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Feasibility Analysis of a Joint H-60 Program Office

December 2022

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Prepared for the Naval Postgraduate School, Monterey, CA 93943

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ABSTRACT

The purpose of this feasibility analysis is to assess the feasibility of a joint program office to manage the cross-service Lockheed Martin/Sikorsky H-60 helicopter. The Lockheed Martin/Sikorsky H-60 helicopter is a multipurpose aircraft employed by numerous United States government agencies including many in the Department of Defense (DoD) and Department of Homeland Security (DHS). This feasibility analysis will use a quantitative comparative analysis to analyze the U.S. Army and U.S. Navy's procurements of the H-60 helicopter and assess if there are cost savings that could be realized with a joint program office. Additionally, we conducted a qualitative comparative analysis to determine if there are benefits or disadvantages to joint program offices.

Our findings revealed that there are legitimate quantitative advantages for joint programs due to common economic principles of economies of scale and volume discounts. However, there are several qualitative detriments that must be overcome in order to transition the H-60 helicopter program to a joint office. These findings led us to recommend that the H-60 helicopter program remain separate offices managed by each individual service due to the established service life of the H-60. Nevertheless, future major weapons systems could benefit from a joint office if adopted early enough in the program's life cycle.

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ABOUT THE AUTHOR

LCDR Drake Thornton joined the Coast Guard through the College Student Pre-Commissioning Initiative in 2008. Following completion of boot camp, LCDR Thornton attended University of North Texas where he earned a Bachelor of Science in Criminal Justice Studies. LCDR Thornton attended Officer Candidate School and received orders to Naval Flight Training in Pensacola, FL. After completing flight training and earning his wings of gold, LCDR Thornton received orders to Coast Guard Air Station Corpus Christi, TX from 2013-2017, then Air Station Miami from 2017-2021. Upon completion of the Systems Acquisition Management curriculum at Naval Postgraduate School, LCDR Thornton will complete a follow-on tour in the Office of Aviation Acquisitions at Coast Guard Headquarters in Washington, DC.

MAJ Scott Betancourt was born in Fort Leavenworth, Kansas and graduated from the United States Military Academy in 2011. He was commissioned into Army Aviation and that summer began the Officer Basic Course at Fort Rucker, Alabama, followed by the completion of SERE training, the Intermediate Entry Rotary Wing course, and the AH64D Longbow Apache flight training course in October 2012. His first assignment following flight school was with 3rd CAB 1-3 ARB at Hunter Army Airfield in Savannah, Georgia.

MAJ Betancourt deployed in 2012 as an Attack Platoon Leader with the B/1-3 ARB under Task Force Brawler to Tarin Kowt, Afghanistan in support of Operation Enduring Freedom XII-XIII. In 2016 MAJ Betancourt completed the Aviation Captains Career Course and Aviation Maintenance Officers Course at Fort Rucker, Alabama. He was then assigned to 1-3 ARB Task Force Viper under 12th CAB in Katterbach, Germany. There he assumed command of both Delta Company and 5th Detachment 603rd ASB. Afterwards, in 2018 he was assigned to Fort Polk, Louisiana as an Observer Coach and Trainer (OC/T) at the Joint Readiness Training Center.

In 2019, MAJ Betancourt accepted a transfer to the Army Acquisition Corps and was assigned to Redstone Arsenal to begin work with PEO Aviation. He then was accepted to attend the Naval Postgraduate School in Monterey, CA from 2021-2022, and graduated with a Master of Business Administration in Systems Acquisition Management.

Lieutenant Nestor Sanchez is a native of Las Vegas, Nevada. He earned a Bachelor of Science in Systems Engineering from United States Naval Academy. He was commissioned through the United States Naval Academy in May 2015 and was designated a Surface Warfare Officer in January 2017. Lieutenant Sanchez first sea tour was onboard USS GONZALEZ (DDG-66), where he served as the Electrical Officer and First Lieutenant. This tour he participated in the 2015-2016 Harry S. Truman deployment in support of Operation Inherent Resolve in the 5th fleet AOR and in the multi-national USW exercise Cutlass fury. His second sea tour was onboard USS FORT MCHENRY (LSD-43), where he served as the Navigator. This tour he participated in the 2018-2019 Kearsarge Amphibious Ready Group (ARG) deployment. His latest shore assignment was to Commander Fleet Activities Chinhae, South Korea as the Installation Operations Officer. Upon completion of the Systems Acquisition Management curriculum at Naval Postgraduate School, LT Sanchez will continue to Department Head School in preparation for his first Department Head tour.

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I would like to thank my amazing family—Jenna, Case, and Emerson—for their support throughout my entire career and specifically for these past 18 months of me reading countless hours and writing seemingly endless papers. I would not have been able to complete this thesis without their support and encouragement. Thank you! Nestor and Scott, it was great working with you guys on this. Y'all inspired me to push on and get this done! Thanks for everything guys. Dr. Mortlock, thank you for your mentorship, leadership, and your time throughout these past 18 months. I know I can speak for Scott and Nestor by saying that we will leave here far more equipped to continue our military career because of what you taught us.

—Drake

Thank you, Dr. Mortlock, Drake, and Scott. Surviving NPS with you all has been great. Thank you for all the help and collaboration on this thesis.

—Nestor

Thank you, Drake and Nestor, for your collaborative efforts during class, on our thesis, and for your friendship. I would also like to thank Dr. Mortlock for his guidance and mentorship throughout my time here at NPS.

—Scott

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LIST OF ACRONYMS AND ABBREVIATIONS

AAF	Adaptive Acquisition Framework
ACAT	Acquisition Category
ADM	Acquisition Decision Memorandum
AoA	Analysis of Alternatives
CAE	Component Acquisition Executive
CDD	Capability Development Document
COTS	Commercial-Off-the-Shelf
DA	Decision Authority
DAMS	Defense Acquisition Management System
DAS	Defense Acquisition System
DAU	Defense Acquisition University
DBS	Defense Business Systems
DepSecDef	Deputy Secretary of Defense
DoD	Department of Defense
DHS	Department of Homeland Security
EMD	Engineering & Manufacturing Development
FRP	Full Rate Production
GAO	Government Accountability Office
GFE	Government Furnished Equipment
IG	Inspector General
JAE	Joint Acquisition Executive
JCIDS	Joint Capabilities Integration & Development System
JROC	Joint Requirements Oversight Council
JSF	Joint Strike Fighter
LCC	Life Cycle Costs
LRIP	Low-Rate Initial Production
MDAPS	Major Defense Acquisition Programs

MDA	Milestone Decision Authority
MDD	Material Development Decision
MRL	Manufacturing Readiness Level
MSA	Material Solution Analysis
MTA	Middle Tier of Acquisition Pathway
NASA	National Aeronautics and Space Administration
O&S	Operations & Support
PD	Production & Deployment
PEO	Product Executive Office
PM	Project Manager
PPBE	Planning, Programming, Budgeting & Execution
PSS	Product Support Strategy
RAA	Rapid Acquisition Authority
RDT&E	Research, Development, Test & Evaluation
RFP	Request for Proposal
SAR	Selected Acquisition Report
SecDef	Secretary of Defense
SIG	Senior Integration Group
TMRR	Technology Maturation & Risk Reduction
TRL	Technical Readiness Level
UAV	Unmanned Aerial Vehicle
UON	Urgent Operational Need
USCG	United States Coast Guard

I. INTRODUCTION

The Lockheed Martin/Sikorsky H-60 Black Hawk helicopter has been in service to the U.S. government since 1979. Shown in Figure 1, the H-60 has been utilized by every branch of the Department of Defense (DoD) and many agencies within the Department of Homeland Security (DHS). Despite numerous agencies employing the H-60 helicopter, there is not a joint program office to oversee acquisition, delivery, sustainment, obsolescence management, or the eventual retirement of the platform. There is a high probability that inefficiencies exist, holistically, when analyzing the individual service DoD/DHS acquisitions of the H-60 Black Hawk helicopter. Basic economic principles and previous acquisition and sustainment programs suggest that the government would be able to take advantage of economies of scale by leveraging the buying power of a joint office—but does the freedom to manage the platform within each agency provide more benefits to the government as a whole? This feasibility analysis uses a comparative analysis method of research to examine the multiple H-60 programs and will make a recommendation for future programs that could benefit from either mimicking the successful H-60 program or determining if a joint program is more beneficial to the government.

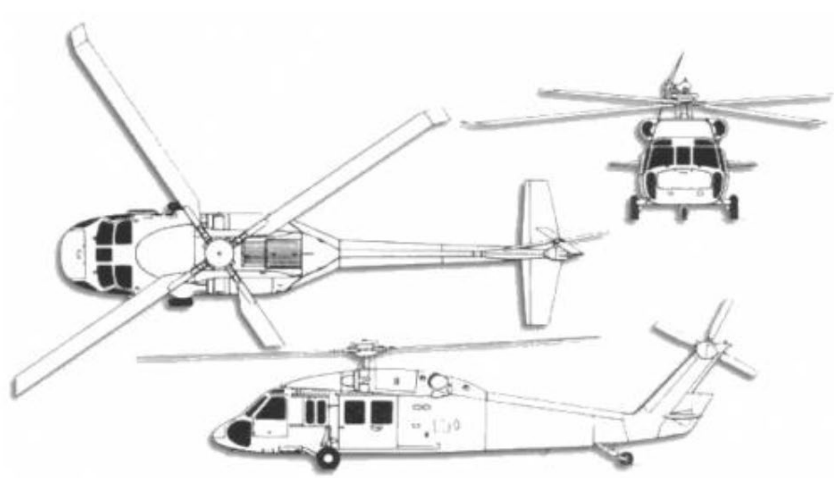


Figure 1. Lockheed Martin/Sikorsky H-60. Source: Pace51 (n.d.).

A. PRACTICAL PROBLEM

In a 2009 interview, then Secretary of Defense Robert Gates said,

> One of the problems we have—and it's one of the reasons I recommended canceling CSAR-X [the Air Force's Combat Search and Rescue helicopter program]—is that we have really come to a point where we do extraordinarily well in terms of joint operations, but we do not do well in terms of joint procurement. (Gates, 2009)

This statement from over 13 years ago is really the heart of the issue for this report. Why doesn't the U.S. government perform well for joint acquisition programs? Our feasibility analysis attempts to assess the claim that a joint program office would benefit the U.S. government as compared to individual program offices. As mentioned earlier, economies of scale should be realized and beneficial to the government and the defense industrial base (Corporate Finance Institute, 2022). Beyond the potential cost savings of a joint office, there are likely benefits to having a single program office negotiate with Lockheed Martin/Sikorsky. We also believe that a single unified office could gain substantial leverage when discussing spares and other aviation material.

B. KNOWLEDGE GAP

Not much research has investigated the feasibility of joint service procurements through the lens of the H-60 Black Hawk helicopter, which is heavily used throughout numerous agencies in the U.S. government. Relatively few studies have explored the inefficiencies in the current Joint Acquisition Process. Howard Harris and Mark Lewis (2012) wrote an article proposing a specific leadership structure that could potentially fix current issues plaguing joint programs by adding a Joint Acquisition Executive (JAE) to oversee all joint procurements. From this, we believe that there is potential to improve joint program execution in areas such as: schedule, cost, coordinated unity of effort, synergy between services, streamlined reporting and budget/funding processes, and a more experienced and established workforce dedicated to joint procurements (Harris & Lewis, 2012).

Additionally, a recent Government Accountability Office (GAO) report on the status of the F-35 Joint Strike Fighter highlights how the DoD continues to experience delays and costs continue to grow due to the dysfunction of the joint program and the differences in platform requirements (GAO, 2022). Though the report does not specifically call for an investigation into the feasibility of joint acquisitions within the DoD, it does infer it by stating the program is over budget and delayed in schedule, which is usually a shortfall of current joint acquisitions (Harris & Lewis, 2012). Therefore, the purpose of this thesis is to conduct a feasibility analysis to assess if there are efficiencies and resource-saving opportunities available when considering a joint acquisition program for the cross-service platform H-60 helicopter. Knowledge gained through this research can be used to determine if a joint service acquisition would yield additional benefits in future major weapon platforms utilized by multiple DoD/DHS services.

C. THESIS CONTRIBUTION

This study aims to analyze the feasibility of a joint program for the H-60 helicopter utilizing a quantitative comparative analysis between the Army and Navy's H-60 programs. Using publicly available acquisition reports from 2004 to 2016, we compare the amount that the Army and Navy paid for base H-60 helicopters. Throughout this feasibility analysis, the research may show that the current course of action with separate program offices for each agency is in fact the better path forward. There are many qualitative factors that have the potential to impact the decision to keep separate program offices. However, if the analysis determines that a joint program office would be beneficial to the government, this research should be used as evidence for future joint acquisition programs for major shared weapons systems and capabilities. This research will help discover inefficiencies in joint acquisitions through increasing knowledge of how the DoD/DHS managed the acquisition of the H-60 helicopter. This knowledge will help leaders of the DoD/DHS identify lessons learned from this aviation platform that is used throughout the U.S. government and potentially improve policies covering joint service acquisitions.

In this chapter, we introduced the problem statement and the main question that we aim to answer throughout the remainder of this thesis. We introduced the basic elements of the H-60 helicopter and the various agencies that utilize the aircraft. Additionally, we discussed the potential benefits of a joint program office, including opportunities for cost savings and efficiencies. In order for the reader to have a basic understanding of government acquisitions, we outline the acquisition policy and major regulations that government agencies must navigate to acquire new major weapon systems. We present the background and historical use of the H-60 helicopter for the U.S. Coast Guard, U.S. Navy, U.S. Army, along with other applications of the aircraft around the world.

II. BACKGROUND

For the background of this feasibility analysis, we reviewed many historical documents to include a breakdown of how each Service within the scope of the analysis acquired and has utilized the H-60 helicopter. Other historical documents included newspaper articles, press releases, journal articles, and other historical Service documents. Additionally, we reviewed the laws and regulations that govern the acquisition and management of major defense acquisition programs.

A. GOVERNMENT ACQUISITIONS

Acquisition and program management literature primarily consists of policy documents including Congressionally mandated policies, DoD/DHS Instructions, and Service-specific instructions. Additional research included publicly available websites and reports. To compare the success of the various H-60 programs with other major weapon system acquisitions, we reviewed several GAO reports that looked at different government acquisition programs and made recommendations to help the programs remain on track for cost, schedule, and performance. Finally, we contacted multiple Service Program Offices for insight into their H-60 programs and to gain valuable knowledge about the future of the H-60 platform for each Service.

B. WHAT IS “BIG A” ACQUISITION?

To understand how we analyzed the problem we must baseline ourselves about the understanding of how the DoD acquires products for its service members. So, what is Big A acquisition? Michael Williamson (2018) states the following:

> We must view acquisition as a comprehensive process that takes us from the design of weapon systems to procurement, testing, fielding and deployment, sustainment, and disposal. Known as “Big ‘A’ acquisition,” this process involves many stakeholders, including Congress, the industrial base, the acquisition workforce and, especially, the men and women in uniform who ultimately take these weapons to war. (Williamson, 2018, para. 2)

In Williamson’s case, he references land force dominance. In our research, this is relevant because it is the same process in which the H-60 helicopter is acquired. What we intend to discover are Joint Service opportunities and efficiencies that may or may not exist for the government, DoD/DHS, to consider for MDAPs, such as the multi-service H-60 helicopter.

Government regulations that align with Big A acquisition come from the DoD 5000 series, which is the overarching directive that describes the principles governing the acquisition process for the DoD (DoD, 2009b). As shown in Figure 2, the acquisition system for the DoD, also known as Big A acquisition, is composed of three interconnected systems. DoD Services follow these regulations and navigate through obstacles inherent in defense development and procurement programs to ultimately acquire weapon systems. In the case of the H-60 family of helicopters, both the DoD and DHS acquire the same aircraft for a myriad of mission sets, but through separate Service program offices and contracts.

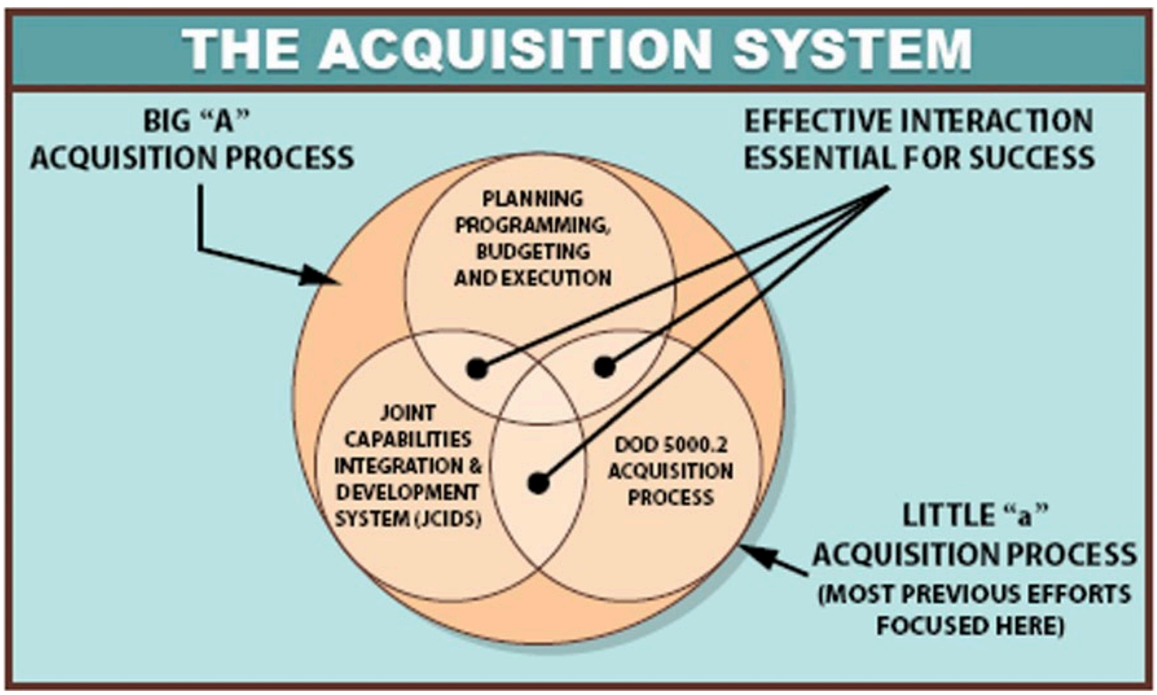


Figure 2. The Acquisition System. Source: Schwartz (2014).

The Defense Acquisition Framework is broken down into three primary decision support systems known as the Planning, Programming, Budgeting & Execution (PPBE); Joint Capabilities Integration & Development System (JCIDS); and the Defense Acquisition System (DAS), also known as the Defense Acquisition Management System

(DAMS) (Rendon et al., 2019, p. 71). PPBE is the process which the DoD uses to allocate funds for capabilities to meet the warfighters' needs. When thinking of PPBE, think planning and funding for capabilities. JCIDS is the process of how the DoD identifies what capabilities are needed and validates them. When thinking of JCIDS, think requirements and the need for a capability. Finally, DAS is the process in which the system is acquired. When thinking of DAS, think the management of acquiring the capability. Also, understand that the PPBE process is schedule driven, JCIDS is needs driven, and DAS is event driven as shown in Figure 3. All three of these systems have different drivers that outline their complexities in defense acquisitions (Mortlock, 2021).

Figure 3. Defense Acquisition. Source: Mortlock (2016).

Big A acquisition is leveraged to acquire and sustain he H-60 for each Service and agency. Each time a Service requires this weapon system or needs to procure more H-60s, they enter the vicious cycle of the defense acquisition process. Scott Moran states,

> Observers of defense acquisition processes increasingly emphasize the importance of understanding problems that arise from interrelationships, interdependencies, and conflicts among these three systems. The need to harmonize different perspectives, interests, and objectives across the

> framework presents a fundamental defense acquisition challenge. (Moran, 2008, pp. 177–178)

With so much concern over the challenges and complexities of Big A acquisition, it is important to outline it in this report to see how that affects each Service acquiring the H-60.

C. WHAT IS "LITTLE A" ACQUISITION?

In addition to a thorough understanding of Big A acquisition, we must also have a basic understanding of "Little A" acquisition and how it connects to the H-60 programs within the DoD. Little A acquisition refers to the Defense Acquisition System (DAS). There is considerable focus on the DAS because it consists of the acquisition phases and milestones necessary to acquire a capability. The DoD Directive 5000.01 (2020) states:

> The objective of the DAS is to support the National Defense Strategy, through the development of a more lethal force based on U.S. technological innovation and a culture of performance that yields a decisive and sustained U.S. military advantage. The acquisition system will be designed to acquire products and services that satisfy user needs with measurable and timely improvements to mission capability, material readiness, and operational support at a fair and reasonable price (DoD, 2020, p. 4).

According to Scott Moran (2008), DAS participants are usually concerned with several factors—such as cost, schedule, performance, and risk—when trying to gain a capability. These same factors are commonly referred to as the triple constraint and form the basis of the acquisition program baseline. Additionally, the relationship between cost, schedule, and performance are the basis for the standards of project, program, and portfolio management principles that are internationally recognized. The triple constraint, little A acquisition, applies to the Services that we analyzed in this study of the H-60 helicopter.

As highlighted within the DAS's objective, the relevance and importance of Little A acquisition is to get affordable, technologically advanced, and reliable weapon systems to meet the needs of the warfighter. The DoD is able to achieve this objective by adopting the Adaptive Acquisition Framework (AAF) as shown in Figure 4 (DoD, 2022). AAF is a construct of six different pathways that support the DAS in order to provide flexibility to milestone decision authorities (MDA), decision authorities (DA), and project/product/ portfolio managers (PM) to plan and manage acquisition programs with sound business practices (DoD, 2022). The six different pathways of AAF are: Urgent Capability Acquisition, Middle Tier of Acquisition (MTA), Major Capability Acquisition, Software Acquisition, Defense Business Systems, and Acquisition of Services.

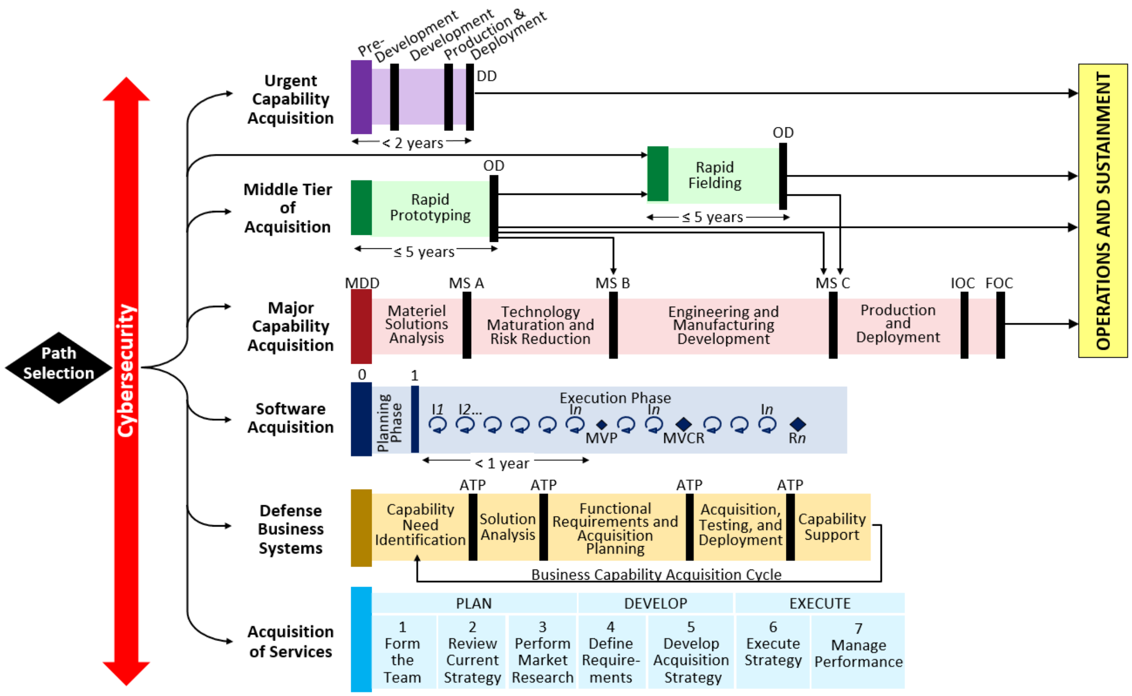


Figure 4. Adaptive Acquisition Framework. Source: DoD (2022).

In the case of the H-60 helicopter, program offices must navigate the acquisition process individually, instead of working within a joint acquisition framework, which could prove more effective for the warfighter and more cost efficient for the U.S. government. Although the H-60 program offices have acquired the H-60 using the traditional major capability acquisition pathway, shown in Figure 5, the AAF has added alternate paths in which future programs can achieve the DAS objective. Each pathway in the AAF is specific and unique which provides flexibility to the program office's acquisition approach. Each pathway will be discussed in greater detail in the following subsections.

1. Major Capability Acquisition Pathway

Major Capability Acquisition Pathway, shown in Figure 5, is the process for acquiring major capabilities in the DAS. The major capability acquisition process is split into five phases and includes three milestones throughout. The five phases are: Material Solution Analysis (MSA), Technology Maturation & Risk Reduction (TMRR), Engineering & Manufacturing Development (EMD), Production & Deployment (PD), and Operations & Support (O&S). In between the MSA phase and the TMRR phase is Milestone A, where the program becomes a program of record and is approved to enter the TMRR phase. Once the MDA has deemed the technology is mature, the program is approved through Milestone B to enter the EMD phase. Lastly, in between the EMD phase and the PD phase is Milestone C, where production begins. Throughout the phases, there are several decision points and major reviews conducted by the MDA. Each major capability is categorized as an acquisition category (ACAT), based on funding required, which identifies the specific regulations the program must follow (DoD, 2021).

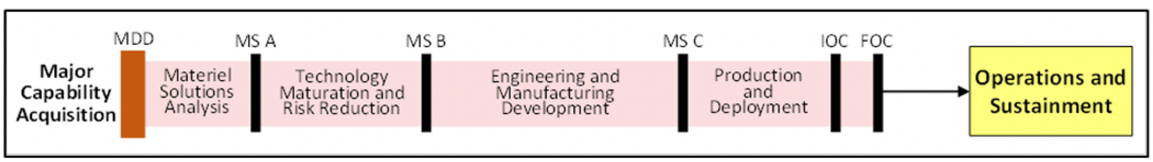


Figure 5. Major Capability Acquisition Pathway. Source: DoD (2022).

To enter into the Major Capability Acquisition Pathway, the MDA must approve the Materiel Development Decision (MDD) which is informed by validated requirement documents and the completion of an Analysis of Alternatives (AoA) study plan (DoD, 2021). At this point the MDA is able to determine which phase the program should enter depending on need, funding, and technology readiness (DoD, 2021). If the technology is immature the program starts at the beginning of the process, at the MSA phase. This phase is directed by the approved validated requirement documents and AoA study plan (DoD, 2021). In this phase, the program will identify a solution that will meet and fill the capability gap derived from the requirement documents and AoA. Additionally, during this phase a majority of the planning is completed to include the acquisition strategy. The focus in this phase is, "identification and analysis of alternatives, measures of effectiveness, key trades between cost and capability, life-cycle cost, schedule, concepts of operations, and overall risk" (DoD, 2021, p.11). The AoA will encapsulate the "affordability analysis, sustainment considerations, early systems engineering analysis, threat projections, and coalition interoperability" (DoD, 2021, p.11). Once the program office has conducted a proper analysis and assessed its acquisition strategy, it will then proceed to Milestone A decision, which needs to be approved to proceed to the next phase.

At Milestone A, the MDA will review the acquisition strategy created in the MSA phase and approve it if they determine it satisfies the requirements for a material solution (DoD, 2021). Along with approval of the acquisition strategy, final requests for proposals (RFPs) will be sent out that are informed by the draft capability development document (CDD) approved by the Joint Requirements Oversight Council (JROC) (DoD, 2021). Once approved, the program will enter the TMRR phase.

The purpose of the TMRR phase is to determine if the technology can be integrated into a full system and to identify if technology risk, engineering, integration, and life cycle cost risk could be reduced (DoD, 2021). In this phase, the JROC will validate the CDD following the Development RFP release decision. At this point, the MDA will approve the final RFP and release it for EMD phase along with determining the preliminary low-rate initial production (LRIP) quantity (DoD, 2021). These decisions will be annotated in the Acquisition Decision Memorandum (ADM) which will be reviewed during Milestone B. The MDA at this point will approve the completion of the TMRR phase and enter Milestone B for review.

At Milestone B, the decision is made to enter the EMD phase and allocate funds to support the program. At this milestone review, the program must demonstrate that "all sources of risk have been adequately mitigated to support a commitment to design, development and production. Risk sources include, but are not limited to, technology, threat projections, security, engineering, integration, manufacturing, sustainment and cost risk" (DoD, 2021, p. 15). Once milestone B has been approved, the program is now considered a program of record and enters the next EMD phase.

The EMD phase is intended to develop and mature a material solution that meets all requirements in order to proceed into production following a Milestone C decision

(DoD, 2021). To finish the EMD phase, the MDA must approve Milestone C to enter the PD phase, which is the last milestone in the Major Capability Acquisition Pathway. For the MDA to approve Milestone C, the program must have met the specific exit criteria to transition into the PD phase, which includes meeting Technology Readiness Levels (TRLs) and Manufacturing Readiness Levels (MRLs).

Once Milestone C has been approved, the next phase is the PD phase. The purpose of the PD phase is to begin production and delivery of the product to the warfighter (DoD, 2021). Once the MDA has conducted its review on the program's initial OT&E and manufacturing processes and deems it satisfactory, the decision for full rate production (FRP) will follow. Once the program is in FRP it will transition into the O&S phase.

The O&S phase is intended to follow the product support strategy (PSS) outlined in the approved acquisition strategy and is broken down into two parts: sustainment, and disposal (DoD, 2021). During sustainment, the program will monitor the product performance throughout its life cycle and validate that the product is meeting the PSS. Disposal marks the end of the product's life cycle where the produce will be "demilitarized and disposed of in accordance with all legal and regulatory requirements and policy relating to safety (including explosives safety), security, and the environment, in accordance with the PSS" (DoD, 2021, p. 18).

The Major Capabilities Acquisition Pathway is utilized by many large acquisition programs to develop and deliver a capability to the warfighter. This is relevant, as the H-60 helicopter was a major weapon system that utilized this pathway.

2. Urgent Capability Acquisition Pathway

The Urgent Capability Acquisition Pathway, shown in Figure 6, is the quickest pathway to field capabilities in the DAS. In order to use this pathway, there must be an urgent need that must be in the warfighter's hands in less than two years (DoD, 2022). This pathway comprises the pre-development, development, PD, and O&S phases. Throughout these phases the PM, the intended user community, requirements validation authority, and the MDA work together to validate that there are effective options to meet the warfighters needs. The need must be met within the intended time, without substantial development, with existing technology, and able to be acquired with a fixed price contract (DoD, 2019).

According to the DoDI 5000.02 (2022), "The estimated cost of any single solution must not exceed $525 million in research, development, and test and evaluation; or $3.065 billion procurement in Fiscal Year 2020 constant dollars. The acquisition; product support and sustainment processes; reviews; and documents are aggressively streamlined due to operational urgency" (p.12). The importance of this pathway is that the DoD is able to rapidly provide the warfighter with the capability when needed. This pathway is relevant to the H-60 helicopter as there are numerous sub-systems and support systems that provide additional capabilities to the H-60 helicopter. Some of these systems could have been acquired utilizing the Urgent Capability Acquisition Pathway.

Figure 6. Urgent Capability Acquisition Pathway. Source: DoD (2022).

3. Middle Tier of Acquisition Pathway

The Middle Tier of Acquisition (MTA) Pathway, shown in Figure 7, is the fastest way to field prototypes and demonstrate the capabilities of those prototypes with available technology that needs minimal development (DoD, 2022). MTA is broken into two major parts: rapid prototyping and rapid fielding. Rapid prototyping must be completed within five years of the MTA program start date and must be fielded meeting the defined requirements demonstrating its operational capability (DoD, 2022). Rapid fielding must be completed within five years of the MTA program start date and be in production within six months (DoD, 2022). Again, this pathway is relevant to the H-60 helicopter as there are numerous sub-systems and support systems that provide additional capabilities to the H-60 helicopter. Some of these systems could have been acquired utilizing the Middle Tier of Acquisition Pathway. We believe that one potential application of MTA for the H-60 helicopters is for manufacturers to place working prototypes onto operational H-60s to increase capabilities.

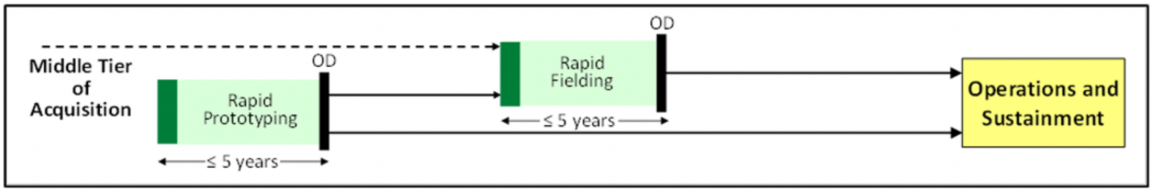


Figure 7. Middle Tier of Acquisition Pathway. Source: DoD (2022).

4. Software Acquisition Pathway

The Software Acquisition Pathway, shown in Figure 8, is the way the DoD obtains capabilities for software intensive systems (DoD, 2022). This pathway is broken into two phases: the planning phase and execution phase. This pathway provides the means to deliver software capability to the user.

The DoDI 5000.02 (2022) states:

> This pathway integrates modern software development practice such as Agile Software Development, Development, Security, and Operations, and Lean Practices. Small cross functional teams that include operational users, developmental and operational testers, software developers, and cybersecurity experts leverage enterprise services to deliver software rapidly and iteratively to meet the highest priority user needs. These mission-focused, government-industry teams leverage automated tools for iterative development, builds, integration, testing, production, certification, and deployment of capabilities to the operational environment. (DoD, 2022, p.14)

This pathway is a result of the rapidly changing technological environment that requires constant updates to protect against current cyber security threats. Like previous pathways, the Software Acquisition Pathway is relevant to the H-60 helicopter due to the onboarding of modernized, software driven technology that exists in nearly every sub-system of the aircraft. The Software Acquisition Pathway will continue to remain relevant for the sustainment of the H-60 helicopter.

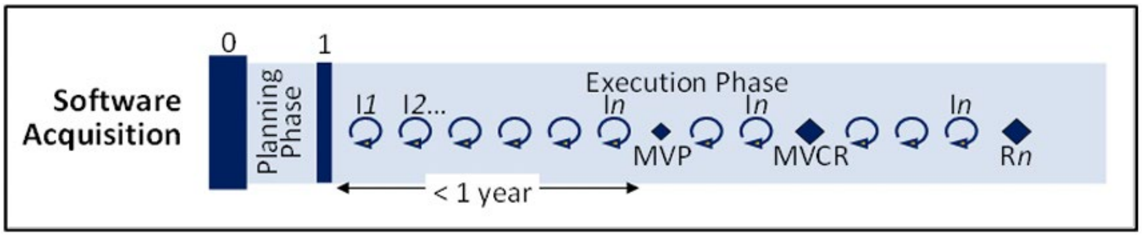


Figure 8. Software Acquisition Pathway. Source: DoD (2022).

5. Defense Business Systems Pathway

The Defense Business Systems (DBS) Pathway, shown in Figure 9, is the way in which the DoD acquires information systems for its business practices (DoD, 2022). In order for the DoD to be aligned with commercial and government business best practices, it constantly evaluates existing systems that could add value and adopts them to fulfill its needs. Those best practices include "as-a-service" solutions such as "financial and financial data feeder, contracting, logistics, planning and budgeting, installations management, human resource management, and training and readiness systems" (DoD, 2022, p.15). Since many of these systems already exist in commercial and government sectors there is less risk in acquiring these commercial-off-the-shelf (COTS) business systems.

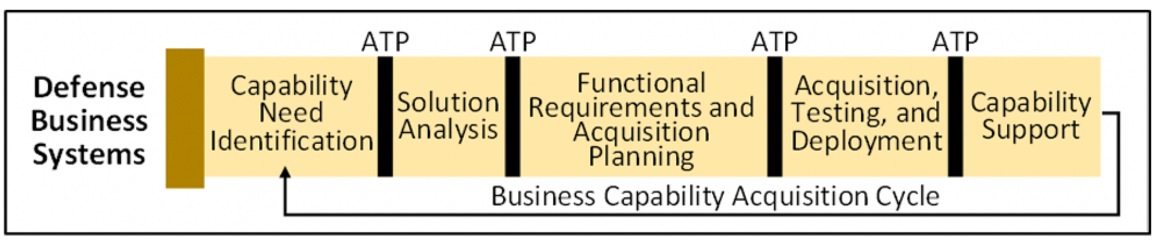


Figure 9. Defense Business Systems Pathway. Source: DoD (2022).

6. Acquisition of Services Pathway

The Acquisition of Services Pathway, shown in Figure 10, is the way the DoD acquires services from the private sector (DoD, 2022). This pathway is a seven-step process that is broken down into three phases; plan, develop, and execute. Services include, "knowledge-based, construction, electronics and communications, equipment, facilities, product support, logistics, medical, research and development, and transportation services" (DoD, 2022, p.16). These previous two pathways have little relevance to MDAPs like the H-60 helicopter, but have been provided for background and context.

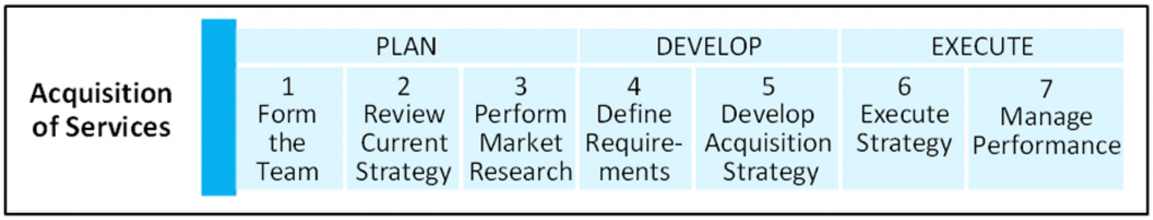


Figure 10. Acquisition of Services Pathway. Source: DoD (2022).

D. U.S. COAST GUARD ACQUISITION PROCESS

Since the U.S. Coast Guard (USCG) does not fall under the DoD, they are required to have their own acquisition process. The Coast Guard acquisition instruction is detailed in COMMANDANT INSTRUCTION 7100.1A Coast Guard Planning, Programming, Budgeting, and Execution (PPBE) Process. The Coast Guard's process is largely identical to the DoD's PPBE process, but includes specific DHS provisions and policies. The PPBE process for the Coast Guard, as shown in Figure 11, follows roughly the same timeline as the DoD process and begins several years before the execution of congressionally approved funds. The PPBE process is intended to execute the strategic initiatives that are laid out in the Coast Guard Strategic Plan and support the multi-year initiatives presented in the five-year Future Years Homeland Security Program.

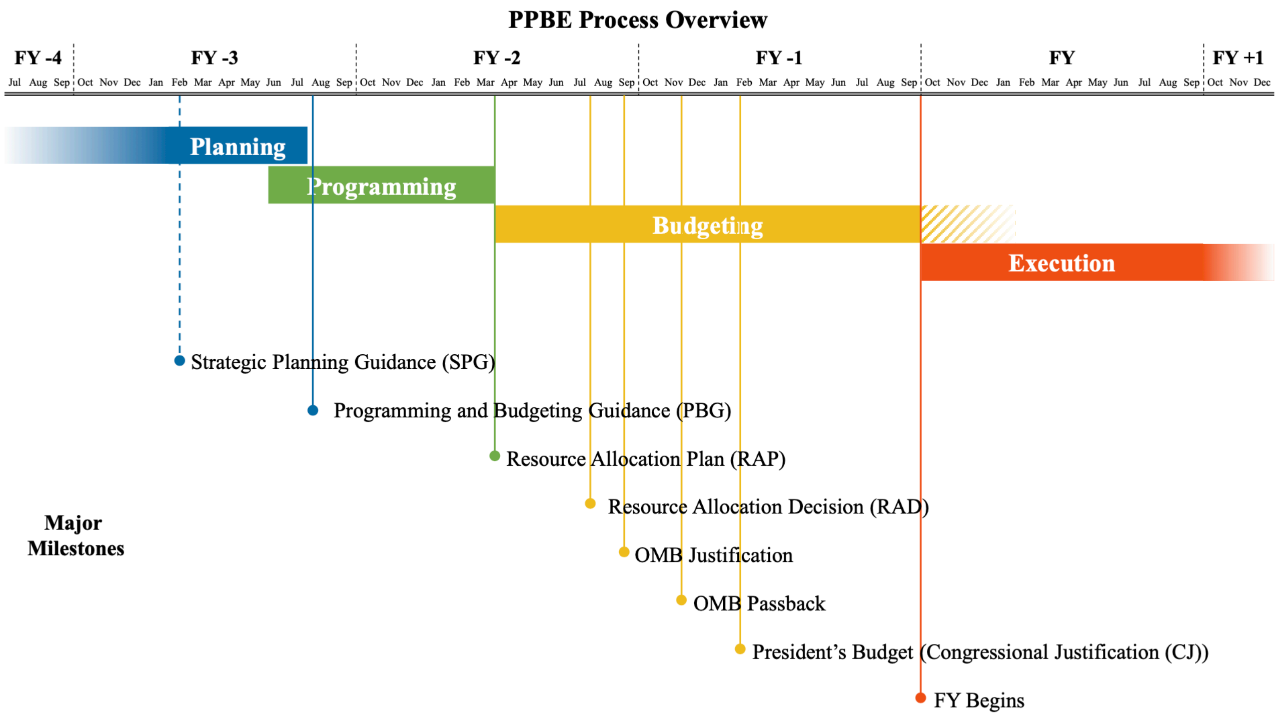
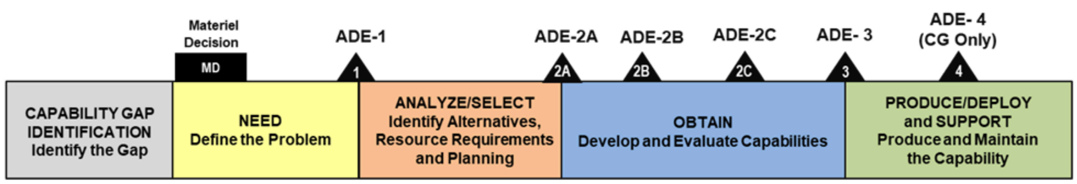


Figure 11. USCG PPBE Process Overview. Source: U.S. Coast Guard (2021a).

In comparison to the DoD's Major Capabilities Acquisition Pathway, the Coast Guard utilizes the Coast Guard Acquisition Life Cycle Framework shown in Figure 12.



Materiel Decision (MD): See page 2-15 or the glossary for a definition of MD.
ADE-1: Validate the Need;
ADE-2A: Approve the Program and Initiate Obtain Phase Activities;
ADE-2B: Approve the APB and Continue Obtain Phase Activities;
ADE-2C: Approve Low Rate Production or Incremental Delivery;
ADE-3: Produce and Deploy Program Products.
ADE-4: Acquisition Program Ends. Responsibility fully transferred to sustainment.

Figure 12. Coast Guard Acquisition Life Cycle Framework Source: Office of the Assistant Commandant for Acquisitions (2021).

Although they follow the same basic framework of identifying a need through the disposal of a capability, they differ in minor areas. One difference is that the Coast Guard utilizes Acquisition Decision Events (ADE), where the DoD utilizes Milestone Decisions.

ADEs are defined as “Critical knowledge-based, event-driven decision points throughout the acquisition life cycle process that require assessment of program readiness and risk” (Office of the Assistant Commandant for Acquisitions, 2021, p. 2-7).

E. STAKEHOLDERS FOR ANALYSIS

This section will describe the primary stakeholders for this H-60 helicopter feasibility analysis. Though numerous government agencies utilize the H-60 helicopter, the three stakeholders analyzed in our research are the U.S. Coast Guard, U.S. Army, and U.S. Navy. Their background and integration of the H-60 into their individual Service operations and mission sets are listed in the following section, along with information on what platform variants will be utilized in this feasibility analysis.

1. U.S. COAST GUARD USE OF THE H-60 HELICOPTER

Before the H-60 helicopter was adopted, the Coast Guard’s primary mission of maritime helicopter search and rescue had been carried out by the aging Sikorsky HH-3F Pelican and the Sikorsky H-52 Seaguard helicopters, shown in Figures 13 and 14 respectively. Both helicopters had been in service since the early 1960s and were reaching their upper limits of expected service life. Replacing the H-52 Seaguard helicopter was a difficult task to accomplish. The H-52 helicopter had been a tremendous success in Coast Guard aviation history, being credited with saving over 15,000 lives in its 26 years of service, thus giving it the honor of having saved more lives than any other helicopter in history (Coast Guard Aviation Association, 2021). In addition to maritime search and rescue, the replacement to these renowned helicopters would be required to carry out many of the 11 total statutory missions of the Coast Guard, including ports and waterway security, drug interdiction, aids to navigation, living marine resources, marine safety, defense readiness, migrant interdiction, marine environmental protection, ice operations, and maritime law enforcement (U.S. Coast Guard, 2021b, para. 2).

Figure 13. Sikorsky HH-3F Pelican. Source: Coast Guard Aviation History. (n.d.).

Figure 14. Sikorsky H-52 Sea King. Source: National Air and Space Museum. (n.d.).

The Coast Guard turned, once again, to Sikorsky Aircraft Corporation with the need for a medium range, medium lift, and all-weather helicopter capable of carrying out their missions. The Coast Guard has utilized the H-60 aircraft since the first H-60 came into service in 1990. The Coast Guard's H-60, as show in Figure 15, is a variant of the

Navy's SH-60 Seahawk helicopter and was converted to meet the needs of the Coast Guard's wide array of missions. In the initial contract, the Coast Guard purchased 42 H-60s, but that number will continue to increase to 127 H-60s that will carry out the Coast Guard's missions until the 2030s (Acquisition Directorate, U.S. Coast Guard, n.d.). Throughout its over 30 years of service in the Coast Guard, the H-60 has occasionally undergone upgrades to components, including engines, life support equipment, and—most importantly—avionics. Beginning in 2007 the Coast Guard began converting their MH-60J to the MH-60T, an upgrade that enabled the helicopter to fly in even more extreme weather for vital lifesaving missions (National Helicopter Association Historical Society, n.d.).

Figure 15. USCG H-60 Conducting Search and Rescue Exercise. Source: U.S. Coast Guard (n.d.).

The Coast Guard's current fleet of H-60 helicopters are spread out among nine Air Stations, including six in the continental United States, two in the State of Alaska, and one in Puerto Rico, shown in Figure 16. The larger circles in Figure 16 show the location of the H-60 assets.

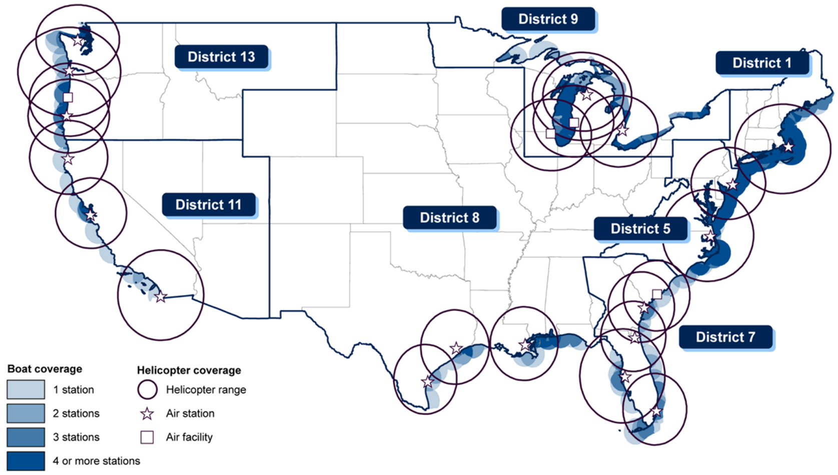


Figure 16. Overlap of U.S. Coast Guard Search and Rescue Coverage Provided by Boat Stations, Air Stations, and Air Facilities. Source: Government Accountability Office (2019).

The management of the Coast Guard's H-60 sustainment and growth to their program objective of 127 helicopters is overseen by the Coast Guard's Acquisition Directorate located at Coast Guard Headquarters in Washington, D.C., The acquisition directorate assists operational units in carrying out the many missions of the Coast Guard (USCG, n.d. b).

2. U.S. ARMY USE OF THE H-60

The UH-60 Black Hawk helicopter, as shown in Figure 17, makes up most of the aircraft in the Army's rotary wing fleet with over 2,100 airframes in inventory to date. It has served as the primary medium lift and utility tactical aircraft for nearly half a century since its initial development in 1972 (U.S. Army PEO Aviation, 2018b). The UH-60 Black Hawk was developed to replace the existing Bell UH-1 Iroquois, commonly referred to as the Huey, which served as the primary means to transport troops and equipment during the Vietnam War. At that time, shortcomings of the UH-1 "helped the Army define what was needed for the next-generation troop carrier that became the UH-60A Black Hawk" (Leoni, 2007, p. 9).

The two primary requirements for the UH-60 Black Hawk focused on lift capability at high altitudes in hot temperatures, and enhanced survival capabilities. It was designed to be a simple, reliable, multi-role lift helicopter capable of fulfilling a various range of mission and operational requirements including aeromedical evacuation, air assault, air transport, command and control, and special operations (Leoni, 2007, pp. 8–10). Simply, the UH-60 Black Hawk is the work horse of Army Aviation.

Figure 17. U.S. Army UH-60 Black Hawk. Source: Lockheed Martin (2022).

Upgrades and enhancements over the years have focused mostly on improvements to the aircraft's lift and flight range capabilities and reduced operation, maintenance, and sustainment costs along with updated air survivability equipment to best protect and equip Army warfighters for success (U.S. Army PEO Aviation, 2018b). Improvements have led to several different variants of the UH-60 Black Hawk utilized in the Army, many of which still exist and operate in today's inventory. UH-60A and UH-60L models make up most of the Army legacy fleet, many of which are operated and maintained by U.S. Army National Guard units throughout the country. The fleet of UH-60A and UH-60L aircraft are to be modified and replenished as UH-60Vs that will be operated and fly well into the future. The UH-60V will include significant upgrades that replace legacy analog architecture with digital internal cockpit suites and instruments that will allow for improved piloting interface and commonality with future models (PEO Aviation, 2018).

The Army's newest model of the UH-60 Black Hawk helicopter in production is the UH-60M. Modernized upgrades include improved flight performance, a fly-by-wire system, and a modern digital common avionics architecture system that enhances the internal cockpit suite and pilot interface (Sikorsky, 2008; Osborn, 2010). Additional requirements emerged for the need of this UH-60M Black Hawk variant, two of which addressed added weight requirements for the aircraft: first, an added door gunner for enhanced performance in lethality and survivability on the battlefield, and second, added weight from modernized 11-man infantry squads and their equipment to operate effectively on the future battlefield (Leoni, 2007, pp. 233–236).

Other variant models of the Army UH-60 Black Hawk exist in significant quantities that are still utilized and operated today. These include the HH-60L and HH-60M medical helicopters that are specially modified with medical mission equipment; and the Army's Special Operation fleet of MH-60L and MH-60M variants that entail significant specialized modifications and mission equipment packages to support a full array of special operation missions (Leoni, 2007).

Management and procurement of the Army's UH-60 Black Hawk helicopter is conducted primarily through the PM Utility Program Office within Product Executive Office (PEO) Aviation. Our study and analysis include focused data from the Army's active-duty UH-60M Black Hawk variant.

3. U.S. NAVY USE OF THE H-60

The first Navy H-60 helicopter variant was the SH-60B, which entered into operational service for the first time in 1984 (Leoni, 2007, p. 205). It was originally designed to replace the Kaman SH-2 Seasprite (see Figure 18), which was the Navy's primary platform for the Light Airborne Multi-Purpose System for maritime warfare as well as search and rescue (Leoni, 2007, p. 204). When looking to upgrade, they considered primary contractors such as Kaman, Bell, MBB, and Westland, but the Navy ultimately based its new maritime helicopter requirements on the Army's UH-60 Black

Hawk for reasons of commonality and minimized costs, and proceeded forward with Sikorsky towards design, procurement, and production of the SH-60B Seahawk (Naval History and Heritage Command, n.d.). Its primary role and mission sets supported by the SH-60B are surface warfare and anti-submarine warfare.

Figure 18. Kaman SH-2 Seasprite. Source: Naval Helicopter Association Historical Society. (n.d.).

Since the SH-60B Seahawk entered the Navy fleet, it has been modified and upgraded into several variant designations that include the SH-60F, HH-60H, MH-60S, MH-60R, and MH-60S. Similar to other DoD services, the HH-60 series was modified to primarily serve and support search and rescue missions. The MH-60 series were developed in the early 2000s as a direct upgrade to the legacy SH-60 variants and included an upgraded internal cockpit with modern digital architecture and interface to the pilots, upgraded armament capabilities, and upgraded air survivability equipment (Leoni, 2007, p. 205). The MH-60R Strikehawk and MH-60S Knighthawk (see Figures 19 and 20) are the Navy's newest H-60 variants and continue to support anti-submarine warfare and anti-surface warfare missions. They are also capable of conducting air and maritime surveillance, communications relay, search and rescue, and personnel and equipment transport (Leoni, 2007, pp. 231–231). Though there are many similarities between the two variants, the MH-60R is newer and includes more significant upgrades to “flight and mission avionics and to offensive and defensive weapons and countermeasures” (Leoni, 2007, p. 233). Like the SH-60s, these Naval platforms can be operated and launched from various locations, including Navy aircraft carriers, destroyers, cruise ships, frigates, and other amphibious ships (Naval Technology, 2015).

Figure 19. U.S. Navy MH-60R. Source: Naval Air Systems Command (n.d.).

For this study, our data collection focuses on the U.S. Navy’s most modern H-60 variant, the MH-60R. However, since the MH-60S is still produced and utilized by the Navy, we have also included some procurement data with it to use for comparison with the MH-60R, which will be shown in our research and findings. The Navy’s H-60 helicopters are managed and procured primarily through its PMA-299 Program Office located at Naval Air Station Patuxent River, Maryland. Currently in the Navy’s inventory, there are 256 MH-60S Seahawks and 273 MH-60R Seahawks, both being ACAT IC Programs (Naval Air Systems Command, n.d.).

Figure 20. U.S. Navy MH-60S. Source: Naval Air Systems Command (n.d.).

4. OTHER SERVICE'S USE OF THE H-60

Not included in this study, but still related and worth mentioning for understanding of scale, are the other Services that also procure and utilize H-60 helicopter platforms , both domestically and internationally. These additional Services within the DoD and DHS include the U.S. Air Force, Special Operations units across all DoD Services, the White House and other various federal and state government agencies, Border Patrol, and NASA. Additionally, the international H-60 helicopter fleet, mostly Black Hawks, consists of over 1,200 aircraft in over 30 countries, managed through foreign military sales program offices (U.S. Army, 2018).

In this chapter we introduced the applicable acquisition frameworks and policies that government agencies must navigate to acquire new major weapons systems. We presented the relevant stakeholders for comparison and their historical uses of the H-60 helicopter platform. The next chapter in the thesis is the literature review that provides context for our research. We present the historical research that has been completed on the idea of joint program effectiveness across many government agencies. The research includes official government documents, opinion pieces, and hypothetical scenarios in which joint programs are compared to individual programs.

III. LITERATURE REVIEW

For the literature review portion of our research, we present varying perspectives of the perceived benefits and risks of joint programs. Much of the literature reviewed presented anecdotal evidence of the risks and the unnecessary burden that joint programs place on government agencies. However, with the potential cost savings and efficiencies gained from a joint program, other literature argues for expanded use of joint programs. This chapter goes into further detail of the cost savings and potential efficiencies gained with joint programs. Cost savings can be realized through reduced administrative costs, economies of scale, and greater leverage with defense industrial base contractors. Efficiencies gained are likely the result of reduced administrative burdens that would be spread out over individual program offices. Additionally, with a joint program office, there would not be the often-lengthy contract negotiations occurring frequently because the program would be negotiated once by the joint office.

The practice of joint acquisition and sustainment programs is nothing new but has been getting more attention as budgets receive more scrutiny. Much of the research is in the form of anecdotal examples of programs succeeding or failing as a joint program. These examples range from simple Joint Service acquisitions to complex Major Defense Acquisition Programs. These examples bring a unique challenge to the research, as each program is unique with varying degrees of success or failure. Potential reasons for failure may include poor program management, immature technology readiness levels, and program risk that exceeds the future perceived benefits of continuing the program. These complexities have led to numerous process guides and journal articles aiming to assist program managers with their management of joint programs.

Other literature we reviewed warns against the use of joint programs due to the increased risks and complexity of such programs. One such report was published in 2014 by Mary Marie Brown with the University of North Carolina Charlotte. It is titled "Acquisition Risks in a World of Joint Capabilities: A Study of Interdependency Complexity" (Brown, 2014). This report was a comprehensive review of the risks associated with joint programs. The report used data analytics to compare MDAPs and analyze the interdependencies with other programs. Commonly used analyses included Monte Carlo analyses, linear programming, and statistical sampling to analyze the interdependencies among funding and data. The data showed that as a joint program progresses, they often become more dependent on funding from other similar programs which can indicate that the joint programs are often not as efficient as once thought (Brown, 2014).

Other literature showed the costs and benefits of venturing into joint programs and how joint programs have benefitted and hindered the DoD. These examples not only showed the holes in the DoD's acquisition process but also uncovered issues within acquisition culture. One example of this culture is found in Hogan's analysis of the management of the joint service acquisition for Unmanned Aerial Vehicles (UAV) Program established in the late 1980s and early 1990s (Hogan, 1992). The key to this analysis comes from two specific aspects of his report. The first is the funding and performance issues that each program office faced at inception. The second is Hogan's observations of the UAV program office as a joint program and identifying benefits and issues of joint acquisitions.

Hogan identified numerous problems facing the UAV program prior to becoming a joint program. Problems identified included a lack of an appropriate acquisition strategy, limited application at the time, and more than 12 different UAVs exceeding budgets and schedule due to immature technology (Hogan, 1992). This was deemed unacceptable by Congress because it was a waste of resources and effort—all the Services were fielding similar products and all had related requirements. Without Congress's intervention, more than 12 programs would have continued until they failed or were cancelled. At this point, Congress shut off funding for any acquisition program that included a UAV. The only way Congress would allow this technological development to continue was if the Services agreed to work together and continue development as a joint procurement (Hogan, 1992).

The UAV program transitioned to a joint program with relative ease given that the different Services had similar operational requirements for UAVs. However, they still needed to compromise over some Service specific requirements. The Services were able to compromise by establishing a proper acquisition strategy and an effective management office. Additionally, they made a family of UAVs that were interoperable and had commonality, which provided variants that catered to specific services (Hogan, 1992).

Hogan’s next observation of the joint UAV program indicated that it was far from perfect. He identified six issues and three benefits, shown on Table 1, from the UAV-short range program. The first issue from the program was deciding on operational requirements. Each Service had specific operational requirements for their UAVs and refused to deviate at the beginning of the joint program. This issue could have resulted in a delay for the development of the UAV because the Services had to agree on one final product. The second issue is related to budgeting and funding of the UAV and the potential problems that could arise from joint management of funds for the program. Funding at the Service level, or with a single-Service program, allows more flexibility in the management and movement of funds, such as under a Service PEO (Hogan, 1992). However, a joint Service program loses that flexibility with funds and must be managed more at the DoD level, likely resulting in less support for funding at the individual Service levels (Hogan, 1992).

The next four issues have commonality between all Services. The issues identified were test and evaluation, project office organization, logistics, and interservice rivalries. Because every Service has their own way of operating a program office, clashes between them tend to arise. Every Service wants ownership of the processes for programs they are involved in. Services infrequently consider working in a joint environment and are used to operating independently through their own processes with more control (Hogan, 1992).

The three benefits of the joint UAV program that arose from his research were funding stability, interoperability and commonality, and cost saving opportunities (Hogan, 1992). Congress deemed the capabilities of the UAV to be essential to mission success, thereby ensuring that funding was available and stable. Additionally, when one UAV was developed to meet all the Services’ requirements, there was an expectation for interoperability and commonality that benefited the program. The final benefit in his observations was in cost savings. Although he was not able to definitively prove the amount of cost savings for the UAV program, he assumed that reducing the 12 programs to one removed duplicate lines of effort from each program office (Hogan, 1992). With the reduction of lines of effort, it is easy to see that the reduction of work and manpower alone could reduce costs.

Table 1. Summary Table of Issues and Benefits. Adapted from Hogan (1992).

Issues	Benefits
Operational Requirements	Funding Stability
Budgeting and Funding	Interoperability and Commonality
Test & Evaluation	Cost Savings
Project Office Organization	
Logistics	
Interservice Rivalries	

These findings are interesting because these benefits and issues are still applicable to the DoD today. Despite Hogan's research being written more than 30 years ago, the government still struggles with the management of Joint Programs. Figure 21 illustrates the number of joint DoD programs in recent years. Note that in 2022, there is only one joint MDAP that exists, the F-35 (GAO, 2022b). We believe that this is indicative of the complexities referenced in Hogan's research. One explanation of this phenomenon is that the Milestone Decision Authority, even for major Joint Programs, can be delegated to the individual Service level's Component Acquisition Executive.

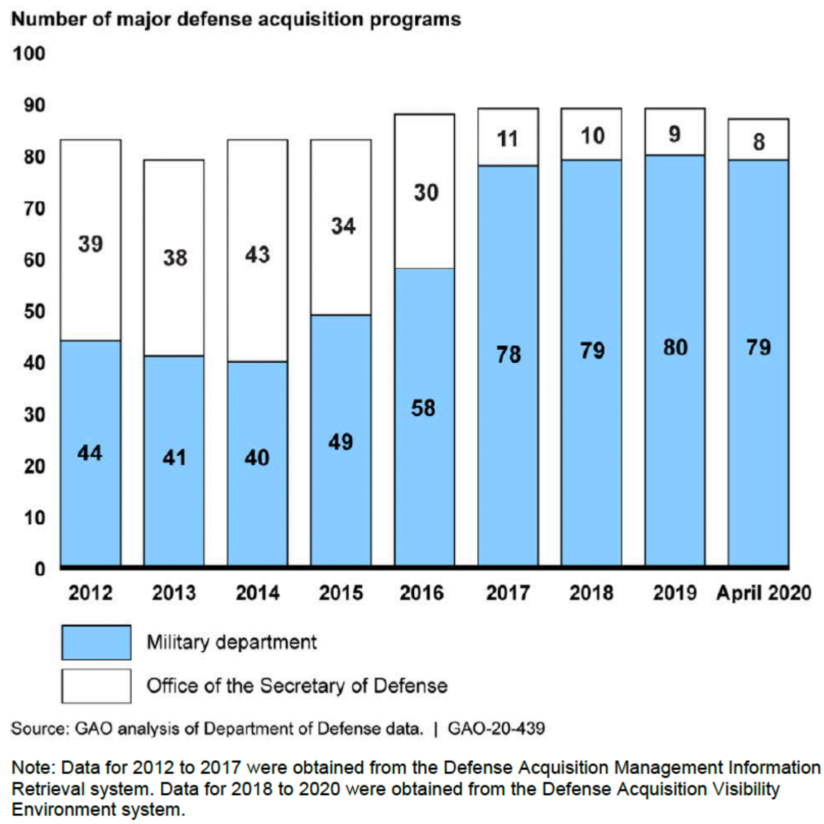


Figure 21. Major Defense Acquisition Programs from 2012 to 2020. Source. GAO (2020).

Literary examples of official government reports regarding the lack of joint programs within the DoD were particularly challenging to find during our research. Many government documents fail to provide evidence in support of or in opposition to joint programs, and merely lay out the circumstantial evidence from individual programs. One report that analyzed the H-60 helicopter program comes from the DoD Inspector General's (IG) office. This report, dated October 2016, summarizes the findings from a year of reviewing over $394 million of spare parts purchases for the H-60 helicopter. From February 2015 to January 2016, the IGs office reviewed 2,136 DoD contracts and purchase orders totaling over 10,000 unique spare parts for the H-60. These redundant and time-consuming contracts resulted in over 1,300 instances when different prices were paid for spare parts procured through different contracts (Inspector General Office [IGO], 2016).

While our research does not specifically address the potential benefits of joint spare parts acquisitions, this report from the IG's office is further evidence of the potential cost savings and efficiency improvements that a joint program office could have on the H-60 helicopter. The IG's report states that the DoD did not effectively manage the procurement of H-60 spare parts, and that this failure to effectively manage the procurements resulted in higher costs due to the DoD being unable to maximize its market leverage and take advantage of quantity discounts. The DoD failed to transfer purchasing authority of spare parts to the Defense Logistics Agency (DLA) despite being recommended to do so by the Base Realignment and Closure Act of 2005 (IGO, 2016). Although the Secretary of Defense concurred with the recommendation to push the majority of spare parts purchasing to DLA, the Secretary of Defense acknowledged that not all parts could be purchased by DLA. Performance based logistics contracts for spare parts would have been difficult to manage for DLA because each Service using the H-60 helicopter require different levels of support (IGO, 2016).

The next literature we reviewed was a 2013 RAND study. RAND conducted and published analysis for the Air Force that focused on historical data from joint aircraft programs and whether joint programs provide significant cost savings opportunities that should be considered when compared to single-Service aircraft MDAPs. Their analysis stemmed from the theory that more cost savings opportunities exist with joint programs when sharing costs throughout a program's life cycle from design, research and development, procurement, and sustainment of the platform (Lorell et al., 2013). RAND initially compiled information and data from the 1960s through 2010 before applying criteria to narrow down the comparison for more sufficient cost analysis (Lorell et al., 2013).

This RAND study is relevant since their data and analysis was conducted on relatable aviation MDAPs, measuring cost growth comparisons between joint and single-Service programs. RAND detailed their analysis methodology with the intention for it to be used in future research and analysis, like we are doing here with the H-60 helicopter. The feasibility analysis we present later for the H-60 is focused on direct Service procurement costs and does not encompass complete life cycle costs (LCC). Below is a summary of RAND's analysis and findings.

RAND found potential for significant, or maximum, cost savings with joint program efforts over single-Service programs that involved elimination of two primary characteristics: iterated research and development costs and maximizing economies of scale during procurement and sustainment (Lorell et al., 2013). First, RAND conducted a calculation of theoretical maximum joint aircraft acquisition program savings that can be offered by joint vs. single-service programs. Through a mix of assumptions based on historical data, such as conventional ratios between Research, Development, Test & Evaluation (RDT&E) costs and procurements costs for fighter jet programs and applying a derived percentage learning curve or cost improvement rate, RAND concluded the theoretical maximum savings for a joint program to be 20% (Lorell et al., 2013).

Next, RAND looked at the joint acquisition cost-growth premium from historical aircraft programs. More specifically, Lorell et al. (2013) analyzed why joint program savings are often less than their theoretical maximums, and concluded there are two main reasons for this:

- More costs for research and development due to complexity and risks associated with combining requirements from different services
- Increased cost due to platform and replacement parts that do not trace back directly to the original design because of added capabilities and weight.

These findings are plausible and still valid concerns for joint program considerations today, as with the H-60 helicopter. As discussed, our background chapter, different Services today utilize the H-60 for various missions and requirements. Identifying a design base, or as RAND refers to it, a "design to the greatest common denominator," would be necessary for joint MDAPs (Lorell et al., 2013). Service efforts would then need to be made toward minimizing costs toward additional capabilities and Service-specific functions thereafter for procurement and sustainment of the platform. RAND goes on to acknowledge that single-Service programs could benefit from sharing common components with other related single-Service programs already in existence for additional cost savings. RAND does not recognize the potential for joint programs doing the same in seeking benefits from other nonaffiliated programs (Lorell et al., 2013).

Continuing with why joint program savings are likely less than their theoretical maximums, RAND explains the data source for the programs they considered for comparison analysis, which they pulled from the Selected Acquisition Report (SAR) database. This database contained around 300 MDAPs, initiated between 1960 and 2010. RAND further narrowed the selection through specific criteria to maximize sufficient and reliable cost data. The research used the following criteria:

- It is a fixed-wing aircraft acquisition program.
- It requires substantial development effort.
- It is not a modification program but rather a program for the acquisition of an entirely new aircraft.
- It was initiated (MS B) between the mid-1980s and more recently.
- It has an MS B cost baseline estimate.
- It is at least nine years past its MS B as of its December 2010 SAR. (Lorell et al., 2013, Appendix B p. 7)

After imposing this criterion, RAND narrowed the data selection for analysis to eight programs—four single-Service programs and four joint programs. See Figure 22 which depicts the eight MDAPs selected (Lorell et al., 2013).

Program Name	Single-Service or Joint	Technological Challenge	Participants	MS B Date
C-17	Single service	Medium	Air Force	December 1985
F/A-18E/F	Single service	Medium	Navy	July 1992
F/A-22	Single service	High	Air Force	August 1991
T-45 TS	Single service	Low	Navy	October 1984
JPATS T-6A/B	Joint	Low	Air Force and Navy	February 1996
F-35 (JSF)	Joint	High[a]	Air Force, Navy, and Marine Corps	October 2001
V-22 Osprey	Joint	High	Marine Corps, Air Force, and Army	May 1986
E-8A (JSTARS)	Joint	Medium	Air Force and Army	September 1985

Figure 22. MDAP Programs for Joint for Joint vs. Single-Service Cost-Growth Comparison. Source: Lorell et al. (2013).

RAND proceeded to break down the aircraft quantities for their comparative analysis between the single-Service and joint programs. They used base-year dollar amounts to remove the effects of inflation, and focused analysis on the 9-year time frame following Milestone B for each program. This is because low-rate initial production normally occurred in that time frame, and most production appropriations were still planned in the future of the program. This is shown in Figure 23 (Lorell et al., 2013).

Program Name	MS B Quantity	Quantity at Nine Years Past MS B	Quantity for Which Cost Growth Was Measured	Percentage of MS B Quantity on Which Cost Growth Was Measured
C-17	210	40	40	19
F/A-18E/F	1,000	548	548	55
F/A-22	648	315	315	49
T-45 TS	300	218	218	73
Single-service program average percentage of MS B quantity				**49**
JPATS T-6A/B	711	782	711	100
F-35 (JSF)	2,852	2,443	2,443	86
V-22 Osprey	913	523	523	57
E-8A (JSTARS)	10	19	10	100
Joint program average percentage of MS B quantity				**86**

Figure 23. MDAP Dataset Quantities at Nine Years Past MS B. Source: Lorell et al. (2013).

RAND took the quantities and percentages of cost growth and used them to calculate the average overall cost growth percentages for the RDT&E, procurement, and total acquisition phases of each program. RAND also calculated the combined averages between the single-Service and joint programs, shown in Figure 24 (Lorell et al., 2013).

Joint Versus Single-Service Program Acquisition Cost-Growth Differential at Nine Years Past MS B (millions of FY 2012 $)

Program Type	RDT&E	Procurement	Total Acquisition[a]
Single-service programs			
C-17 40 aircraft			
MS B	$6,400	$15,600	$22,300
9 years past MS B	$9,000	$20,000	$29,000
Difference	$2,600	$4,500	$6,800
Percentage	41	29	30
F/A-18E/F 548 aircraft			
MS B	$7,600	$49,700	$57,300
9 years past MS B	$7,450	$48,700	$56,150
Difference	–$150	–$1,000	–$1,150
Percentage	–2	–2	–2
F/A-22 315 aircraft			
MS B	$25,500	$37,300	$63,100
9 years past MS B	$33,000	$43,500	$76,700
Difference	$7,500	$6,200	$13,600
Percentage	29	17	21
T-45 TS 218 aircraft			
MS B	$920	$4,000	$4,900
9 years past MS B	$1,200	$6,000	$7,300
Difference	$280	$2,000	$2,300
Percentage	30	50	47
Single-service programs average cost growth (%)	**25**	**23**	**24**
Joint programs			
JPATS T-6A/B 711 aircraft			
MS B	$423	$3,360	$3,870
9 years past MS B	$368	$5,000	$5,410
Difference	–$55	$1,640	$1,540
Percentage	–13	49	40
F-35 (JSF) 2,443 aircraft			
MS B	$39,300	$155,700	$197,000
9 years past MS B	$59,000	$270,900	$331,000
Difference	$19,700	$115,200	$134,000
Percentage	50	74	68
V-22 Osprey 523 aircraft			
MS B	$4,300	$26,100	$30,600
9 years past MS B	$9,800	$38,600	$47,800
Difference	$5,500	$12,500	$17,200
Percentage	128	48	56
E-8A (JSTARS) 10 aircraft			
MS B	$2,300	$2,100	$4,500
9 years past MS B	$4,800	$3,900	$8,800
Difference	$2,500	$1,800	$4,300
Percentage	107	86	97
Joint programs average cost growth (%)	**67**	**64**	**65**
Joint versus single-service cost-growth differential (%)	**42**	**40**	**41**

Figure 24. Joint vs. Single-Service Program Acquisition Cost-Growth Differential at Nine Years Past Milestone B. Source: Lorell et al. (2013).

The data RAND presented in these figures illustrates substantially more cost-growth potential for joint aircraft MDAPs over single-Service aircraft MDAPs during the nine years following Milestone B. RAND concluded this was mostly due to underemphasized negative attributes of joint programs, which entailed added complexity, difficulty meeting independent Service requirements, and challenges agreeing on a common base design between multiple Services that minimizes future costs. However, RAND also indicated that while, according to their analysis, joint programs show more potential for cost growth during the research and development and production phases, there are still significant cost saving opportunities during follow-on O&S (Lorell et al., 2013).

This literature review indicates why this research is necessary. Several areas of interest about considerations for Joint Service programs are shared between both Hogan's and RAND's studies discussed previously. One benefit both Hogan and RAND identified was cost saving opportunities, especially with procurements, due to economies of scale for MDAPs. Benefits under the same principle could be applied during the operation and sustainment phases, with the handling of maintenance, equipment, parts, and spares. Shared commonality and interoperability are likely additional benefits during operation and sustainment. Alternatively, both Hogan and RAND commented on the difficulty for separate Services to agree on operational requirements, while compromising on different Service specific requirements. The complexity of combining different Service requirements, along with their priority level against other Services, leads to many related and connected issues. Some of these include contributed funding ratios between Services for a joint MDAP, program control, and ownership from each individual Service.

In addition to quantitative findings, many qualitative complications may arise when combining single-service program offices into joint programs. Some of the research discussed here, such as the RAND study, suggests that the suspected cost savings may not be as substantial as originally anticipated. The cost savings likely make up for the lost independence and control that separate offices would have had. In the next chapter, we use the existing literature that we reviewed to compare the individual programs between the Army and Navy. The initial quantitative findings between the Army and Navy show notable differences in the amounts that each service paid for a H-60 helicopter. We will hypothesize why the difference between the two services is so large and introduce the assumptions that we made in our research. Furthermore, we will present qualitative barriers to implementing a joint program office in the next chapter.

IV. DATA ANALYSIS

A. RESEARCH METHOD

To complete this thesis, we used a comparative analysis between existing H-60 helicopter programs. The research incorporated a quantitative approach to compare two data sets focusing on cost and quantities procured over a period of time. Additionally, we made qualitative comparisons between the two programs that revealed supplementary and noteworthy information. The two programs we compared are the U.S. Army UH-60M Black Hawk and the U.S. Navy MH-60R. Historical context for the U.S. Coast Guard's MH-60 helicopter program was included in our research initially; however, the Coast Guard has not acquired a new MH-60 in over two decades and therefore cost data for the purpose of comparison was deemed irrelevant. Qualitative comparisons will include the Coast Guard as these comparisons include topics relevant to the Coast Guard and other DHS agencies.

To adequately compare the Army and Navy H-60 helicopter programs, quantitative data was obtained from selected acquisition reports and individual Service procurement forms to compare cost data. To maximize the relevance of data collected, we focused our research on years 2004–2016, as they provided the most comparable Army and Navy procurements regarding cost and quantities. Additional procurement information was collected from the Army Utility Helicopter Program Office under Program Executive Office- Aviation. Similarly, we also contacted the Navy's Naval Air Systems Command, PMA-299 H-60 program office for similar information; however, we were unable to obtain specific procurement values outside of verifying information obtained from public sources.

B. ASSUMPTIONS

The following is a list of assumptions we made in comparing the data between Army and Navy H-60 helicopter procurements. We felt it was important to list the assumptions and briefly explain why those assumptions were necessary in our research.

- Inflation was not considered relevant to address since data from the same years was available. Since same year data was available between the U.S.

Army and U.S. Navy, inflation played no significant role in the difference in costs between each Service.

- Pricing data on specific parts, per variant of aircraft, was unavailable. The mission specific equipment on each Service's H-60 variant makes up an unknown amount of the cost difference between the Army's and Navy's H-60 procurements. One example of this is for the Army's UH-60M, which fiscal year 2023 included approximately $630,000 of Government Furnished Equipment (GFE) that the Army will provide for each UH-60M helicopter. That amount is not included in the end item recurring flyaway cost, nor would assumed similar GFE costs in past years. We assume that the amount of GFE the Navy provided for each aircraft is higher, however we were not able to obtain details on their GFE installments. We believe this true as the Navy's MH-60R ASW mission package alone includes an acoustic subsystem that consists of 14 different components, along with the naval undersea sensor, the Helicopter Long Range Active Sonar.
- We assume that an unknown dollar amount of GFE was not included in the total procurement costs under each Service's contract with Sikorsky and was not included as part of the comparative analysis. There is a portion of GFE that is undisclosed due to the sensitive nature of the missions these aircraft carry out.
- We believe that additional cost savings and efficiencies could be gained through better bargaining power from a joint program office. In addition to economies of scale, a joint program office would have greater bargaining power, or leverage, due to the larger volume of sales that would be completed through that single office.

C. COMPARISON DATA

When comparing data between the H-60 helicopters, the end item recurring flyaway cost for the Army's and Navy's H-60 was used. The Defense Acquisition University (DAU) defines flyaway costs as,

> Costs related to producing a usable end item of military hardware, originally associated with aircraft. Includes the cost of creating the basic unit, that is, the Work Breakdown Structure (WBS) elements of prime mission equipment (e.g., propulsion equipment, electronics, armament, etc.), system engineering, program management, system test and evaluation, warranties, engineering changes, nonrecurring start-up production costs, and other installed Government-Furnished Equipment (GFE). "Rollaway costs" and "sailaway costs" are analogous to "flyaway costs" for vehicles and ships, respectively (Defense Acquisition University, n.d.).

In Table 2, we broke down the cost data for the Army's procurement of the H-60 helicopters from 2004 to 2016. During that time, the Army paid over $14 billion for 907 aircraft procured. That results in an average end item recurring flyaway cost of $15,596,779.49 per aircraft.

Table 2. Army H-60 Helicopter Procurement Cost

Army H-60			
Fiscal Year	Quantity	End Item Recurring Flyaway	Flyaway cost per unit
2004	17	226,800,000.00	13,341,176.47
2005	43	491,900,000.00	11,439,534.88
2006	49	653,300,000.00	13,332,653.06
2007	72	1,086,300,000.00	15,087,500.00
2008	77	1,238,611,000.00	16,085,857.14
2009	68	1,006,119,000.00	14,795,867.65
2010	83	1,332,714,000.00	16,056,795.18
2011	99	1,512,500,000.00	15,277,777.78
2012	89	1,497,776,000.00	16,828,943.82
2013	59	1,107,087,000.00	18,764,186.44
2014	70	1,201,000,000.00	17,157,142.86
2015	87	1,356,227,000.00	15,588,816.09
2016	94	1,435,945,000.00	15,276,010.64
	Total aircraft procured	Cumulative program cost	Average unit cost per aircraft
Totals	907	14,146,279,000.00	15,596,779.49

In Table 3, we illustrated the cost that the Navy paid for H-60 helicopters from 2004 to 2016. During that time, the Navy paid nearly $8 billion for 275 aircraft. This results in an average end item recurring flyaway cost of $28,999,272.73 per aircraft.

Table 3. Navy H-60R Helicopter Procurement Cost

Navy H-60 Romeo			
Fiscal Year	Quantity	End Item Recurring Flyaway	Flyaway cost per unit
2004	6	352,100,000.00	58,683,333.33
2005	6	289,400,000.00	48,233,333.33
2006	12	433,400,000.00	36,116,666.67
2007	25	795,300,000.00	31,812,000.00
2008	28	781,600,000.00	27,914,285.71
2009	30	857,900,000.00	28,596,666.67
2010	24	627,900,000.00	26,162,500.00
2011	24	624,600,000.00	26,025,000.00
2012	24	614,200,000.00	25,591,666.67
2013	19	538,000,000.00	28,315,789.47
2014	19	478,300,000.00	25,173,684.21
2015	29	739,800,000.00	25,510,344.83
2016	29	842,300,000.00	29,044,827.59
	Total aircraft procured	Cumulative program cost	Average unit cost per aircraft
Totals	275	7,974,800,000.00	28,999,272.73

Figures 25 and 26 provide graphical representations of the previous analyses. The lines on these figures represent the fluctuations in cost between fiscal years for each program. The cost data for both the U.S. Army and the U.S. Navy's H-60 helicopters are shown together on Figure 27 for comparison on the same scale.

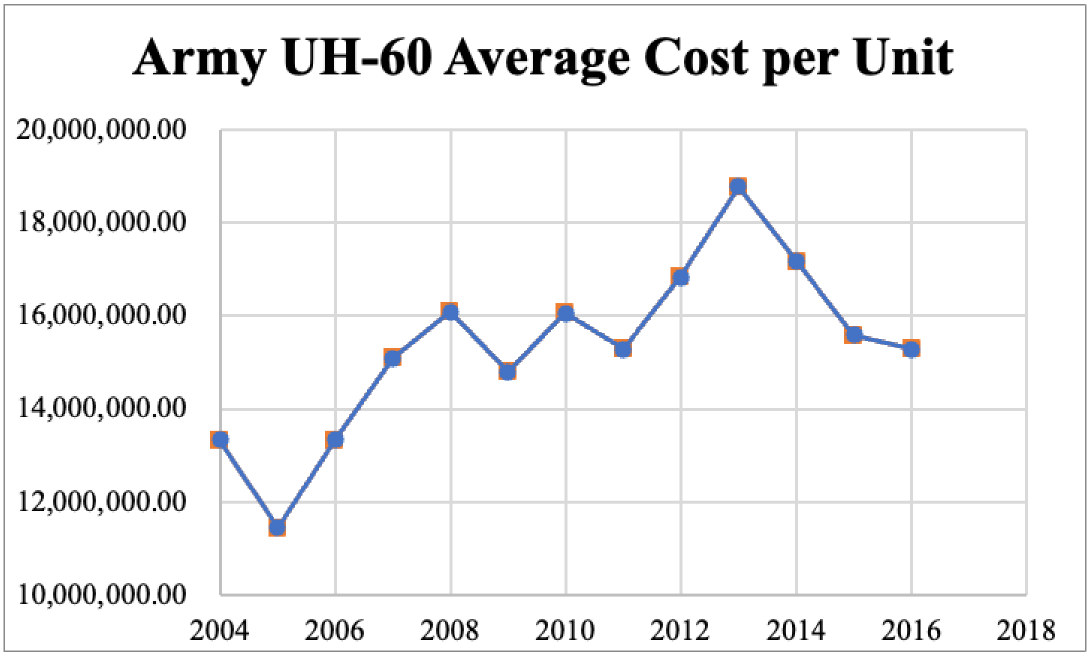


Figure 25. Army UH-60 Average Cost per Unit

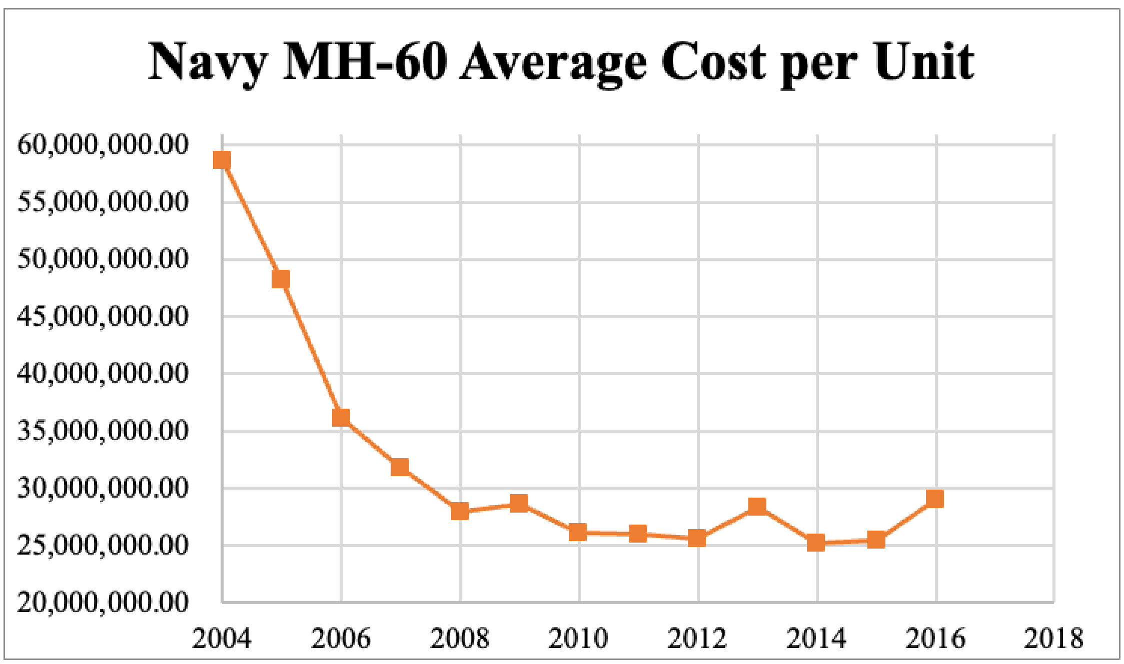


Figure 26. Navy MH-60R Average Cost per Unit

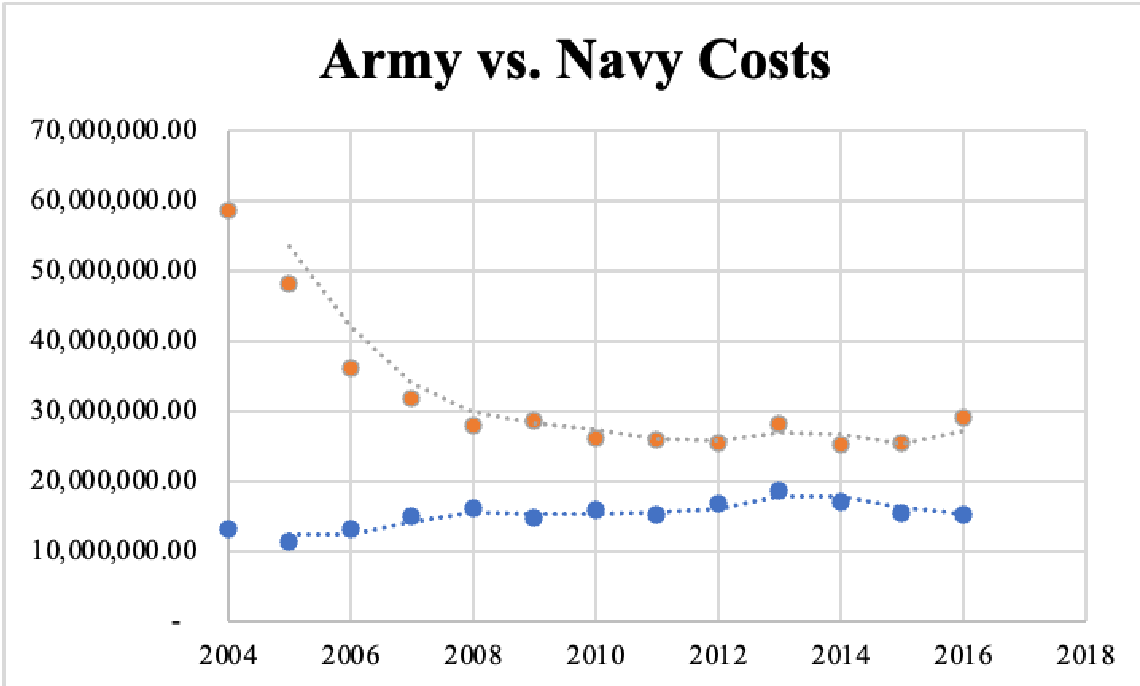


Figure 27. Army vs. Navy Costs

D. FINDINGS

From our quantitative approach in comparing the Army and Navy H-60 helicopter procurements from Sikorsky, it was necessary to normalize the costs for effective comparisons. Our method in doing so entailed comparing end-item recurring flyaway costs of the H-60 from Sikorsky for each Service. More simply put, we compared the cost of the base model version H-60 helicopter for each Service prior to Sikorsky customizing builds that tailored to each Service's mission equipment requirements, and prior to the government providing GFE. Through our research from 2004 to 2016, the average Army end-item recurring flyaway cost was $15,596,779.49.

Following completion of the airframe by Sikorsky, the Army received this base model UH-60M Blackhawk and transported it to a separate facility to receive follow-on GFE installments for specific mission equipment tailored for the Army mission set. Examples of these GFE installments include high dollar items such as the aircraft turbo-shaft engines, crew chief seats, blade folding kits; along with lower dollar items such as headsets, display mounts, fire extinguishers, and batteries. The total dollar value of GFE provided and installed into the Army's UH-60M helicopters is not included in the end-item recurring flyaway costs, as to best normalize and compare with the Navy's procurements.

Comparatively, the Navy end-item recurring flyaway cost was $28,999,272.73. It should be noted that the Navy MH-60R average unit cost of nearly $29 million is slightly misleading. From 2004 to 2007 the Navy paid significantly higher amounts than from 2008 to 2016. From this analysis, we can more heavily consider the average unit cost for the Navy MH-60R from 2008 to 2016, which was $26,926,085.02. This was nearly $11 million higher than the Army's average unit cost during the same years, which was $16,203,488.62.

Unfortunately, we were unable to obtain more cost details regarding the special mission equipment and GFE, as it pertained to the overall recurring flyaway cost of the Navy MH-60R, which would help us better understand reasons behind the $11 million difference between Army and Navy end item recurring flyaway costs. We then must assume that a portion of the costs the Navy paid was GFE and was included in the recurring flyaway cost. Furthermore, consider the average unit cost of the Navy MH-60S, which does not contain as much special mission equipment as the MH-60R. The MH-60S average unit cost from 2008 to 2016 was $27,063,964.51, which is higher than the MH-60R. This is illustrated in Table 4.

Table 4. Navy H-60S Procurement Cost

Navy H-60 Sierra			
Fiscal Year	Quantity	End Item Recurring Flyaway	Flyaway cost per unit
2004	13	379,900,000.00	29,223,076.92
2005	15	390,800,000.00	26,053,333.33
2006	26	571,300,000.00	21,973,076.92
2007	18	534,800,000.00	29,711,111.11
2008	18	506,900,000.00	28,161,111.11
2009	18	551,400,000.00	30,633,333.33
2010	18	471,500,000.00	26,194,444.44
2011	18	548,700,000.00	30,483,333.33
2012	18	482,900,000.00	26,827,777.78
2013	19	538,000,000.00	28,315,789.47
2014	19	478,300,000.00	25,173,684.21
2015	29	739,800,000.00	25,510,344.83
2016	29	646,000,000.00	22,275,862.07
	Total aircraft procured	Cumulative program cost	Average unit cost per aircraft
Totals	258	6,840,300,000.00	26,512,790.70

All this considered, we believe that $11 million more per aircraft for the Navy is significant, and evidence that economies of scale in a joint procurement could have benefited both Services.

The stark differences in cost between the Army and Navy led us to attempt to uncover the root cause of the issue. Utilizing the Ishikawa diagram, commonly known as a fishbone diagram, we determined that it is not a single factor contributing to the root problem of large differences in cost between Services, but many factors. Figure 28 shows the fishbone diagram with the problem statement and contributing factors that led to the difference in H-60 helicopter costs between Services.

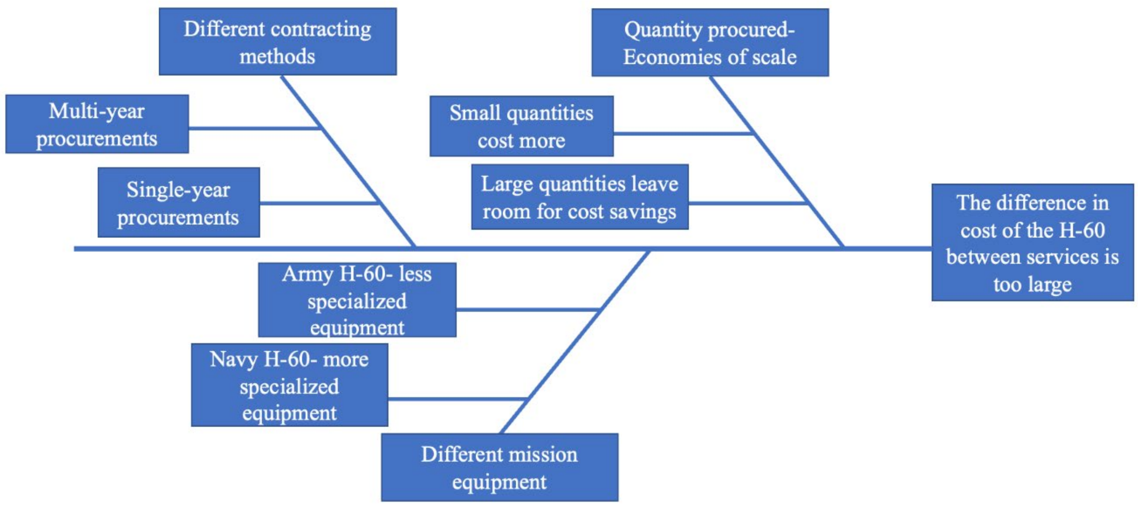


Figure 28. Cost Difference Fishbone Diagram

The identified root causes in the Fishbone Diagram are a result of our analysis of the Army and Navy's historical procurement costs of the H-60 helicopter. Furthermore, inferences from the literature review were applied to the H-60 programs to provide additional comparisons to previously researched aircraft platforms.

While the bulk of our analysis focused on quantitative cost comparisons between Army and Navy H-60 procurements, there are noteworthy qualitative factors that exist in determining the benefits or downsides to joint Service procurements. Many of these qualitative findings have already been researched by RAND in 2013 and are summarized in the literature review. One of the main findings from RAND illustrated two significant reasons why joint program savings often end up being less than their theoretical maximums. The first is the additional costs during research and development phases due to different Service requirements (Lorell et al., 2013). Differences in requirements and mission sets exist under our study for the Army, Navy, and Coast Guard's use of the H-60 helicopter. This qualitative procurement attribute has direct impacts to long-term costs associated with joint programs benefiting from economies of scale. The second reason is increased costs due to platform and replacement parts because added capabilities specific to each Service (Lorell et al., 2013). Special mission equipment usually entails special parts and tools for installment and sustainment. Any additions to special equipment and capability that would hypothetically exist under a joint service procurement contract could add substantial costs to support, not only during production but throughout all following stages of the systems entire life cycle.

To summarize, Lorell et al. (2013) found two primary reasons why joint program savings are often less than their theoretical maximums, and concluded there are two main reasons for this:

- More costs for research and development due to complexity and risks associated with combining requirements from different services
- Increased cost due to platform and replacement parts that do not trace back directly to the original design because of added capabilities and weight.

These findings are plausible and are still valid concerns for joint program considerations today, as with the H-60 platform in this study. As discussed in the background section, different Services today utilize the H-60 for various missions and requirements. Identifying a design base, or as RAND referred to it, a "design to the greatest common denominator," would be necessary for joint MDAPs (Lorell et al., 2013). Effort would then need to be made toward minimizing costs toward additional capabilities and Service-specific functions thereafter for procurement and sustainment of the platform. Single-Service programs could benefit from sharing common components with other related programs already in existence for additional cost savings (Lorell et al., 2013). RAND did not recognize the potential for joint programs doing the same in seeking benefits from other nonaffiliated programs.

E. BARRIERS TO IMPLEMENTATION

Qualitative barriers exist that make transitioning H-60 helicopter programs to a joint program difficult. One of those barriers is the perceived order of priority between the separate Services. For example, which Service would receive the first delivery from the production line if each Service believes they have a more important need? This, as mentioned in the literature review earlier, also relates to spare parts and support equipment in addition to the aircraft itself. Another barrier to implementation is determining the level and ratios of funding each Service would be expected to contribute towards the total life-cycle cost of the aircraft. The Coast Guard's annual budget, which is significantly smaller when compared to the larger DoD Service budgets, would likely not be able to afford a significant contribution to the overall cost and could potentially impact them in priority.

Another potentially delicate barrier to implementing a joint office is maintaining a positive relationship with the defense industrial base. The Joint Strike Fighter (JSF) program has experienced numerous complications regarding overly complex performance specifications. Major General Christopher Bogdan, the JSF PEO was quoted as saying the relationship between Lockheed Martin and the DoD "is the worst I've ever seen, and I've been in some bad ones; I guarantee you: we will not succeed on this if we do not get past that" (Tirpak, 2012, para. 1). This quote is an example of how delicate the relationships with industry can be, and how they are often made more fragile with joint programs. There is not one singular reason the JSF program has been plagued with delays and cost overruns, but we believe the added complexity that joint programs bring to the table contributed to the program's troubles. Additional barriers to implementing a joint office are summarized in Table 5.

Table 5. Additional Barriers to Implementation

Additional Barriers to Implementation
Different PPBE processes between DoD and DHS
Loss of ownership of the program
Additional oversight with added bureaucracy
Less experience with joint programs and policies within both program management and contracting
Varying performance specifications between Services
Fluctuating budgets across fiscal years

Despite over 30 years having passed since Hogan's research and numerous updates to defense acquisition policy, many of the same issues and benefits identified apply today and can be connected to our findings in the barriers to implementation. In Figure 29, we link Hogan's findings to our own and compare the issues that he identified with the barriers to implementing a joint program office for the H-60.

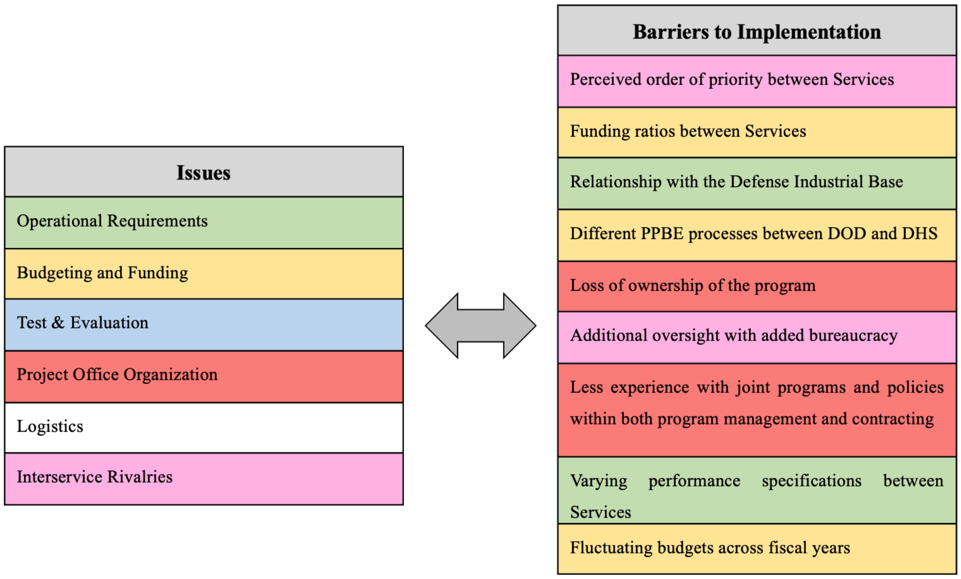


Figure 29. Hogan's Issues and Barriers to Implementation. Source: Source: Adapted from Hogan (1992).

In this chapter, we presented the findings of our quantitative and qualitative comparative analyses. We used the literature presented in Chapter III to support the findings that we uncovered. The findings show that the quantitative and qualitative comparisons paint very different pictures of the effects of establishing a joint program office for the H-60 helicopter. While the quantitative comparison shows obvious cost benefits to the individual Services, the qualitative comparison shows that individual offices forfeit control, flexibility, and independence in managing the program. In the next chapter, we will summarize our thesis, provide our recommendations for the H-60 program office, and offer our recommendations for future academic research into the topic of joint DoD acquisition and sustainment programs.

V. CONCLUSION AND RECOMMENDATIONS

Throughout our research, the main question we aimed to answer was if it was feasible for the H-60 helicopter program to be a joint program instead of individual program offices for each Service. We concluded that a joint service program office for the H-60 helicopter is feasible.

The primary benefit to the DoD and DHS for entering joint programs is quantitative in nature. Economies of scale have the potential for significant cost savings opportunities. This is clearly evident in the more than $11 million average procurement difference between the Army UH-60M Black Hawk and the Navy H-60R helicopters. While we were forced to make broad assumptions about the amount of GFE and mission specific equipment included in the end item recurring flyaway costs for each Service, we believe that economies of scale would have offered overwhelming cost savings for each.

Others might argue that it was not feasible that the H-60 be a Joint Service program based on qualitative reasons. The qualitative findings that emerged through our research support this, as well as prove that these considerations and attributes still exist today and will continue effect future Joint Service programs, especially larger ACAT I programs. The most significant qualitative barriers to implementing a Joint Service office include the difficulty of agreeing and compromising on common performance specifications and requirements between Services, friction from funding contributions from each Service, and individual Service's loss of program ownership and control.

A. FINAL RECOMMENDATION

Our recommendation is for the individual Services to maintain independent program offices for the duration of the helicopter's service life. It would not be practical to shift to a joint office going forward given the maturity of the programs today. The DoD has the potential to see cost savings for future purchases of the H-60 given Lockheed Martin/Sikorsky's commitment to ensuring the H-60 remains relevant for decades to come. In an interview conducted on October 10th, 2022, Sikorsky test pilots Bill Fell and John Groth stated, "We are currently working on a variety of enhancements in coordination with the Army that will continue the BLACK HAWK legacy for another 40 years" (Fell et al., 2022, para. 5). If the H-60 is to remain in Service for the next 40 years, or longer, perhaps the cost savings for future versions would be enough for the DoD to consider merging Services into a joint program office; however, the qualitative disadvantages would be difficult to overcome.

Our findings show that the quantitative and qualitative comparisons paint very different pictures of the effects of establishing a joint program office for the H-60 helicopter. While the quantitative comparison shows obvious cost benefits to the individual Services within the DoD and DHS as a whole, the qualitative comparison shows that individual offices forfeit control, flexibility, and independence in managing MDAPs and is the basis behind our recommendation.

B. FUTURE POTENTIAL RESEARCH

The extensive research we conducted answered the main thesis question about the feasibility of a joint H-60 program office, but there is undoubtedly further academic research that would benefit the DoD and DHS. Potential future research topics might consider the effects of inter and intra Service rivalries, the inherent bureaucratic obstacles that joint offices face, and the potential benefits of future technology driven programs incorporating modular open system architecture that could lead to more efficient interoperability across joint service operations.

LIST OF REFERENCES

Coast Guard Aviation Association. (2021). Sikorsky HH-60J “Jayhawk.” https://cgaviationhistory.org/aircraft_/sikorsky-hh-60j-jayhawk/

Coast Guard Aviation History. (n.d.). *Sikorsky- HH-3F “Pelican.”* Coast Guard Aviation History. Retrieved November 3, 2022, from https://cgaviationhistory.org/aircraft_/sikorsky-hh-3f-pelican/

Corporate Finance Institute. (2022, May 8). Economies of scale. https://corporatefinanceinstitute.com/resources/knowledge/economics/economies-of-scale/

DoD. (2020, September 09). Defense Acquisition System (DoD Directive 5000.01). http://www.acqnotes.com/acqnote/acquisitions/DoDd-5000

DoD. (2020, September 09). *Defense Acquisition System Directive Goes Into Effect* [Press Release]. https://www.defense.gov/News/Releases/Release/Article/2340746/defense-acquisition-system-directive-goes-into-effect/

Department of Defense. (2019, December 31). *Urgent Capability Acquisition* (DoDI 5000.81). https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/500081p.PDF

Department of Defense. (2021, November 4). *Major Capability Acquisition* (DoDI 5000.85). https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/500085p.pdf

Department of Defense. (2022, June 8). *Operation of the Adaptive Acquisition Framework* (DoDI 5000.02). https://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/500002p.pdf

Fell, B., & Groth, J. (2022, October 10). *How Black Hawk Modernization Will Drive Down Risk for Future Vertical Lift*. Lockheed Martin. Retrieved November 2, 2022, from https://www.lockheedmartin.com/en-us/news/features/2022/how-black-hawk-modernization-will-drive-down-risk-for-future-vertical-lift.html

Gates, R. (2009, April 7). *Gates Sees Opportunity for Additional Weapon System Kills Info*. InsideDefense.com. http://www.military-quotes.com/forum/501655-post.html

Government Accountability Office. (2019). *Coast Guard Shore Infrastructure: Actions Needed to Better Manage Assets and Reduce Risks and Costs* (GAO-19-711T). Government Accountability Office

Government Accountability Office. (2020). *Defense Acquisitions Annual Assessment: Drive to Deliver Capabilities Faster Increases Importance of Program Knowledge and Consistent Data for Oversight* (GAO-20-439). Government Accountability Office

Government Accountability Office. (2022*). F-35 joint strike fighter: Cost growth and schedule delays continue* (GAO-22-105128). Government Accountability Office

Government Accountability Office. (2022*). Weapons Systems Annual Assessment: Challenges to Fielding Capabilities Faster Persist* (GAO-22-105230). Government Accountability Office

Harris, H., & Lewis, M. (2012). *Proposed Leadership Structure for Joint Acquisition Programs*. Defense Acquisition Review Journal, 19(1). https://www.dau.edu/library/arj/_layouts/15/WopiFrame.aspx?sourcedoc=/library/arj/ARJ/arj61/Harris61.pdf&action=default

Hogan, M. E. (1992). *Management of joint service acquisition: An analysis of the Joint Unmanned Aerial Vehicles Program* [Master's thesis, Naval Postgraduate School]. NPS Archive: Calhoun. https://calhoun.nps.edu/handle/10945/23948

Inspector General Office. (2016). *Consolidation Needed for Procurements of DoD H-60 Helicopter Spare Parts*. https://www.oversight.gov/sites/default/files/oig-reports/DoDIG-2017-002.pdf

Leoni, Ray D. (2007). *Black Hawk, the Story of a World Class Helicopter*. American Institute of Aeronautics and Astronautics.

Lockheed Martin. (2022, June 28). *Sikorsky Black Hawk Helicopter*. Lockheed Martin. Retrieved October 26, 2022, from https://www.lockheedmartin.com/en-us/products/sikorsky-black-hawk-helicopter.html

Lorell, M. A., Kennedy, M., Leonard, R. S., Munson, K., Abramzon, S., An, D. L., & Guffey, R. A. (2013). *Do joint fighter programs save money?* Technical appendixes on methodology. RAND. http://www.jstor.org/stable/10.7249/j.ctt5vjwkm

Moran, S. (2008). *System of systems development for the DoD: Tailoring acquisition reform for emerging needs*. Defense AR Journal,16(2), 174–189. https://www.dau.edu/library/arj/ARJ/arj48/Defense%20ARJ%20Issue%2048.pdf

Mortlock, R. F. (2016, August 10). *Been there, done that: Acquisition reform*. www.army.mil. Retrieved October 18, 2022, from https://www.army.mil/article/173083/been_there_done_that_acquisition_reform

Mortlock, R. F. (2021, February 15). *'Big A' Acquisition: A Primer*. USAASC. Retrieved October 25, 2022, from https://asc.army.mil/web/news-big-a-acquisition-a-primer/

National Air and Space Museum. (n.d.). *Sikorsky HH-52A SEAGUARD*. Sikorsky HH-52A Seaguard. Retrieved November 3, 2022, from https://airandspace.si.edu/collection-objects/sikorsky-hh-52a-seaguard/nasm_A20160034000

National Helicopter Association Historical Society. HH-60J Jayhawks. Operational history of HH-60J Jayhawks. https://www.nhahistoricalsociety.org/coast-guard-hh-60j-jayhawk-helicopter/

Naval Air Systems Command. MH-60S Seahawk. https://www.navair.navy.mil/product/MH-60S-Seahawk

Naval Air Systems Command. MH-60R Seahawk. https://www.navair.navy.mil/product/MH-60R-Seahawk

Naval History and Heritage Command. SH-60B Seahawk. https://www.history.navy.mil/content/history/museums/nnam/explore/collections/aircraft/s/sh-60b-seahawk

Naval Helicopter Association Historical Society. (n.d*.). UH-2A,b/SH-2D,F,G (Kaman K-20) Seasprite/Super Seasprite Helicopter*. Naval Helicopter Association Historical Society. Retrieved November 3, 2022, from https://www.nhahistoricalsociety.org/uh-2ab-sh-2dfg-kaman-k-20-seasprite-super-seasprite-helicopter/

Naval Technology. (2015). MH-60R Seahawk Multi-Mission Naval Helicopter. https://www.naval-technology.com/projects/mh-60r-seahawk-multi-mission-naval-helicopter/

Office of the Assistant Commandant for Acquisitions. (2021, December 1). *Major Systems Acquisition Manual (MSAM)* (COMDTINST M5000.10G). Department of the Coast Guard. https://media.defense.gov/2021/Dec/08/2002905785/-1/-1/0/CIM_5000_10G.PDF

Osborn, Kris. (2010). *New Army Black Hawk Succeeds in Combat*. U.S. Army. https://www.army.mil/article/35310/new-army-black-hawk-succeeds-in-combat/?ref=news-science-title6

Pace51. (n.d.). Sikorsky UH-60 Black Hawk silhouettes. http://www.combataircraft.com/aircraft/HUH60_vl.jpg

Rendon, R. G., Snider, K. F., & Park, P. (2019). *Management of Defense Acquisition Projects*. American Institute of Aeronautics and Astronautics, Inc.

Sikorsky. (2008). Sikorsky's UH-60M Upgrade Black Hawk Helicopter Achieves First Flight. https://www.lockheedmartin.com/en-us/

Schwartz, M. (2014). *Defense Acquisitions: How DoD Acquires Weapon Systems and Recent Efforts to Reform the Process* (CRS Report No. RL34026). Congressional Research Service. https://crsreports.congress.gov/product/pdf/RL/RL34026

Tirpak, J. (2012, September 17). *F-35 Hope and Gory*. Air & Space Forces Magazine. Retrieved November 2, 2022, from https://www.airandspaceforces.com/f-35hopeandgory/

U.S. Army. (2018). Black Hawk Utility Helicopter. https://www.army.mil/standto/archive/2018/10/29/

U.S. Army. (2018). 40 Years of Aviation Service: The Black Hawk Helicopter. https://www.army.mil/article/213155/40_years_of_aviation_service_the_black_hawk_helicopter

U.S. Coast Guard. (2021, August 18). Coast Guard Planning, Programming, Budgeting, And Execution (PPBE) Process. (COMDTINST 7100.1A). https://media.defense.gov/2021/Aug/24/2002837711/-1/-1/0/CI_7100_1A.PDF

U.S. Coast Guard. (2021). USCG. A Multi-mission Force. https://www.gocoastguard.com/about-the-coast-guard/discover-our-roles-missions

U.S. Coast Guard. (n.d.). *MH-60T Sustainment Program*. Retrieved October 26, 2022, from https://www.dcms.uscg.mil/Our-Organization/Assistant-Commandant-for-Acquisitions-CG-9/Programs/Air-Programs/MRR-MH-60T/

U.S. Coast Guard. (n.d.). *Mission Support Home*. About Us. Retrieved November 2, 2022, from https://www.dcms.uscg.mil/Our-Organization/Assistant-Commandant-for-Acquisitions-CG-9/About-Us/

Williamson, M. E. (2018). Big 'A' acquisition. USAASC. https://asc.army.mil/web/news-alt-jfm17-big-a-acquisition/

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