $0.000 | $0.000 |
| Current President's Budget | $0.000 | $0.000 | $39.608 |
| Total Adjustments | $0.000 | $0.000 | $39.608 |
| - Adjustments to Budget Years | $0.000 | $0.000 | $39.608 |

**Change Summary Explanation**

In FY2018 funding for Unmanned Ground Vehicles (UGV) Robotics Development (RD) transitions from PE 0604641A Tactical Unmanned Ground Vehicle, Project DV7 Small Unmanned Ground Vehicle to PE 0604017A Robotics Development, Project FD2 Soldier Robotics Systems, and funding for Applique and Large Unmanned Ground Systems (ALUGS) Robotics Development (RD) transitions from PE 0604641A Tactical Unmanned Ground Vehicles, Project DV7 Small Unmanned Ground Vehicle to PE604017A Robotics Development, Project FD9 Robotics Systems.

Source: Department of Defense Fiscal Year (FY) 2018 Budget Estimates, Army Justification Book: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 4, May 2017, p. 234. Notes: Orange highlight is then-present year's Justification Book year. Amounts shown are a combination of multiple projects contained in the Program Element, including: FD2: Soldier Robotics Systems, FD3: Battery Modernization & Interface Standardization, and FD9: Robotics Systems. All amounts are U.S. dollars in millions.

**Table 3.15: FY 2017 Budget Request, DV7: Small Unmanned Ground Vehicle**

| Item | Funding Category | Request ($M) FY 2015 | FY 2016 | FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 | Total Cost |
|---|---|---|---|---|---|---|---|---|---|
| DV7: Small Unmanned Ground Vehicle | RDT&E | $2.663 | $15.374 | $39.282 | $60.120 | $59.915 | $32.857 | $31.848 | Continuing |

Source: Department of Defense Fiscal Year (FY) 2017 Budget Estimates, Army Justification Book: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 5, February 2016, p. 215.

Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

**Table 3.16: FY 2017 Program Change Summary, PE 0604641A / TACTICAL UNMANNED GROUND**

| | FY 2015 | FY 2016 | FY 2017 Base |
|---|---|---|---|
| Previous President's Budget | $2.769 | $40.374 | $50.782 |
| Current President's Budget | $2.663 | $15.374 | $39.282 |
| Total Adjustments | ($0.106) | ($25.000) | ($11.500) |
| - Congressional General Reductions | - | ($25.000) | - |
| - SBIR/STTR Transfer | ($0.106) | - | - |
| - Other Adjustments 1 | - | - | ($11.500) |

Source: Department of Defense Fiscal Year (FY) 2017 Budget Estimates, Army Justification Book: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 5, February 2016, p. 216.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

**Table 3.17: FY 2016 Budget Request, DV7: Small Unmanned Ground Vehicle**

| | | Request ($M) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Item | Funding Category | FY 2014 | FY 2015 | FY 2016 | FY 2017 | FY 2018 | FY 2019 | FY 2020 | Total Cost |
| DV7: Small Unmanned Ground Vehicle | RDT&E | - | $2.769 | $40.374 | $50.782 | $30.099 | $23.886 | $9.927 | Continuing |

Source: Department of Defense Fiscal Year (FY) 2016 Budget Estimates, Army Justification Book: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 5A, February 2015, p. 214.

Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

**Table 3.18: FY 2016 Program Change Summary, PE 0604641A / TACTICAL UNMANNED GROUND VEHICLE**

| | FY 2014 | FY 2015 | FY 2016 Base |
|---|---|---|---|
| Previous President's Budget | - | $6.770 | $20.290 |
| Current President's Budget | - | $2.769 | $40.374 |
| Total Adjustments | - | ($4.001) | $20.084 |
| - Congressional Rescissions | - | ($4.001) | - |
| - Adjustments to Budget Years | - | - | $20.084 |

Source: Department of Defense Fiscal Year (FY) 2016 Budget Estimates, Army Justification Book: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 5A, February 2015, p. 215.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

**Table 3.19: FY 2015 Budget Request, DV7: Small Unmanned Ground Vehicle Vehicle**

| Item | Funding Category | Request ($M) FY 2013 | FY 2014 | FY 2015 | FY 2016 | FY 2017 | FY 2018 | FY 2019 | Total Cost |
|---|---|---|---|---|---|---|---|---|---|
| DV7: Small Unmanned Ground Vehicle | RDT&E | - | - | $6.770 | $20.290 | $77.279 | $92.402 | $123.352 | Continuing |

Source: Department of Defense Fiscal Year (FY) 2015 Budget Estimates, Army Justification Book: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 5A, March 2014, p. 214.

Notes: Orange highlight is then-present year's Justification Book year. RDT&E = Research, Development, Test, and Evaluation; $M = U.S. dollars in millions.

**Table 3.20: FY 2015 Program Change Summary, PE 0604641A / TACTICAL UNMANNED GROUND VEHICLE**

| | FY 2013 | FY 2014 | FY 2015 Base |
|---|---|---|---|
| Previous President's Budget | $13.141 | - | - |
| Current President's Budget | - | - | $6.770 |
| Total Adjustments | ($13.141) | - | $6.770 |
| - Congressional General Reductions | ($13.141) | - | - |
| - Adjustments to Budget Years | - | - | $6.770 |

Source: Department of Defense Fiscal Year (FY) 2015 Budget Estimates, Army Justification Book: Research, Development, Test & Evaluation, Army RDT&E - Volume II, Budget Activity 5A, March 2014, p. 215.

Notes: Orange highlight is then-present year's Justification Book year. All amounts are U.S. dollars in millions.

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# CASE STUDY 4: SPACE DEVELOPMENT AGENCY (SDA)

## 4.0 EXECUTIVE SUMMARY

The mission of the SDA is to "create and sustain lethal, resilient, threat-driven, and affordable military space capabilities that provide persistent, resilient, global, low-latency surveillance to deter or defeat adversaries."[1] SDA's mandate is to make use of commercially procured, cheaper satellites to create a space architecture facilitated by a cross-domain, AI-enabled network. SDA aims to develop this architecture through use of a "spiral model" with regular technology upgrades and contract competition over a two-year cycle for each tranche.[2] SDA uses several rapid and flexible acquisition authorities and tools to meet these cycles, particularly Section 804 MTA. It also conducts programming before planning, as it budgets for tranches before specific requirements are set by a Warfighter Council (SDA does not use the JCIDS process for validating requirements while using the MTA pathway). The SDA is protective over its distinct, mission-focused, and consolidated program elements, but still draws from separate appropriations accounts for its satellite purchases and launches. SDA's successes and challenges in meeting its goals for two-year cycles within the PPBE process are highlighted as key findings summarized in Figure 4.1.

**Key Findings**

1. SDA's use of the MTA pathway and the agile, iterative incorporation of commercial technologies are central to its rapid product delivery.
2. Due to SDA's mandate to rapidly deliver capabilities, budget requests must be made before requirements are finalized—programming occurs before planning.
3. PE consolidation gives SDA flexibility for program success, while external stakeholders who seek to impact the program prefer a divided PE structure.
4. Building and launching SDA tranches can be challenging to manage in existing budgetary categories.

**Figure 4.1. SDA Case Study Key Findings**

Research findings suggest that SDA has thus far successfully accomplished its program milestones and objectives within the current PPBE framework, especially through capitalizing on rapid acquisition authorities and by fighting to keep tight, consolidated funding lines. However, these findings, as described in detail below, also make clear that PPBE processes do not necessarily accommodate the highly agile and iterative nature of SDA programs and can use certain changes to support such programs. The key findings appear to align with several areas of concern identified in the Commission on PPBE Reform's Interim report, including 1) Improve PPBE processes to support innovation and adaptability, 2) Improve alignment of budgets to strategy, and 3) Improve PPBE-related relationships between DoD and Congress.

## 4.1 PROGRAM OVERVIEW

SDA was created in 2019 by the Office of the Under Secretary of Defense for Research and Engineering, and officially transferred to the United States Space Force (USSF) in 2022. SDA aims to accomplish its mission by developing and fielding a Proliferated Warfighting Space Architecture (PWSA) consisting of multiple layers (or "tranches") of satellite constellations providing navigation, surveillance, deterrence, defense, communication, and various other functions. SDA intends to launch at least five tranches of satellites (each tranche will represent one generation of the PWSA). These tranches will support an integrated, low-Earth orbit system.[3]

The director of the SDA reports to the Assistant Secretary of the Air Force for Space Acquisition and Integration for acquisition matters, and the Chief of Space Operations for all other matters. SDA has 250 employees, including contractors, managing operations, and funds.[4] Within the PPBE process, SDA provides its Program Objective Memoranda (POM) and Budget Estimate Submissions (BES) directly to USSF/S8 for incorporation into the USSF POM, which is then incorporated into the Department of the Air Force Submission.[5] Section 1601 of the FY21 NDAA requires that the SDA retain PEs separate from other Space Force programs.[6] SDA has three RDT&E PEs, with one additional PE shared with Space Command. Additionally, SDA's launch costs are funded by Procurement in the Space Force's Systems Command budget.

Distinct from other elements of the Space Force, SDA does not use the JCIDS process for validating requirements. Instead, SDA has a Warfighter Council which establishes requirements through habitual coordination and collaboration between the agency and end users. This approach has been essential to SDA's response to new mission imperatives and technology developments.[7] While SDA is not exempt from JCIDS by law, unlike the Space Rapid Capabilities Office, it is exempt from JCIDS while using the MTA pathway, which did not apply to Tranche 0.[8]

SDA's mandate is to make use of commercially procured, cheaper satellites to create a space architecture facilitated by a cross-domain, AI-enabled network. SDA aims to develop this architecture using a "spiral model" with regular technology upgrades and contract competition over a two-year cycle for each tranche.[9]

SDA uses several rapid and flexible acquisition authorities and tools to meet its two-year cycles. The implementation of two-year cycles is possible thanks to the SDA's reliance on Section 804 MTA, which constitute an alternative approach under the Adaptive Acquisition Framework to allow for rapid prototyping and fielding of proven technologies that require less development. It procures commercial launches through a central contract. For its Tranche 1 and 2 launches, SDA has used the services of the National Security Space Launch (NSSL) program, which SDA leadership initially opposed due to potential administrative and other markups. After the NSSL program office and SDA negotiated a better deal, unnecessary activities adding extra costs were removed.[10] Under the NSSL, SDA is beholden to specific requirements and a timeframe that requires them to procure launches 24 months prior to launch.

As the SDA continues its research, development, test, and evaluation processes for the first iterations of its planned satellite tranches, its budget continues to grow. SDA's successes in rapidly acquiring and fielding satellites has generated DoD and Congressional support for SDA budget increases from $125 million in its first year of existence to over $4.6 billion as of the FY24 funding request.[11] SDA's FY24 budget request represents a 55% increase from its FY23 budget request of $2.6 billion, with an additional $23 billion projected for fiscal years 2025 to 2028.[12]

## 4.2 IMPACT OF PPBE ON SDA: KEY FINDINGS AND INTERVIEW VIGNETTES

Case study findings pertaining to SDA were developed through one interview conducted with five personnel associated with SDA on the government side, three interviews with two different industry professionals associated with separate companies under contract with SDA, and one interview with a senior acquisition professional with relevant domain expertise. Case study findings were also derived from written feedback provided by SDA personnel in response to the interview questions. In advance of the interviews, a literature survey was conducted which prepared the researchers and served as a foundation to the interview questions concerning SDA and PPBE. Among other readings, this literature review included the Commission on PPBE Reform's Interim Report.[13] Interview feedback and other material collected by the research team, summarized and analyzed in the following sub-sections of this case report, have been curated to align with the key findings summarized in Figure 4.1 in the Executive Summary. In all circumstances, the research team's interview and attribution methodologies abided by the Chatham House Rule, and any subsequent excerpt quotes from interview participants included in this case study report have been anonymized.

### *4.2.1 SDA'S USE OF THE MTA PATHWAY AND THE AGILE INCORPORATION OF COMMERCIAL TECHNOLOGIES ARE CENTRAL TO RAPID PRODUCT DELIVERY*

SDA's acquisition processes use spiral development to launch a minimum viable product into orbit every two years. Thus far, SDA has delivered its first satellites to orbit 27 months from contract award. Feedback collected from Space Development Agency personnel stressed that the organization's agile and iterative acquisition model remains its most important asset for achieving success:

> SDA's unique model relies on speed to achieve its mission and represents a departure from big, slow, expensive acquisition programs. Our model works because it doesn't rely on delivering the perfect solution, which tends to focus on capability over schedule and cost and instead choosing to provide 'good enough' capability to the warfighter at the speed of relevance.[14]

Two principal enablers of SDA's agile and iterative acquisitions are the use of MTAs and the adoption of commercial technologies for its satellite constellations.

SDA has been successful in harnessing MTAs for spiral development for rapid prototyping and fielding. Case study interviews and literature review note that SDA efforts to learn from previous tranches and improve upon previous satellite tranche deployments have largely been guided by what was learned through the execution of previous tranches.[15] In turn, MTAs have been highlighted as essential for SDA to rapidly improve satellite technologies through incorporating lessons learned.

> SDA is focused on delivery of capability to the warfighter. The greatest near-term risk to our model is failing to use the Middle-Tier Acquisition pathway or any pathway that enables speed in favor of an obsolete acquisition model and strategies that are no longer adapted to the new threat environment, or that fail to provide timely, effective, and credible solutions.[16]

Interview participants cited several concerns with possible new MTA reporting requirements, which are viewed as detracting from SDA's mission. Since MTAs were intended to eliminate milestone reporting requirements, putting them back in would make SDA "a lot more like a major capability program," not in alignment with its emphasis on agility.[17] The SDA personnel observed that timelines for MTA approval already seem to have slowed, potentially due to the creation of an MTA advisory board. To restore full agility in the MTA approval process, they recommended delegating MTA approval authority back to service acquisition executives.[18]

**SDA as a model for rapid acquisitions using commercial technologies**

SDA's approach to procuring comparatively mature commercial technology constitutes a distinct acquisition model that could be used for other programs and entities within the DoD, but not all. Moreover, while many defense programs typically lag behind the commercial market in their incorporation of advanced technologies, SDA faces the reverse issue. The industry segments from which it purchases, such as those for optical communication link satellites, do not yet exist at scale to produce for SDA. SDA is in the position of helping to build up new commercial supply chains, which poses unique challenges to its acquisition model. One interview participant summarized this finding:

> We certainly think [SDA] could be a model, but it's not a model for everything. There is a certain type of capability that it's well-suited for, and there are large exquisite systems the Department is going to continue to need, and this is not the model for those. We are not the James Webb Space Telescope of space operations. That's not what we're building. We are looking at doing things that are much more in-line with rapid acquisition approaches, software acquisition approaches, rapid capability development. And so no matter what you do to the budget process, you can't acquire things on our timeline if industry is not prepared to respond.

*Source: Space Development Agency, Interview #1*

**Figure 4.2. SDA Key Finding #1 – Interview Vignette**

Alongside its effective use of the MTA pathway, SDA's strategies for incorporating mature commercial technologies have kept prices lower, accelerated satellite fielding, and precluded expensive future maintenance through the reduction of non-recurring engineering needs. Interviews with SDA and industry personnel alike reiterated that SDA's contracting strategies are crucial to its mission to deliver a minimum viable product into orbit every two years. SDA deliberately fosters "full and open competition for each layer of each tranche, as much as possible. Through that model, we hope to create a reliable and predictable marketplace that allows industry to invest, plan, and compete on a predictable timeline while also avoiding vendor lock."[19]

SDA's commercial-focused strategy requires a reliable, competitive, and affordable marketplace from which to choose suppliers. SDA takes steps to build up the necessary marketplaces for the technologies it procures through various methods. For example, it leverages small business programs such as Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) to mature capabilities and help new marketplace entrants become more competitive for future work. It also publicly shares technology roadmaps to help companies determine what will be needed and when for future tranches.[20] Future tranches of satellites are also developed using data from design reviews of previous tranches.[21]

Both industry and government interview perspectives acknowledged that SDA's rapid timelines for acquisitions and satellite launches can put a strain on industry, but they praised SDA's progress thus far in helping contractors meet their goals. According to one industry perspective, one way the SDA has accomplished this so far has been by promoting system compatibilities across different satellite constellations. For example, when the planned timeline for the launch of Tranche 0 had been delayed slightly by Covid-related supply chain difficulties, SDA authorized one contractor to release some of its additional radios to another contractor directly impacted by radio supply chain shortages. The receiving contractor was able to integrate the other performer's radios without pricey or lengthy customization efforts, since the SDA had ensured from the start that all performers' satellite designs would be versatile and adaptable.[22] The interview participant also suggested that asking for firm-fixed-price contracts had been beneficial for driving performers to tailor their offerings to meet commercial standards, supporting the development of space platforms with substantial military utility which could even incorporate payloads adapted from ground and airborne systems.[23]

To continue to build a healthy industrial base for future SDA development and acquisition efforts, one interview participant recommended the use of longer contracts to attract and keep business, and also endorsed the use of Defense Production Act Title III authorities for additional government investment in the industrial ecosystem to promote responsive and healthy commercial marketplaces for advanced space technologies.[24]

In addition to commercial technologies, SDA has proven its model can successfully adopt and field technologies developed in previously existing government research and development projects, as illustrated in the FOO Fighter vignette highlighted in Figure 4.3. The technological and timeline-related risks which deter other DoD entities from taking on new technology development or transitional efforts appear to be less of an issue for SDA thanks to its unique model.

## FOO Fighter: How it was able to transition under SDA

Although FOO Fighter achieved its objectives as a DARPA S&T research and development initiative, Department of Air Force decision makers chose not to include the project in the Space Force POM during two annual budget cycles. Other potential Air Force partners were averse to taking on the technological risk of the new program. However, after Secretary of the Air Force Frank Kendall became aware of the project and incorporated it into one of his operational imperatives (OIs), the project was assigned to SDA, and the agency successfully took on the development and fielding of FOO Fighter:

> SDA is the ideal transition partner for mature capabilities … FOO Fighter was seen as a technology that could be incorporated into program architectures in the future. The cultural design of SDA is why FOO Fighter is with us right now.

Without interrupting any of its prime mission objectives for building the PWSA, the SDA chose to support maturation of the FOO Fighter technology and is carefully ensuring it will achieve sustained funding. The agency also recognized the potential for the technology to be incorporated into PWSA architecture in the future, as it aligned with several capabilities currently in development by the SDA in support of missile defense and warning mission programs.

Interview participants emphasized that Secretary Kendall's strong endorsement was critical to the success of FOO Fighter's transition. For example, an interview subject observed, "You can bring things in late in the game if you have the right advocate."

*Sources: Space Development Agency, Interview #1; Subject Matter Expert*

**Figure 4.3. SDA Key Finding #1 – Interview Vignette**

### *4.2.2 DUE TO SDA'S MANDATE TO RAPIDLY DELIVER CAPABILITIES, PROGRAMMING OCCURS BEFORE PLANNING*

SDA personnel stated a contrast between their organization's mandated delivery timelines and the PPBE process timeline. One interview subject explained:

> It is imperative that funding not be delayed or pushed out in the FYDP when you are acquiring things at speed every two years. A one-year slip in funding can't be absorbed the way it is in legacy programs.[25]
>
> Inability to plan beyond a single year of funding and the threat of continuing resolutions each year creates instability for short-term programs … Delivery on two-year cycles requires the ability to continuously pay contracts without interruption.[26]

Interviews with SDA-affiliated participants, as well as the literature review and findings from additional case studies, underscored that PPBE timelines can be slow or inflexible to accommodate evolving findings and technologies:

> Budgets are built on what is known at that time and that plan is submitted to meet the set timeline. However, that timeline doesn't necessarily support changes that may result from emergent discoveries or findings during program execution because that plan is still going through the approval process.[27]
>
> What's challenging is that our schedule is our core value. So maintaining that two-year cadence for acquisition programs is the secret sauce to our success, and starting a planning process two and half years before the budget is going to be released does not leave a lot of room for making modifications along the way.[28]

Mitigating the long timeline of PPBE, SDA conducts programming before planning. The requirement for a tranche is endorsed by its Warfighter Council six months prior to acquisition as opposed to 2.5 years. With a compressed schedule, SDA determines the budget for each tranche before actual requirements are known.[29]

SDA personnel noted that "reversing" the Ps of PPBE works well for the organization, since SDA does not have a clear understanding of what will be acquired two years out.[30] Nevertheless, SDA faces difficulties juggling cost estimates, requirements, and potential budget changes when budget planning for one tranche, while working on another tranche of satellite capabilities, and fielding a third.[31]

When it comes to the latter phases of PPBE, SDA personnel expressed the need to streamline existing processes for reprogramming. In one instance described by interview subjects, important launch funds were delayed when SDA missed the threshold for a below-threshold reprogramming they could have "worked out with the Department" for a more agile movement of funds, but ultimately, they needed to utilize a late above-threshold reporting request that held up the process.[32] SDA personnel provided the following recommendation for the DoD to address such scenarios and maximize flexibility to quickly respond to changing needs:

> Adjust reprogramming thresholds to accommodate the potential for acceleration of an acquisition or delivery of a capability. For instance, a congressional plus-up to a program may require other reprogramming changes in the year of execution, after the PBR has been finalized for the next fiscal year.[33]

Because of SDA's unique approach, its ability to regularly communicate to Congress and key DoD offices throughout each phase of PPBE is essential for decision-makers to support program success. A Program Office overseeing a distinct mandate, technology, or use of authorities can easily be misunderstood by external decision-makers, who are operating based on different vantage points and experiences—occasionally to the detriment of program success. An interview subject noted:

> CAPE is looking at what we're doing and trying to update their own cost models. They're still uncomfortable with the risk of acquiring new tranches before the previous tranche was fielded. They feel everything has to be consecutive, but SDA's model doesn't work that way.[34]

SDA accomplishes programming before planning and navigates its compressed timeline via detailed communication and collaboration with Congress. The Commission on PPBE Reform's Interim Report emphasized this effective engagement between SDA and Congress as an important cornerstone of efficacious transparency, a prescriptive finding that was bolstered by the research team's subsequent case study interviews. Through frequent staffer engagements, SDA builds trust by providing detailed cost and work structure breakdowns, including comparisons between original cost estimates and actual cost outcomes—for each tranche, each performer on contract, each program element, and for other project details.[35]

#### *4.2.3 PE CONSOLIDATION GIVES SDA FLEXIBILITY FOR PROGRAM SUCCESS*

Interview feedback, written responses, and literature review findings highlight that SDA's consolidated PE structure is an important contributor to the agency's success. The agency's consolidation occurred after it was transferred to the Space Force for administrative reasons decided by the Department of the Air Force. Program budget flexibility is attributed to SDA's budgetary autonomy as delineated by statute in Section 1601 of the FY21 NDAA. SDA's mandate and unique authorities intended to preserve the SDA's unique program element structure, which lends it flexibility to execute.

**A relationship between consolidated PEs and execution flexibility**

One SDA interview participant noted that managing space platforms, ground stations, transport layer operations, and integration all in one PE allows for the Program Office to be immediately responsive to events or proactive in being ahead of challenges.

> Having ground and space delivery in one PE gives flexibility on contract … To say, ground is costing more, and we need to make adjustments within that program execution, and we can do that if it's all in one line.

*Source: Space Development Agency, Interview #1*

**Figure 4.4. SDA Key Finding #3 – Interview Vignette**

SDA personnel acknowledged the rationale behind Congressional and Department attempts to split ground funding into separate program elements. However, SDA's position is that the organization's Program Office is better positioned than the legislature to protect and advance program accomplishments and determine program element structure. Ultimately, SDA personnel reported that their organization's "large PEs encompassing multiple programs" allow for the greatest flexibility to move funds when needed to ensure timely mission success.[36]

### *4.2.4 BUILDING AND LAUNCHING SDA TRANCHES CAN BE CHALLENGING TO MANAGE IN EXISTING BUDGETARY CATEGORIES*

SDA's management of different appropriation categories or "colors of money" – specifically Procurement and RDT&E – has been essential to the agency navigating PPBE processes while achieving the agency's mandate. An example occurred in fiscal years 2022 and 2023:

> Congress decided that they wanted us to accelerate the fielding of our tranche 1 track. They wanted us to speed up getting to a capability that could cover INDOPACOM by about a year. And they gave us a significant amount of money over the course of two years to do that. What they didn't do was fund the associated launches that go with that. And by the time appropriations passed, it was too late for us to then program for those launches because the budget was already headed to the Hill and closed out. The process for the next fiscal year in which we would have to acquire the launch to go with that was closed.[37]

The interview participant further explained that when the split funding results in discrepancies between different accounts supporting the same mission, it prompts DoD and Congress to have to work together to resolve the issue through either reprogramming the funds or appropriating a plus-up, potentially delaying program executions. In this specific instance, Congress eventually appropriated a plus-up to provide additional funding for the satellite launch.[38] The anecdote supports overall case study findings that the budgetary structures and timelines of the PPBE process can make it more difficult to accommodate immediate operational needs, especially on an as-needed basis by the combatant commands (CCMD).

SDA interviews underscored that accelerating such operational needs through shared service funding lines is difficult when a system's delivery depends on two distinct funding methods. For example, SDA capabilities are rapidly developed with RDT&E monies. But the ultimate delivery of those capabilities demands launch vehicles funded by procurement monies on a traditional timeline.[39] All SDA launches are managed by NSSL. In turn, SDA must procure and pay NSSL contractors for launches two years prior to the intended launch. In this case, SDA is paying for launches (budgeted two years before that payment), concurrent with SDA planning a budget for the development of the platforms that will be on those launches.[40]

**On drawing from separate pots of money for satellite launch vs. development**

One SDA interview participant explained issues that arise as a result of color of money splits for satellite development and launches:

> If you're operating a 20th century [legacy] model you might be able to do that without problems, because you fund the development of satellites, and program for launches for years from now. It wouldn't be a problem to just factor it into the program. But because the schedule is so compressed and you launch [21st century] satellites within a two-year time frame, you have to buy the launches now. So the PPBE process is already well down the road for the next fiscal year by the time you get appropriations.

*Source: Space Development Agency, Interview #1*

**Figure 4.4. SDA Key Finding #4 – Interview Vignette**

SDA's solution has been to collaborate closely with stakeholders in the Space Force, the Department of the Air Force, the Office of the Secretary of Defense, and Congress. Through iterative and deliberate communication and coordination, SDA has addressed color of money conflicting demands and competing requirements. However, this case study underscores the ramifications of constraints that are put upon Program Offices through the limitations in shifting monies across colors of money – particularly when Program Offices are dependent upon other agencies for the success of their programs.

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# CASE STUDY 5: TACTICAL INTELLIGENCE TARGETING ACCESS NODE (TITAN)

## 5.0 EXECUTIVE SUMMARY

TITAN will fuse massive amounts of incoming sensor data from the warfighting theater for holistic intelligence-gathering in support of effectual Intelligence Surveillance and Reconnaissance (ISR) and long-range precision targeting. With its powerful deep sensing abilities, TITAN is a major modernization effort intended to serve as the next-generation ground system for the U.S. Army. TITAN's ongoing prototyping efforts and its future mission require the rapid acquisition and incorporation of advanced technologies. According to case study interview participants, this can be a challenge due to the long timelines inherent to the PPBE process. As summarized by the main research takeaways highlighted in Figure 5.1, TITAN has navigated traditional PPBE and PPBE-adjacent processes through several distinct program features, including its use of rapid acquisition and development approaches, its incorporation of prior Army efforts, and its smooth accomplishment of a major shift of funds between accounts.

**Key Findings**

1. TITAN's use of MOSA, the MTA pathway, and OTA contracts has led to rapid prototyping and program success.
2. TITAN prototyping efforts have benefited programmatically and technologically from being a continuation of previous Army research efforts and funding lines.

The shift of program funding from Procurement to RDT&E, accomplished with effective stakeholder alignment, ensured that appropriate investment was made in prototyping but had downstream effects on industry efforts.

**Figure 5.1. TITAN Case Study Key Findings**

Based on current case study interview feedback and other case study findings, TITAN has been able to meet most of its current program goals and expectations within the scope of PPBE. As a high-profile capability derived from a major legacy program, it enjoys robust Army and other government support. Since TITAN is only one third of the way through its planned rapid prototyping, case study findings were more likely to be germane to the early phases of PPBE as opposed to observed experience regarding PPBE's impact on technology transition (if technology transition is to be understood as the graduation from development efforts to production and deployment to the warfighter). Key findings align with several areas of concern identified in the Commission on PPBE Reform's Interim report, including 1) Improve PPBE processes to support innovation and adaptability, 2) Improve alignment of budgets to strategy, and 3) Improve PPBE-related relationships between DoD and Congress.

## 5.1 PROGRAM OVERVIEW

The TITAN program, currently under development and in its competitive prototyping phase, comprises the Army's next-generation intelligence ground system. The purpose of TITAN is to rapidly ingest and fuse incoming data from terrestrial, aerial, high-altitude, and space layer sensors, thus allowing the system to deliver real-time intelligence to the warfighter via lethal and non-lethal networks. TITAN's sensor processing capabilities will support automated target recognition, identification, geolocation, and other functions enabling immediate situational awareness for mission command, as well as critical long-range precision targeting and firing.[1] Heavily dependent on software technologies, it will be the first intelligence ground station of its kind to use artificial intelligence and machine learning for data analytics purposes and for classifying sensor feedback.[2] As a cutting-edge program, TITAN will also use MOSA to incorporate evolving technologies. While TITAN will not be a "one-to-one" replacement of legacy ground stations, it is meant to improve upon the capabilities provided by those systems, and the Army expects that the legacy systems will eventually be phased out after TITAN is fielded.[3]

TITAN began as a risk reduction effort in 2020 within the scope of the Distributed Common Ground System-Army (DCGS-A) program comprising the elements for a vast amount of Army intelligence capabilities at the tactical, operational, and strategic levels, including funding for ground stations. The concept for TITAN emerged as a natural evolution of the capabilities of the DCGS-A program's current and legacy ground stations. From FY20 to FY21, the Army worked with the milestone decision authority, the Army acquisition executive, to receive authority to execute a TITAN precursor as a ground system modernization activity within DCGS-A. By FY22, TITAN was fully initiated into the acquisition process and executed using rapid prototyping authorities under the MTA.[4] Evolving from previous efforts under DCGS-A, TITAN was also made to draw on expertise and resources from various Army organizations and initiatives. In particular, it leverages and builds on many precursor technologies developed and prototyped through Project 907, known as the Tactical Exploitation of National Capabilities (TENCAP).[5]

In the Army budget justification books, TITAN advanced development funding is primarily designated by PE 0604037A under BA 4, and also consists of line items 0605148A BY5 (Tactical Intelligence Targeting Access Node EMD (Engineering & Manufacturing Development Phase) supporting development, integration and systems engineering for TITAN prototypes), and K57311 funding for the ground station aspect.[6] Current funding for TITAN covers the advanced version, which will eventually be adapted into the basic version in the future.[7] The total cost of TITAN's MTA effort is $486 million in RDT&E funding from FY22 to FY26.[8]

TITAN is one-third of the way through its planned rapid prototyping efforts, with competing contractors submitting proposals for the follow-on maturation phase, and production is not slated to occur until FY26.[9] A major aspect of its contracting strategy, system design approach, and software development has been its use of a down-select competition for prototyping. Originally, the government had planned for a one-year down-select, in which case the contractor with the winning prototype would have already been chosen. However, this competition has been delayed to a 24-month cycle, after which it is expected the government will take six to eight months to select the winner.[10]

In 2021, TITAN awarded C5 OTA contracts worth $8.5 million each to Palantir and Raytheon for the first year-long phase of a competitive prototyping effort, and in 2022, both companies were awarded $36 million each for another 14 months of design prototyping. By the fourth quarter of FY23, the Army, after testing the prototypes and incorporating ongoing soldier feedback, will select one of the competing companies' prototypes for transition to production and fielding.[11] The Army has also tested a pre-TITAN prototype built by Northrop Grumman for the TENCAP office and Defense Innovation Unit under an OTA contract. During the Project Convergence experiments of 2022, the Army tested the pre-TITAN prototypes' ability to transport images from satellites to commanders and weapon systems. The pre-prototype was deployed with the first Multi-Domain Task Force in support of INDOPACOM operations, further informing TITAN's progress.[12]

## 5.2 IMPACT OF PPBE ON TITAN: KEY FINDINGS AND INTERVIEW VIGNETTES

TITAN was selected as one of two additional case studies required by Research Task One due to the program's unique and relevant implications for the research. Critical case study findings pertaining to TITAN were developed through literature review, one interview conducted with ten U.S. Army personnel associated with the Program Executive Office (PEO) for TITAN, and two industry interviews conducted with a total of four professionals with two different defense companies on contract with the Army in support of TITAN development efforts. In advance of the interviews, a literature survey was conducted that prepared the researchers and served as a foundation to the interview questions concerning TITAN and PPBE. Among other readings, this literature review included the Commission on PPBE Reform's Interim Report.[13] Interview feedback and other material collected by the research team, summarized and analyzed in the following sub-sections of this case report, have been curated to align with the below key findings summarized in Figure 5.1 in the Executive Summary. In all circumstances, the research team's interview and attribution methodologies abided by the Chatham House Rule. Any subsequent excerpt quotes from interview participants included in this report have been anonymized.

### *5.2.1 USING MOSA, THE MTA PATHWAY, AND OTA CONTRACTS HAVE LED TO RAPID PROTOTYPING AND PROGRAM SUCCESS IN TITAN BUT STILL POSE UNIQUE CHALLENGES*

Interview participants highlighted that PPBE's time requirement hinders Program Office development and integration of advanced and rapidly evolving software. A key concern expressed by TITAN PEO staff was the inefficiency of a two-and-a-half year time frame between a Program Office's budget submission to their Service headquarters and those funds being available to a Program Office for contract obligation. However, TITAN PEO staff stated they had been insulated from the negative impacts of the PPBE time frame through use of a MOSA approach to acquisitions, MTAs, and OTA contracts. This approach allowed TITAN to make timely adoptions of new technologies and lessons learned – without the extended timelines organic to JCIDS, PPBE, and Federal Acquisition Regulation (FAR) processes.

TITAN staff noted the PPBE process "puts the Department behind the commercial sector right off the bat, before we've even started with one dollar, because we are trying to frame something and get money into a process so far in advance of ourselves."[14] The staff expressed that PPBE timelines do not correspond to the advancement of new technology: a Program Office completes its budget in the early Winter, the Service headquarters adjudicates and integrates the PEO budget during the Spring (sometimes informed by the Defense Planning Guidance (DPG), sometimes without the DPG having been published), the budget is reviewed by OSD in the Autumn, submitted to Congress in February, debated until passed into law in December (after a Continuing Resolution), and funds made available to the PEO for obligation in March. In prototyping, software advances, and iterative lessons learned, the PEO observed that the 30-month gap between PEO budget formulation and PEO obligation of funds is problematic. For software-intensive programs such as TITAN, an interview participant even expressed that "planning is a waste of time since the tech is changing so much."[15]

Another interview participant observed the contrast between technological advancement and government timelines:

> It's not that the funding doesn't give you flexibility, but that you're telling Congress that what you're doing may or may not align with new technologies that need to be pushed into the system. And none of this is true right this second for the program, but in the other programs this holds true. The technology comes online, we've already told Congress how we're going to spend our money. You can go back and do a Congressional notification, but you may or may not have the dollars, you may or may not have the ability to do that. Three years is just too long.[16]

An additional interview participant added that he foresees PPBE timelines posing an issue for TITAN's antenna technology in the future. "Things go obsolete, or you know they're going to go obsolete in two years and you still want to buy, you have to buy it now because it is being programmed. But the replacement can be considerably more money than what you were planning for."[17] Basically, the "unknowns" of technology were viewed as not well accounted for to accommodate the short lead times of advancing technologies. TITAN staff noted there are approaches to mitigate the PPBE long timeline, like MOSA.

**TITAN's use of MOSA: benefits and challenges**

MOSA was emphasized as TITAN's most valuable acquisition approach for keeping up with the pace of technology advancements. A key factor found in the case study research is MOSA's use of commercial-off-the-shelf (COTS) solutions, reducing the need or frequency of expensive modifications and capability upgrades. A TITAN PEO lead explained MOSA's importance:

> Bottom line, the approach since the inception of TITAN is that it's gotta be MOSA, we've got to be able to plug and play as new technologies become available, we can't get locked in, either with proprietary software or proprietary solutions, and we can't lose access to our data in the system and need a proprietary decoder ring to get our data back out. In other programs, we've gone down that path over the decades so from inception we've written all of our contract language and all of our requirements documents to emphasize that modular open systems approach.

Interview participants suggested that MOSA is an asset to TITAN by helping to counter the effects of PPBE timelines slowing down the military's incorporation of commercial advances in technology. They also suggested that MOSA could allow TITAN systems to be more responsive to ongoing soldier feedback, as well as make it less cumbersome to budget for the future development and acquisition of highly specific components. However, they also pointed out that the benefits of rapidly adopting new technologies via MOSA are accompanied by increasing challenges in cost estimating, resulting in "more uncertainty when it comes to budgeting for how those capabilities will change over the next one to five years."

*Source: Tactical Intelligence Targeting Access Node, Interview #1*

**Figure 5.2. TITAN Key Finding #1 – Interview Vignette**

The MTA rapid prototyping pathway was also highlighted as an important tool for TITAN to award contracts faster than they would have using FAR-based contracting. This speed has given TITAN a rapid succession of prototypes, allowing the Program Office to mature relevant designs before final requirements documents are written. A TITAN program lead explained how MTAs have supported prototyping efforts:

> Say for example, if we had approached TITAN as a major capability acquisition program, we would've gone to a milestone B, we would've had an ADM [Army Design Methodology], we would've had an APB [Acquisition program baseline], and that would've established specific parameters for the program that by the time we initiated, we probably would've been oriented on that procurement funding and a lower RDT&E number than where we've gone to in the rapid prototyping program. Which would've led to us initiating a program and then probably doing a significant deviation or a breach within the first year, because we learned so much in the first six months that caused us to have to look at different funding alignments and what we would resource and program. And that's where the interaction of PPBE and the MTA approach was beneficial to the TITAN program, otherwise we probably would've had to re-baseline program at least once, already, in the first 15 months of this program.[18]

Industry interview participants associated with the TITAN program generally referred to MOSA, the MTA pathway, and OTAs as positive mechanisms for promoting speed and innovation, especially for accommodating TITAN's heavy software component. However, perspectives on OTA procurement authorities were the most nuanced in these interviews, distinguished by the nontraditional versus traditional defense contractor experiences. Understandably, the nontraditional contractor perspective placed greater value on the OTA's ability to level the playing field for industry competitors, while the traditional contractor perspective valued the protection afforded by structures of FAR-based contracts as opposed to OTAs.[19] The nontraditional industry interview perspective designated the treatment of the OTA contract like a FAR-based contract as the biggest challenge currently faced from an industry perspective. The insertion of more FAR clauses was said to have reduced flexibility, increased bureaucratization, slowed funding timelines in the POM cycle, and hamstrung the government from moving forward more quickly with decisions and future phases due to fear of bid protest.[20]

The traditional contractor perspective also acknowledged the potentially negative impact of insertion of FAR clauses but cited several major issues inherent to OTAs. The first issue cited was that they create middle barriers between government and industry, possibly leading to communication delays and loss of information in translation, as well as reducing direct collaboration. A second issue was that for certain development programs, they may not be as effective because of the competitive nature they drive, cost driving relationships, and add an artificial element to the contract that does not necessarily move technological progress faster. And finally, OTAs often necessitate a large cost-sharing component, which can impact the traditional contractors' ability to innovate.[21]

Referring to TITAN's use of a MOSA approach, the MTA pathway, and OTA contracts, one government interview participant concluded, "There are a lot of tools in the toolbox, a lot of flexibility, and it's really on acquisition professionals to determine how to use those tools to best achieve what they are asked to deliver."[22]

### *5.2.2 TITAN HAS BENEFITED PROGRAMMATICALLY AND TECHNOLOGICALLY AS A CONTINUATION OF PREVIOUS ARMY RESEARCH EFFORTS AND FUNDING LINES*

TITAN personnel explained that the program has faced fewer complications in funding largely due to its privilege as a high-priority program replacing legacy systems and building on previous research. One interview participant believed that if the program had been a completely new start, the Army would still be waiting to start advancing the program and obtain dedicated funding lines.[23] Another explained:

> If we had completely approached this from a traditional method, we probably would just be barely starting TITAN in '24 if we had truly followed the full PPBE process for initiating. But we were able to find ways in 2020, 2021 in particular, to begin the program and start doing work to advance it in advance of having funding lines specifically for TITAN. And that was done through coordination with OSD, with Congress, and everyone else being very transparent on it. We would begin applying money within the scope of existing programs towards these future requirements.[24]

TITAN's budget structure also benefits through leveraging technological expertise from other organizations doing advanced technology development. Interview participants noted that strong relationships with other Army entities have helped the program save money, profit from decades of previous expertise, and move quickly without having to grow a new workforce. Interview participants highlighted BA-4 as a transition vehicle for segueing technologies from the TENCAP 907 line into TITAN, especially for the space-based component of ISR technologies that will support TITAN's overall evolution.

One interviewee described the relationship between TENCAP and TITAN as a "habitual relationship where they're an incubator as new space technology comes online. There's a logical bridge there over the valley of death where it's a natural transition from the TENCAP Office into the TITAN program of record."[25] He expounded on the importance of overall collaboration with other programs and offices besides the TENCAP Office:

> We're trying to do something similar with artificial intelligence and machine learning to build that bridge from the S&T lab into the program of record. And since you've mentioned the valley of death, I think there are times when the Army and the Department ended up stove-piping when folks were doing really great work in basic and applied research. There's a desire to get something out of the lab and into a program of record… But if we're not tracking that … and if we're not programming it three years ahead of time, there's just no natural landing pad, so there can't be stovepipes. Everyone has to be collaborating and talking so we can plan ahead three years and make sure we've got a wedge in the POM for whatever exquisite technology will come out of the lab and into the program.[26]

Another feature of TITAN's budget structure as a continuation from a prior program is that the advanced and basic versions of the system are not found within separate budget items, due to the technological overlap, especially in software, between the expected advanced and basic configurations. The prototyping process has been almost exclusively on the advanced variant, the progress of which will inform future up-select decisions and designs for future basic variants. For Congressional justifications, TITAN personnel show different amounts of the prototypes they intend to buy, without differentiating funding for different software configurations.[27] This streamlined approach has contributed to program agility and success. One interview participant explained:

> For a program like TITAN, having one funding line is helpful. With DCGS, which was twice the order of magnitude (it was a giant program, ACAT I), that can look like just a large bill fare for the rest of the Army when you have one giant funding line. And now they will take that to pay bills and the PMs are left to figure out how you execute the remainder of the dollars. Having more specificity is nice because it makes it easier to defend cuts to one of our individual program lines, but it also kind of locks you in; you just have less flexibility. So, it's definitely a balancing act in how we write our P and R Forms and how we lay out funding lines. It's a little bit of an art and a science.[28]

Industry interviews reinforced that there are perceived benefits to streamlining TITAN's budget structure, with emphasis on a holistic approach to programming for advances in both software and hardware:

> It's one thing to create pathways specifically for software, but all advanced programs in development have a software component either from a mission perspective or from a design, production, or operations and maintenance perspective. So, looking at these technology-heavy programs in general rather than just separating them into hardware metal bending exercises versus software development exercises is key.[29]

### *5.2.3 MOVING FUNDS FROM PROCUREMENT TO RDT&E, ACCOMPLISHED WITH EFFECTIVE STAKEHOLDER ALIGNMENT, ENSURED CONTINUED INVESTMENT IN NECESSARY PROTOTYPING EFFORTS BUT IMPACTED INDUSTRY EFFORTS BY EXTENDING THE COMPETITIVE PHASE*

Annual President's Budget requests for the TITAN program were changed between FY 2023 and FY 2024. While FY 2023 projected $298.9 million in procurement funding for FY 2024, FY 2024 budget documents included zero procurement funding.[30] The interview with TITAN personnel provided context for this major shift in the types of appropriations used by the program, as highlighted in the Figure 5.3 vignette.

The consensus among the interview participants was that the funding realignment was done quickly and without any negative impact on the TITAN program – largely due to effective stakeholder engagement. The staff noted this success as an example of program office "collaboration across the enterprise, between Army and OSD and the Hill to work on right-sizing the funding lines … it was the Army speaking with a unified voice, it wasn't a bunch of different opinions … It was quite effectively communicated and supported at all levels."[31]

Interview participants also cited TITAN's rapid acquisition authorities as a reason why the shift of funds from procurement to RDT&E made sense. Another interview participant followed up by contrasting TITAN with other Army programs in relation to RDT&E funding:

> Because we're now in a different situation, we're doing a lot of prototyping and we're using a lot of RDT&E to buy that hardware. And the problem with that is you do not have disbursements in your RDT&E until you receive that hardware. I don't think that's an issue per se with the TITAN program, but we have other programs where it might take two or three years to receive a piece of hardware, and if you don't have disbursements showing that as you're going through your under-execution with OSD, you're getting dinged constantly.[32]

**Changing colors: no muss, no fuss**

Early on, the needed Procurement funding for FY 2024 was greatly overestimated, possibly due to TITAN's evolution from a previous program. As TITAN evolved, the Program Office recognized RDT&E funding was more appropriate to developing and integrating new technology into the program. The Army's interpretations of the program's progress and what was needed had changed rapidly after the President's budget request had already been submitted. An interview participant summarized the thought process and subsequent shift in appropriation strategy:

> There was a thought that we could accelerate and produce more TITANs more quickly if we put a giant tranche of Procurement dollars in early in the program; as we went to ASA (ALT) over the course of making our decision to start the competitive prototyping phase, they looked at it and said you can't use Procurement dollars for prototypes, based on their review of the most recent Congressional language. That was a problem because we did not have enough RDT&E to do the prototyping phase and we had way too much Procurement way too early. Then it was working with ABO [Army Budget Office] and the Hill to rephase and realign the procurement dollars to later in the program, and reprogram some of those procurement dollars to RDT&E to let us do the prototyping.

*Source: Tactical Intelligence Targeting Access Node, Interview #1*

**Figure 5.3. TITAN Key Finding #2 – Interview Vignette**

Both the literature review and the interviews highlighted that program managers are graded on how they spend appropriations and are penalized ("dinged") if they don't spend within a prior ordained timeline. As a consequence, the speed of spending is often a greater concern than the effectiveness of the spending. As a result, spending decisions are made that could easily be called into question if the standard was effectiveness, efficiency, or even performance, rather than whether money is spent according to a quarterly sequence.[33] Often, as exemplified by the TITAN program office's decision to extend the prototyping phase, it is more important for the PPBE process to allow for flexibility to change course when needed, rather than for finding ways within PPBE to accelerate technology transition within the program of record.

Within the context of TITAN, however, program personnel reported being generally pleased with the ease of money realignments, which occurred during the budgeting phase following the President's budget submission. Congress was asked to change the budget, marking budget lines and moving money, before the budget submission was approved prior to the year of execution. Funding adjustments were made within the portfolio without additional dollars moved to the program.[34] For the TITAN program office, this distinction was directly related to their engaged and positive relationship with Congress.

Both the literature review and the research team's interview with the TITAN program team underscored that the program office's proactive relationship and regular communication with Congress were essential to the program. Because the program office was effective in framing TITAN as a natural evolution of DCGS-A, Congress accepted the program as a continuation, not a new start. This designation accelerated the program's funding. Likewise, the program office's habitual communication with Congress concerning program details and updates ensured Congress accepted the program's consolidated funding line. Program Element consolidation provided the Program Office with greater flexibility in execution than they would have had otherwise. In turn, the effort the Program Office put into establishing and maintaining trust and confidence of Congressional authorizers and appropriators was vital to the program.

Although the funding realignment was accomplished with relative ease and without noticeable impact to TITAN's early success, industry interviews captured some of its downstream effects and potential implications. The realignment, due to initial overestimation of Procurement funding needed for TITAN at the start of the PPBE process, adds an additional 18-20 months to the competitive down-select process. It is estimated that approximately one-third of the delay, comprising the final months, will be caused by government deliberation on selecting the winning contractor. While the extension of the competitive cycle and additional months required for decision-making could support TITAN's development efforts, the resulting timeline delays have several implications.

One industry interview participant highlighted the final months of government deliberation as the main culprit for any potential negative impacts of a delayed technology transition. He explained that "not only is it delaying program progress, but [the government is] also spending extra money to keep both vendors on an additional 18 months before they can actually move to an award decision."[35] Another interview participant working for a different contractor rationalized that such delays are not unique to the TITAN program—rather, they are inherent to development efforts that occur alongside competitive scenarios. It occurs due to a variety of reasons, such as difficulties balancing fair competition among suppliers with specific standards for innovation and broad requirements.[36]

However, the extension of prototyping efforts was technically not to blame for additional government spending, as funds were realigned rather than added while keeping two companies on contract in the down-select. One interview participant summarized the impact of the realignment, including potential prototyping tradeoffs and increased spending on the industry side:

> The color of money change didn't specifically impact us, but the money that the government would've awarded us for the competitive prototyping phase was split in half and awarded to each vendor. And the government found themselves in a position of wanting everything they originally wanted with half the budget to do it, forcing them to make hard decisions about what they would not get in the phase of development. But that also put significant pressure on us in industry to go competitively fill that gap with funding.[37]

Despite TITAN's protracted competitive process, industry interview participants still emphasized the unprecedented speed of its technological progresses in comparison with other defense programs they observed. And although timeline delays caused by prolonged development vendor selection efforts are issues linked to the disadvantages of a long PPBE timeline, which cannot easily predict changes in the disbursement of funds or colors of money, it is important to note they are also largely dependent on many other factors separate from the PPBE process. For example, the difficulties of keeping multiple competing contractors on FAR-based contracts is more of a contracting-related issue than a PPBE-related issue. Furthermore, the use of MOSA and less prescriptive, broader requirements, which can slow down the competitive process and ensuing government choices, should be considered within the context of requirements processes.

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# CASE STUDY 6: JOINT RAPID ACQUISITION CELL (JRAC)

## 6.0 EXECUTIVE SUMMARY

The JRAC was established to rapidly address the urgent, operationally critical acquisition needs of CCMDs. The JRAC's aim is to ensure that these operational needs, submitted as JUONs or JEONs, are eventually addressed and rolled into fully funded programs of record by a designated DoD entity (usually a military service). The JRAC's exercise of Rapid Acquisition Authority (RAA) facilitates its dual leadership and helper role in the resolution of JUONs and JEONs. Despite their small dollar values, JRAC-facilitated solutions often struggle to be funded and sustained through the Services' PPBE processes. Two case study anecdotes are described in sections 6.2.1 and 6.2.2 to exemplify this challenge: in one, a hardware solution could not find sustainment funding to continue as a Service program of record; in a second one, a software solution remained stationary in the PPBE process for two years before it was rolled into a DoD agency program. As illustrated by these vignettes and the overall research findings outlined in the below Figure 6.1, approaches for implementing rapid responses are weakened and slowed by budget battles with preexisting Service programs of record, a byproduct of PPBE shortcomings.

**Key Findings**

1. JRAC efforts highlight the challenges of developing and deploying urgently needed capabilities to support operational needs via the Services' respective PPBE processes.
2. Phasing out Overseas Contingency Operations funding has made it increasingly difficult to secure funding to fill urgent capability gaps, especially JUONs and JEONs.

**Figure 6.1. JRAC Case Study Key Findings**

Key findings from JRAC interviews and the literature review highlighted several barriers to rapidly incorporating the U.S. warfighter's urgent operational needs into fully funded, sustained programs of record. Even for organizations such as the JRAC that are specifically created to enable rapid acquisitions, these barriers exist in the form of procedure-related and funding-related obstacles that intensify Service protectiveness over other legacy and prioritized funding accounts. Navigating Service-specific PPBE processes further complicates the budgeting and execution of urgently needed capabilities. Additional funding and acquisition flexibility may be necessary to meet the goals of DoD components like the JRAC or to fulfill urgent warfighter requirements. The key findings appear to align with several areas of concern identified in the Commission on PPBE Reform's Interim report, including 1) Improve PPBE processes to support innovation and adaptability, 2) Improve alignment of budgets to strategy, and 3) Improve PPBE-related relationships between DoD and Congress.

## 6.1 PROGRAM OVERVIEW

The JRAC is a small organization within the DoD that is uniquely positioned to coordinate with the Services (and sometimes DoD agencies) in helping them fulfill their mandated obligation to fund, deploy, and sustain solutions for urgent operational needs (UONs) submitted by the CCMDs to the warfighter within a rapid time frame. As one of several measures designed to meet the demands of asymmetric warfare during the wars in Iraq and Afghanistan, the JRAC was created and its basic structure established in a 2004 memorandum emanating from the Office of the Deputy Secretary of Defense.[1] The mission of the JRAC is twofold: first, to facilitate the resolution of UONs through the designation of the Service responsible for filling the operational capability gaps. Second, the JRAC must monitor and ensure the timely fulfillment of the solution from development to sustainment, helping to resolve issues that arise as the UON transitions into a Service program of record.

UONs, defined as capability requirements impacting contingency operations, originate from one of the CCMDs and are further classified as JUONs for ongoing contingency operations, or JEONs for anticipated contingency operations.[2] CCMDs submit JUON or JEON requests because they highlight operational capability gaps that cannot be filled by the Services, which are chartered to train and equip forces employed by CCMD. The potential JUON/JEON therefore necessitates action in the form of a DOTMLPF solution.[3] Even though they may be ultimately programmed into the budget of a sole military service, JUONs/JEONs are also considered joint in that their importance overlaps Service-specific missions.[4]

After the CCMD chain of command has validated a JUON or JEON, it is received and processed by the JRAC in conjunction with the Functional Capabilities Board (FCB) and the J-8 Force Structure, Resources, and Assessment Directorate. Together, these entities serve a gatekeeping role in the further validation of the JUON/JEON before the JRAC can designate a Service for long-term management of the potential solution or begin formulating funding strategy in cooperation with the Comptroller.[5] As JUONs/JEONs must be reviewed and validated at multiple levels of authority, represent CCMD priorities, and require the Services to make tradeoffs in their defense portfolios, the threshold for their approval is high: the potential for unacceptable loss of life and/or critical mission failure if the capability is not provided.[6]

The JRAC is equipped to accommodate the urgency of operational needs through its unique authorities to advance acquisitions along a rapid timeline. DoD entities selected to absorb and oversee JUON/JEON solutions are also mandated by statute and DoD Directive 5000.71 to procure, field, and sustain the capabilities. To help translate the operational priorities of the CCMDs into the Program Objective Memorandum (POM) cycles of the Services, JRAC leverages a set of acquisition and funding authorities known collectively as RAA. RAA allows certain DoD components to make use of available funds on a flexible basis without following the typical phases of the planning, programming, and budgeting phases of the PPBE process, as long as Congress is notified and the capability supports urgent acquisition and deployment needs.[7]

The origin of the JRAC's RAA, which was codified into statutory language in 2022, can be linked to two National Defense Authorization Acts (NDAAs) from twenty years ago—the Ronald W. Reagan NDAA for FY 2005, and the Bob Stump NDAA for FY 2003. These two pieces of legislation provided the necessary provisions and authorities for the Secretary of Defense to acquire and deploy materiel within a strict and rapid time frame, waive regulatory impediments to acquisitions, and access broad financing avenues, albeit under a relatively low threshold of $100 million.[8] The JRAC's role as the lead administrator of the RAA and resolver of validated UONs was delineated in subsequent DoD memoranda and Instructions, and legislation over the years.[9] The RAA threshold is now $200 million in authority at the start of each fiscal year, for each of the four existing categories of RAA for four different types of national security deficiencies.[10]

The JRAC process also establishes a time limit of 14 days but aims for a goal of 48 hours to further validate and recommend a course of action for the JUON or JEON.[11] According to interviews with JRAC personnel, the average length of time from JUON/JEON approval to the obtainment of a funding line is two to three months, and the average dollar amount for a JRAC-facilitated program or capability falls between $25 and $75 million.[12] While the JRAC has no specifically-stated timeline goal for fielding the solution other than seeing that it is deployed to the warfighter as rapidly as possible, the timeline to delivery is normally between 120 days and two years for 70-80 percent of the solution.[13] If it is determined that the timeline to deliver the JUON/JEON solution must be achieved in less than 120 days, the JUON can be further designated an immediate warfighter need (IWN).[14] The subsequent processes for JUONs and JEONs as referred to throughout this case study report can be comparably applied to IWNs, which were created in 2004 as a special subset of JUONs to place increased emphasis on timely resolution and enhanced visibility to DoD leaders.[15]

Although the JRAC itself cannot fund a capability or roll it into a program of record, it is also empowered to facilitate rapid acquisitions for JUONs and JEONs by serving as a single point of contact and intermediary for critical decision makers within the DoD. The place of JRAC within the overall DoD chain of command is relatively streamlined and designed to facilitate the JRAC Executive Director's access to senior leaders and OSD. The JRAC capitalizes on both its RAA and its close ties with senior DoD leaders to serve a helper role for the resolution of JUONs/JEONs. For example, if there is a situation where a Service does not have funds within a specific type of appropriation to develop and field a solution for a JUON or JEON, the JRAC can leverage RAA on behalf of the Deputy Secretary of Defense to change the color of funding if Congress is notified.[16]

Many success stories have been attributed to the JRAC, especially for the rapid procurement of counter-improvised explosive device (IED) equipment. The JRAC's acquisition management and oversight contributed to the rapid development, procurement, and deployment of a counter-rocket, artillery, and mortar intercept capability that helped base camps engage and destroy rocket, mortar, and artillery rounds.[17] The JRAC was also responsible for securing funding for the development of a platform that provided CCMDs with a suite of non-lethal measures for urban fighting, and in another instance, it successfully gained approval and funding in under 30 days to purchase commercial radios for improved interoperability and communications among U.S. and coalition forces during counterterrorism operations in rugged environments.[18]

The context of the JRAC has changed since its original conception during the previous wars in the Middle East, when discontinued supplemental funding lines such as the Iraqi Freedom Fund often provided the primary source of funding for JRAC-enabled solutions.[19] In the past, the JRAC was also able to facilitate the use of separate Overseas Contingency Operations (OCO) funding lines for subsidizing the development and sustainment of new urgently-needed capabilities. Today, JUONs and JEONs are almost exclusively funded by the Services. After the end of the wars in Iraq and Afghanistan, the scope of JRAC activities has also been somewhat expanded to address federal acquisition and sustainment shortcomings. For example, in 2020, the functionalities of a COVID-19 Joint Acquisition Task Force focused on medical supply chains were folded into the JRAC.[20] Nevertheless, the JRAC continues to facilitate the fielding of a wide range of requests supporting soldiers under various geographical CCMDs around the world.

## 6.2 IMPACT OF PPBE ON JRAC: KEY FINDINGS AND VIGNETTES

The JRAC was selected as one of two additional case studies required by Research Task One due to the organization's unique and relevant implications for the research. Case study findings pertaining to the JRAC were developed through two interviews conducted with two subject matter experts, both U.S. Government personnel with positions of responsibility within the JRAC. Throughout the JRAC interview processes, a literature survey was conducted that prepared the researchers and served as a foundation to the interview questions concerning JRAC and the PPBE. Among other readings, this literature review included the Commission on PPBE Reform's Interim Report.[21] Additional findings relevant to the JRAC were derived from interviews conducted by the research team to obtain industry perspectives for other Task One case study research efforts. Interview feedback and other material collected by the research team, as summarized and analyzed in the following sub-sections of this case report, have been curated to align with the key case study research findings summarized in Figure 6.1 in the Executive Summary. In all circumstances, the research team's interview and attribution methodologies abided by the Chatham House Rule, and any subsequent excerpt quotes from interview participants included in this case study report have been anonymized.

### *6.2.1 JRAC EFFORTS HIGHLIGHT THE CHALLENGES OF TRANSLATING URGENTLY NEEDED CAPABILITIES INTO THE SERVICES' PPBE PROCESSES*

A critical takeaway from interviews with JRAC personnel was their emphasis on turning rapid warfighter requirements, designated as JUONs or JEONs, into capabilities that can be sustained through the Services' respective PPBE processes. Even after handling initial difficulties designating a Service or agency for incorporation of the capability, the JRAC cannot avoid complications related to the Services' readjustments of their programmatic priorities and the funding streams for those preexisting priorities. These challenges adapting urgent operational needs stem from the difficulty of capturing reliable new funding lines through PPBE and the nature of PPBE that induces the Services to segment their own priorities separately from the Defense Department and CCMDs.

It is important to note that the JRAC does not duplicate the functions of Service-unique rapid acquisition processes, and once the Service adapts a JUON or JEON into a capability within its portfolio, the schedule to deployment is contingent upon them. Moreover, despite the JRAC's RAA and the statutory requirement for DoD components to address JUONs or JEONs, the process for rapidly filling operational gaps lacks a forcing mechanism for the Services to turn a possible solution into a program of record.[22]

A recurrent theme throughout the interviews was that the Services are often averse to adjusting their programming and budgeting for JUONs/JEONs because it requires them to make tradeoffs affecting their priorities. In particular, the interviews suggested that funding for ongoing Service modernization efforts are among the most selected sources of quantity and funding cuts to accommodate the solutions.[23] Since Services designated for fulfilling a JUON/JEON are responsible for full lifecycle costs, the JRAC sometimes struggles to insure against "drive-by acquisition," a phrase that was coined to describe instances where materiel solutions are fielded to the warfighter without adequate Service support for long-term program management and oversight.[24]

The vignette summarized in Figure 6.2 describes a scenario in which a JUON solution met an earlier-than-intended end due to failure to obtain Sustainment funding through a designated Service's POM process. The issue also highlights broader themes across the DoD, as such scenarios that occur with other defense efforts intended to help address urgent technological or national security needs when they cannot obtain reliable sources of funding as budgeted programs of record. For example, the Defense Innovation Unit efforts face similar technology transition and sustainment hurdles in the valley of death, which can preclude the Pentagon from rapidly acquiring and fielding potentially promising commercial technologies.[25]

The exact impact of the discontinued capability described in Figure 6.2 is not known. However, since JUONs/JEONs are validated as high-stake operational needs for the warfighter, their lack of fulfillment and sustainment, at worst, could negatively impact a mission or the safety of the warfighter. Furthermore, drive-by acquisition also wastes money. If a program is not supported to the point of full operational capability and sustainment, then the funds that went into the development and initial fielding of the solution were spent on a solution that was not capitalized on to its intended capacity.

**Drive-by acquisition: The demise of a JRAC-fielded solution**

In one recent scenario, the JRAC helped oversee the development of a hardware solution, valued at approximately $25.7 million, that was initiated in FY18 and sustained through FY21. Although the Service designated for oversight had identified the system as a future program of record to be fielded until FY25, it chose not to fund further program sustainment after the capability lost its JUON designation. To fund continued sustainment of the capability, the Service would have had to reduce the quantity of another unrelated system they were going to procure and detract funds from that program element, which they were unwilling to do. Without adequate support from the Service, the funding necessary to sustain the capability could not be captured through the PPBE process:

> The Service responsible said they reduced risk by fielding the initial capability, but that it did not align with their long-term strategy … It just wasn't on their list, they were no longer compelled to do it, and so they were focusing more on strategic long-term modernization priorities, not a short-term band-aid solution.

*Source: Joint Rapid Acquisition Cell, Interview #2*

**Figure 6.2. JRAC Key Finding #1 - Interview Vignette**

One of the interview participants emphasized that the JRAC's special authorities are not enough to compensate for delays and difficulties of capability transitions:

> And even using all our special authorities and rapid acquisition authority, the budget process sometimes delays the start of work, even when using a magic wand to change the color of money. You may burn three, six, nine months before you can start work, when you break ground for the first time … And you know the [PPBE] process, so that's still fast when we're looking out four years at a time. A new start in three or nine months is still pretty fast, but for something that's a top priority of the Department, we don't have enough agility to start it the next day.[26]

The challenges faced by the JRAC while trying to initiate new programs of record are also relevant for other case studies. The PPBE's process emphasis on maintaining or adding funds to prior programs of record negatively impacts many other DoD entities, including the Services themselves, attempting to deliver important capabilities to the warfighter within a timely manner. One non-JRAC interview participant observed that programs were rarely cut or slowed down, even when they were not executing well, reducing available room for new programs and receiving more scheduling "in hopes that these programs would deliver something, someday."[27] Additionally, the interview participant observed an ongoing scenario of a government organization "waiting out the PPBE cycle" to incorporate a new program architecture, because its other ongoing programs of record have left no room in the organization's budget.[28]

According to the JRAC interviews, changing types of appropriations, or colors of money, can also present issues. If a Service does not have the correct color of money needed to fund an immediate warfighter need, the JRAC's RAA enables it to assist with shifting those appropriations, but it still results in delayed time frames and other complications. If a Service must change the color of money after it has identified a PE from which to draw funding, it is likely to require significantly more personnel-hours in assistance from the JRAC. It is also likely to require substantial additional time; for example, an extra two weeks to put together an RAA package, two more weeks to obtain staffing, and three more weeks to obtain a signature from the Deputy Secretary of Defense, plus an additional waiting period for Congressional notification.[29]

The isolation of the CCMDs from the PPBE process is another potential contributor to the JRAC's obstacles translating JUONs and JEONs into Service budgets. Across multiple case study research efforts, interview feedback from the JRAC and non-JRAC personnel associated with other defense programs suggested that the PPBE process for incorporating new funding lines can engender rigidity and lack of fluidity between CCMDs and the Services. Although the Services will accommodate the CCMD's high-level needs through the incorporation of new programs when they are compelled to do so, they may not prioritize those needs if they do not align with the Service's objectives at that time. One non-JRAC interview subject with relevant domain expertise had observed that because CCMDs were insufficiently integrated into the PPBE process, the Services often fail to budget according to the CCMDs' broad-lens vision in the planning process.[30]

**A disconnect between CCMDs and military Services**

Part of the difficulty transitioning JUONs and JEONs into Service programs of record might be attributed to a disconnect between the CCMDs and the Services. One JRAC interview participant described a potential dynamic that could occur, illustrating discrepancies between CCMD and Service aims and their ensuing difficulties programming and budgeting for mission responsibilities:

> For something like long-distance ISR, you might hear from combatant commands that they want ISR that can remain in the air for days collecting data. The Air Force has the mission for the ISR, but can say they don't need it because they have the ISR program for the MQ-9 and want to focus on manned aircraft rather than unmanned. Meanwhile, the combatant command will tell you they need to expand the unmanned need. It then becomes a question of who becomes responsible in that force … Who's going to pay the new bill? At the end of the day what is the requirement? And you get into other questions. How many hours or platforms? How many people need to get it on this? … The Services look at this in terms of having a new bill.

*Source: Joint Rapid Acquisition Cell, Interview #1*

**Figure 6.3. JRAC Key Finding #1 – Interview Vignette**

Beyond the constrained effectiveness of rapid acquisition authorities within the context of PPBE processes, the JRAC's challenges were not attributed to PPBE processes alone. Interview participants cited other possible causes, such as training issues and a lack of understanding of procedure for UONs. One interview participant explained that DoD personnel who do not prioritize the JUON/JEON solutions must be reminded that they are required by statute and directive to do so, and "because a lot of people don't do JUONs or JEONs, they don't really understand their being compelled to do it by the Deputy Secretary of Defense. So sometimes there's a learning curve."[31]

Interview participants stressed that it is necessary for the JRAC to be vocal about advocating during the POM process to ensure that the capabilities can be developed and rapidly fielded.[32] This could include person-to-person advocacy (i.e., calling the three-star general responsible for program funding) or going up the chain of command to escalate involvement in funding solutions for a JUON or JEON. The JRAC's close relationships with other DoD executive offices support its efforts to place increased pressure on the Services to proceed with a program or maintain the visibility of the program.[33]

### *6.2.2 PHASING OUT OCO MADE IT HARDER TO SECURE FUNDING TO FILL URGENT CAPABILITY GAPS*

A second important finding from the JRAC case study provides additional granularity into the funding-related challenges of rapid acquisitions. Case study research indicates that the decline of OCO funding has significantly impacted the ability of the DoD to fund and sustain immediate warfighter needs. In particular, the loss of previously available OCO funds has exacerbated the JRAC's pre-existing challenges securing funding for JUONs and JEONs. One interview participant explained the previous relationship between OCO funding and the JRAC:

When there was OCO, or Overseas Contingency Operations funding for both the Iraq and Afghanistan wars, sometimes that OCO would make it a lot easier to the Services to where they didn't have to take funding out of their topline budget. In these cases, even Sustainment funding didn't have to come from the Service, it was all OCO. So that was certainly much less painful for the Services that way because they didn't have to look internally and say they had to kill this ground vehicle program to fund this because this is de facto the highest priority of the Department, even though it doesn't align with our long-term modernization efforts.[34]

As OCO funding for enduring requirements has been shifted into base budgets, the Services have been forced to balance between their budgetary priorities and those of CCMD. When they are expected to cut quantities and funding lines for their other programs, there are more likely to be delays in funding for new capabilities to meet immediate needs. As highlighted by the interview vignettes, it is extremely difficult for the Services to draw from their own funding in support of top priorities such as JUONs or JEONs, which, by dollar value, comprise "small bites, by DoD standards."[35]

JRAC personnel described one recent scenario in which funding difficulties led to a two-year lag in the JUON/JEON process before the capability was programmed or executed. The capability was eventually turned into an agency program rather than a Service program of record as highlighted in Figure 6.4.

**Funding difficulties: A two-year struggle in the valley of death**

In FY19, the JRAC helped to develop a JUON solution consisting of an adaptation of existing software to merge data from multiple sources. At an estimated $28 million in cost, the software capability needed home and fit through a maintained program of record. In the POM cycle, work on the software adaptation failed to find funding for two years, through which the JRAC had to be highly proactive about continuing the capability. The software was eventually rolled into a larger DISA program, which used sustainment funding for the program. It eventually succeeded thanks to strong advocacy and the perceived importance of the capability:

> The system itself was very successful, and so it grew into a very useful program that the user community could rely on. And so there was a loud outcry of, 'we can't lose this capability,' and so that was briefed back to us in program review. And my director, to the three-star that was responsible for funding it, told him to cut another program going forward, and there was value in the [software]. And the three-star saw the value, understood it. It required person-to-person advocacy, but it was not a hard sell, it just required … seeing it across the finish line.

*Source: Joint Rapid Acquisition Cell, Interview #2*

**Figure 6.4. JRAC Key Finding #2 - Interview Vignette**

Although the software eventually succeeded, it highlights the funding issues that delay rapid acquisitions of urgently needed capabilities when Services (or agencies) must draw from their own funds rather than OCO. The impact of the delay was that the warfighter needed to go without this critical capability for two years. For JUON and JEON solutions that were exclusively funded through the OCO funding line in the past, the Service would not have had to detract funding or quantity from any of their other programs, nor would they grapple with the same challenges of changing colors of appropriations. With OCO funding in this scenario, not only would the two-year lag likely not have occurred, any potential negative impacted of the corresponding program cut would also be avoided.

Again, additional factors such as the role of the human element (i.e., strong leadership and advocacy) should be taken into consideration when examining the role of PPBE-related issues, such as the loss of OCO, in the funding of urgently needed capabilities. As stressed in Key Finding 1, the interviews with JRAC personnel reiterated that training and knowledge play a major role in the ease with which capabilities can be rolled into the PPBE process. When defense professionals know how and what to offset in the budget to accommodate JUONs coming out of the warfighter theater, it reduces the complexity of the JRAC's and the Services' responsibilities.[36] And ultimately, the impact of OCO should also be considered in tandem with the fact that it originated out of a wartime sense of urgency. To provide another explanation beyond OCO, a shift in the DoD mindset as the wars in Iraq and Afghanistan ended also likely impacted the Services' willingness to rapidly fund warfighter needs.

Despite a clear relationship between Service willingness to fund JUON/JEON capabilities and the availability of alternative funding streams such as OCO, it is worth noting that the JRAC still struggled to find funding solutions during years that comprised the peak of OCO funding. In one instance, the JRAC had to repeatedly press for the resolution of a 2006 JUON necessitating only $6 million in capability funding. Nevertheless, earliest delivery of the solution was completed within four months, and complete delivery within eight months, comprising substantially shorter time frames than acquisitions not facilitated by the JRAC.[37]

It is possible that the implications for JRAC regarding the loss of OCO funding are comparable to the impact on other DoD components responsible for developing and deploying solutions for meeting urgent operational needs. However, the JRAC personnel interviewed were unable to quantify specific differences in rapidity and/or intra-Department cooperation, nor did the interviews discuss other relevant impacts when comparing OCO-funded and non-OCO-funded JUON/JEON solutions. Further case study anecdotes may be necessary to confirm the validity of this research finding.

Research efforts for the JRAC case study were also unable to capture detailed recommendations to ameliorate funding difficulties for urgent capability gaps, or the potential for creating viable alternative O&M budget activities for funding JUONs/JEONs. However, interviews with other case study experts conveyed a recurrent interest in bridging the disconnect between multi-service, emergent warfighter needs and Service priorities through the allocation of greater authority to CCMDs. One interview participant with both industry and government experience in integrated program review cycles provided the following feedback and broad recommendation, specifically referring to difficulties funding JUONs and JEONs:

> I see the CCMDs participating, but their needs are secondary … categorized as JUONs or JEONs … So I guess my thinking is: why are the programs of record always first? Why do we always take care of their needs [even if] they're not executing properly, and the CCMDs get put in the urgent need process and hopefully get unfunded dollars. I think that needs to be flipped and the warfighter and combatant commanders' needs need to come first. There's got to be a balance.[38]

Another interview participant, who also possessed industry and government experience, suggested that money be given directly to CCMDs for taking control of decisions to meet the needs of the warfighter. Their overall perception was that CCMDs consistently lack the resources they need:

> The Services do PPBE, but a Service does not go to war; CCMDs are the ones who go to war … [the PPBE process is] about trying to optimize allocations of money to equip the Services … Yet the CCMDs have virtually no say.[39]

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