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THESIS

BUSINESS LOGIC OF THE WARFIGHTER

by

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Current acquisition processes and strategies often result in the delivery of warfighter tools, whether aircraft, ships, weapons, or submarines, that do not meet current mission needs or usability standards. A causal factor is the lack of integration of end-users with the designers and developers throughout the acquisition process. Recent DOD directives support providing alternative pathways to the traditional acquisition process by acquiring technologies at the speed of relevance to meet fluid mission needs. Integrating end-users with design teams in a continuous iterative methodology style, i.e., Agile, provides feedback early and often, from requirements generation to testing for flexibility should capabilities or requirements change. Including warfighters brings their operational, maintenance, and user perspectives to better support the program. It is also essential to modify warfighter training courses and curriculum to educate warfighters on the requirements process. The resulting process and product are improved tri-fold. First, the contractor understands the desired capability requirements earlier in and throughout the acquisition process regardless of the process used. Second, the warfighter is involved early in the capability and functional requirements development and gains an understanding of the acquisition process and barriers. Third, the warfighter has better training to troubleshoot and maintain these more complex systems.

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ABSTRACT

Current acquisition processes and strategies often result in the delivery of warfighter tools, whether aircraft, ships, weapons, or submarines, that do not meet current mission needs or usability standards. A causal factor is the lack of integration of end-users with the designers and developers throughout the acquisition process. Recent DOD directives support providing alternative pathways to the traditional acquisition process by acquiring technologies at the speed of relevance to meet fluid mission needs. Integrating end-users with design teams in a continuous iterative methodology style, i.e., Agile, provides feedback early and often, from requirements generation to testing for flexibility should capabilities or requirements change. Including warfighters brings their operational, maintenance, and user perspectives to better support the program. It is also essential to modify warfighter training courses and curriculum to educate warfighters on the requirements process. The resulting process and product are improved tri-fold. First, the contractor understands the desired capability requirements earlier in and throughout the acquisition process regardless of the process used. Second, the warfighter is involved early in the capability and functional requirements development and gains an understanding of the acquisition process and barriers. Third, the warfighter has better training to troubleshoot and maintain these more complex systems.

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LIST OF ACRONYMS AND ABBREVIATIONS

AAF	Adaptive Acquisition Framework
AAR	After Action Report
ADM	Acquisition Decision Memorandum
ALIS	Autonomic Logistics Information System
AR	Acquisition Readiness
ASNRDA	Assistant Secretary of the Navy Research, Development and Acquisition
BLWT	Business Logic of the Warfighter Training
CBA	Capabilities Based Assessment
CBO	Congressional Budget Office
CENTCOM	U.S. Central Command
CJCSI	Chairman Joint Chief of Staff Instruction
CO	Contracting Officer
COI	Critical Operational Issues
COR	Contracting Officer Representative
CNO	Chief of Naval Operations
CTOL	Conventional Landing and Takeoff
CV	Carrier-based Variant
DAMS	Defense Acquisition Management System
DARPA	Defense Advanced Research Projects Agency
DAU	Defense Acquisition University
DFAR	Defense Federal Acquisition Regulation
DOD	Department of Defense
DODI	Department of Defense Instruction
DON	Department of the Navy
FAR	Federal Acquisition Regulation
FEA	Front End Analysis
GAO	Government Accountability Office
HQE	High Qualified Experts
ICD	Initial Capabilities Document

IOT&E	Initial Operational Test and Evaluation
JCIDS	Joint Capabilities Integration and Development System
JDTA	Job Duty Task Analysis
JROC	Joint Requirements Oversight Council
JSF	Joint Strike Fighter
KPP	Key Performance Parameters
MCA	Major Capability Acquisition
MOE	Measures of Effectiveness
MOS	Measures of Sustainment
MVP	Minimum Viable Product
NDS	National Defense Strategy
NETC	Naval Education and Training Command
NMS	National Military Strategy
NPS	Naval Postgraduate School
NSS	National Security Strategy
OMB	Office of Management and Budget
OMS	Off-board Mission Support
OUSD A&S	Office of the Under Secretary of Defense Acquisition and Sustainment PPBE Planning, Programming, Budgeting, and Execution
QDR	Quadrennial Defense Review
R&D	Research and Development
SCD	Soldier-center design
SGE	Special Government Experts
SME	Subject Matter Expert
STOVL	Short Takeoff and Vertical Landing
T&E	Testing and Evaluation
TMRR	Technology Maturation and Risk Reduction
TMS	Training Management System

EXECUTIVE SUMMARY

The one consistent element of DOD acquisition programs and pathways is the need to entail changes effectively and efficiently deploy relevant capabilities to the warfighters. The adaptability to advancements in funding, technology, and database management contribute to the developments to identifying the most rapid means to acquiring new capabilities. In addition to the updates of the aforementioned contributions, feedback from the end-user captures the fundamental baseline in the research and recommendations presented here.

21st century warfighters enter military service with advanced technological knowledge and skills that represent potentially high-value tangible benefits to the DOD acquisition infrastructure. Research allows acquisition professionals to identify in previous programs where input from the end-user would have resulted in an increased pace to requirements necessary for the materiel solution. Training the end-users to engage their professional service in terms of capabilities not only increases purpose in their efforts, but also links to the relevance needed to advance military lethality.

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I. INTRODUCTION

This thesis focuses on how the integration of the warfighter, or end-users, with the acquisition team, can lead to better technical successes in delivering capabilities within programs' cost and schedule constraints. This integration with early and often inputs and feedback from the warfighters can emulate recent acquisition reform that adopts an Agile methodology, a continuous iterative development model, in place of the waterfall model, a serial-based model. The background and history provides trends in acquisitions and user training to highlight recent acquisition challenges and advocate for the need to improve and increase the business logic of the warfighter and inclusion within the acquisition teams and process.

A. BACKGROUND

The Department of Defense (DOD) of the United States has maintained a superior military in the world with advanced technologies and innovation. However, adversaries are closing the gap for various reasons, and one reason is that they have a far less complex and lengthy acquisition process than the one used by the DOD (Rand, 2015). Additionally, the service life of DOD military assets is decades, and when the assets were more mechanical than electronic, upkeep and maintenance were simpler. In today's current technological environment, advancements are continuous and fast-paced. They can influence the next generation of warfighting technology in years rather than decades, but with the expectations to sustain and operate assets for decades. Yet, the lengthy and complex acquisition process and the training of the warfighters are negatively impacting the DOD's chances of maintaining their superiority.

The DOD 5000 Series of directives and instructions have been the foundation of the DOD's acquisition environment. The DOD's execution of the acquisition process has come under fire for continuous cost overruns and schedule delays of significant acquisitions. The Government Accountability Office (GAO) asserts the substantial impact of the use of waterfall as required by older versions of the DOD Instruction (DODI) 5000.02 Operation of the Defense Acquisition System (Harris, 2020). Cost and schedule

impacts usually occur during the design and development phases due to technology and maturity, which highlight the need to present the functional requirements, such as mission and system critical features, as well as non-functional requirements during the design phase. For example, from the Navy's acquisition, the costs for the lead ships for the most recent 11 ship class have exceeded the initial budgets, with three exceeding their initial budgets by about 80% (Oakley, 2018). The Navy is not faring better with meeting approved budgets for follow-on ship costs and is consistently delivered behind schedule. With increasing cost overruns and schedule delays, there is pressure to shorten the test and evaluation phase to advance the program and reduce cost. By the testing stage, the capabilities of the asset may no longer be as cutting edge with the technology or meet recently evolved threats (Oakley, 2018). Also contributed from this GAO report, warfighter equipment is delivered to the fleet with known deficiencies and incomplete work.

DOD strategists focus on potential future wars with American adversaries and multiple angles America would attack. These adversaries substantiate the primary documents used to establish strategic objectives, such as the National Security Strategy (NSS), National Military Strategy (NMS), and National Defense Strategy (NDS), as well as service-specific documents. An attack could come against our military hardware assets, such as ships or aircraft, or they may come against our cyber community to attack the information channels currently in place. These threats raise the importance of every military member to prepare support for the mission with the most lethal capabilities possible. The DOD utilizes acquisition pathways to accumulate the necessary materiel solutions to aid warfighters across all military services. The materiel solutions result from the requirements identified in the Joint Capabilities Integration Development System (JCIDS), presented by the Joint Requirements Oversight Council (JROC), representing only one element of the DOD integrated procurement process (Joint Chiefs of Staff [JCS], 2009). This system was introduced in 2003 to offer a joint focus to identifying requirements and provide solutions that would benefit warfighters across all services and approach the acquisition process with cost-benefitting measures.

Reforms in defense acquisition processes and policies have continuously evolved since the establishment of the DOD after World War II. The most notable acquisition

change began with implementing the DOD 5000 (series) in the early 1970s. The latest restructuring of defense acquisition took place in January 2020 with DODI 5000.02 Operation of the Adaptive Acquisition Framework (AAF). One primary purpose of this latest update "restructures defense acquisition guidance to improve process effectiveness and implement the AAF" (DOD, 2020, p. 1). This policy established the selection process of which there are six pathways involved to support operations and sustainment. Utilizing the AAF is key to developing the integrative information processes necessary to maintain advantages against adversaries strategically.

The Honorable Frank Kendall, when reflecting on the constant policy changes in defense acquisition, stated, "There seems to be an expectation that all programs should execute perfectly on time and schedule. This doesn't happen, of course, so we are often dissatisfied with results, leading to political and management practices of constant change. The occasional acquisition disaster further fuels this tendency" (2017, p. 180). The latest materiel solutions to the battlefield and information from the battlefield are equally important, although the acquisition framework focuses primarily on sending materiel solutions to the battlefield. The current acquisition framework identifies capability gaps in defense performance criteria based on the security strategies. The NDS, for example, replaced the Quadrennial Defense Review (QDR) and is released every four years. This strategy presents the DOD force's posture and role to support the President's NSS. If there are capability gaps discovered when comparing against currently existing capabilities, the JCIDS process initiates resolutions. The Capabilities Based Assessment (CBA) from the sponsor determines the need for a materiel solution.

There have been numerous innovations to defense acquisition strategies and processes through the years. The goal is relatively the same: get materiel solutions to meet capability objectives into the hands of warfighters as quickly as possible. Everything from increasing speed to establishing a Program of Record to Urgent Operational Needs requests has been deconstructed and reconstructed with each iterative development of acquisition. Aside from random events or 'one-offs' wanting to capture the creativity and experience from the force, there is little to no exposure training the most common users on understanding materiel solutions and basic principles of the acquisition processes, defining

the warfighters, and contributing to their craft efficiently. Additionally, there is limited exposure to relationships with developing contractors that would grant insight into how each component would benefit the objectives.

Historically, training is the key to tactically fighting wars and maintaining effectiveness, retention, and promoting innovation in the ranks. Training improves a warfighter's operational performance and helps build knowledge to contribute to future developments. When considered an aid to the performance indexes of the 'triple constraints' in program management—budget, schedule, and scope—there are tangible benefits to training DOD warfighters. These end-users of new capabilities should be trained on the implications of the triple constraint so that they can set more realistic, achievable, and affordable requirements.

B. PROBLEM STATEMENT

Technological capability advancements continue to outpace the traditional acquisition process and expected life span of military assets. The design and implementation of newer, software-intensive capabilities take years, often decades, to deploy, resulting in obsolescence issues and often do not meet warfighter needs, expectations, new threats, or missions. Many factors contribute to this misalignment, such as the DOD's inflexible and typically high-risk waterfall method. Also, the lack of end-user involvement in the acquisition requirements process, sustainment, and lack of training inhibit their ability to positively contribute to the development of military assets. As Figure 1 depicts, it is all about perspective.

Figure 1. All About Perspective. Adapted from Gary Larson's "*The Four Basic Personality Types*" (1990).

C. OBJECTIVES

1. Primary

How can the business logic of the warfighter be improved to incorporate the concepts borne from continuous iterative methodologies, such as Agile, to incorporate the users early and throughout for constant feedback?

2. Secondary

How can warfighter training courses and curriculum be modified to more fully educate them on the requirements process?

D. PURPOSE/BENEFIT

The purpose of this topic is to dive into how improving the education of the warfighter by including the acquisition business and including the end-users early and often can positively influence programs meeting their triple constraint. The end-users, who are often among the enlisted ranks, are integrated with the acquisition team, both government

and contractor industry base, to refine requirements, better understand the acquisition and trade-off processes, and provide feedback on usability. The resulting process and product are improved two-fold. First, the design team, particularly the contractor who performs most of the design and development, understands the desired capability requirements earlier in and throughout the acquisition process regardless of the methodology. Secondly, the warfighter has early input and more knowledge to troubleshoot and maintain these more complex systems.

The scope of this research and analysis focuses on the Defense Acquisition Management System (DAMS), also known as "Little A" acquisition. The authors understand and acknowledge that DAMS is part of the "Big A" Acquisition that comprises Requirements Generation System, Joint Capabilities Integration and Development System (JCIDS), Planning, Programming, Budgeting, and Execution (PPBE), and DAMS. Both JCIDS and PPBE affect the planning, strategy, and execution of DAMS, and all three have different drivers. JCIDS is needs-driven, PPBE is calendar-driven, and DAMS is events-driven. The three major areas do not align for smooth acquisition execution. Secondly, the authors also acknowledge that Congress and its actions play a prominent role in the "Big A" and "Little A" acquisitions. To bind this thesis, the authors are focusing on DAMS. The authors narrowed the discussion to the Navy as they work for the DON, one uniform, and one civilian.

The benefit of this analysis is to move forward with some of the reform that the DON has instituted and continue to demonstrate how the research can ultimately change the culture of defense acquisition. While we do not speak specifically about culture, changes lead to cultural differences, which is needed to embrace these changes long-term. Aside from changes to the acquisition process, the benefit is a more educated and knowledgeable military to operate and maintain these more complex systems.

E. SCOPE METHODOLOGY

In outlining why the business logic of the warfighter is critical to the success of defense acquisitions, this paper reviews the literature and analyzes the DAMS process of defense acquisition, the current training of the warfighter, and how to integrate the two.

The authors used the Joint Strike Fighter's (JSF) program acquisition strategy, particularly the Automated Logistics Information System (ALIS), as case studies to illustrate challenges and successes against the acquisition process and end-user inputs. The authors combined the Literature Review and Analysis Sections, even though this is atypical, to streamline the logic. Analysis of data tends to occur during the literature review and is difficult to separate without repeating some of the information from the Literature Review Section. The Literature Review and Analysis Section focused on early data with qualitative analysis of the JSF acquisition strategy and warfighter training reports from organizations such as the GAO, Congressional Research Service, and the Naval Education and Training Command. Newer released information outlines the Findings Section to outline actual status with baseline plans.

F. SUMMARY

This chapter outlined the issues with the defense acquisition process and the general ability to provide capability at the speed of relevance. There needs to be reform in the defense acquisition process, including contracting to increase participation by a broader commercial industry and reform in training curriculums and methods to improve the involvement of warfighters in the acquisition process.

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II. LITERATURE REVIEW AND ANALYSIS

This research evaluates several factors in the struggles of the DOD's significant acquisitions. The first is how the DODI 5000.02 influenced the current trends of substantial procurements, focusing primarily on the DON with an overview of the Joint Strike Fighter acquisition strategy. The second outlines the roles and responsibilities of the acquisition teams and the end-users. The third topic highlights how the reductions in training budgets may have been adequate before the systems were more mechanical. Still, the training curriculum has not kept pace with increased system complexities and technologies. Lastly, we focus on the Autonomic Logistics Information System (ALIS) component of the F-35 program that missed the mark of what the warfighter needed versus what was built and delivered. The authors included the analysis in the literature review as the research often leads to analyzing the data, and the information presentations are logical.

A. DOD ACQUISITION

This section expands on the DOD acquisition process and the increased role of the warfighter with additional training. Areas of warfighter inclusion characterize an underutilized element when reviewing the DOD acquisition environment. Additionally, the type of additional training can be determined to increase the knowledge of the warfighters to be key stakeholders on the acquisition teams.

1. DOD Acquisition Process

The DOD acquisition process is complex, and it is how the DOD procures warfighter assets and supporting systems and services. DOD acquisition comprises of three components: 1) Resource Allocation through Planning, Programming, Budgeting and Execution (PPBE); 2) Requirements Generation System through the Joint Capabilities Integration and Development System (JCIDS); and 3) Defense Acquisition Management System (DAMS). Each component has different driving factors, and each factor influences the performance, schedule, and cost of programs. This thesis focuses on the DAMS component and DODI 5000.02. The DOD acquisition process has undergone several iterations of reform to combat schedule delays and cost overruns. The reform has primarily

focused on DAMS, or "Little A" acquisition, part of the DOD's Acquisition Environment (see Figure 2). The DOD Directive 5000.0 (DODD 5000.01), *The Defense Acquisition System*, and DODI 5000.02 (DOD, 2020), *Operations of the Defense Acquisition System*, govern acquisition. DODD 5000.01 is "the management process by which the DOD provides effective, affordable, and timely systems to the users" (DOD), 2007, p. 2). The DOD acquisition process includes two branches of the federal government and an influential industry base with influence from the media, warfighters, and the public. The DOD is dependent on Congress for funding. Program authorization serves under the Executive Branch with its statutory and regulatory requirements and relies heavily on the industrial base for janitorial services to major weapons systems. In the center is the program manager (PM), who is responsible for managing the program within the triple constraints but with no decision authority. An approval and authority hierarchy exists above the PM that further adds layers and complexities.

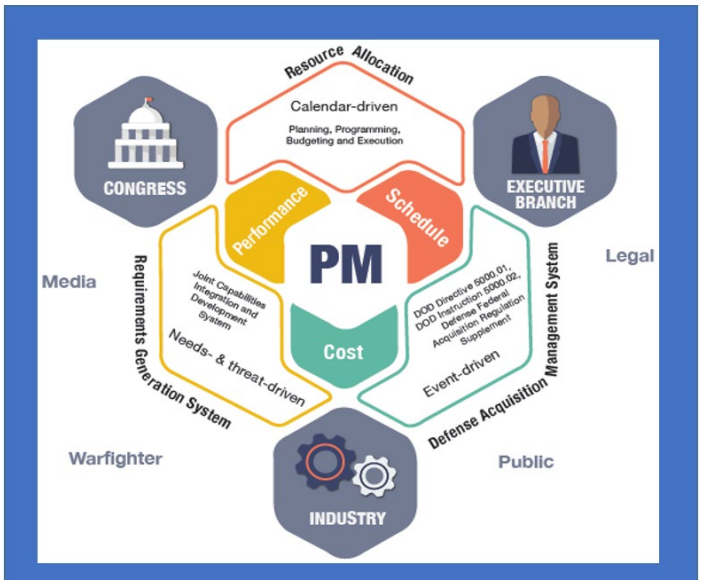


Figure 2. DOD Acquisition Environment. Source: Mortlock (2021).

Until early 2020, DOD programs followed DODI 5000.02 *Operations of the Defense Acquisition System* designed to follow a waterfall methodology, as shown in Figure 3. The chronology of the phases is serialized with rigid milestones, prerequisites,

and approvals to enter the next stage. The instruction includes five acquisition objectives—flexibility, responsiveness, innovation, discipline, and streamlined and effective management, which allows for flexibility through tailoring against program needs. Responsiveness would provide time-phased capability needs through incremental acquisition. There was recognition that the commercial industry performed better than the DOD innovation by adopting best commercial practices and business solutions. The oversight and milestones managed programs following statutory and regulatory requirements. Lastly, decentralization and empowerment would lead to streamlined and efficient management.

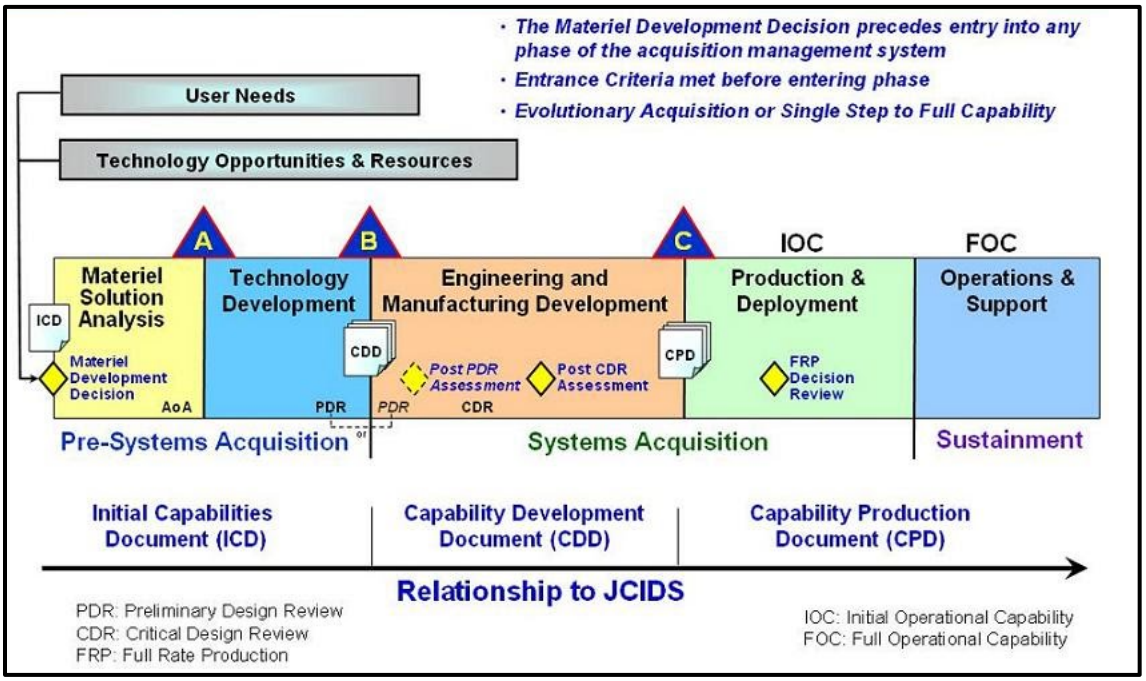


Figure 3. Operations of the Defense Acquisition System. Source: Quick Reference: Defense Acquisition Management System (2008).

Despite the intent of the 2015 version of DODI 5000.02, the DOD continued to experience challenges with the acquisition of major acquisition systems. As stated in the background, numerous news articles and GAO reports highlight evidence, delayed critical programs, and over-budget—USS *Gerald R. Ford* (CVN 78), USS *Zumwalt* (DDG 1000), Virginia Class Submarines, and the Joint Strike Fighter (Oakley, 2018). There have been

many efforts to review the acquisition process to understand the best areas of reform. One such investigation performed by the Section 809 Panel charged Congress to focus "its efforts on modernizing defense acquisition for the 21st century and making recommendations to enable the DOD to more consistently buy what it needs in a timely and cost-effective manner" (Section 809 Panel, 2019, p. 1). The core of Section 809 Panel's Roadmap to Success, per Figure 4, illustrates four focus areas to reshape the culture of defense business to acquire and deploy capabilities at the speed of relevancy. Each section, at a high level, can contribute to continued reform.

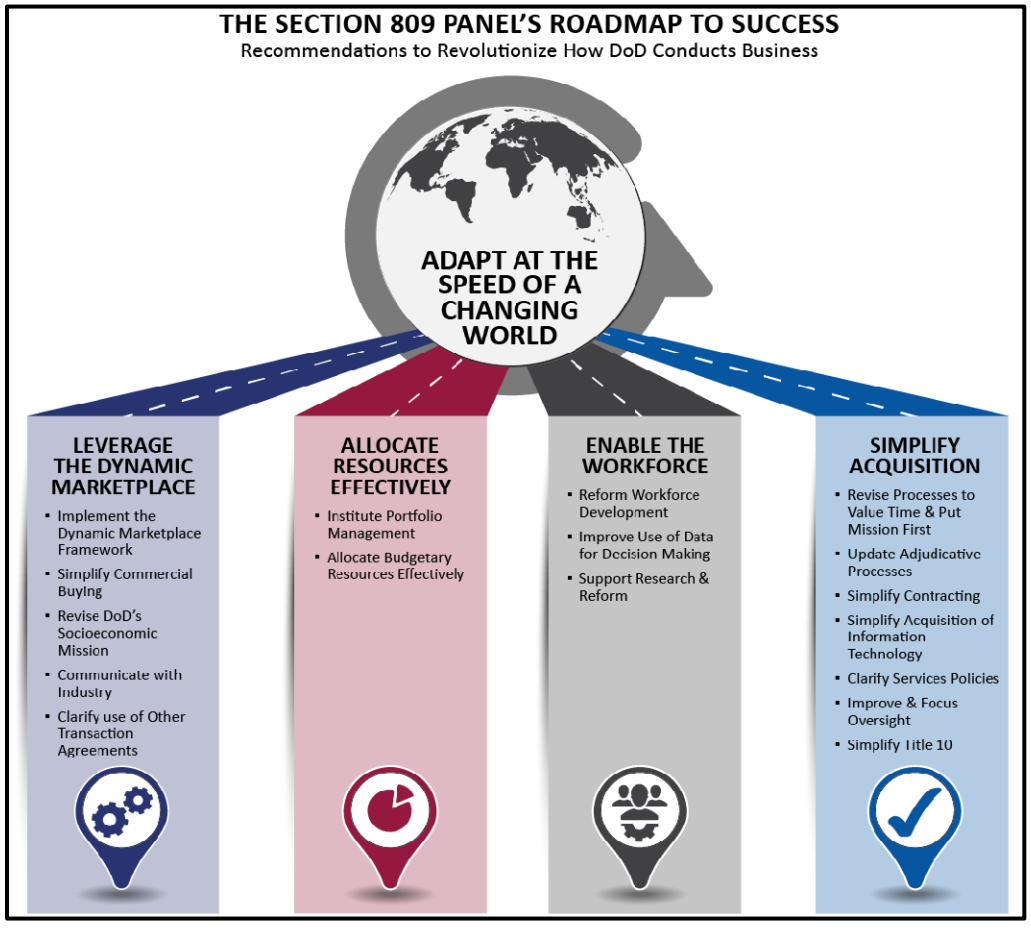


Figure 4. Advisory Panel on Streamlining and Codifying Acquisition Regulations. Source: Section 809 Panel (2019).

The most obvious recommendation is the "Simplify Acquisition." Section 809 Panel's recommendations dive into statutory and regulatory requirements to reduce redundancies and consolidate cumbersome and burdensome acquisition laws for efficient and increased industry participation. This recommendation can help with the inclusion of a broader set of skills from the industry by removing barriers to better align with planned technical capabilities. These changes lead to Section 809 Panel's recommendation for *"*Leveraging a Dynamic Marketplace.*"* As the commercial sector has surpassed the DOD in technological advancements, adopting commercial practices, processes, and methodologies into the DOD acquisition process can further revolutionize the acquisition environment.

Additionally, the Panel further recommends improving how the DOD communicates with the industry. Traditionally, the DOD tends to hold the requirements close to the vest and receive industry input during the post-contract award. Instead, the Panel recommends having early and ongoing communications with the industry with the benefits of engaging them as partners and having a better knowledge of market capabilities. This industry to DOD communications would continue into the acquisition process and include the appropriate end-users. The dynamics of contacts and teaming would change the culture of the materiel solution business. Having the right skill sets in the design team composition further enables teaming with warfighters in a continuous feedback loop.

2. Roles and Responsibilities

High acquisition performance is not dependent upon one stakeholder in the process, and the varied stakeholders have different agendas based on expertise and experience. The typical primary stakeholders involved in the acquisition process to identify the requirements are the warfighters, contractors, DOD, and the industrial base. The non-defense industrial base is a market that the DOD is trying to and needs to engage. Each brings their specialized skills and knowledge to a specific role and responsibility:

a. Warfighters

Warfighters are the ultimate end-user of the system and product. The design and development can support a range of requirements, from administrative to weapons.

Warfighters also play a critical role in establishing objectives for service contracts. Defining "warfighter" is not as easy as it sounds. Often during acquisitions, there is a warfighter representative, not actual end-users, such as the enlisted and younger officers.

b. Military-Industrial Base/Contractors

The industrial base is the private sector that supports the DOD. The industrial base has been shrinking and now consists of fewer prime vendors. These vendors performed most of the design, development, testing, and fielding of capabilities per the requirements of the contracts. Other contractors carry out service contract requirements.

c. Department of Defense

The DOD identifies capabilities, defines requirements, and acquires services, systems, and products for the warfighters to meet mission areas. Program Managers effectively lead the capability developments through decision-making milestones.

d. Commercial Sector

The non-defense industrial base or the commercial sector is responsible for the recent technological advancements, while the military-industrial base is catching up.

The warfighter's role does not focus on obtaining an understanding of the Defense Acquisition process, including knowledge of the Joint Capabilities Integration and Development System (JCIDS) and Planning, Programming, Budgeting, and Execution (PPBE). The DOD is a dynamic environment because the DOD has continuously changed requirements to increase uncertainty levels as customers of the industrial base. Mixing the acquisition elements, such as JCIDS and PPBE, to the industrial processes creates a complex task for the warfighters unfamiliar with both the DOD and industry processes for developing new capabilities. Mission requirements may vary as fast as the latest intel provided. Furthermore, incorporating new acquisitions may also lead to new conditions on the battlefield, as we see done with service contracts in a drawdown period in the U.S. Central Command (CENTCOM) region. Warfighters adding clarity to the capability conversation must speak through JCIDS to the industrial base in common terminologies and, in doing so, seek to increase the efficiency of the acquisition process. The current

DOD Decision Support Systems must revolve around the warfighter. This research guided the theory that the business logic of the warfighter increases the cost and schedule performance indexes of DOD acquisition programs as the DOD increases utilization of the industrial base for capability developments.

3. Understanding the Acquisition Workforce to Include the Warfighters

The acquisition workforce includes a blended variety of specialized personnel to contribute to national defense. The easy answer is to say every member of the DOD is part of the acquisition workforce. Ideally, everyone would approach their job as a craft worth contributing improvement ideas for safer, more reliable, and cost-effective solutions. While one benefit of this workforce approach is to provide the typical private citizen an opportunity to contribute to the nation's security and defense via contracting, the warfighter should trust the DOD acquisition methodologies to capture the most efficient and innovative products to meet the mission needs. The right balance of skills needed must also include effective communication with the warfighter to accomplish program objectives. Whether Subject Matter Experts (SMEs) are internal to the government or Special Government Employees (SGEs) and Highly Qualified Employees (HQEs) via Direct Hire, none of these matter if the result does not meet mission objectives. With many stakeholders involved in the acquisition process, it is essential to ensure everyone clearly understands their respective roles that focus on the goals coming from the program office. The warfighter and service entities want to receive the best capabilities. The government service employees want to ensure the performance cost-effectively with low risk. At the same time, this rewards the contractor with a sustainable business that helps meet the program objectives.

The benefits are seen in the Defense Software Innovation Board engaging in specialized training that led to new software acquisition pathways and rectified workforce issues. In the past two decades, we have seen high levels of hiring authorities build up the current acquisition workforce that now includes 180,000 personnel (OUSD A&S, 2020). Many of these maintain long-term employment and become SMEs leading program and

project offices. Many of the program offices turn to Direct Hire Authorities with SGEs and HQEs to increase innovation across the acquisition (as seen in Figure 5).

The need to understand who the stakeholders are and how contracting for acquisitions works is seen by reviewing the latest trends in DOD contract spending compared to the overall DOD budget context. The *Defense Acquisition Trends 2020* report states, "Defense contract obligations have grown 31% since FY2015, which was the last year of the previous defense drawdown" (McCormick, 2020, p. 2).

As reflected in Figure 5, contract obligations consume 55% of 2019's DOD Total Obligation Authority, the "third highest over a span of the last twenty years" (McCormick, 2020, p. 1). What is perhaps the most relevant to the business logic of the warfighter is the increased usage rate of contracts compared to the overall budget leveling off. Contract usage has increased though the budget is becoming stagnant (McCormick, 2020). Business logic or acquisition capability logic would present a framework for warfighters to contextualize their experiences that improve the DOD's relationship with the industrial base. The largest chasm seen moving forward with the increase of contractors and 50% of Total Obligation Authority in acquisition displays how the contracts do not include any role for the warfighters to contribute to the requirements of acquisition programs.

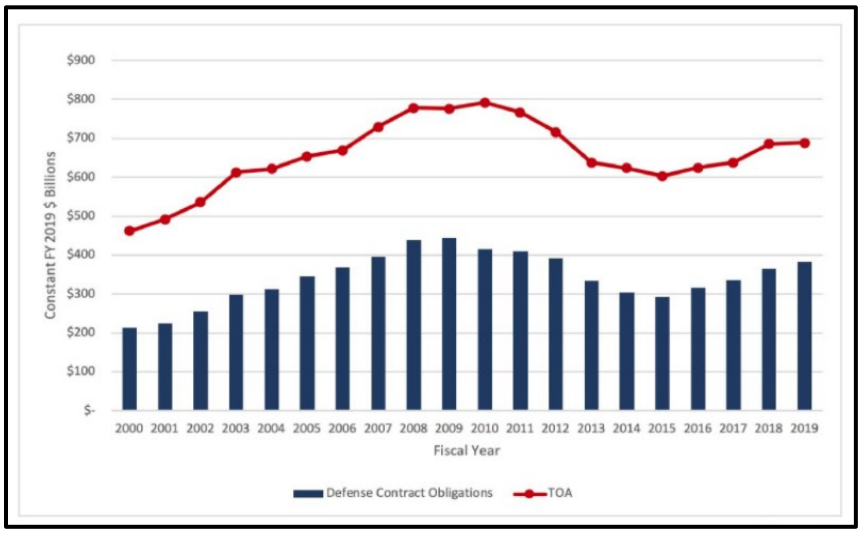


Figure 5. DOD Contract Obligations vs. Budget Authority. Source: McCormick (2020).

4. Training the Acquisition Workforce to Include the Warfighters

The federal government utilizes a business practice called "category management" that refers to "eliminating redundancies, increasing efficiency, and delivering more value and savings from the Government's acquisition programs" (OMB, 2019, p. 1). This effort to increase responsiveness aligns with the President's Management Agenda but is void of the role of the warfighter in the acquisition process and fails to address the need for developing the business logic of the warfighter. The findings highlight the lack of training for the typical end-user or warfighter about defense acquisition, obtaining feedback from recent operations, and little involvement in systems maintenance. Section 9.504 of the Federal Acquisition Regulation (FAR) provides a list of the Contracting Officer's responsibilities as "identify and evaluate potential organizational conflicts of interest as early in the acquisition process." The category management efforts from the Office of Management and Budget (OMB) include the roles and responsibilities of Contracting Officers as found in the FAR, improving relationships with the defense industry, maintaining accountability to regulations, and adopting the best solutions for critical functions.

One method to introduce the warfighter to developing an understanding of the defense acquisition system, the role of federal employees, the relationship with contractors, and what information would benefit contracting officers that do not currently exist is training. Training takes place for every warfighter who enters service in the DOD. Yet, training warfighter processes and methods to increase the overall effectiveness of the acquisition process does not exist outside the scope of After-Action Reports (AARs) that may provide data to Combatant Commanders submitting capability gaps to the JROC. DODI 5000.02, released January 23, 2020, only mentions warfighters when referring to Urgent Capability Acquisition needs. This instruction also does not address training opportunities that would benefit the Office of the Under Secretary of Defense Acquisition and Sustainment (OUSD A&S) priority to enable acquisition innovation nor the goal of development. It also highlights the "speed of relevance" needed to respond to maintain readiness against adversaries. Of all the documents produced to increase acquisition performance, none focus on integrating the warfighter into the acquisition process.

GAO-17-468 reviewed DODI 1322.31 Common Military Training. Of the 11 common military training requirements across all DOD services, none include training sessions that provide the average warfighter insight into these documents, their role in identifying capability gaps, nor any insight into the defense acquisition system. Understanding that the generation of requirements does not fall into the Defense Acquisition Management System category, but rather the JCIDS category, there are still opportunities to integrate the warfighter in the acquisition life cycle in other ways than Testing and Evaluation. Acquisition processes do not focus on training the warfighter to enhance the overall acquisition process in two critical ways. First, there are opportunities for end-users to contribute more to the Materiel Solution Analysis. The disparity between the JCIDS process and the Defense Acquisition System, where the Materiel Solution Analysis decision occurs, highlights the missed opportunities for warfighters to contribute to the desired capabilities. Secondly, the warfighter currently has limited maintenance and reporting requirements for the latest materiel solutions. The projected outcomes of increased training and development of a warfighter's business logic are improvements to system resilience.

Three recent examples reflect the importance of training to meet current needs and improve overall efficiency and effectiveness in DOD programs. A February 2021 GAO report states, "DOD has updated aspects of war-game exercises and mobility training to prepare for a contested environment but has not updated training for the surge sealift fleet" (Williams Brown, 2021, p. 17). In another example from a January 2021 memorandum, the CNO stated, "the Naval logistics enterprise must be fundamentally transformed to become more agile and resilient, both operationally and administratively," and "the enterprise must also have the capabilities, proficiency, and training to match fleet emission control and tactical situation requirements" (Chief Naval Operations [CNO], 2021, p. 1). The Navy, Marine Corps, and Coast Guard Maritime Strategy *Advantage at Sea* is the third recent example. This strategy, released in December 2020, seeks ways to employ long-term strategic competitions by delivering integrated All-Domain Naval Forces. One of the six priorities established in this strategy is "training and education for warfighting advantages in dynamic environments" (Secretary of the Navy [SECNAV], 2020, p. 17).

The answer across the DOD to remain a lethal force, adaptive to quickly evolving threats, is to incorporate innovative training for warfighter development. Our findings identify DOD acquisition processes that have yet to provide warfighter integration, much less training on acquisition principles and understandings necessary to improve the speed of capability.

The civilian sector of the DOD is quite inclusive, allowing SMEs to interact with SGEs and HQEs by use of the Direct Hiring Authority. Maintaining life cycle support for new systems has noticeable increases in contractor responsibilities established that prevent the warfighters from engaging. Training focuses on operating the system but overall lacks increasing the warfighters' ability to repair the system should it break down. The issue here is the critical impact of sustaining military operations for forward-deployed assets should they fail. Having training and experience with the acquisition processes and teams would give end-users advanced knowledge on systems and positively impact the triple constraints program managers face with any program of record.

Despite the size of the workforce, minimal training is presented to the average frontline warfighter on understanding acquisition processes, showing improvement methods to the acquisition process, and feedback opportunities on current capabilities. Currently, on the Navy's Learning Management System, only e-learning courses related to the Risk Management Framework concerning Acquisition and Information System Security Engineers are found. Most of the training delivered is to those participating in the CBA as part of the 10-step process, including study definition, needs assessments, and solution recommendations. According to the CJCSI 5123.01H, performance requirements, which refers to a "performance attribute of a system considered critical or essential to the development of an effective military capability" (Appendix A-4), are held responsible to the Chief of Staff of an Armed Force to be validated by the Joint Requirements Oversight Council. The JROC "assesses joint military capabilities, and identifying, approving, and prioritizing gaps in such capabilities, to meet applicable requirements to meet national defense strategies" (Joints Chiefs of Staff [JCS], 2018, A-5). Combatant Commanders, Services, and other DOD components submit capability requirements documents to the Special Access Program Control Office and the Requirements Management Branch as

reflected in Figure 6. This demonstrates the review boards and functional relationships across the JCIDS processes that include validation of requirements for six entities. Those are the Services, Special Operations, Intelligence, Defense Business Council, USCYBERCOM, and the Nuclear Weapons Council. Each grants authority to validate and document capability requirements.

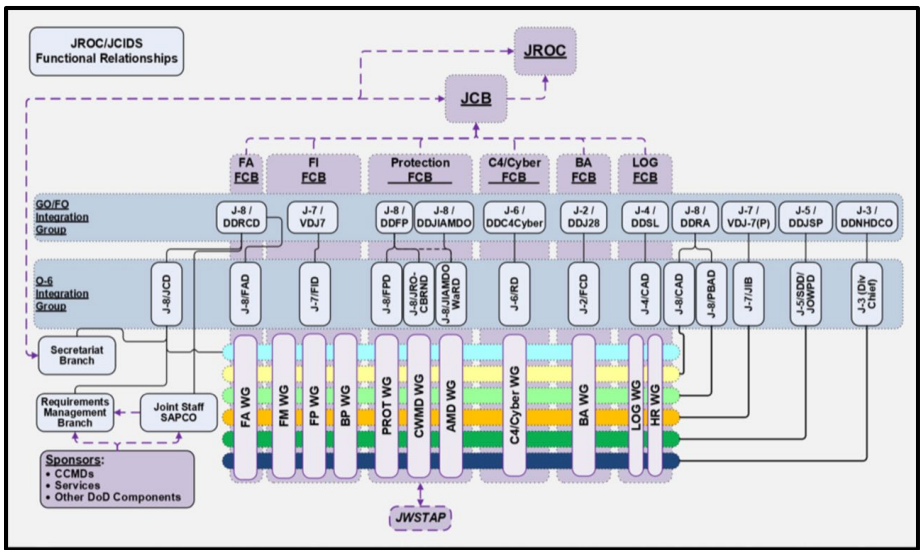


Figure 6. JROC Subordinate Boards and Related Organizations. Source: CJCSI 5123.01H (2018).

With the exponential layers between the warfighter and the JROC, while considering the amount of time it would take to route capability requirements through that chain of command, the need for clarity with speed is critical to successfully delivering the product acquired. Technology and internal SharePoint websites and other document delivery services may minimize the time spent between each echelon. Still, the business logic of the warfighter remains an issue. Without being trained to present essential requirements in how the JROC offers capabilities via the JCIDS process, the warfighter hinders the most efficient acquisition framework. Additionally, taking the knowledge the end-user gained from participating in the JCIDS process into the DAMS process would ensure continuity in interpreting the capability requirements into functional requirements and so forth. The findings of this research identified the restructuring of defense acquisition

with the AAF focused on restoring military readiness, but primarily through the means of expanding and strengthening alliances and partnerships as defense business reform lines of effort build “a safe, secure, and resilient defense industrial base” (Vergun, 2020, para 12).

“Allocate Resources Effectively” and “Enable the Workforce,” of Section 809 Panel’s recommendations, see Figure 4, extend beyond acquisition programs and acquisition professionals to the incorporation of the warfighters. Warfighters are considered the end-users of the acquisition but do not have methods to take more responsibility and accountability for the product they are receiving. The increased defense industrial base depends on the industrial base’s ability to maintain contractual obligations of the acquired capability through life cycle support, including up to and during operations and sustainment.

Conducting a SWOT analysis (Humphrey, 2005), as seen in Figure 7, brings balance and understanding of the recommendations set forth by the Section 809 panel. The internal strengths of a warfighter rest in their experience and ability to provide feedback on the human integration with current capabilities. As it pertains to the current status of the warfighter’s business logic, the weakness is that it is relatively non-existent. With no means to identify requirements, capabilities, or performance measures being commonplace, there remains nothing to shore up internally. The review of the warfighter’s business logic specifically against the barriers found in their limited exposure to acquisition concepts maximizes the benefit for its development. Crucial to the analysis is developing means to minimize or eliminate weaknesses and integrate strategy and plans for the opportunities available. Reflected in the research was the potential role warfighters could have earlier in the acquisition process. Specifically, this included the Initial Capability Assessment, providing end-users a chance to present KPPs and criteria desired, which would impact the decision on a materiel solution or a change to current capabilities.

STRENGTHS	OPPORTUNITIES
• Warfighters have first-hand knowledge of current capabilities and the operational environment. • Usability of current technologies.	• Train to identify gaps impacting operations and sustainment to meet strategic objectives. • Clearer communication with design teams. • Increased lethality and effectiveness on the battlefield.
WEAKNESSES	**THREATS**
• No acquisition training options for the end-user/warfighter on identifying performance requirements or presenting Key Performance Parameters on products or services would increase mission effectiveness.	• Lack of a clear role for warfighters in the acquisition process. • Complex systems. • Automated systems. • Outsourcing typical warfare maintenance support.

Figure 7. Business Logic of the Warfighter SWOT Analysis

Identifying opportunities and threats, the external factors, come more straightforward than the strengths and weaknesses. Specifically, training to identify gaps among operations and sustainment would allow warfighters a higher level of ownership in the capability development process. Integrating warfighters earlier in the development process also provides moments for senior leadership to guide the warfighter's feedback to harmonize with the security strategies and capabilities. Threats against the business logic of the warfighter include the increase in autonomous systems, which would take away the need for warfighters to engage as thoroughly, and the increased use of contracts and outsourcing for product sustainment. These potential threats decrease the overall need to prepare warfighters for a more hands-on engagement with developing capabilities and identifying requirements.

B. JOINT STRIKE FIGHTER (JSF) PROGRAM

The Joint Strike Fighter (JSF) program makes an excellent case study. The literature review and analysis focuses on data from the early years of the initial program's acquisition strategy to establish the baseline and program expectations. The JSF program leveraged

acquisition reforms to streamlined approaches, and this paper reviews and analyzes the successes and failures of the program in its acquisition execution. Another strategy used was the IPT that included the end-user. This paper uses the Automated Logistics Information System (ALIS), part of the F-35 aircraft sustainment system, to highlight the effectiveness of the IPT.

1. JSF Acquisition Program

Developed out of the Joint Advanced Strike Technology (JAST) program, the Joint Strike Fighter (JSF) program set out in late 1993 to replace the Navy's A-6 attack planes and possibly the F-14s and Air Force's F-16s (Bolkcom, 2002). The Air Force required a conventional landing and takeoff (CTOL), and the Navy needed a carrier-based (CV) variant. (Bolkcom, 2002). Per congressional direction in 1995, the Defense Advanced Research Projects Agency (DARPA) developed an advanced short takeoff and vertical landing (STOVL) aircraft that extended capabilities for the Marine Corps to replace the AV-8B jump jet (Bolkcom, 2002). In 1994, Congress directed the JSF program to incorporate STOVL (Bolkcom, 2002). Figure 8 illustrates the three variants. The DOD designated the Joint Strike Fighter as a major defense acquisition program in May 1996 (Bolkcom, 2002). The JSF program's initial plan was to procure approximately 3,000 JSFs from 2005–2030, with two-thirds for the Air Force, 640 for the Marine Corps, 300 for the Navy, and 60 for British Royal Navy (Congressional Budget Office, 1997). The purpose of the Joint Strike Fighter program was "to focus on joint development and production of a next-generation fighter/attack plane" and "have maximum commonality in airframe, engine, and avionics components to reduce production and operation and support costs" (Bolkcom, 2002, p. 2). To align with maximum commonality, even though the services have different uses and missions for their aircraft, the program office targeted 80% by value in commonality for interchangeability among the variants. The commonality and large procurement would keep costs down (Congressional Budget Office, 1997). Even at the program's start, the cost was a factor, and early requirements included price goals (Congressional Budget Office, 1997).

Boeing and Lockheed Martin (LM) were both involved in the concept demonstration phase, planned for 1997–2001 (Bolkcom, 2002). The purpose was for each contractor to "build and flight-test two aircraft (one CTOL and one STOVL) to demonstrate their concepts of three JSF variants to meet the different operational requirements of the various services" (Bolkcom, 2002, p. CRS-2). Schedule delays occurred during the concept demonstration, with LM's testing taking place a month after Boeings' testing (Bolkcom, 2002). Different views place the blame on other areas ranging between technical challenges with the complex software integration and STOVL propulsion design, reduction in funding during the Engineering and Manufacturing Development Phase (EMD), and the delayed receipt of Congressional mandate for 20 hours of STOVL flight testing completed before EMD (Bolkcom, 2002).

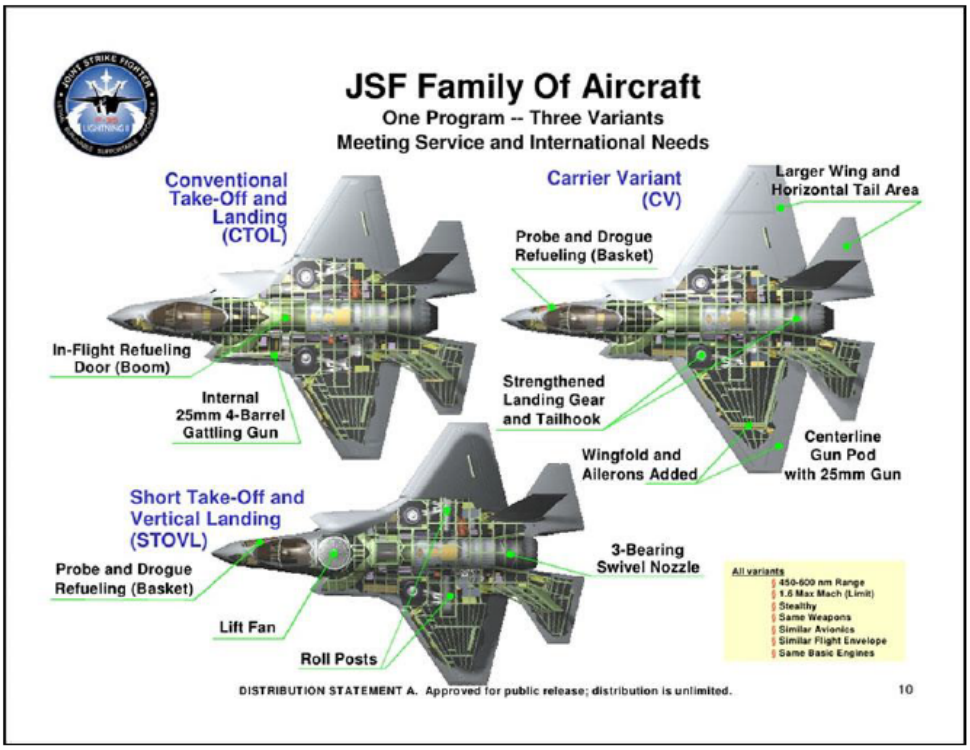


Figure 8. Joint Strike Fighter Variants. Source: Congressional Research Service (2020).

Lockheed Martin's design won the bid to lead a team of contractors in the down-selection after the concept demonstration phase (Bolkcom, 2002). Lockheed Martin developed and produced the JSF with three variants—CTOL (Air Force), CV (Navy), and STOVL (Marine Corps and the British Royal Navy) (Bolkcom, 2002).

The JSF program was proactive and ahead of its time, implementing recent acquisition reforms to tailor the acquisition process, including industry and warfighter interaction early in the acquisition through integrated Products Teams and simplifying and streamlining the contracting process. JSF is the DOD's largest acquisition and one of the most complicated with complex technologies, multi-service requirements, and the pressures of keeping costs down (Congressional Budget Office, 1997). Before the concept phase, the DOD had not provided the JSF program costs to Congress (Congressional Budget Office, 1997). The Congressional Budget Office (Congressional Budget Office) gleaned that the flyaway cost goals of the fighter through the contract instructions offered to the industry to calculate the total acquisition cost of about $165 billion. However, the CBO's estimate was about $219 billion (Congressional Budget Office, 1997). Both estimates accounted for incorporating commercial practices and existing or developing technologies to reduce costs (Congressional Budget Office, 1997). The cost estimates also accounted for the commonality of the systems "—airframe structure and systems, engines, and avionics—as great as possible" across the three variants (Congressional Budget Office, 1997, p. 42). Developmental and operational phases projected further cost savings (Congressional Budget Office 1997).

Cost and affordability was the central focus of the JSF program by trading off capabilities to meet cost goals to the point where the "the contractors have been instructed to estimate the sensitivity of the JSF's costs to desired capabilities so that the program and the services will be able to make trade-offs to lower the prices" (Congressional Budget Office, 1997, p. 43). Affordability provided the basis to achieve commercial processes, off-the-shelf technologies, and developing technologies (Congressional Budget Office, 1997). For an advanced aircraft intended to replace an aging aircraft fleet and last well into the future, the cost directed the contractors to lower risk technologies, even if that meant giving up capabilities (Congressional Budget Office, 1997). Figure 9 shows the JAST/JSF funding

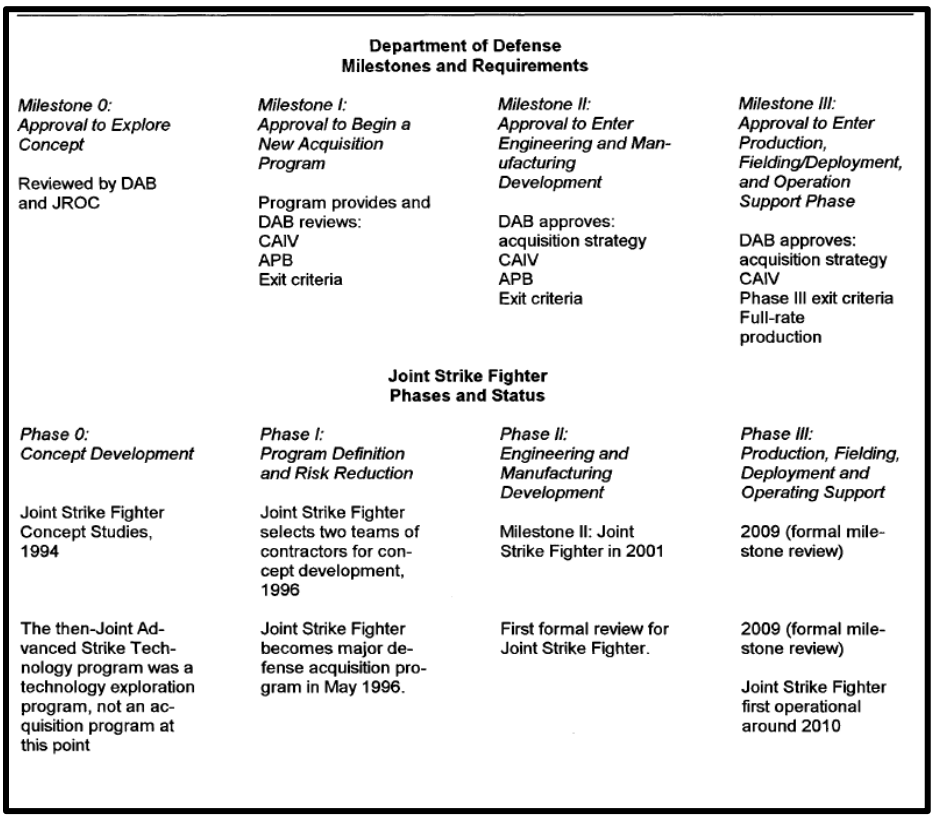
as requested by the DOD and recommended by the Senate Appropriations Committee (SAC).

At the start of program initiation, the DOD was undergoing another acquisition reform in the face of budget challenges that the JSF program leveraged. Instead of the traditional DODI 5000.02 as described in Section A, Part 1 above, the JSF exercised new levels of flexibility and efforts to reduce unnecessary reporting and review procedures (Congressional Budget Office, 1997). The JSF could also continue research and development of its new technologies further into the acquisition process with the required formal reviews (Congressional Budget Office, 1997). With tailoring options and less formalized oversight and approvals, the JSF opted to bypass the Milestone I review as outlined in the initial program schedule shown in Figure 10 (Congressional Budget Office, 1997).

JAST/JSF FUNDING (in millions of then year dollars)		
	Request	**Appropriation**
FY1994	50	29.7
FY1995	201.4	182.1
FY1996	331.2	190.2
FY1997	589	571
FY1998	930.8	945.9
FY1999	919.5	927
FY2000	476.6	491.6
FY2001	856.7	688.6
FY2002	1,536.7	1,539.2
Total	5892	5565.3

Figure 9. JAST/JSF Funding in FY1997. Source: Bolkcom (2002).

The JSF program management was proactive in "early and intensive involvement of a number of personnel who will be affected by decisions about the design (according to a program briefing that approach will involve industry and 'warfighter'—a potential user of the system-earlier in the process)" (Congressional Budget Office, 1997, p. 45). The program chose to implement an Integrated Product Teams approach to promote early engagement with industry and warfighters (Congressional Budget Office, 1997).



Department of Defense
Milestones and Requirements

Milestone 0: *Approval to Explore Concept*	*Milestone I:* *Approval to Begin a New Acquisition Program*	*Milestone II:* *Approval to Enter Engineering and Manufacturing Development*	*Milestone III:* *Approval to Enter Production, Fielding/Deployment, and Operation Support Phase*
Reviewed by DAB and JROC	Program provides and DAB reviews: CAIV APB Exit criteria	DAB approves: acquisition strategy CAIV APB Exit criteria	DAB approves: acquisition strategy CAIV Phase III exit criteria Full-rate production

Joint Strike Fighter
Phases and Status

Phase 0: *Concept Development*	*Phase I:* *Program Definition and Risk Reduction*	*Phase II:* *Engineering and Manufacturing Development*	*Phase III:* *Production, Fielding, Deployment and Operating Support*
Joint Strike Fighter Concept Studies, 1994	Joint Strike Fighter selects two teams of contractors for concept development, 1996	Milestone II: Joint Strike Fighter in 2001	2009 (formal milestone review)
The then-Joint Advanced Strike Technology program was a technology exploration program, not an acquisition program at this point	Joint Strike Fighter becomes major defense acquisition program in May 1996.	First formal review for Joint Strike Fighter.	2009 (formal milestone review) Joint Strike Fighter first operational around 2010

Figure 10. Program Schedule for the Joint Strike Fighter through the acquisition management process. Source: Congressional Budget Office (1997).

2. Joint Strike Fighter Concerns

Even in the early days, representatives from Congress, the executive branch, and the involved military services had concerns with the JSF program. In its 1997 report, the Congressional Budget Office raised many problems with the JSF program strategy–cost,

commonality, technology, capability trade-offs, acquisition reform, schedule and potential for concurrency, impact to the industrial base, and program management structure (Congressional Budget Office, 1997).

The primary concern was whether the program could maintain reduced costs as previously touted. One challenge was if the program was over-optimistic about managing costs, given that historically, aircraft acquisition had exceeded original budgets and schedules (Congressional Budget Office, 1997). For the Air Force, the price was also a factor. Air Force aircraft are at a lower cost because the requirements are more straightforward than the Navy's, which require increased stealth and the ability to take off and land on the shorter landing strips of aircraft carriers (Congressional Budget Office, 1997). Additional reflections made in the report focused on the Air Force, Navy, and Marine Corps variants. The Air Force did not want to pay more for aircraft with more capability than needed to remain standard with the Navy's variant—considering the Air Force purchased the bulk of the JSF, which became a factor for the JSF program team. The Marine Corps' cost would be affected due to Navy requirements. This same report suggests overarching concern was that of the nearly 3,000 aircraft, the Navy was only procuring 300 and yet seemed to require the most capabilities, contributing to the cost per aircraft.

The increase in cost to the Air Force and the Marine Corps was due to the push for commonality to reduce the acquisition costs and future modernization and sustainment costs (Congressional Budget Office, 1997). Figure 11 provides data on past joint acquisitions that have either ended with the original joint venture requirements, quantities, and services envisioned but not yet met. Commonality, while a goal for a specific asset, such as one aircraft or ship class, requires compromise when involving services that have different missions and therefore different needs. Someone needs to give up something or gain too much in a settlement. The Navy conceded some requirements to help with keeping the costs down (Congressional Budget Office, 1997). To attain commonality to keep costs down, if there is enough departure from needs, then the risk is that any of the services can exit the JSF program, thereby potentially jeopardizing the program's future.

Past trends indicated the DOD was not successful in increasing the performance of existing systems. Yet, that was one of the plans for the JSF program—use existing or

mature technologies to reduce development costs (Congressional Budget Office, 1997). An integrated system concept introduced methods to reduce aircraft weight, budget, and make maintenance and sustainment easier. However, some analysts believed that any costs saved with lesser weight would create significant maintenance challenges depending on the type of problem or failure that could require fixes to the whole system (Congressional Budget Office, 1997).

Aircraft[a]	Early Estimate	Midterm Estimate	Most Recent Estimate
F/A-18E/F	60 to 70 (1988)	25 (1991)	0 (1995)
AV-8B	50 (1978)	5 to 10 (1980)	0 to 5 (1981)
T-45A	64 (1992)	10 to 12 (1988)	8 to 10 (1990)
P-7[b]	59 (1988)	0 to 5 (1989)	Terminated

SOURCE: Congressional Budget Office based on Department of Defense data.

NOTE: Table uses examples of recent development programs. Weight of common parts are expressed as a percentage of total airframe weight.

a. Reflects common features of the airframes with earlier models. Commonality in subcomponents may be higher. For example, the Navy argues that 90 percent of the F/A-18E/F avionics subcomponents are the same as those in the F/A-18C/D.

b. Reflect commonality with the P-3 aircraft. The P-7 design was originally expected to be a modified P-3.

Figure 11. Trends in Commonality during Selected Development Programs. Source: Congressional Budget Office (1997).

A central theme of the program was trade-off capabilities to achieve affordability (Congressional Budget Office, 1997). As costs inevitably grow, so do the trade-offs related to which performance requirements to keep. The JSF program's plan was to trade-off capabilities for cost to a limited extent. With three variants with specific capability requirements for very different mission goals, the capability trade-off would not be an easy task. The Navy's variant is the most expensive with the fewest quantity to be procured (Congressional Budget Office, 1997). The report also highlighted the Air Force's variant is less costly than the Navy's, but with the most planes needed, while the Marine Corps variant is vastly different and intended for an important ally. There are many stakeholders when discussing which capabilities become a lower priority to sustain the budget. The trade-off for costs can have unintended consequences. For example, with existing

technologies as the technical base, there were plans to reduce redundancies with the in-flight controls to control costs further; however, that could introduce a vulnerability risk during operation.

The JSF program's leveraging of acquisition reform raised concerns that the reduced oversight through formal reviews could "introduce a risk that DOD leadership could overlook important elements of program planning, developing, testing, and reviewing" (Congressional Budget Office, 1997). Additionally, the "design to cost" concept, developed in the 1970s by the Deputy Secretary of Defense David Parkard, used by the JSF program, did not inspire confidence in analysts that the program would be successful in staying within the budget.

The flexibility resulting from acquisition reforms provided greater flexibility to the JSF program. From a schedule perspective, the JSF program overlapped the development and production phases. This overlap is called "concurrency," and how much of the schedule was concurrent was of concern, mainly if delays occurred. Delays could result from technical to funding problems. With the requirement for three variants, even with 80% value in commonality, remaining on schedule was met with skepticism given the history of other aircraft acquisitions.

The DOD intended the JSF contract award to be a "winner-take-all" approach rather than a workshare agreement among multiple contractors (Congressional Budget Office, 1997). As the largest DOD acquisition and combining aircraft requirements for three services, there would be an impact on an already shrinking military-industrial base and the future of competition. However, the Bush administration preferred the "winner-take-all" strategy at that time, and a study conducted by the DOD confirmed this was the best option (Bolkcom, 2002).

Lastly, as a joint program, the program management structure was designed with the Air Force and Navy jointly running the program with each service taking lead roles (Congressional Budget Office, 1997). The cooperative program organization meant frequent turnover of program managers and shortening of tenures (Congressional Budget Office, 1997). In previous attempts at acquisition reform, "past reformers of the acquisition

process have recommended that acquisition executives remain in place for long periods to improve continuity and thus increase expertise and enhance accountability" (Congressional Budget Office, 1997, p. 53). The JSF program's structure goes against previous recommendations for longer tenures. The other concern is the liberties the program management team took in its interpretation of the acquisition reform. Given the size and scope of the program, reductions in informal reviews to meet affordability goals raised concerns with Congress and the DOD (Congressional Budget Office, 1997).

C. AUTONOMIC LOGISTICS INFORMATION SYSTEM (ALIS)

This section focuses on the effectiveness of the IPT and end-user inputs with the Autonomic Logistics Information System (ALIS) and aligns to the introduction presented in section B. As part of the F-35 program, ALIS offers a sustainment tool to aid the warfighter with maintaining and sustaining the F-35 aircraft systems. ALIS is an information technology system with web services on a distributed network to provide users' security and the latest information. The system offers integrated "capabilities including operations, maintenance, prognostics, supply chain, customer support services, training, and technical data" (Lockheed Martin, 2009, para 2). With increased data on the software-intensive and globally networked F-35 fleet, ALIS reduces operations and maintenance costs to meet the overall program cost goals. With the in-flight transmission of data, such as Health Reporting Codes, the system could proactively enable "the pre-positioning of parts and qualified maintainers on the ground, to minimize downtime and increase efficiency once the aircraft lands. ALIS allows the F-35 system to deliver operational and training execution with innovative technologies that meet the demands of everyday use" (Lockheed Martin, 2009, para 4–5).

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III. FINDINGS

This chapter discusses the findings from the analyses performed in Chapter II on the DOD acquisition environment and benefits of updating training. Additionally, the findings from the JSF and ALIS are further discussed.

A. DOD ACQUISITION

With the faster pace of technological advancements requiring quicker updates to remain relevant, the DOD reached a critical juncture on the future of acquisitions. The DOD recognized that despite previous changes and the ability to tailor the DODI 5000.02 *Operations of the Defense Acquisition System*, the DOD continued to deliver warfighting assets late, over budget, with some capability obsolescence. In January 2020, the DOD released the upgraded DODI 5000.02 "Operation of the Adaptive Acquisition Framework" (AAF) to implement rapid and agile acquisition, providing multiple and varied acquisition pathways. Following on the heels of the newly released DODI 5000.02, the DOD released an updated DODD 5000.01. The coupled release of both instructions reflects "a comprehensive redesign of the DOD 5000 Series acquisition policies, which were streamlined and modernized to empower program managers, facilitate flexibility and enhance our ability to deliver capability at the speed of relevance" (Defense.gov, 2020). This overarching policy design allows the United States "to acquire products and services that satisfy user needs with measurable and timely improvements to mission capability, materiel readiness, and operational support, at a fair and reasonable price" (Kobren, 2020). The goals are to "Deliver performance at the speed of relevance" by using the principles of operating policies of 1) Empowering program managers; 2) Simplifying acquisition policy; 3) Employing tailored acquisition approaches; 4) Conducting data-driven analysis; 5) Actively managing risk; and 6) Emphasizing product support and sustainment (Kobren, 2020, para 3). Along with the operating policies, other goals are to 1) Use the adaptive acquisition framework, DODI 5000.02; 2) Emphasize competition; 3) Employ performance based-acquisition strategies; 4) Plan for product support; 5) Implement

effective life cycle management; 6) Implement reliability and maintainability by design; and 7) Maintain a professional workforce (Kobren, 2020).

With a new directive and instruction availability, the F35 program opted to switch and align to the AAF strategy. It is too soon to know the impacts of the updates on these acquisition processes in this paper. Still, these changes align with the rapid speed at which warfighter assets are acquired and deployed. The framework of the acquisition process design, Figure 12, promotes critical thinking in the strategic planning and tactical execution of programs to pivot better as capabilities accommodate changing mission needs.

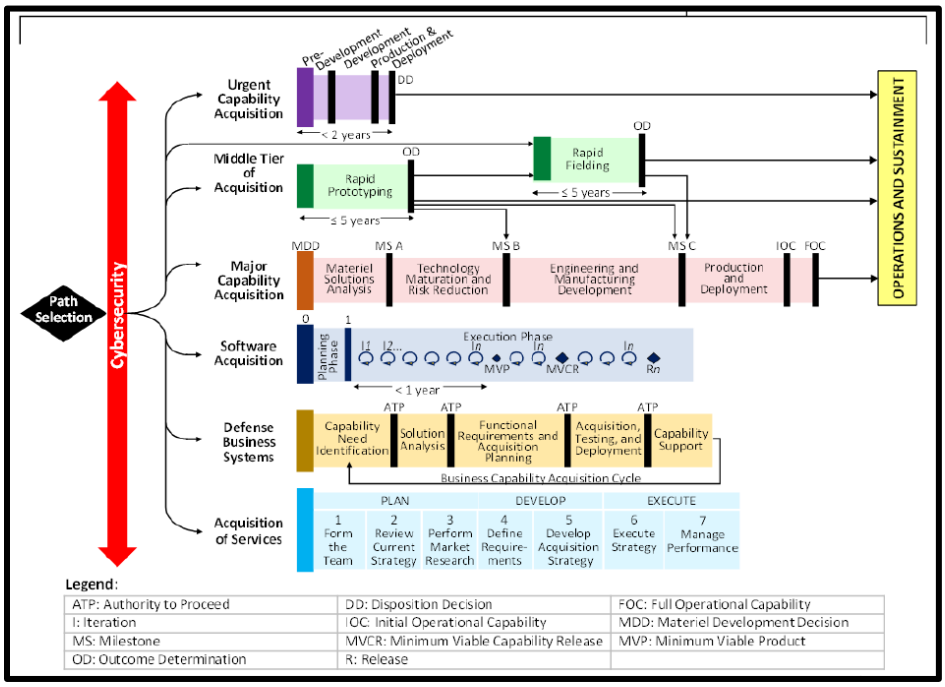

Figure 12. DOD Adaptive Acquisition Framework Pathway. Source: DODI 5000.02 (2020).

Today, the commercial industry is surpassing the DOD in innovation. The panel uncovered that the defense acquisition process did not allow for the easy inclusion of new competition, particularly in software-related industries such as cybersecurity and software development practices. Effects to the business logic of the warfighter include the lack of enabling the workforce integration throughout the acquisition process, the lack of

immediate access or unrestricted access to new industry bases, and the lack of a collaborative relationship with industry in general. The relationship structure allows the DOD to provide requirements and oversight while the contractor plans and executes. There are specific management tools; however, the DOD has not realigned the oversight process to today's acquisition needs. Collaboration requires appropriate and ongoing communications to ensure both parties agree on interpreting the requirements during the process in case there is disagreement. Without this cooperation, the government and industry teams remain stove-piped and less inclined to share when there are issues.

When capabilities requirements changed, there was no method to revise the JCIDS requirements and budgeting to account for the changes and plans associated with the program. There is no requirement by the DOD to ensure services do not drop out of joint ventures or reduce the quantity. One example is the Marine Corps' V-22 joint venture with the Army, Navy, and the Air Force: "about 600 for the Marine Corps, 230 for the Army, about 300 for the Navy, and about 80 for the Air Force" (Congressional Budget Office, 1997). While the V-22 program had progressed well in development, the Army decided to exit, the Navy reduced its quantity to 50, the Marine Corps reduced its amount to 425, and the Air Force reduced its number to 50. Total V-22 quantity went from 1,200 to about 525. The reduction of unit quantities leads to increases in the per-unit cost.

B. BENEFITS OF TRAINING REVISIONS

Training is fundamental across all DOD entities and services. In the Navy, the Naval Education and Training Command (NETC) identifies, validates, and resources training requirements for every service member and government service worker across a wide range of topics. Currently, the valuable principles and lessons associated with acquisition (i.e., identifying requirements, developing capabilities, understanding measures of performance) are not part of the training catalog. Should training in these principles become resourced, the current training framework offers an agile nature to maintain the pace of change in the latest industry developments. The steps associated with a Job Duty Task Analysis (JDTA) (Figure 13) provide pertinent data to course developments and training validations that satisfy training objectives.

Figure 13. NETC Course Development/Revision End to End Process. Source: Naval NAVEDTRA 137 (2011).

By working through the NETC process to deliver a course of instruction, the latest updates with training requirements adjust with the principles associated with AAF. BLWT involves all stakeholders in the acquisition framework, not just the warfighter. These would include requirement and resource sponsors, warfare sponsors, community managers, and various SMEs. These inputs allow accurately trained technical documentation to reflect the latest acquisition framework principles and processes. One additional benefit of utilizing the NETC course development process is that it enables changes to training based on gaps in training analysis to quickly adapt to the requirements using tasks such as the Front-End Analysis (FEA). The FEA "establishes a repeatable, defendable, and standardized process to improve performance of existing training" (NAVEDTRA 135C and 138).

The primary focus for training warfighters is to operate with capabilities in mind while developing their ability to increase Acquisition Readiness effectively. Acquisition Readiness (AR) refers to the ability of the DOD service or entity to request and integrate new capabilities per the AAF efficiently. AR reflects adjusted cost and schedule performance indexes, the development of an ICD, and cost-efficient management. It also represents the user-feedback integration throughout the acquisition life cycle. The recommendation to introduce business logic to the warfighter involves training titled AR. Three phases make up AR: Acquisition Readiness I, Acquisition Readiness II, and Acquisition Readiness III, as seen in Figure 14.

Each phase of Acquisition Readiness would provide incremental steps to professional development. Starting with the basics in AR I, the warfighter learns the current acquisition framework available and wherein the process is best for their contributions to the discussion on new capabilities. This method presents a technical approach to tactical warfighting. AR II is the next level which begins a more in-depth review of the acquisition

pathways and roles the warfighters may participate in once they become more senior and enter a manager role. Testing, fielding, and risk management make up most product support elements found in AR III training.

ACQUISITION READINESS I	ACQUISITION READINESS II	ACQUISITION READINESS III
Training focuses on: • Big "A" Acquisitions • AAF Objectives • JCIDs • CBAs, ICDs, CDDs • Mission Capabilities • Functional Assessments • DOD Solution Process • Materiel/Non-Materiel Solutions	Training focuses on: • Contract Management • FAR/DFAR Overview • Vendor Criteria • Awarding contracts • Request for Proposals • Contract Clauses • Milestone Decisions • Testing and Evaluation	Training focuses on: • Life Cycle Maintenance • Risk Management • Production and Testing • Fielding and Deployment • Operations and Support • QA Analysis • Contract Services

Figure 14. Acquisition Readiness Training Phases I, II, and III

The functional areas identified in the proposed BLWT seek to promote understanding of the warfighter's role in the DOD Adaptive Acquisition Framework and increase the feedback to their respective chain of command through the JCIDS process and industry professionals. Warfighters not typically engaged with the acquisition cycles would officially understand how to relay to leadership Key Performance Parameters to desired capabilities. Aside from educational programs with Naval Postgraduate School (NPS) and Defense Acquisition University (DAU), the average warfighter obtains limited exposure to acquisition life cycle processes. Still, their input may provide the right focus areas even in the assessment elements. In the same way that greater flexibility from acquisition reform benefits the JSF program, this too bestows flexibility to the role of the warfighter in the acquisition framework.

By offering BLWT training, the DOD is able to collect better information aligned to the acquisition methods and processes because the business logic of the warfighter insights can increase AR. The ability of the warfighter to communicate the requirements needed on the battlefield enhances with the increase of BLWT. The need is present for the warfighters to have a streamlined and automated ability to provide feedback on current capabilities, such as key performance parameters (KPPs), while simultaneously presenting system requirements to improve operational performance. Integrating trained warfighters reduces the number of barriers between the public and private sectors involved.

Recent experiences during the Integrated Battle Problem 21 Exercise with the 3rd Fleet speak to the need. Mr. Jay Stefany, Acting Assistant Secretary of the Navy (Research, Development, and Acquisition), remarked about incorporating the end-users of the new technology tested during the 2021 Acquisition Research Symposium. He said, "We learned not only that the technology did what it was supposed to do, but we learned how to use it differently." He also stated, "The real value was learning better ways to utilize manned and unmanned vessels both undersea and on the surface" (Stefany, 2021). This example highlights a practical result when warfighters are allowed to offer input. However, end-users trained to present their ideas for materiel solutions based on their experience in KPPs, Critical Operational Issues, Measures of Effectiveness/Suitability, among other data elements, support the CBA process with increased effectiveness, especially if it aligns with the national strategic objectives.

The second recommendation for BLWT is to allow warfighters to train newly acquired systems that would impact operational readiness. As reflected in the findings, the critical nature of the modern acquisition contract prevents most of the maintenance from being carried out by the warfighter. With much effort given to training warfighters on how to use the new system, very little is focused on their ability to conduct minor updates, such as software releases or repair components to the system itself. Contracting systems with our defense industrial base benefits end-users with the opportunity to learn ways to ensure it remains operational.

This training could either be written as part of the materiel solution contract or contracted to the government entities that oversee personnel on the system's platforms.

This increases knowledge of the warfighter on the system itself and provides the industrial base an opportunity to work alongside warfighters and gain insight into their thought processes associated with what would make the system the most effective. This recommendation also allows the defense acquisition programs to promote interoperability with our defense industrial base and increases the viability of suppliers by opening their perspectives to potential future capabilities.

Although military personnel do make up internal elements of the Program of Record team, the emphasis presented here narrows on the end-users to fully capture the integrated role of the warfighter and the ability to develop requirements and capabilities. Like the Agile framework with continuous iterative developments, our research emphasized the opportunities that end-users have throughout the program life cycle, even to the LRIP or Milestone C stages. Military personnel assigned to the program removed from the front of the line experience, perhaps even for multiple years, limit the ability to present the latest operation tactics utilized. Current warfighters perhaps offer better insight to develop the performance measurements further to accomplish program objectives.

While training warfighters to individual programs could benefit the relationship with industry meeting capability parameters that only meets an immediate goal. There are benefits to introducing end-user agreements and training to such in adaptive acquisition software upgrades. All stakeholders involved maintain clear lines of distinction regarding liabilities, risk, and restrictions for the materiel solution. However, the ultimate goal for developing the warfighter improves the overall efficiency in program life cycle processes.

Acquisition Readiness by way of BLWT is a sustainable path forward to meeting all national strategy objectives and defense acquisition lines of effort. ‘Tailoring’ is a crucial concept for acquisition support. For example, the AAF allows the Major Capability Acquisition pathway to tailor “processes, reviews, and documentation…based on program size, complexity, risk, urgency, and other factors” (DOD, 2020, p. 12). Training the warfighters on acquisition principles would also benefit from tailoring to qualify based on the capability requirements. The distinction resides in some acquisitions being software-intensive while others are hardware. The ability to tailor training allows opportunities to cultivate a deeper relationship between defense services and the industrial base while

allowing the business logic of the warfighter to reduce delays and mitigate gaps in identifying requirements and support life cycle maintenance of materiel solutions during operations.

The DOD can review and leverage how the U.S. Army is instituting a concept called "Soldier-Centered Agile" that aligns with this paper's first objective to include the user in the acquisition process and the team from the cradle to the grave. For over a decade, the U.S. Army focused its attention on reforming its acquisitions by adopting the Agile methodology: "The promise of Agile acquisition to enable responsive delivery of capabilities based on continuous user feedback (Soldier touchpoint events) has become a reality" (Savage-Knepshield, 2021, p. 23). A secondary benefit of revolutionizing its acquisition process was "to shed its reputation for being slow, frustrating, complicated, and expensive" (p. 23). The goal of "Soldier-Centered Agile" is to have the users in the design process and use the system to provide feedback. The feedback is critical when considering design trade-offs and making decisions. Many positives, such as innovation, can arise from this teaming; however, the users' attention is the design team's attention. This teaming brings about an investigation into prevalent or consistent issues.

In contrast to the developer-led Agile philosophy, "Soldier-center design (SCD) is driven by human factors practitioners, human-systems integration analysts, or user experience professionals" (Savage-Knepshield, 2021, p. 24). The planning is early and informed by the touchpoint events to produce "a rough design that will evolve and crystallize through iterative user testing into a concrete final product" (p. 24).

The Army integrated continuous iterative development, such as the sprints, releases, user stories, backlogs, and burn-down with the Soldier-centered design. The Army still followed the Defense Acquisition Framework. It merged the Agile methodology with its Soldier-Centered Design early in the plan to identify design areas that were critical and frequent tasks or problematic tasks. This process illustrates divergence from the F-35 JSF and other acquisitions that did not incorporate alternate or multiple acquisition pathways. User stories documented the design team demonstrating the capability in the field or during operations. Usability testing is conducted on software releases to catch issues early and

plan for their fixes as part of the process and planning. The Army identified the top lessons learned as listed below (Savage-Knepshield, 2021).

1. "Build a strong design foundation with early Soldier-centered design activities" with iterative testing with users per Figure 15 (Savage-Knepshield, 2021, para 9).

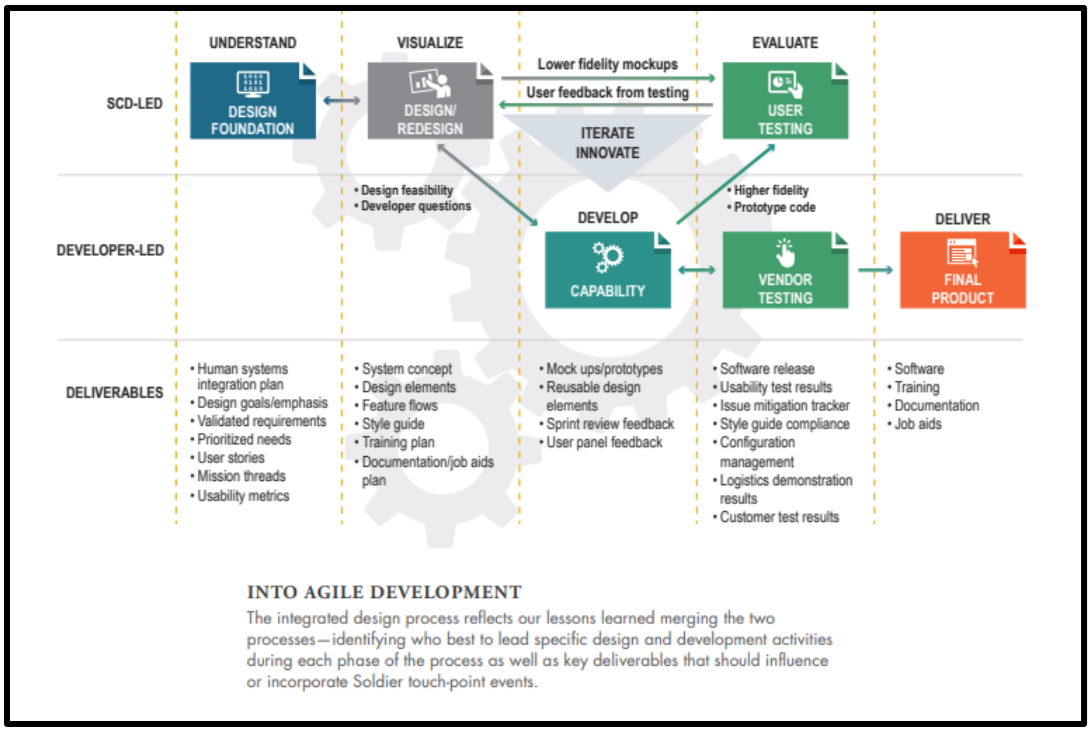

Figure 15. Agile-SCD Process Integration. Source: Savage-Knepshield (2021)

2. "Create multidisciplinary, user-focused, collaborative teams" (Savage-Knepshield, 2021, para 10). The team should contain "developers, designers, engineers, domain subject matter experts, logistics, training, safety, cyber, and testers" (Savage-Knepshield, 2021, para 10).

3. "Ensure development of a user interface style guide for all agile teams" with the needed inputs illustrated in Figure 16 (Savage-Knepshield, 2021, para 11).

Figure 16. Crucial Components for an Interface Style Guide. Source: Savage-Knepshield (2021).

4. "Refine the design with user feedback early and often" where "Soldier-centered design teams work one step ahead of the sprint to collect user feedback" (Savage-Knepshield, 2021, para 13).

5. "Create user advisory panels" for feedback during events (Savage-Knepshield, 2021, para 15).

6. "Identify design goals and usability metrics" to ensure the team understands the performance and preference measures and metrics (Savage-Knepshield, 2021, para 16).

7. "Standardize Soldier touchpoint event procedures" for consistency in templates and data collection (Savage-Knepshield, 2021, para 17).

8. "Fuel innovation with user feedback" by listening to their inputs during operational testing (Savage-Knepshield, 2021, para 19).

9. "Include the team and stakeholders in Soldier touch-point events….as observers, facilitators, and data collectors" to gain concurrence for changes. (Savage-Knepshield, 2021, para 21).

10. "Ensure funding and resources are set aside for Soldier touch-point events" (Savage-Knepshield, 2021, para 22).

11. "Ensure Soldier-centered design changes are included in the configuration management process" (Savage-Knepshield, 2021, para 23). Figure 17 is an example of how and what is reviewed and documented.

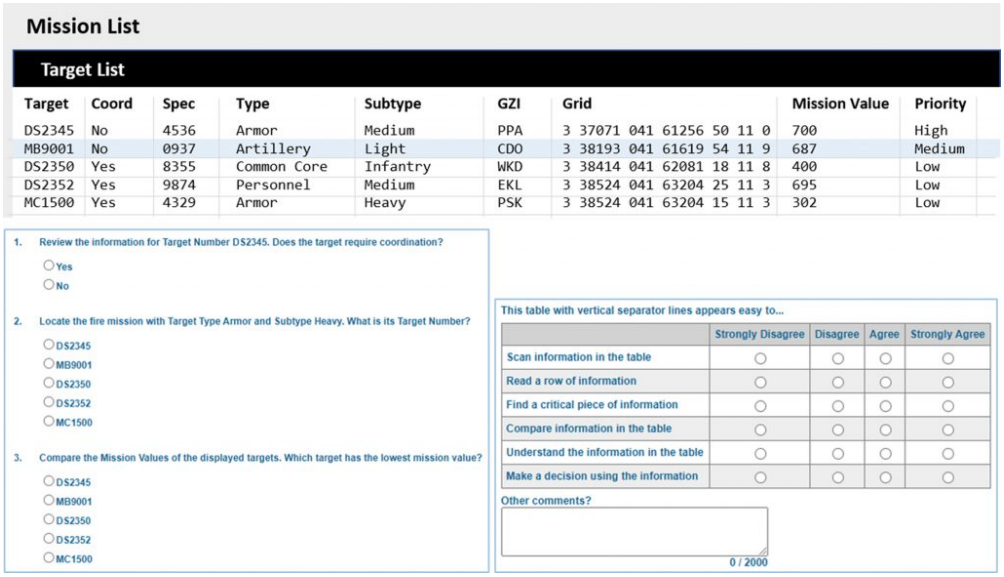

Figure 17. Refine the Design: A screen shot from an online survey designed to collect preference and performance data. Source: Savage-Knepshield (2021).

C. JSF PROGRAM AND ALIS

The JSF acquisition remains DOD's highest procurement cost to date and has expanded to include other Allies cost-sharing to obtain this aircraft (Gertler, 2020). Since 2001, the program's schedule and costs have undergone three revisions (Ludwigson, 2021).

In one example, in early 2010, an Acquisition Decision Memorandum (ADM) formally restructured the JSF program. The restructure extended the System Development and Demonstration (SDD) phase by 13 months, further delaying achievement of Milestone C and Full-Rate Production to late calendar year 2015, revised program funding to align with the 13-month delay, and transitioned procurement funds to R&D to continue with development over procurement (Gertler, 2020). Additionally, under the reorganization, $614 million in award fees was withheld from "the contractor for poor performance, while adding incentives to produce more aircraft than planned within the new budget" (Gertler, 2020, p. 13). The realignment delayed the Initial Operating Capability (IOC) and reduced aircraft by 122 (Gertler, 2020). Even with the program restructuring, the program's "average procurement unit cost, in FY2002 dollars, had grown 57% to 89% over the original program baseline" (Gertler, 2020, p. 13). Despite cost being a primary program goal, the program was unable to contain costs.

The acquisition costs exceeded the cost goals by $13.5B, along with schedule delays by six and half years, as shown in Figure 18 (Gertler, 2020). In 2016, the DOD assessed that a more significant government leadership role was necessary to help the struggling program and that while there are better improvements, they have not reached perfection yet (Gertler, 2020.) The bumper sticker in Figure 18 acknowledges that overcoming past challenges has been difficult. Designing and developing three variants while maintaining a high degree of commonality and undertaking the most complex and software-intensive system creates these challenges.

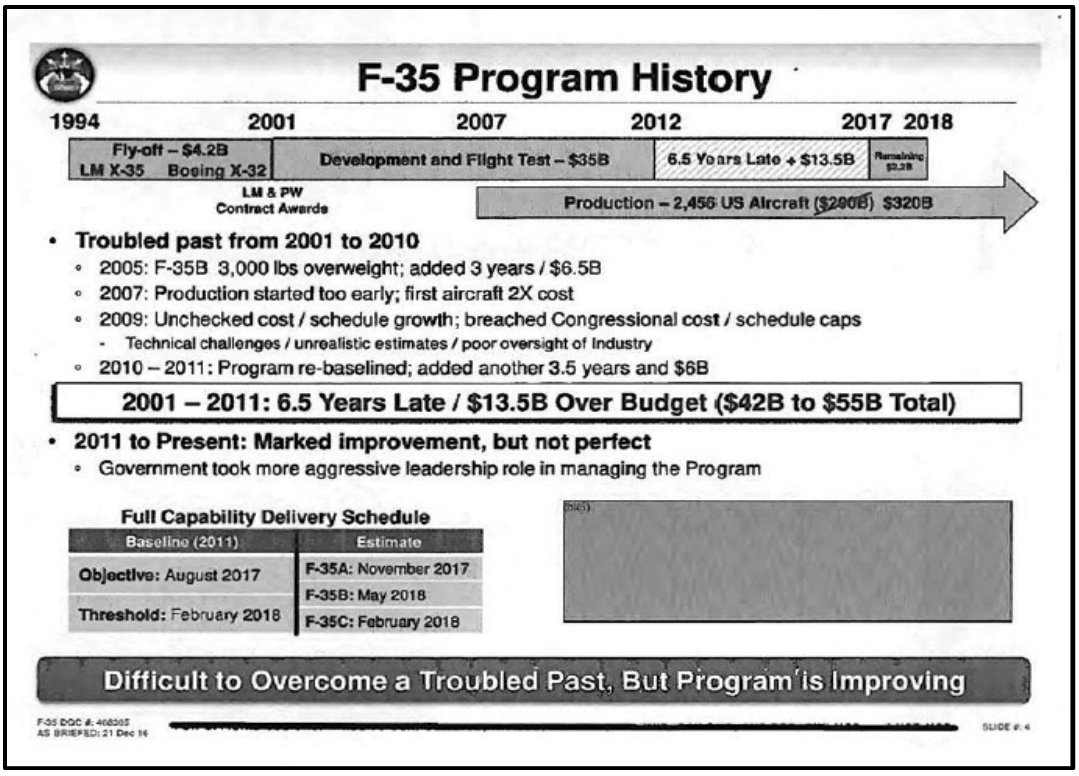

Figure 18. F-35 Program History as Brief to President-elect Trump, 2016
Source: Congressional Research Service (2020).

In early 2020 per FY2017 NDAA, the DOD reviewed alternate program management structures and proposed future changes to the F-35 Joint Program Office (Gertler, 2020). The overhead associated with the joint program did not seem like the appropriate format once the program was in the production phase (Gertler, 2020). Another reason for devolving the program office was acknowledging that the program had not reached its common goal and three distinct and separate aircraft (Gertler, 2020). The program achieved about 20–25% in commonality (Gertler, 2020). When the IOCs for the services were adjusted to accommodate schedule slips, each service would receive different software packages (Gertler, 2020). At the time of the Congressional Research Service 2020 report, there was no schedule for the restructuring of the program office.

The concurrency acquisition strategy by the JSF program did not result in as much success as expected initially. Schedules and milestones reflected design tools, modeling, and simulation data that were neither perfect nor precise enough to positively influence

concurrent development, testing, and production (Ferran, 2012). The issue with the accompanying plan is that the "first demonstrations will occur after the critical design review after most of the design drawings have been released and after manufacturing has begun for many of the remaining test aircraft" (GlobalSecurity.org, n.d., para 6). The issue with the program schedule is the discovery of significant design problems during prototype demonstration and the "time and money for redesign efforts and retrofitting of test aircraft already in the manufacturing process" (GlobalSecurity.org, n.d., para 6). The program entered Initial Operational Test and Evaluation (IOT&E) phase in December 2018 with 13 Category 1 or "must-fix" deficiencies that impacted safety or combat capability (Gertler, 2020). Test pilots involved with the acquisition team in 2004 "were involved with the continuing development of the F-35's control system, improving the aircraft/pilot interface and control functions" (GlobalSecurity.org, n.d., para 11). The test pilots performed in-flight simulations.

The program adopted the Continuous Capability Development and Delivery (C2D2) for software systems based on the Agile software development processes (Ludwigson, 2021). This change aimed to improve the cycle of software development, validation, and testing and add capabilities with succeeding blocks (Gertler, 2020). However, the Director of Operational Test and Evaluation noted that the current C2D2 process was already lagging behind schedule, ineffective in adding new capabilities in increments or fixing deficiencies, and "often introduced stability problems and adversely affected other functionality" (Gertler, 2020, p. 22). Figure 19 shows the iterative development and testing plan. Similar to the Agile process with incremental builds and releases, the C2D2 contains four increments:

- **"Increment 1** should contain all new capabilities for the software drop so initial testing may proceed as planned" (Williams Brown, 2021, p. 32).
- **"Increment 2** should address any identified deficiencies found during testing of Increment 1 and mature capabilities as needed" (Williams Brown, 2021, p. 32).

- **Increment 3** handles deficiencies discovered during prior testing and ensures improvements to capabilities (Williams Brown, 2021).
- **Increment 4** version is intended to be production-ready version with no significant fixes needed. This final version is for delivery to the user (Williams Brown, 2021, p. 32).

Figure 19 depicts uniformed users; however, we could not find data because some issues, such as missing capabilities and software defects, were not uncovered during various developmental testing. This diagram does not show how the defects were discussed and prioritized with the team, including the warfighter. In reality, the iterations with the increments did not go as planned per Figure 20.

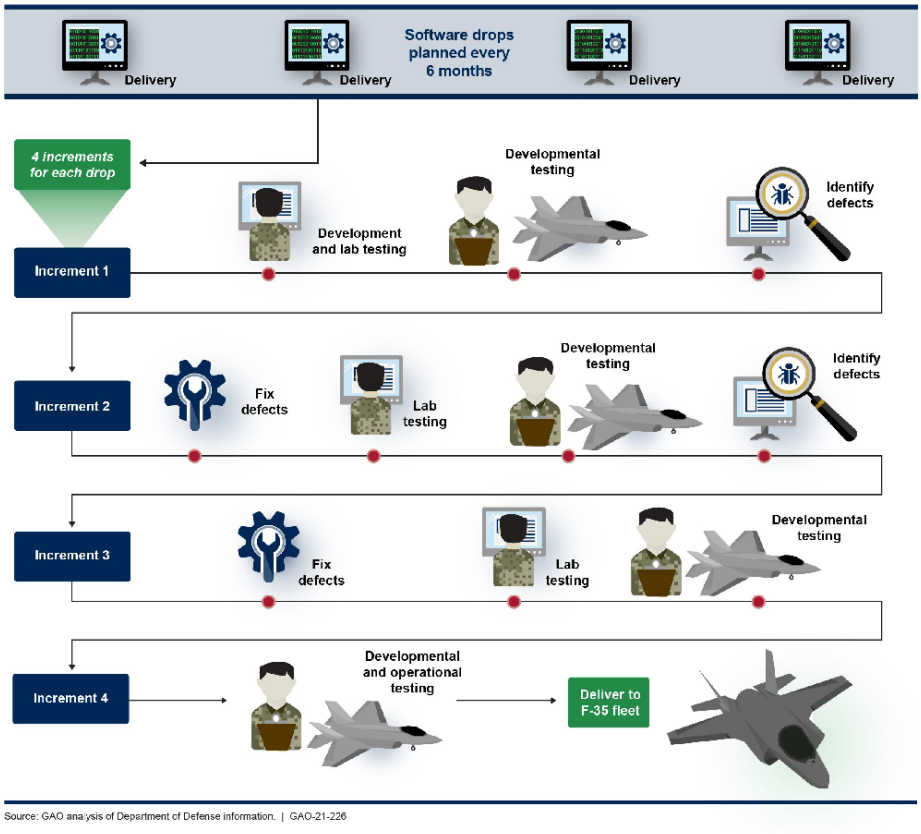

Figure 19. F-35 Notional Block 4 Iterative Development Test and Delivery Schedule. Source: Government Accountability Office (2021).

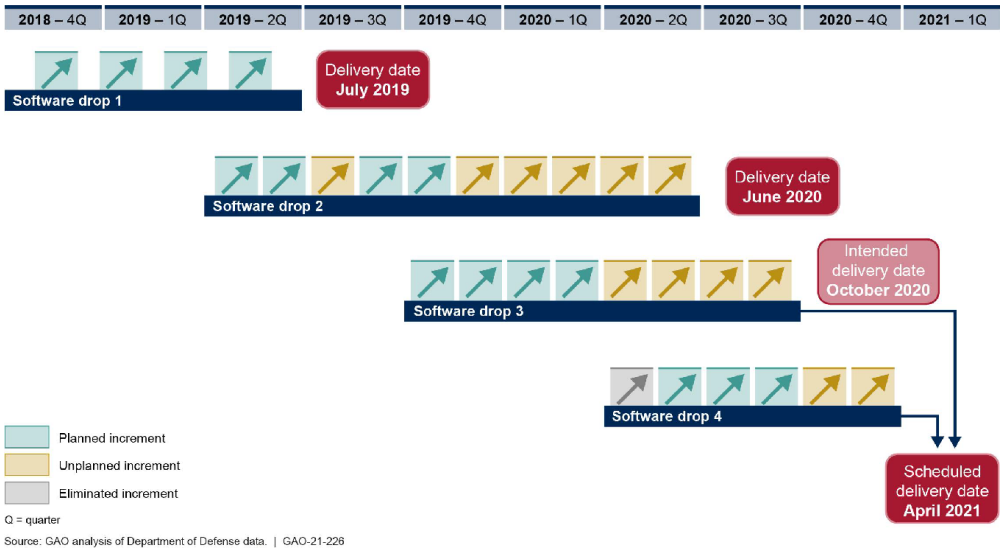

Figure 20. F-35 Actual Software Increments Exceed Number of Planned Increments. Source: Government Accountability Office (2021).

As of March 2021, the program is still in the low-rate initial production while at the same time modernizing and performing operational testing (Ludwigson, 2021). The decision to delay Milestone C and Full-Rate Production is due to delays in the F-35 Joint Simulation Environment or the aircraft simulator development (see Figure 21) (Ludwigson, 2021). The aircraft simulator is essential to replicate test scenarios that are not practicable to execute in the operational or real-work environment (Ludwigson, 2021). There is currently no schedule from the DOD or the JSF program for Full-Rate Production.

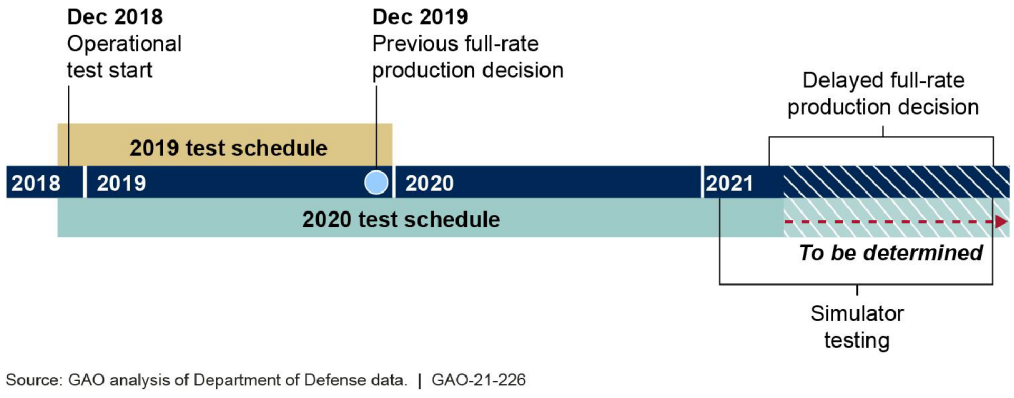

Figure 21. F-35 Operational Test Schedule and key Events Through 2021, as of November 2020. Source: Government Accountability Office (2021).

Regarding ALIS and user testing, program data was not easy to find on the internet. However, the GAO formed focus groups with ALIS users from pilots, maintainers, administrators, and trainers. The focus groups were "held at five F-35 operational or testing sites'' to identify "some benefits of the system" (Russell, 2016, p. 14). The main benefit was a single, electronic system that contained information traditionally located in several databases or on paper. The singular access to all technical data created more accessibility to maintain updates to the data and manuals. The focus group accepted the immaturity of the system given where it was in the program schedule. The group noted several functionality issues as outlined in Figure 22 (Russell, 2016). GAO recommended plans to fix the problems related to deployability, lack of redundancy in the infrastructure, little interoperability with legacy systems, lack of transparency of Action Request and the reliance on the contractor, inaccuracy and accessibility of the data, immaturity of the Off-board Mission Support (OMS) and Training Management System (TMS), and cybersecurity concerns.

ALIS Risks Identified by Users in GAO's Focus Groups[a]

Functionality issue	Description of Autonomic Logistics Information System (ALIS) user concerns
Deployability of ALIS	Users are concerned about ALIS's ability to deploy in operational environments because of the large Standard Operating Unit (SOU) server size and connectivity requirements. The Marine Corps, which often deploys to austere locations, declared initial operational capability in July 2015 without conducting deployability tests of ALIS. Although a more deployable version of ALIS was put into operation in the summer of 2015, the Department of Defense (DOD) has not yet completed comprehensive deployability tests.
No redundancy in its infrastructure	Users are concerned that ALIS's current design results in all F-35 data produced across the fleet to be routed to the Central Point of Entry and then to the Autonomic Logistics Operating Unit, with no backup system or redundancy. If either of these fail, it could take the entire F-35 fleet offline.
Ability to communicate with legacy systems	Users are concerned that ALIS does not have much interoperability with legacy systems. The services will continue using legacy systems for other weapon systems, and some of these data must be shared with ALIS. Because ALIS currently has little interoperability with legacy systems, some of this information is currently being tracked manually outside of ALIS, which is inefficient and could potentially result in data not being populated back into the system.
Action Request[b] (AR) process is inefficient and problematic	Users report that the current AR process does not provide transparency of all ARs submitted across F-35 sites, and places responsibility for resolving the requests primarily on the contractor.
Data accuracy and accessibility issues	Users report concerns about data that reside within ALIS, including errors related to missing or inaccurate information about parts and not being able to extract raw data to generate needed reports.
Off-board Mission Support (OMS) and Training Management System (TMS) are immature	Users report that both ALIS applications are important to their day-to-day operations, but are immature and do not function as intended. OMS is a key application used by pilots to conduct mission planning and debriefing. TMS is used by pilots and maintainers to track training qualifications.
Security concerns	Users report concerns related to transferring information between unclassified and classified computer servers and related to cyber security. A 2012 DOD Inspector General's report[c] on ALIS also highlighted some security issues, including security accreditation and testing of hardware.

Source: GAO | GAO-16-439

Figure 22. ALIS Risks Identified by Users in GAO's Focus Groups. Source: Government Accountability Office (2016).

The ALIS system did not work as designed when deployed. The system's cybersecurity capability was not quickly upgradable and was vulnerable to hacks (Gertler, 2020). The system performed poorly—false alarms resulted in wasted time and resources with unnecessary maintenance, the data entry interface was labor-intensive, system boot-up and updates were lengthy, and the tablets that the maintainers relied on did not stay technologically up to date with market capabilities (Tirpak, 2020). Software version updates improved the system, but continued inadequacies due to deficiencies negatively impacted troubleshooting and fixing non-operational aircraft back into service (Gertler, 2020). The GAO had published reports detailing ALIS issues and discovered that for maintainers in one U.S. Air Force unit, "more than 45,000 hours per year performing additional tasks and manual workarounds because ALIS was not functioning" as promised (Tirpak, 2020, para 9). The challenge to the system appears to be the architecture designed in the 1990s (Gertler, 2020). The acquisition process took too long where the system was obsolete and not easy to upgrade once ready for operational use. No matter how cutting-edge the technology, there are limitations on existing technologies that affect the ability to upgrade well into the service life of assets.

According to GAO analysis, "ALIS may not be deployable" (Gertler, 2020, p. 23). The Marine Corps often works in remote areas ill-equipped to provide simple internet services for ALIS to connect to the globally networked infrastructure. ALIS does not contain redundancy, and any loss of system components can "take the entire F-35 fleet offline" (Gertler, 2020, p. 23). Operators have had to use manual workarounds for automated taskings. And while the F-35 aircraft can operate and fly without ALIS, the promised capability of proactive maintenance and sustainment planning is missing. Had the JSF program team indeed received user feedback early and often throughout the acquisition process, the situation with ALIS could have been caught earlier and managed. One questions how the system fared during the Test and Evaluation Phase where there were users involved and how ALIS passed testing.

With technology in the United States, the design teams often forget that parts of the world are rural enough not to have some of the amenities available. Understanding the operating conditions of current and potential mission areas is critical. This knowledge

provides engaged warfighter data to ensure requirements are achievable in the environments where the assets are be deployed and used.

Sustainability costs of F-35 aircraft remain a concern (Gertler, 2020). Adding to the short-term funding challenges, the DOD and the JSF program already had plans to replace the ALIS with a new system that is called the Operational Data Integrated Network (ODIN). With the later introduction of ODIN, the system can leverage modern software languages and architectures, hardware technologies, and best commercial practices (Gertler, 2020). In contrast to a typical acquisition where the complete system is developed and delivered by the vendor, with ODIN, Lockheed Martin is required to provide the hardware; however, the government has taken the lead and control on the software package (Insinna, 2021). ODIN expects to be "more user-friendly and less prone to error" (Gertler, 2020, p. 24). With a new integrated data environment, the purpose of the new development effort through ODIN is to provide the F-35 fleet with a working sustainment tool that includes readiness performance (Tirpak, 2020). Another goal to learn from ALIS is the reduction in workload for operators and administrators and "allow software designers to rapidly develop and deploy updates in response to operator needs" (Tirpa, 2020, para 2).

The fully operational program, planned for December 2022, was impacted by a funding cut in FY21. ODIN development and testing funding was trimmed by 42%. Part of the funding challenges appears to be affected by the program's "underestimating the complexity of deprecating ALIS capabilities while migrating to ODIN" (Insinna, 2021, para 5). With this reduction, the program office has opted to pause the ODIN project. Until ODIN is completed and deployed, the Air Force, Navy, Marines, and Allies continue to use ALIS and manual workarounds. The program is continuing to improve ALIS until the funding situation for ODIN improves.

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IV. CONCLUSION

A. SUMMARY

Developing the business logic of the warfighter adds an understanding of the financial risks involved within the acquisition framework. The industrial base managers thoroughly understand the financial risks involved in contracts as it directly affects their profits, revenue, and job security. The untrained DOD service member assigned to a project increases the associated financial risk by not fully understanding the important connection between budgets and future years defense planning. Increasing business logic aims to decrease the liabilities of the decision-makers. While the industrial base manager is eager to thrive on a capitalistic opportunity in a potentially significant contract with the DOD, the warfighter's expectations of a new weapon system may overshadow the understanding of economic indicators. Gross domestic product, price indexes, and production rates are examples of those indicators. Business managers rely on economic indicators. Alternatively, the DOD focuses on acquiring a specific capability, unaware of how these indicators work and their impact on the contract.

The objective of developing the business logic of the warfighter is to ensure all activities, processes, products, and concerns lead to a more efficient defense acquisition program. Business logic leads to not only documenting these needs but developing them faster and more accurately. Building a sustainable model creates the business logic of the warfighter that requires DOD leadership to see beyond the basic managerial concepts of planning, organizing, and directing service members towards war prevention objectives. It is one that also includes a partnership with the industrial base around their economics and technological developments.

Meeting this objective provides the much-needed balance to the industrial base's competitive advantage over the military in recent decades. The industrial base advances capabilities much faster than the DOD. Demands for product changes often show a specific pattern that industrial base business managers are familiar with overall. Marketing teams are dispersed into the consumer market to gather data that reflects how products are

performing and meeting the needs of their customers. There is not much cognitive dissonance of how well the latest development is performing. Immediate feedback is communicated back rather quickly due to dedicated customer service representatives and social media. Also included on the front end for the industrial base managers are decision support systems.

B. RECOMMENDATION FOR FURTHER STUDY IN ACQUISITION ALIGNMENT

The DOD is addressing the historical concerns and working to influence current major acquisition programs. Recently, the DOD pushed significant reform in two essential areas. One is the revisions to the DODI 5000.02 to DODI 5000.02T *Operation of the Adaptive Acquisition Framework* to expedite acquisition through additional options and emphasize the move away from the waterfall process. The second is organizational, with dividing the Under Secretary of Defense (USD) for Acquisition, Technology, and Logistics into two divisions: USD for Acquisition and Sustainment (A&S) and USD for Research and Engineering (R&E). These changes will largely influence how the DOD and industry collaborate for improved and agile acquisitions. These advancements push for new opportunities to broaden the business logic of the warfighters and incorporate them further in the acquisition and sustainment programs.

Whether intentional or not, the DODD 5000.01 rewrite implements recommendations from the Section Panel to maintain a professional workforce. Enabling the workforce of acquisition professionals and warfighters is vital to national defense. Current DAU training states, "Consequently, the DOD must recruit, develop, and maintain a fully proficient military and civilian acquisition workforce that is highly skilled across a broad range of management, technical, and business disciplines" (Kobren, 2020, para 9). Revising warfighter training aligns with methods to understand acquisition concepts and processes and meets the objectives associated with DAMS and the acquisition life cycle.

The technological advancements of knowledge management systems could also be valuable to future acquisition teams. These systems provide information virtually for all employees to contribute to or learn from that promotes enterprise-wide communication,

and the increased rate at which information becomes available is increasing. Personnel with specific skill sets and expertise may use these systems to provide feedback to top-level management. Doing so removes the obstacle of getting the latest information without delay to aid future decisions. Establishing this type of risk management from which to operate is critical. Senior leaders may then proactively champion employees and stakeholders down to the lowest level to provide feedback.

C. AREAS FOR FURTHER RESEARCH

Four additional areas could benefit from further research. The first area is research into DOD's Acquisition Environment, including "Big A" and "Little A" acquisition. While this research topic touched on the "Big A" acquisition as a limitation to continued success for reform with "Little A" acquisition at a very high level, we did not dive into researching the "Big A" acquisition. Analysis and recommended reform to better align with the rapid acquisition strategies of "Little A" acquisition warrant further research. Programs with realignment to rapid acquisition strategies gain limited success with flexibility and agility if there is no flexibility with the budgeting through the PPBE and capability updates through the JCIDS.

The second topic is whether the current military design fights today and tomorrow's wars or is too entrenched in the structure that led to successes during the two world wars. The United States military has struggled since the Vietnam War, where guerilla warfare was prevalent. Today's wars have not been traditional, and tomorrow's wars do not look to return to conventional warfare.

The third suggested topic is researching the effects of program managers' levels of authority to go with their responsibilities. The dynamics of how program managers would strategically plan and tactically execute could result in better results with on-time deliveries of warfighter assets within cost and schedule. Though government regulations drive many decisions made by program managers throughout the acquisition life cycle, internal barriers, such as rank or positional authority, may contribute to negative externalities associated with high-risk choices.

The final area recommended here is the role of warfighters in the acquisitions of autonomous materiel solutions. As more integration occurs between artificial intelligence-enabled systems, warfighters' contributions in designing these emerging capabilities will align closer to mission objectives and maintain advantages in competition and conflict.

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