Joint Requirements Framework for Collaboration at the U.S. Department of Homeland Security

SUZANNE GENC, JOHN MATSUMURA, WILLIAM SHELTON

HSOAC
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About This Report

With this report, the authors aim to provide U.S. Department of Homeland Security (DHS) leadership with a framework for determining suitability and structuring of joint activities. U.S. Department of Defense leadership has pursued joint programs, which Congress sometimes imposes to promote cross-Component collaboration and improve cost-effectiveness during the acquisition process and life cycle of a system or capability, for several decades. Recently, DHS has sought such programs as well. We developed a framework to organize the thought process around joint program formation, which includes a decision aid for joint collaborations, a taxonomy of five types of joint programs along the jointness spectrum, a notional tool for selecting program type, and recommendations for structuring joint programs to increase the likelihood of their success. By understanding the motivations for the formation of joint programs, assessing select DHS joint programs (and sometimes Department of Defense programs), and analyzing what makes successful joint programs, DHS Components can identify when joint programs might be beneficial to them and to DHS overall. This research should be of interest to DHS leadership, DHS Components, the Joint Requirements Council, and any organization interested in participating in joint activities.

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The results presented in this report do not necessarily reflect official DHS opinion or policy.

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Summary

Through this report, we aim to provide U.S. Department of Homeland Security (DHS) leadership with a framework for determining suitability and structuring of joint activities. We created a framework that consists of a decision aid that incorporates the factors that should be considered when forming joint programs and collaborations, a taxonomy of five types of joint programs along the jointness spectrum, a notional tool for selecting program type, and recommendations for structuring joint programs to increase the likelihood of their success.

Joint programs have been initiated for various reasons, and they are not by any means new to the government acquisition process. For example, DHS has had multiple joint programs,[1] and the U.S. Department of Defense (DoD) has pursued them for several decades. Congress has the authority to mandate joint program formation and has sometimes done so in DoD. Congress could mandate joint program formation in DHS in the future, and Components could benefit from being prepared in the event of congressional mandate. In addition, DHS leadership could mandate joint program formation, or the Joint Requirements Council could recommend engaging in joint activities, including joint programs. Joint program formation has been used to reduce cross-Component rivalry,[2] and joint programs are often intended to improve cost-effectiveness across programs, both during the acquisition process and throughout the life cycle of a system or capability when acquisition needs are aligned. Beyond cost savings, there are other reasons for pursuing joint programs, including developing new capabilities that could not be created without cross-Component collaboration, improv-

[1] Since the inception of DHS, 11 joint programs have submitted requirements documents through the Joint Requirements Council. This includes the DHS Financial Systems Modernization (FSM) project.

[2] Throughout this report, whether referring to a DHS or other federal entity, we use *Component* to be consistent with DHS lexicon and structure.

ing Component interoperability, reducing Component redundancy, and reducing logistics requirements.[3]

Motivation and Research Questions

For the reasons described above, joint programs might be of some benefit to DHS. Our intent with this report is to offer a framework for thinking about joint program formation. We aim to answer the following research questions:

- How can DHS leadership and Components determine whether a joint program will fulfill the determined need?
- What are the types of joint programs on the jointness spectrum, and what factors should be considered when selecting a type of program?
- What are the key considerations for structuring joint programs to maximize their effectiveness?

We developed the framework through extensive literature reviews, discussions with RAND subject-matter experts, and analysis of the results.

A Framework for Engaging in Joint Activities

In this section, we describe the four elements of the framework: the decision aid graphic listing the initial conditions for joint program formation, the types of joint programs along the jointness spectrum, a notional tool for selecting a joint program, and guidelines for structuring joint programs. If Congress, DHS leadership, or some other authority mandates a joint program, a joint program must be formed; however, even in those cases, the Components will still need to do the analysis to determine what the program should look like. Before making any such decisions or participating in any joint programs, the Components will need to understand their own requirements.

[3] Although many of these have cost-reduction elements, the primary reason might be more oriented toward operational effectiveness.

Deciding Whether to Form a Joint Program

Absent a congressional or DHS leadership mandate, the first part of the framework involves deciding whether to form a joint program. When deciding whether a joint program should be pursued as a course of action for the desired capability or acquisition, several factors (i.e., initial conditions) should be considered because joint programs are typically more complex than single-Component programs and have sometimes led to greater cost growth than that of single-Component programs. To aid decisionmaking, Components should consider whether any one of the following conditions applies:

1. Are the requirements similar, and, if so, to what degree?[4]
2. Do they need to leverage resources (development money or subject-matter expertise)?
3. Are the key performance parameters (KPPs) similar?

If one or more conditions applies, forming a joint program or activity could be the right solution. If none applies, a joint program should not be formed, unless mandated. After analyzing academic literature on joint programs in government organizations and previous RAND research (Drezner, Roshan, and Whitmore, 2017; Dwyer et al., 2014; Johnson, Hilgenberg, and Sarsfield, 2001; Lorell et al., 2013; National Research Council, 2011), we developed a decision tree to illustrate the process for considering joint program formation. It can be seen in Figure S.1.

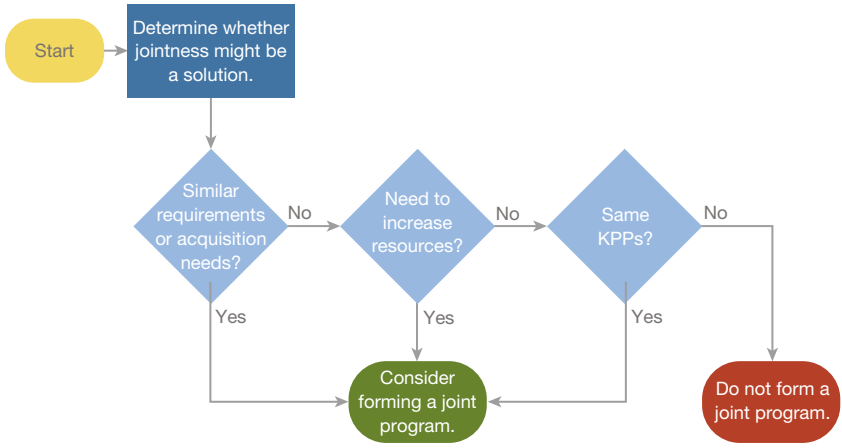
Types of Joint Programs

Correspondingly, many types of joint programs are possible; they are defined largely by when and the degree to which the participating Components collaborate with one another. The next part of the framework is selecting a program type. Joint programs are more of a spectrum than distinct types (Drezner, Roshan, and Whitmore, 2017), so we developed a tax-

[4] Components having similar capability gaps and mission needs (as described in the capability analysis study plan, capability analysis report, or mission need statement) could indicate a possible opportunity for jointness in addition to the requirements developed in the operational requirements document.

FIGURE S.1

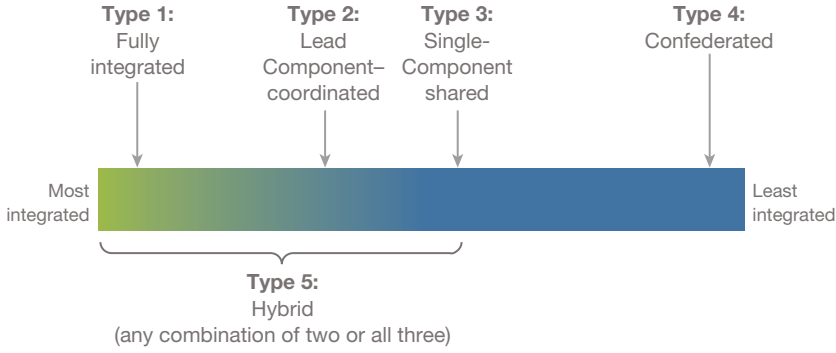
Determining Whether Conditions Are Right for Considering a Joint Program



onomy that characterizes five broad types falling along the jointness spectrum, with some potential for overlap. These types in the spectrum can be used as part of the framework for organizing thinking about joint program formation, once it has been determined that a joint program will be formed. Figure S.2 illustrates the spectrum nature of jointness of the five types that we describe.

FIGURE S.2

The Five Types of Programs Along the Jointness Spectrum



The first three types in our taxonomy are actual joint programs that reach from the far left—most integrated—to the middle of the spectrum. Type 1, the *fully integrated* program, is the model joint program. In this type of joint program, participating Components create requirements together; collaborate on development; jointly test and evaluate; and use economies of scale to reduce cost in acquiring, sustaining, and modifying a desired system or capability over its life cycle. A program of type 2, a *lead Component–coordinated* program, or type 3, a *single-Component shared* program, has a *lead Component* and Components that follow the lead Component, referred to as *following Components*. Type 2 might include a lead Component developing the core requirements and one or more following Components having only limited involvement in development but still reaping potential economy-of-scale benefits across the acquisition and life cycle of the system or capability. Possibly the least involved of the actual joint programs, type 3 is essentially conducted by a single Component, but following Components gain critical insight into the program from shared information and can plan for minor modifications to the system or capability downstream in the acquisition process. Table S.1 summarizes our analysis of the expected benefits and challenges of each type of program.

We also identified another type of joint activity, referred to here as type 4, *confederated*. This type of joint activity, although not technically a joint program, can be used when there is very high cost or risk at the very early phases of a potential system or capability (e.g., advanced technology). For this type of activity, Components can pool resources with the intent to share costs and risks, as well as early lessons that might come out of the activity (e.g., science and technology) phase of a prospective future system or capability. An example of this kind of partnership among Components is the initial phase of the DHS FSM in 2013. Other relevant examples are the collaborations among the DoD service branches (Components) conducted for both unmanned aircraft systems and unmanned ground vehicles.

Type 5 is a *hybrid* of other types. Sometimes, joint programs do not neatly fit into one of the previously identified types and can have characteristics of more than one type. Type 5 can have a combination of characteristics of types 1, 2, and 3.

Not only can joint programs take on combinations of type 1, 2, and 3 programs; they can also evolve over time, especially as the threat or the threat

TABLE S.1

Summary of Expected Benefits and Challenges for Different Types of Joint Activities

Type	Expected Benefits	Challenges	Example
1: Fully integrated	• Reduced cost, including development and production costs, across the acquisition process for all participants • Distributed risk (e.g., technological, among participants) • Reduced long-term life-cycle or sustainment cost	• More difficult than other programs to execute because of wider stakeholder community of needs • Often a longer acquisition schedule than if run as a single-Component program • Possible common vulnerability of system or capability across Components • Possible impact on industrial base (less competition in industry)	• FSM • Defense Integrated Military Human Resources System
2: Lead Component–coordinated	• Limited development cost sharing and possible cost reduction among participants • Reduced cost and risk for following Components	• Limited ability for following Components to affect the end system or capability • Possible common vulnerability of system or capability across Components • Possible impact on industrial base (less competition in industry)	• Utility Tactical Transport Aircraft System

Table S.1—Continued

Type	Expected Benefits	Challenges	Example
3: Single-Component shared	• Accrued benefits to following Components • Cost and risk reduction • Can result in faster fielding of system or capability than a new-start program • Might not need to stand up a separate program management office	• Even less ability than in type 2 for a following Component to affect the end system or capability • Common vulnerability for system or capability • Possible impact on industrial base	• M1A1 Abrams tank
4: Confederated	• Shared science and technology risk across participating Components	• Typically limited to activities rather than programs—if a program is initiated, it becomes type 1, 2, or 3	• FSM • Joint Tactical Unmanned Aerial Vehicle • Joint robotics
5: Hybrid	• Flexibility in program design • Cross-Component interaction during the formal acquisition process	• Might require more initial planning than other types to design and structure	• Distributed common ground system • Joint Tactical Radio System

environment evolves, and might start off as one type and become another. History has shown that such threat-based changes are often very difficult to foresee, and, unless participating Components' needs are truly aligned, friction can result when determining how best to address these changes.

Selecting a Type of Joint Program

If a joint program will be formed, the type of program needs to be selected. Table S.2 shows a notional chart that we developed to assist with this selection. Although three conditions, assuming that no mandate exists, are useful in determining whether a joint program should be considered, once a program or activity is being considered, four prerequisites would be used to select the type. The four prerequisites are based on analysis of key inputs of joint programs and previous RAND research that determines the motivations for engaging in joint activities, as well as the areas in which misalignment has caused undesirable outcomes, such as cost or schedule growth.

TABLE S.2
Notional Chart for Selecting a Type of Joint Program

			Resources			
Type	Component	Requirements	Sufficient Funding	Expertise	Schedule	KPP
1	1	+	+	+	+	+
	2	+	+	+	+	+
2	1	+	+	+	+	+
	2	+	–	–	+	–
3	1	+	+	+	+	
	2	+	–	–	–	
4	Technology programs might be more loosely aligned than acquisition programs.					
5	As programs transition from one type to another, alignment between categories might change.					

NOTE: + = the Component meets the prerequisite. Two plus signs (one for each Component) for a prerequisite indicate alignment, while a plus and a minus sign in either order indicates a lack of alignment. We use this table to illustrate a way to organize thinking about selecting a joint program type. But varying degrees of alignment are possible, and a table cannot capture all of the nuances for each case. Joint programs can evolve over time, and how prerequisites are met might evolve as well.

This table can be used to visualize the degree of alignment of the four major prerequisites: requirements; development resources, which include funding and subject-matter expertise; schedule; and KPPs.

The first column in this table lists each type of joint program discussed. Within each type, there are two Component rows. For simplicity, we limit the placeholders for Components under each type to two to represent two Components that could be forming a joint program. The four prerequisites are then listed as columns. A plus sign for a Component indicates that the Component has met the prerequisite. Two plus signs (one for each Component) for a prerequisite indicate alignment, while a plus and a minus sign in either order indicates a lack of alignment. For example, if all prerequisites are met (two plus signs in the two Component rows), a type 1 program should be considered. If one Component has the funding (plus sign) but one does not (minus), this would be a type 2 or type 3. Evaluating the schedule and KPPs would determine which of the two would be more appropriate. If types 1 through 3 do not seem suitable, type 4 or 5 should be considered.

Guidelines for Structuring Joint Programs

The final part of the framework offers guidelines and best practices for structuring the selected joint program. We present some guidelines for structuring joint programs to minimize cost growth, which has sometimes been a challenge with joint programs, and identify characteristics of successful joint programs. Organizational alignment of certain key elements—mission responsibility, decision authority, expertise, and budget—can help reduce the possibility of cost growth (Dwyer et al., 2014). The specific alignment and the order in which they are applied can affect the program's success. The following principles should be applied, in the order listed, to facilitate designing a structure that maximizes success (Dwyer and Szajnfarber, 2014; Dwyer et al., 2014):

1. *mission responsibility and decision authority.* Authority and responsibility should be aligned so that Components have the power to make decisions about the systems that execute their missions. This avoids delayed decisions.

2. *budget and decision authority.* These should be aligned so that Components can consider cost when making decisions.
3. *expertise and decision authority.* This feature provides a system of checks and balances and prevents one Component prioritizing its unique mission over the shared mission of the joint program. This also helps ensure that Components make informed and effective decisions.

In addition, the following guidelines for forming joint programs can be applied as a way to approach structuring joint programs in DHS (adapted from Drezner, Roshan, and Whitmore, 2017; Johnson, Hilgenberg, and Sarsfield, 2001; and National Research Council, 2011):

- *Understand requirements*. Understand fully an individual Component's own requirements.
- *Document requirements*. Create a well-formed requirements document that allows explicit trade-offs between priorities as necessary and provides a foundation for resisting changes in mission scale and scope.
- *Establish policy.* Create a joint, signed implementation plan and document it in a memorandum of understanding to provide a foundation for the relationship. The memorandum should define a chain of command, outline roles and responsibilities, and describe measures for dispute resolution. It should also explicitly explain how requirements are to be decided and resource disputes resolved. This implementation plan supersedes individual agencies' policies in the event of conflict, even if the Components change their internal policies.

Recommendations

Here we highlight our recommendations based on our research and analysis. For DHS leadership, joint programs could offer an opportunity to reduce costs both during the acquisition phases and throughout the life cycle. Not only can shared resources be leveraged, but the technical risk of the program can be shared and even collectively reduced. Other possible operational benefits (e.g., improving cross-Component interoperability, reducing redundancy, or developing a new capability that cannot be created

without cross-Component collaboration—that is, synergy) could provide the underlying rationale. For example, for very high-risk areas, especially those involving advanced technology, such as harnessing artificial intelligence, it might be sensible to collaborate across Components in a type 4 joint activity even before official programs of record are put in place. This relationship could serve as a "technology push" across the DHS Components, which could place the department ahead of the usual "requirements pull" approach often used to address capability gaps. This kind of collaboration could provide the foundation for further joint programs of type 1, 2, or 3, resulting in fieldable systems or capabilities. Utilizing the framework could help organize the decisionmaking process around joint program formation, beginning with looking to initial conditions to determine whether a joint program even makes sense. Given a demonstrated commonality of mission and need across the many DHS Components, we recommend considering the spectrum of joint program types as a way to move forward on acquiring future systems and capabilities.

Prioritizing the joint program will help it to be successful in achieving the intended goal. Successful collaboration is most likely when each entity considers the partnership one of its highest priorities (National Research Council, 2011). Each Component should understand its own requirements before exploring development of requirements with other Components and considering whether participation in any joint programs with another Component makes sense. After Components evaluate their own requirements, they can determine whether they have synergy with other Components. First, determine whether a joint program is mandated and whether it serves the best interests of participating Components, then select the type of joint program by examining the degrees of alignment of requirements, resources, schedule and KPPs. Finally, by implementing best practices and addressing policy questions before and during formation of a joint program, DHS can increase the probability of success in joint programs.

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CHAPTER ONE

Introduction: Research Motivation and Approach

Since its inception in 2014, the U.S. Department of Homeland Security (DHS) Joint Requirements Council (JRC) has facilitated the development and validation of requirements, some of which are labeled or considered *joint*. Consequently, the JRC is establishing best practices to facilitate joint—or cross-Component—requirements for identification, analysis, and validation. Once requirements have been identified and validated, a possible solution to filling capability gaps and matching similar requirements among Components would be to form a joint program. DHS defines *joint programs* as those requiring cooperation or coordination with external entities.[1] The Joint Requirements Integration and Management System (JRIMS) designates its documents as *joint* as follows:

> Applies to all JRIMS documentation that affects or impacts the activities, operations, or organizations of two or more Components. These include all documents that explicitly apply to more than one DHS Component, or are co-sponsored by more than one DHS Component. (DHS Instruction Manual 107-01-001-01, 2018, p. 26)

[1] For instance, the 2018 DHS lexicon defines a *joint project/program* as a "project or program that involves DHS Components and outside Components, whether they are federal, state, local, or other," citing a prior version of the Acquisition Management Instruction (DHS Instruction 102-01-001, 2021) as its source (Management Directorate, 2017, p. 355).

Motivation, Approach, and Research Questions

As DHS embraces the unity-of-effort ethos and seeks enterprise-wide efficiencies, it might identify more joint capability gaps, operational requirements, and potential acquisition needs. These activities could lead to developing more joint requirements. For these reasons, joint programs could offer some benefits to DHS. Some joint programs have ended up costing more or taking longer than single-Component programs (Dwyer et al., 2014), which could be of concern to the Components. The intention of this report is to offer a way to guide the thinking about joint program formation, specifically in DHS, to maximize the probability of joint program success. We aim to answer the following research questions:

- How can DHS leadership and Components determine whether a joint program might fulfill the determined need?
- What are the types of joint programs on the jointness spectrum, and what factors should be considered when selecting a type of program?
- What are the key considerations for structuring joint programs to maximize their effectiveness?

Through extensive literature reviews, discussions with RAND subject-matter experts, and analysis of the results, we developed a framework to aid in thinking about joint program formation. The framework consists of tools to aid in decisionmaking about whether to consider forming a joint program, a taxonomy describing five types of programs and collaborations, a notional tool for selecting a type of program, and guidelines for structuring joint programs to maximize the possibility of their success. We present and explain each of these in the subsequent chapters.

Definitions of *Jointness*

The JRC does not currently have a widely accepted definition of *joint*, and joint acquisition programs that involve cooperation or coordination across

DHS Components are rare.[2] Two DHS efforts that could be considered joint are the DHS Financial Systems Modernization (FSM) program and potentially the Counter Unmanned Aircraft Systems (C-UAS) program (more on these in Chapter Two). The JRC charter specifies that the primary purpose of the JRC is to develop DHS into "a more unified and operationally effective and efficient organization through the creation of a Component-driven joint requirements process" (DHS, 2014, p. 1). This report is intended to provide a framework for thinking about joint programs that draws on information and lessons learned from DHS and, to some extent, U.S. Department of Defense (DoD) experiences, as well as literature reviews and prior RAND research to support decisionmaking around joint program formation and the subsequent selection and formation of such programs.

JRIMS emphasizes department-wide review and validation of requirements but does not clearly delineate processes related to joint requirements collaboration and writing (DHS Instruction Manual 107-01-001-01, 2018). The motivation for pursuing joint requirements can come from various sources, including political pressure, operational needs, executive orders, or economic incentives. Reasons for identifying joint requirements or establishing joint programs include

- improving inter-Component interoperability and agility
- reducing acquisition costs through increased bargaining power
- reducing sustainment costs through commonality
- reducing duplicative requirements and acquisition efforts for similar requirements.

Types of Joint Programs

In this report, we explore multiple definitions of *joint*. These definitions are used, although not always with the same lexicon, across both industry and the federal government. In reality, joint programs exist on a spectrum instead of being distinct types (Drezner, Roshan, and Whitmore, 2017), but, for the sake of discussion and to create a framework to aid in

[2] A complete list can be found in Table 2.2 in Chapter Two.

organizing thinking about joint program formation, we developed a taxonomy that characterizes five types of joint programs, which we describe in this report. These types are found along the full spectrum of joint program types. It is possible that, when forming a joint program, the result will fall into one particular type, but it might, instead, have aspects of one or more types.[3] Figure 1.1 illustrates the concept of jointness and the five types on a spectrum.

Chapter Two outlines real-world examples of programs that are considered joint. Additionally, each joint program summary lists the various benefits and challenges associated with the corresponding joint program model and how the requirements for that program were developed. Chapter Three summarizes the considerations that DHS and the JRC will have to address to move forward with a consistent definition of *jointness*, as well as to gain the benefits of joint programs and mitigate potential challenges. We discuss the following types of jointness:

- fully integrated joint (type 1)
- lead Component–coordinated (type 2)
- single-Component shared (type 3)
- confederated (type 4)
- hybrid (type 5).[4]

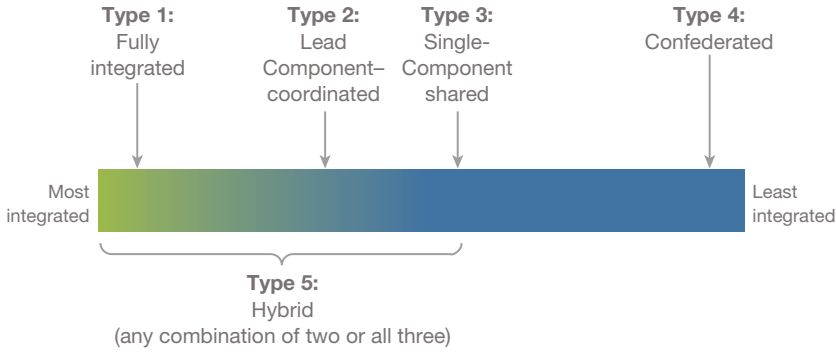
Each type is explained in detail in Chapter Two. We describe them separately; however, many joint program structures will not fall perfectly into one category. In fact, significant variation occurs within each of these categories, and hybrids (type 5) are possible.

Implemented approaches will evolve naturally over time in response to changing requirements, levels of Component participation, or changes in program scope.

[3] We provide examples of programs that cut across types later in this report.

[4] Confederated (type 4) is not an actual program but rather a joint activity and is included here so we can be comprehensive in our explanation of joint programs.

FIGURE 1.1
The Five Types of Programs Along the Jointness Spectrum



Leveraging Examples of Joint Programs from the Department of Defense

Because DoD has implemented numerous joint programs over the course of its history, we examined selected joint programs at DoD as examples to explain the types of joint activities described in this report and the reasons for creating the programs. We drew on DoD experience because DHS shares many similar challenges (e.g., multiple Components, advanced technology, complex concepts of operation) in current and future programs. Within DoD, *joint program* is defined as any acquisition system, subsystem, service, or technology program that involves formal management or funding by more than one service branch during any phase of a system's life cycle.[5] Joint programs have been pursued within DoD, offering the potential for a combination of new warfighting capability, improved interoperability, reduced redundancy, reduced development and production costs, or reduced logistics requirements, among other possible returns across service branches (Department of Defense Directive [DoDD] 5000.1, 2001). Much of DoD's posture on joint programs originates from the 1986 Goldwater–Nichols Department of Defense Reorganization Act of 1986 (Pub. L. 99-433, 1986). This legislation provided the foundation for joint programs within

[5] Based on the definition of *joint* within Defense Acquisition University, undated.

DoD and expanded the role of combatant commanders relative to the service branches and their respective Title 10 authority. Part of the underlying motivation for this legislation was to reduce the interbranch rivalry and improve cross-agency efficiency within DoD.[6]

DHS also stands to benefit from joint programs, given the inherent parallelism of many of the department's roles, the similar variety and range of missions and functions, and the level of commonality that can exist among the various Components. The potential exists to improve universal efficiency as a core motivation to pursue joint programs or activities. The examples we present show that there are several different ways in which joint programs or activities can be organized and executed among the key Components and stakeholders; each type of program or activity comes with both benefits and challenges.

Why Have Joint Programs?

A joint program can be formed when two or more Components agree to do so or when a mandate calls for one. Whether it is due to mutual agreement or by mandate, the underlying rationale for forming joint programs is often cost savings. Joint programs can reduce management costs and spread risks across participating organizations. The purpose is to realize economies of scale and save during development, production, and support phases (Drezner, Roshan, and Whitmore, 2017). Only a few organizations will have sufficient expertise or budget to develop needed systems and technology independently (Dwyer et al., 2014). Within DHS, a joint program might enable Components to leverage enterprise expertise and access funding for a desired technology or system. The government has an interest in aligning authority, budget, responsibility, and expertise across different organizations, which often motivates leaders to form joint programs (Dwyer et al., 2014).

In some cases, forming joint programs is not optional and is, in fact, mandated or recommended by some authority, such as Congress, DHS

[6] The formal process for this is outlined in DoDD 5000.1, 2001, and DoD Regulation 5000.2-R, 2002.

leadership, or the JRC. For example, Congress mandated in the National Defense Authorization Act for Fiscal Year (FY) 2006 that DoD's Joint Light Tactical Vehicle (JLTV) program be joint. The declaration required that the U.S. Army and U.S. Marine Corps (USMC) pursue a joint program in the modernization and capitalization of their fleet of tactical wheeled vehicles (Pub. L. 109-163, 2006, § 114). The F-35 Joint Strike Fighter Program is another joint program. In 1994, Congress mandated that the Marine Corps effort be merged with the already-joint U.S. Air Force (USAF) and U.S. Navy program. The reason given was to minimize the costs of procurement, development, and operation of three tactical designs when the services' needs, although not identical, were similar (Gertler, 2020). Future Vertical Lift is a joint program that Congress mandated to explore opportunities for jointness in the Duncan Hunter National Defense Authorization Act for FY 2009 (Pub. L. 110-417, 2008, § 288; Drezner, Roshan, and Whitmore, 2017). This trend suggests that understanding the possible benefits of jointness might be useful to DHS.

Potential Benefits of Joint Programs for Components

Joint programs could enable individual Components to pool resources and use the expertise of other Components to achieve a desired outcome or acquire and develop technology that the programs otherwise might not be able to attain. Joint programs offer many potential benefits to the participating Components, which include the following (Drezner, Roshan, and Whitmore, 2017; Dwyer et al., 2014; Lorell et al., 2013):

- savings because of shared development, production, and operations costs
- enabling design for interoperability
- leveraging an agency's unique technical expertise
- reducing redundancy and duplicate investment in technologies and systems.

Components could realize benefits from joint programs when implemented with certain considerations. Conversely, however, joint programs can sometimes experience greater cost growth and other problems, such as management of increased risk, than single-Component programs.[7] These considerations are addressed in Chapter Three.

Challenges of Joint Programs

The favorable expectations associated with establishing a joint program can exceed the actual outcome. There are numerous reasons that early intents are not fully realized. Some Components might resist participating in joint programs because they worry about losing their autonomy or slowing their decisionmaking processes. Sometimes, joint programs can experience greater cost growth than nonjoint programs (Lorell et al., 2013). The potential reasons for this include

- too many requirements, leading to a concatenation of requirements and increased complexity of the final technology (Lorell et al., 2013).
- divergent institutional interests, duplicative approval and decisionmaking processes, differences in missions and operational procedures, and competing institutional interests of collaborating organizations; Components could perceive other organizations with similar missions or overlapping jurisdictions, and thus overlapping decision authority, as rivals.

Although not a potential cause of cost growth, participating Components typically share cost increases, regardless of whether they are the result of difficulties with other Components' requirements. One Component attains a desired capability at someone else's expense. Although this is a risk of joint programs, with proper management, it is possible to keep the joint organization from becoming unstable, inefficient, and costly (Dwyer et al., 2014).

[7] This was the case with the F-35 program.

Framework for Organizing Thinking About Joint Programs

Because joint programs can be beneficial for the participating Components but can also be challenging, we designed the framework as a set of guidelines to help organize the thinking around joint programs rather than as a prescriptive "how-to" guide. We explain each element of the framework in detail in Chapters Two and Three. In Chapter Two, we describe the five types of joint programs, with examples of each type, and the possible benefits and challenges of each. This will help to illuminate some of the major considerations for successful and effective joint programs. Then in Chapter Three, we provide the full framework.

CHAPTER TWO

Approaches to Jointness

Characteristics of Joint Programs

In this chapter, we describe different kinds of joint programs and activities that can involve varying levels of jointness among the DHS Components. Further elaborating on the taxonomy that we introduced in Chapter One (fully integrated joint programs [type 1], lead Component–coordinated programs [type 2], single-Component shared programs [type 3], confederated activities [with a high degree of commonality, e.g., leadership-directed technology programs that cut across broad areas of interest among Components] [type 4]), we provide a description of the key characteristics and examples of programs, as we define them, in Table 2.1.

A fifth category, hybrid (type 5), involves joint activities that do not directly fall into any of the four types defined above, but they still involve some level of cross-Component interaction during the formal requirements-generation process. These can be joint programs that have changed from one type to another or single-Component programs that have become joint at some point.

Since the inception of DHS, 11 joint activities have submitted requirements documents through the JRC. They are listed in Table 2.2. In instances in which no DHS program exists or to further illustrate the example of each type, we refer to DoD programs.

The decision about whether to conduct joint, collaborative, or integrated activities that lead to official acquisition programs can be made at different points in time. Thus, evolving the relationship to the necessary level of collaboration and integration can be an iterative process (Johnson, Hilgenberg, and Sarsfield, 2001). For type 1 programs, the collaboration, often mandated from the outset (as discussed later), precedes the development

TABLE 2.1

Types of Joint Component Coordination

Type	Key Characteristics	Examples
1: Fully integrated joint	• Program is multi-Component and collaboratively managed and funded. • A JPMO, with executive authority, is created with staff from all participating Components.	• DHS FSM (DHS Management Directorate, TSA, USCG) • DIMHRS (DoD service branches)
2: Lead Component–coordinated	• Individual, coordinated programs exist in multiple Components. • The lead Component's program office manages and coordinates with other participating Components' programs. • Each Component has executive authority over its own programs.	• UTTAS (DoD Army and Navy)
3: Single-Component shared	• Each program is managed and funded within a single Component. • Participating Components liaise during development and production. • There are no formal coordination requirements.	• M1A1 Abrams (MBT) (DoD Army and USMC)
4: Confederated	• Programs have commonality in technical areas. • Participating Components share technical information or development data.	• Original (2013) DHS FSM (DHS-wide) • Joint UAV activity or program (DoD services) • Robotic Systems Joint Project Office (DoD services)
5: Hybrid	• Characteristics vary.	• DCGS (DoD services) • JTRS (DoD services)

SOURCE: Categories derived from Defense Acquisition University (DAU), undated, and DAU, 2004.

NOTE: JPMO = joint program management office. TSA = Transportation Security Administration. USCG = U.S. Coast Guard. DIMHRS = Defense Integrated Military Human Resources System. UTTAS = Utility Tactical Transport Aircraft System. MBT = main battle tank. UAV = unmanned aerial vehicle. DCGS = distributed common ground system. JTRS = Joint Tactical Radio System. The types are derivative of DoD joint programs, as originally proposed in Johnson, Hilgenberg, and Sarsfield, 2001.

TABLE 2.2
U.S. Department of Homeland Security Joint Activities with Requirements Documents Submitted Through the Joint Requirements Council

Activity	Sponsor
DHS FSM	DHS Management Directorate, USCG, TSA, JPMO
C-UAS	CBP, USCG, Federal Protective Service
DHS Enterprise Freedom of Information Act IT	Office of Privacy, Office of the Chief Information Officer
Human Resources and IT	Office of the Chief Information Officer, Office of the Chief Human Capital Officer
Homeland Security Enterprise Information Sharing	CBP, USCG
DHS Digital Forensics and Document and Media Exploitation	Office of Intelligence and Analysis, U.S. Immigration and Customs Enforcement, USCG
Joint Interoperable Tactical Communications	Joint Wireless Program Management Office
Command and Control	CBP, USCG
Common Operating Picture/Common Intelligence Picture	CBP, USCG
Law Enforcement Information Sharing Environment	U.S. Immigration and Customs Enforcement, Information Sharing Portfolio Team
Maritime Patrol Aircraft Mission System	CBP, USCG

NOTE: CBP = U.S. Customs and Border Protection. IT = information technology.

of requirements and possibly even concept development. For type 2 and type 3 programs, the collaboration period varies from earlier to later, with the extreme type 3 case being well after the system or capability is developed and the participating Component acquires a production article.

We present these five types in greater detail in this chapter. Specifically, we include a summary of how requirements are developed within a specific type of joint program or activity. We focus on requirements because their degree of similarity among potential stakeholders has been found to be the

major determinant of the type of program to which they are assigned to address their requirements (Lorell et al., 2013; Drezner, Roshan, and Whitmore, 2017). Additionally, we provide a discussion of several helpful examples that correspond to the type of joint program or activity,[1] along with their associated benefits and challenges.

Type 1: Fully Integrated Joint Programs

Description

A fully integrated joint program, as we define it, involves two or more Components that collaboratively fund and develop a program from concept through production and typically collaborate on sustainment. This type of joint program is generally considered the model joint program, involving the creation of a centralized program office, frequently referred to as a JPMO, that serves the core function normally served by the single-Component program office.[2] This JPMO operates with the same authority as the single-Component program office, and, although it is staffed with representatives from the participating Components, its members act primarily on behalf of the JPMO rather than the Components from which they were assigned.[3] Congress (and DoD) prefer this type of joint program given the potential for eliminating cross-Component rivalry and maximizing the variety of possible benefits (DoDD 5000.1, 2001).

How Requirements Are Generally Developed

This type of joint program is usually the result of a top-down assessment process whereby potential opportunities for cross-Component benefits are usually recognized at a very early phase of the acquisition process, often well

[1] Using DHS and DoD joint programs as a reference.

[2] For very large or expansive programs, this could involve a joint program executive office (JPEO), which is overseen by a flag officer or a government Senior Executive Service official.

[3] A JPMO is essentially a single integrated program that is independent of, but responsive to, parent organizations.

before requirements are officially established (DAU, undated). For DHS, this might occur either before or in the early phase within the JRIMS process, during which DHS leadership conducts a high-level analysis for potential benefits and costs or through DHS leadership or congressional mandate.

For practical purposes, one of the Components is designated to provide the administrative elements associated with the stand-up and execution of the JPMO. However, once the initiative is established, the specific responsibilities are shared among the participants. These include providing common documentation, conducting any necessary reporting (e.g., presentations and updates to acquisition officials), and overseeing funding actions required to support the capability development and acquisition process for a specific capability proposal (DAU, undated). In conjunction with these activities, the guidelines that are typically used for fully integrated joint programs are often adopted from those already in place with the designated Component. Correspondingly, that same Component would assign the program manager (PM) and office responsibility of overseeing the JRIMS process. Furthermore, the JPMO would be responsible for ensuring the production of formal acquisition documentation, such as the capability analysis report (CAR), mission need statement (MNS), concept of operations (CONOPS), and operational requirements document (ORD) (DAU, undated). Typically, a deputy to the PM would be assigned from another Component.[4]

First Example: Financial Systems Modernization

According to the information available to us, the current version of FSM appears to be type 1. FSM is a DHS department-wide acquisition program to procure and modify any existing financial management system capability (Borras, 2013). The end capability was intended to be software that would streamline financial management within DHS and replace outdated and incompatible financial systems in the Components (Office of Inspector General, 2019). The FSM program "was initiated to strengthen access to, and the quality of, financial information to support decision making and improve the ability to provide timely and accurate reporting to ensure efficient stewardship of taxpayer dollars" (Office of the Chief Financial Officer,

[4] Although key decisions would typically made by the program management office, a memorandum of agreement (MOA) between the Components would be in place.

2015, p. ii). It is a joint program under the governance of the FSM JPMO, which is in the Office of the Chief Financial Officer. The JPMO provides centralized oversight, program management, and coordination of program activities for all of the FSM efforts across the Components (Management Directorate, 2021). The JPMO is staffed with both DHS headquarters personnel and subject-matter experts from the Components (Fulghum, 2017).

When formed in 2013, the FSM initiative followed a confederated approach (type 4) so that each Component could define its own operational requirements. But this led to creation of separate CONOPS and ORD documents that resulted in complex and contradictory requirements with no clear articulation of DHS's goals of enhanced efficiency and security (Management Directorate, 2021; U.S. Government Accountability Office [GAO], 2017). To try to standardize requirements, in 2018, the Office of Financial Management issued a joint CONOPS for FSM articulating the DHS financial management modernization approach and defining a comprehensive vision, which was validated by the JRC the same year.[5] An ORD was also issued. Both the joint CONOPS and ORD were signed by DHS management, the FSM JPMO, TSA, and USCG. Currently, the program supports TSA and USCG and includes addenda for TSA and USCG. Additional Components will leverage FSM in the future and create addenda to the ORD. An FSM executive steering committee was formed and included a senior financial management representative from each Component. The strategy for modernizing the financial systems was to establish guidelines for Components rather than impose a single enterprisewide solution.

Second Example: Defense Integrated Military Human Resources System

Another example of program that can be considered a joint fully integrated program (type 1) is DIMHRS, which was a software-based enterprise resource program (ERP). This joint program was initiated to solve ongoing problems within the military personnel and payroll-processing area (Snyder, 2005).

The DIMHRS program was initiated in 2002 as a top-down Office of the Secretary of Defense (OSD)–mandated program to streamline the exist-

[5] As of November 2021, the CONOPS was being updated.

ing human resource system and related processes. The goal was to create a simpler and more integrated ERP, replacing approximately 90 legacy systems in use across DoD service branches. The long-term benefit would be a more efficient human resource management system that could serve multiple functions and reform business system processes across DoD. Given its broad scope, DIMHRS represented one of the largest ERP undertakings of its time. The development phase for this program began in 2003. However, major unforeseen issues arose.

From a technical standpoint, transitioning from multiple, disparate legacy data systems to a new and holistic ERP was a challenging undertaking. Thus, there were resultant administrative and technical problems across the program with multiple delays, which might have been unrelated to it being a joint program. Ultimately, the Army decided to move to a less encompassing system, and, shortly thereafter, in 2010, the Secretary of Defense canceled the program altogether. The problems with the DIMHRS program might have been less about being a joint program per se and more about being an overly complex and perhaps too structured defense business system program.

Potential Benefits

The main rationale for initiating this type of joint program is the perceived opportunity to maximize the variety of possible benefits—for example, enabling new capability, improving interoperability, reducing redundancy, reducing development or production costs, or reducing support and logistics requirements. Of all joint program types, the level of collaboration within this type of joint program should yield the highest possible level of benefit. In some cases, in which requirements are identical (such as for FSM), the fully integrated joint program is the sensible acquisition path to realize economic benefits—for example, cost sharing during development and the economy-of-scale effect in production and sustainment. In other cases, fully integrated joint programs might be desirable to ensure feasibility and maximize interoperability. In constrained resource environments (e.g., tightening budgets) or in advanced technological programs, DHS can seek to minimize development cost and risk by pursuing joint programs of this type.

Challenges

Fully integrated joint programs tend to be more complicated to manage than single-Component programs. The additional steps of coordinating and maintaining consensus among a wider set of stakeholders, particularly if the specific DHS needs and interests do not overlap, can take significantly more time in the acquisition schedule than a single-Component program. In some cases, compromises to the program or system performance might have to be made to ensure compliance with a wider set of stakeholders across the Components. This can occur from the origination of the program—for example, during requirements generation—and continue throughout the life of the program. Historically, fully integrated joint programs can become single-Component shared programs or simply single-Component programs.[6] Some of the challenges associated with executing fully integrated joint programs have included

- reprioritization and budget adjustments by any of the participating Components
- evolution of the requirements associated with the joint program (e.g., responding to changing threat capability); in some notable cases, major joint programs have been terminated as a result[7]
- withdrawal of one or more partner Components from the program.[8]

These challenges can present increased risks for type 1 programs over single-Component ones. The core factor to minimizing these risks in large, complex joint programs is to maximize requirements overlap, with identical ones being optimal (Drezner, Roshan, and Whitmore, 2017; Lorell et al., 2013).

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[6] Some fully integrated joint programs have evolved in ways that were not expected. One notable example of this is JTRS, for which subprogram elements continued after the cancellation of the larger joint program. Another example is the Light Armored Vehicle (LAV) 25, currently a USMC program, which was initially a joint program between the Army and USMC.

[7] An example of this was the Aerial Common Sensor program.

[8] One example of this was the Tri-Service Standoff Attack Missile, which was terminated and, by some measures, reconstituted later as a different program with a new set of requirements.

Type 2: Lead Component–Coordinated

Description

Lead Component–coordinated programs, as we define them, represent a type of joint program that involves two or more Components managing separate programs for a particular system or capability and maintaining mutual collaboration rather than fully integrated joint programs. In this type of joint program, one Component is the lead for the system or capability, and any other Components follow, typically producing a derivative of the system or capability that includes modifications that better meet the following Component's specific needs. Depending on the level of collaboration, which can be codified through a memorandum of understanding (MOU) or an MOA,[9] many of the same general guidelines are followed as if the program were a fully integrated joint program, with one major exception: The lead Component does not have executive authority over the following Components' programs. In the lead Component–coordinated type of joint program, the lead Component's program office manages program development and coordinates with the other following Components. This can include providing critical and timely engineering and manufacturing development (EMD) information to facilitate desired modifications for the following Components. With respect to schedule, the lead Component often develops and produces the system or capability ahead of the other participating Component programs.

How Requirements Are Generally Developed

For the lead Component, the requirements are often created as if the joint program were a single-Component program; for the coordinating Components, the requirements are either taken directly or possibly derived from those of the lead Component. Usually, participating Components recognize that the lead Component is planning to acquire a system or capability that closely matches the needs of the following Components. In some

[9] In this report, we use the term *MOU* to refer to both MOU and MOA.

cases, the decision to pursue such a program is driven by cost.[10] Depending on the level of the collaboration between lead and coordinating Components, there could be some opportunity to influence the lead Component's requirements; however, this would typically be at the discretion of the lead Component. In the current acquisition environment for DHS, the program would go through the JRIMS process, and the program management office would be staffed based on the level of collaboration that is agreed upon, which could be established through an MOA.[11]

First Example: Counter Unmanned Aircraft Systems

C-UAS is still in an early phase, so the type of jointness has not been determined. However, according to the information available in mid-2020, C-UAS could be type 2. The growing threat of unmanned aerial systems is being addressed by DHS. A capability analysis study plan (CASP) was completed on October 17, 2018, and was sponsored by USCG and CBP to analyze C-UAS's existing and future needed capabilities and requirements across DHS. The CASP outlines the objectives of the CAR, including identifying capability gaps, redundancies, and overlaps, and provides recommendations for development and implementation of materiel and nonmateriel solution approaches (Counter–Unmanned Aerial Systems Working Group, 2018). DHS's Science and Technology Directorate (S&T) submitted a privacy impact assessment study on November 9, 2018, to explain the measures that DHS took to minimize privacy risks and protect personally identifiable information during testing and evaluation of counter–unmanned aircraft system technologies (DHS, 2020). The C-UAS CAR was validated by the JRC in December 2019. The JRC and S&T are leading the effort to produce the joint MNS and the joint nonmateriel change recommendation. Once these and other ongoing C-UAS analyses are complete, DHS may

[10] For example, a Component has a limited development budget and is motivated to leverage another Component's program. Or a Component might be driven by schedule or risk and, by pursuing a joint program, the system or capability can be fielded sooner or with less risk than if run as noncoordinated, distinct, single-Component programs.

[11] An example of an MOA from the UH-60 program can be found at Blanken and van der Wall, 2013. That document is an MOA between the United States and Germany on helicopter mechanics.

have enough information to decide what type of program C-UAS should be (type 2 or other).

Second Example: Utility Tactical Transport Aircraft System

One example of a lead Component–coordinated program that has evolved to a broader Component program and an international and foreign military sales program is UTTAS. The resulting utility helicopter is extensively used today by USCG, CBP, the Army, USAF, and the Navy. Although the original requirements for the UTTAS program predates the current Joint Capabilities Integration and Development System process, the program's intent makes it a relevant case study for type 2.

From the late 1960s to the early 1970s, both the Army and the Navy were seeking replacements for their aging utility helicopter fleets.[12] In 1976, the Army selected the Sikorsky YUH-60A helicopter, and it was subsequently designated the UH-60A Black Hawk. About two years later, the Navy, basing its requirements on UTTAS, selected the SH-60B Sea Hawk as its utility helicopter. This platform maintained approximately 83-percent commonality with the UH-60A (Eden, 2008). Aside from the inherent commonality of the platform, which might have resulted in a production economy of scale, much of the long-term coordination benefits and cost savings occurred after the original buy of the systems. In the extended life cycle, along with the many subsequent variants of the helicopter, the Army and the Navy worked together on joint platform modifications that were developed, tested, and evaluated.[13]

DHS uses the Sikorsky H-60 platform in USCG and CBP. More specifically, USCG uses the MH-60 Jayhawk as a medium-range recovery helicopter and the HH-60J as a rescue variant (Leoni, 2007). USCG acquires retired marinized aircraft from the Navy and then converts them to standard J configuration. CBP's Air and Marine Operations UH-60s are on loan

[12] Other entities, including USCG and USMC and, later, USAF and U.S. Special Operations Command, as well as many other countries, were also seeking replacements. DHS next-generation vertical lift is being developed under the same premise (see Aviation Governance Board, 2019b).

[13] For example, the Army adopted the enhanced engines and gearbox version of the Navy model; it also jointly tested various airframes for survivability (see GlobalSecurity.org, undated).

from the Army, and CBP uses them in its operations specifically along the northern, southwest, and southeast borders to interdict illegal entry into the United States, as well as to conduct search-and-rescue operations, among other missions. This relationship has been somewhat problematic from both a cost-effectiveness perspective and a rights-of-use perspective.[14] An opportunity to coordinate conversions within the DHS community (e.g., have USCG perform conversions for CBP) was identified as a potentially better way to continue the DHS H-60 operation, among other recommendations for improvement (Office of Inspector General, 2013). A more recent study on next-generation vertical lift (Aviation Governance Board, 2019a), sponsored by the DHS Aviation Governance Board, found that, although USCG and CBP have differing mission requirements that lead to differences in aircraft configurations, many areas exist for collaboration. These possibilities, such as facility usage and supply chain cooperation, should be pursued (Aviation Governance Board, 2019a).

Potential Benefits

In lead Component–coordinated programs, a lead Component develops a system or capability, but information is coordinated to allow other Components enough access to develop a variant of that system or capability. The inherent benefit of this type of partnership is the potential for reduction in development, production, or life-cycle support cost (and potentially maintenance costs), especially if the same set of prime contractors and subcontractors are used across the Components. In addition to commonality of parts, which can result in a long-term economy-of-scale effect, there have been opportunities to share life-cycle costs, and the Army and the Navy have coordinated various survivability improvements along with follow-on test-and-evaluation initiatives (GlobalSecurity.org, undated). This coordination has reduced the long-term costs associated with maintaining the shared-base helicopters across Components.

[14] Because of the current loan agreement with the Army, as well as CBP's need for more-effective program management, CBP H-60 conversions and modifications have cost more and taken longer than necessary (see Office of Inspector General, 2013).

Challenges

A key constraint of lead Component–coordinated programs, particularly those that end up with a common system or capability across the Components, is the inherent lack of diversity in the end system or capability. For example, similarity within a weapon system can produce a common vulnerability across the Components (i.e., where the systems can be vulnerable to the same threat). In the case of the H-60 platform, it could be susceptible to one kind of man-portable air defense system. This is often used as an argument against the use of common systems across the services in DoD and might also be applicable to the Components within DHS. Another constraint, from a longer-term perspective, is that having a common platform across Components could reduce competition and create an industrial base issue. Hence, although type 2 programs might produce savings through development and production efficiencies, if competing design teams (which can easily exceed a thousand specialized personnel for modern airframes) close shop, it could be difficult and extremely costly to reconstitute them.

Type 3: Single-Component Shared

Description

A single-Component shared program, as defined here, represents a lead Component–managed and –funded program in which one or more other Components can participate, mostly in a liaison role, during development and production of a system or capability with the intent to acquire it in production. The resulting system or capability is what is shared. This program typically involves even less interaction during the development phase than type 2 programs and, in the extreme case, involves a Component simply acquiring the lead Component's system or capability after production has begun. During development and production of the system or capability, there are no formal coordination requirements among the Components.

How Requirements Are Generally Developed

Requirements under a type 3 program are generally developed in the same way as for a single-Component program. As with most joint programs, there

might be an MOU; in the case of joint type 3, the MOU would describe what information is to be shared and when it is made available to the participating Components. This assumes that the decision to participate in the program is made early enough in the acquisition cycle. In many ways, although such early involvement by participating Components would be desirable, often the decision to participate in this type of a program occurs after the initial EMD phase within the system's or capability's acquisition process.

Example: M1A1 Abrams Main Battle Tank

The M1 Abrams MBT, which is currently in the Army and USMC, is an example of a type 3 program. Specifically, the M1 Abrams was developed by the Army as a replacement for the M60 Patton MBT. Between 1979 and 1985, General Dynamics' Land Systems division delivered more than 3,000 production M1 Abrams MBTs to the Army. This program has been a major undertaking for the Army, resulting in numerous upgrades in the past several decades. Through service life–extension program efforts and various upgrades, the M1 is expected to remain in the Army's inventory for years to come.[15]

Contrary to its desire to remain a "light" expeditionary force, in the late 1980s and early 1990s, USMC was in need of an armored vehicle that had more firepower and protection than its mainstream LAV, the LAV-25, particularly in battle areas where the threat situation was highly uncertain.[16] Although a new-start MBT might have been the preferable approach to meet specific USMC MBT needs, the development costs relative to the number of vehicles that USMC planned to acquire made it difficult to justify a major new-start program.[17] Thus, to directly address this deficiency in firepower and protection, USMC decided to acquire the Army's MBTs. By doing

[15] The Army has initiated the next-generation combat vehicle program, which might lead to an M1 Abrams replacement.

[16] The LAV-25 was initially a joint program with the Army, but the Army withdrew from the program. Many years later, the Army acquired a small number of LAV-25s to complement its 82nd Airborne units, a recommendation from unpublished 2017 RAND research led by John Gordon.

[17] USMC has a much smaller research and development budget and science and technology capability than the other services.

this, USMC was able to leverage the Army's large initial investment, which greatly reduced programmatic risk.[18]

USMC had minor changes made to the M1A1s it acquired. For example, phones that infantry could use to connect with buttoned-up tank crews were installed on USMC M1A1 MBT production units.[19] These minor modifications were made through USMC Systems Command rather than a program office.[20] Although USMC had to make some sacrifices (such as integrating a heavy weight penalty for more than 65 tons into its force structure), it was able to equip specialized active and reserve units with a world-class MBT by joining the Army in acquiring the M1A1.

Potential Benefits

The main benefits of participating in this type of joint program reside largely with the participating Components. For those Components, the costs associated with EMD can generally be avoided, along with any early programmatic risks associated with the development. That is, the risk is borne by the single Component that initially develops the system or capability. In the M1 example, the Army bore the costs and risks of developing the M1 chassis, as well as further upgrades and improvements that resulted in the M1A1—the version that USMC acquired. Thus, rather than create a separate program management office, USMC managed most of its modifications through an existing command.

In addition to reducing early development costs and schedule risk, additional long-term benefits can be achieved through reduced production and life-cycle costs. Depending on the contract with industry partners, it might be possible to benefit from an economy-of-scale effect with a larger total number of systems acquired. This benefit could cascade into the sustainment phase with replacement prime contractor or supplier parts, as well as

[18] Part of the cost savings can be attributed to Components paying greater attention to cost when it comes from their own resources.

[19] The Army deleted this requirement for phone communications in its transition from M60 to M1. Interestingly enough, years later, it installed phone communications for counterinsurgency operations as part of the M1A2 upgrade.

[20] Communication between John Gordon and us.

personnel and training cohesion. In this scenario, all of the Components can potentially benefit.

Challenges

The possible key overarching constraint in this type of program is the inability of the participating Components to effect any substantive change to the planned system or capability in development. The participating Components are effectively outside the requirements-generation process and, as a result, would have to basically acquire a system that meets the single or lead Component's requirements. It is possible that a type 3 program would become very much like a type 2 program if a separate or parallel program management office were created and additional requirements were imposed. As noted before, some changes are often made to the system or capability even if it is a type 3 program, as in the case of the USMC M1A1. It is a matter of degree that this change ultimately results in a modified end system or capability.

Type 4: Confederated

Description

A confederation consists of "multiple entities that form an acquisition 'alliance' to accomplish limited, albeit challenging objectives" (DAU, undated). This type of joint activity involves bringing together Components more often than specific programs per se at a more general level, and it can involve highly advanced technology, high-risk systems or capabilities, high-cost systems or capabilities, or any combination of these. Examples of confederated activities include high-level or leadership-directed technology activities that share science and technology investments cutting across broad areas of interest that are common to all participating Components. As we define it here, a joint type 4 activity can be any substantive alliance between Components to achieve key objectives across them. This activity involves participating Components that combine acquisition resources, personnel, and funding to improve the activity's success (e.g., reduce risk, increase efficiency). A type 4 activity can be initiated when Components

wish to form alliances to comply with leadership guidance (which might include enterprise funding).[21] Although Type 4 works for materiel solutions, Components can also accrue benefits with a nonmateriel change recommendation. These kinds of high-level activities can end up creating specific types of joint programs downstream.

How Requirements Are Generally Developed

Because type 4 alliances and collaborations tend to be more general than official programs, there are defined objectives rather than official requirements. For a leadership-directed activity, the organization that directed the collaboration may define the objectives. In some cases, joint activity (or program) offices will be created to oversee and manage the activities.

First Example of Type 4: The Original Program Approach of U.S. Department of Homeland Security Financial Systems Modernization

When originally formed in 2013, the FSM initiative was characterized as a type 4, following a confederated program approach—with the intention of acquiring software for the entire department. An acquisition decision memorandum was filed by the chief acquisition officer in September 2013, formalizing the DHS-wide acquisition program strategy for FSM. The Components defined their own operational requirements (Borras, 2013). FSM evolved into type 1 to streamline the creation of a single ORD and CONOPS, which articulated the vision of DHS and deconflicted the separate Component requirements.

Second and Third Examples of Type 4: Department of Defense Joint Unmanned Aerial Vehicle Program Office and Robotic Systems Joint Project Office

Before it became known by its current name, the Joint Tactical UAV program, a joint UAV activity was created in the 1990s with the intent of reduc-

[21] Enterprise funding does not necessarily indicate joint program formation, but it can have joint implications if the Components decide to coordinate on development and implementation.

ing redundancies and adding structure across DoD services' various initiatives.[22] At the time, all the services had UAV initiatives with various and often overlapping objectives. OSD mandated that the services coordinate their various UAV initiatives and created a technology framework to help organize the activities. Similarly, there were activities that involved coordination among unmanned ground systems (e.g., the creation of the Joint Ground Robotics Enterprise and the Army and USMC collaboration on ground robotics through the Robotic Systems Joint Project Office, jointly staffed by senior officers from both services). During this time, OSD and the joint staff further recognized the commonality of these programs and created a broader organizing approach and defined *unmanned vehicle*, through the joint staff, in Joint Publication 1-02 (Joint Chiefs of Staff, 2016).

Additionally, OSD and the joint staff produced an unmanned-system roadmap that mandates the following:

> All science and technology efforts, future acquisition, and research projects should be consistent with the tenets of this document. Although there is a risk of stifling innovation if all future unmanned systems conform to strict requirements, there is a balance between innovation and standardization that each individual effort must consider. (DoD, 2007, p. 1)

The intent was not to usurp specific Component programs; instead, it was intended to ensure some level of unity moving forward and to serve

> the plan for future prioritization and funding of these systems development and technology, thus ensuring an effective return on the Department's investment. Its overarching goal, in accordance with the Strategic Planning Guidance (SPG), is to guide military departments and defense agencies toward logically and systematically migrating applicable mission capabilities to this new class of military tools. (DoD, 2007, p. i)

[22] Also, the Joint Unmanned Aircraft Systems Center of Excellence was stood up in 2005. Its objective was a design "to improve interoperability and use and examines the use of sensors and intelligence collection assets to meet joint operational requirements of U.S. forces in any combat environment" (USAF, 2005).

Potential Benefits

With type 4 joint activities, Components can share technical information or development data. In addition, the science and technology risk is distributed across the participating Components. This type could be very useful for acquiring advanced technologies that are very high risk and provide a foundation for further joint programs.

Challenges

A type 4 activity is typically a precursor to a joint program, and its usefulness can have limited duration. In addition, if Components are reluctant to share information, this could affect the effectiveness. If a formal program is formed, then it would become type 1, 2, or 3.

Type 5: Hybrid

Description

We treat programs that do not neatly fall into any of the other four types of programs or activities described earlier as type 5. Additionally, it tends to be a program that has the characteristics of more than one type among types 1, 2, and 3. As previously noted, often a time factor shapes joint Component programs or activities, as does the degree of collaboration and integration. These relationships can be codified officially through the establishment of a JPMO or less formally through MOAs and other supporting documentation. However, over time, changing and competing priorities, along with an evolving threat environment and other factors, can alter or even end the relationship between two or more participating Components. Similarly, a single-Component program can become a joint program after it demonstrates applicability to other Components. In some way or another, most joint programs or activities could theoretically fall into this category.

How Requirements Are Generally Developed

Requirements for type 5 programs might be developed by any of the methods described for type 1, 2, or 3 or by some combination of the three. Because type 5 is a hybrid and might incorporate elements of three types, the Com-

ponents can customize the process for generating requirements. Components should look at their own requirements first and then determine how to develop requirements for a type 5 based on the level of participation of each Component.

First Example of Type 5: Distributed Common Ground System

DoD's DCGS family of systems was a collection of hardware and software assets envisioned to provide military intelligence across the services. In its initial form, DCGS was a USAF initiative. It became a joint program in 1998, when it was to provide an opportunity for increasing interoperability, specifically for disseminating tactical-level intelligence, surveillance, and reconnaissance across the services.

Once conceived as a joint program, the USAF version (DCGS-AF) came first, followed by the Army variant (DCGS-A) a few years later. DCGS-A employed a different team of contractors from those on DCGS-AF. The Navy variant and Special Operations Command then became the third and fourth members, respectively, of the DCGS family of users, through DCGS-N (Navy) and DCGS-SOF (Special Operations Forces).

Second Example of Type 5: Joint Tactical Radio System

Another example of a type 5 in DoD is JTRS, which morphed from a type 1 into separate service programs.[23] In the push for the services to modernize and become more network-centric, this program was seen by OSD as not only beneficial but essential as a joint program.

The Army was initially assigned as the lead Component for the joint program office (JPO).[24] In its initial form, the JTRS JPO was primarily responsible for developing the communications architecture, radio waveforms, and security subsystems, while the participating DoD services were primarily responsible for developing, acquiring, and funding the actual radios (GAO,

[23] Prior to forming a type 1 program, the services had separate next-generation radio programs that were loosely connected (according to a conversation with Jeffrey Drezner on February 5, 2020).

[24] DoD typically uses the term *JPO* rather than *JPMO*.

2003). Subordinate PMs from different lead services oversaw five related programs:

- the JTRS Network Enterprise Domain
- JTRS Ground Mobile Radio (GMR)
- JTRS Handheld, Manpack, and Small Form Fit
- JTRS Airborne Maritime/Fixed Station
- JTRS Multifunctional Information Distribution System (GAO, 2003).

The JTRS program was correspondingly subdivided into clusters, in which each respective service was assigned to take the lead (see Table 2.3 for the initial organizational structure, including the participating services within each cluster). Like with DCGS, different combinations of contractors and contractor teams were being used to develop JTRS clusters.

In addition to taking the lead responsibility for the JPO, which oversaw the development of the waveforms and cryptographic algorithms, the Army took the lead on cluster 1, approximately 139,000 radios; Special Operations Command took the lead on cluster 2, approximately 117,000 radios; the Navy took the lead on cluster 3, approximately 7,500 radios; and the USAF took the lead on cluster 4, about 9,500 radios. From an acquisition schedule perspective, the clusters were envisioned to be developed and produced in order, with cluster 1 reaching full-rate production before cluster 2 and so forth; the separation between cluster 1 and cluster 4 was envisioned to be approximately two years (GAO, 2003).

The program encountered competing technical issues, and, although there were many proposed solutions to address the problems, the issues led to a changing and unstable set of requirements that the JPO struggled to resolve. This resulted in major schedule delays, large cost overruns, and a Nunn–McCurdy breach.[25] To address the key problems, the JTRS program underwent a major restructuring program in 2005 (Oppenheim, 2006). In its revised form, a higher-level JPEO was created and led by the Navy. The

[25] A Nunn–McCurdy breach occurs when a program's cost growth exceeds its statutory thresholds. It is named for amendments to the U.S. Code introduced by Senator Sam Nunn and Representative Dave McCurdy (Pub. L. 97-252, 1982) and codified at 10 U.S.C. § 2433.

TABLE 2.3

Programmatic Organization of the Joint Tactical Radio System and the Clusters

Program or Cluster	Platform	Lead Service	Deliverable	Other Services Involved
JPO Network Enterprise Domain		Army	33 waveforms and 26 cryptographic algorithms	USAF, USMC, and Navy
Cluster 1: GMR	Helicopters and ground vehicles	Army	A four-channel aviation set, a three-channel ground-vehicle radio, 21 legacy waveforms, and a wideband networking waveform; ~139,000 radios total	USAF and USMC
Cluster 2: Handheld, Manpack, and Small Form Fit	Handheld or manpack	Special Operations Command	A one- and two-channel handheld set and a two-channel manpack set; ~117,000 radios total	USAF, Army, USMC, and Navy
Cluster 3: Airborne Maritime/ Fixed Station	Maritime and fixed station	Navy	A four-channel maritime fixed-station set; ~7,500 radios total	USAF
Cluster 4: Multifunctional Information Distribution System	Airborne	USAF	Eight-channel aviation sets; ~9,500 radios total	Army, USMC, Navy, and Special Operations Command
Cluster *x*	Embedded	Army	To be determined	To be determined

SOURCE: GAO, 2003.

NOTE: WNW = wideband networking waveform.

JPEO implemented the following changes: a more centralized management structure, a constrained and incremental approach to developing requirements, an expanded schedule, and a reduction in the number of waveforms. Ultimately, the restructured JTRS program was planning to deliver or has delivered key capabilities in four of the five major areas. However, most notably, the GMR—one of largest parts of the JTRS program—was ultimately canceled in 2011.

Potential Benefits

Type 5 programs are often former type 1 programs that have changed as organizational requirements changed. This type of program offers the flexibility to evolve with program requirements, as well as possible threat changes over time. But type 5 still allows for cross-Component interaction during the formal acquisition process.

Challenges

Type 5 programs can require more initial planning to design and structure the program. This type of program draws on elements of types 1, 2, and 3, so the program design process might use more resources during the initial planning process than the other types do. Because programs can evolve, sometimes programs become type 5 by default rather than by design. This can happen if a program management office underestimates the capability of the technology that would be necessary to address diverse Component requirements. For example, identifying software that can be a universal solution to wide-ranging, diverse requirements can be challenging and can lead to program evolution.

Summary of Expected Benefits and Challenges

The first three types of joint programs come with various benefits and challenges, listed in Table 2.4. In many ways, the fully integrated joint program, our type 1, comes with the most potential benefits, which include potential cost sharing over the acquisition and life cycle of the system or capability across the participating Components. However, this kind of program can also come with key compromises that can translate to acquisition risk. That is, through the process of jointly developing requirements, some sacrifices might have to be made to accommodate other Components' needs; thus, the joint system or capability might be suboptimal for all of the participant Components.

Lead Component–coordinated (type 2) and single-Component shared (type 3) programs provide less potential cost savings, as well as the first or lead Component's level of sacrifice than type 1 programs. Still, these types

TABLE 2.4

Summary of Expected Benefits and Challenges for Different Types of Joint Activities

Type	Expected Benefits	Challenges	Example
1: Fully integrated	• Reduced cost, including development and production costs, across the acquisition process for all participants • Distributed risk (e.g., technological, among participants) • Reduced long-term life-cycle or sustainment cost	• More difficult than other programs to execute because of wider stakeholder community of needs • Often a longer acquisition schedule than if run as a single-Component program • Possible common vulnerability of system or capability across Components • Possible impact on industrial base (less competition in industry)	• FSM • Defense Integrated Military Human Resources System
2: Lead Component–coordinated	• Limited development cost sharing and possible cost reduction among participants • Reduced cost and risk for following Components	• Limited ability for following Components to affect the end system or capability • Possible common vulnerability of system or capability across Components • Possible impact on industrial base (less competition in industry)	• Utility Tactical Transport Aircraft System

Table 2.4—Continued

Type	Expected Benefits	Challenges	Example
3: Single-Component shared	• Accrued benefits to following Components • Cost and risk reduction • Can result in faster fielding of system or capability than a new-start program • Might not need to stand up a separate program management office	• Even less ability than in type 2 for a following Component to affect the end system or capability • Common vulnerability for system or capability • Possible impact on industrial base	• M1A1 Abrams tank
4: Confederated	• Shared science and technology risk across participating Components	• Typically limited to activities rather than programs—if a program is initiated, it becomes type 1, 2, or 3	• FSM • Joint Tactical Unmanned Aerial Vehicle • Joint robotics
5: Hybrid	• Flexibility in program design • Cross-Component interaction during the formal acquisition process	• Might require more initial planning other types to design and structure	• Distributed common ground system • Joint Tactical Radio System

of programs can offer large potential savings for the participating Components, with some possible compromise on the end system or capability. All three program types offer long-term life-cycle sustainment benefits through economy-of-scale effects, but they also raise the possibility of long-term industrial base issues, with contractors and suppliers having fewer programs for which to compete. This latter issue could represent a major issue for DHS because much of its industrial base might be deriving systems or capabilities from the much larger commercial market or the defense contractor base.

Types 4 and 5 provide some advantages by establishing the foundations for shared costs, risks, and increased interoperability. The amount of advantage that the participating Components receive aligns with the requirements and cooperation of the stakeholders.

It is worthwhile to reiterate that the categorization of joint programs can change based on the program's current phase of the acquisition cycle. In some cases, fully joint integrated programs are required by law, or the Components foresee the mutual benefit in pursuing such an integrated program. For this type of program, the requirements are typically mutually developed, and changes require concurrence between the participating Components. In other cases, the Components might join a program after a lead Component demonstrates the performance of a system or capability, which creates opportunities for other Components to capitalize on it by reducing or eliminating their development risk and cost while potentially reducing their life-cycle costs. This can occur during any time during the acquisition schedule; however, often, the later the decision is made, the less likely it is that there will be major changes that can be integrated into the program.[26]

In practice, joint programs can represent different types of categories to different Components, depending on the participating Components' roles. One example is the JLTV, a program to replace light transport vehicles for some of DoD. For the Army and USMC, this is a fully joint integrated program as mandated by public law (Pub. L. 109-163, 2006, § 114). However, to USAF, it is something different because it only recently decided to replace some of its high-mobility multipurpose wheeled vehicles (HMMWVs) with

[26] As noted earlier, in DoD, there are range of joint programs between types 2 and 3 as presented here.

JLTVs;[27] hence, for USAF, this program could represent more of a type 3 program. Thus, should DHS elect to acquire JLTVs within its force structure (e.g., within CBP's reconnaissance and surveillance force), that acquisition will more than likely be a type 3 program.

Type 4 confederated activities, particularly those that involve science and technology programs, have produced long-term capability in DoD, particularly in high-risk areas that involve advanced technologies. These programs can serve to pool resources at an early phase through science and technology activities to demonstrate concepts or capabilities before official programs of record are initiated. As a result, coming out of a type 4 activity, any program (joint type 1 through 3 or even single-Component programs) can be developed and produced with reduced risk using the lessons of the precursor confederated activity.

Interestingly, several of the larger software-based or IT programs that we would have called type 1 at one time (e.g., DIMHRS) became something else, sometimes type 5. Possible reasons for this include that a program management office might have underestimated the amount of overlap between stakeholder requirements, the level of customization desired, and compatibility with legacy hardware. Essentially, joint software or IT programs might look straightforward in theory but prove much more difficult to build in practice. Many of the DoD software and IT systems that were problematic at one point were anticipated to produce usable, residual systems or capabilities directly either through a reorganization of the joint program or through a reconstituted service branch program but with significant cost increases and schedule slips. For DHS, where smaller-scale programs might be more appropriate, or if the participating Components have requirements that are more closely aligned, these joint software and IT issues might not pose as large of a challenge as they have in DoD.

[27] The decision to make an initial buy of 140 production JLTVs was made in 2018. It is expected that USAF will acquire many more, perhaps replacing its entire fleet of HMMWVs (see Insinna, 2017).

CHAPTER THREE

A Framework for Engaging in Joint Activities

Joint programs and activities potentially offer numerous benefits to Components, but they can also come with challenges that, if not addressed, can lead to failure to deliver the desired capability. To address these and other relevant issues, we created a framework as an overall approach for thinking about engaging in joint activities:

1. Decide whether to consider forming a joint program.
2. Select the type of joint program.
3. Structure the joint program.

Each of these elements of the framework is explained in this chapter in more detail. In addition, we describe guidelines to follow for structuring joint programs.

When to Form a Joint Program

Conditions for Forming a Joint Program

The first part of the framework is to decide whether a joint program is the best option for the acquisition or capability need that two or more Components have. When deciding on whether forming a joint program will increase the likelihood of delivering the desired capability without cost growth and within the desired schedule, knowing the initial conditions is key. Components should understand their own requirements before participating in any joint programs with other Components. After this, they can

determine whether they have synergy with other Components. As discussed in Chapters One and Two, Components might consider forming joint programs when they have similar acquisition needs, need to leverage technical expertise, or need to increase budget availability to develop systems or technology.

A Mandate to Form a Joint Program

Sometimes, forming a joint program is not optional, as in the case of a congressional or DHS leadership mandate. Congress or DHS leadership might mandate a joint program, but, because Congress and DHS leadership do not do the analysis, it is up to the Components to determine ways to achieve maximum benefits from such a program. Even in the case of mandate, the Components should develop their own requirements before engaging in any joint activities.

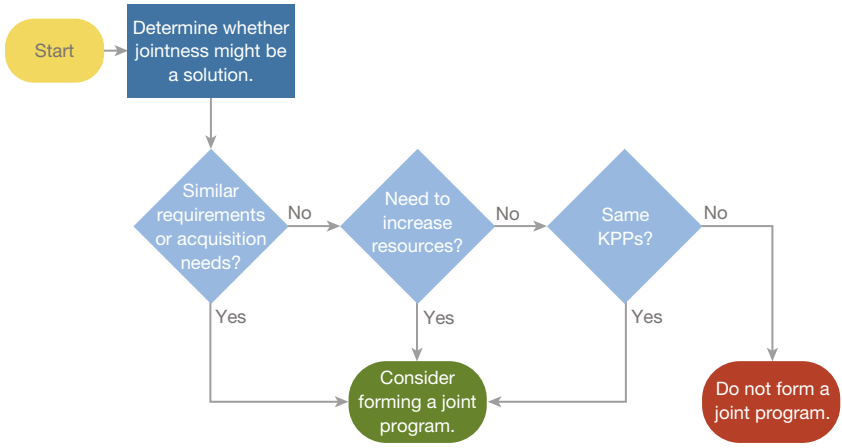
A Decision Tree for Joint Program Formation

Figure 3.1 shows a decision tree with steps to aid in deciding whether a joint program might make sense. If Congress or DHS leadership has mandated a joint program, a joint program must be formed, but the questions posed in the decision tree might still be useful for the initial analysis. The purpose of the figure is to illustrate how to determine whether the initial conditions are present for forming a joint program. To use the decision aid, begin at the yellow "Start" button and continue to the rectangle, "Determine whether jointness might be solution." The next step is to determine whether forming a joint program could benefit the participating Components. By answering questions about whether two or more Components have similar requirements,[1] sufficient resources, and similar performance parameters,[2]

[1] If capability gaps and mission needs (CASP, CAR, and MNS) align with those of other Components, then perhaps joint could be considered as a future possibility, depending on the requirements (ORD). Components can use the acquisition for their different missions and to fulfill their specific capability gaps, but, if the requirements (ORD) are similar, this is the time to consider jointness.

[2] Key performance parameters (KPPs) are one area in which jointness can be identified. Possible jointness can be identified earlier than the development of KPPs if the

FIGURE 3.1
Determining Whether Conditions are Right for Considering a Joint Program



DHS can determine whether forming a joint program would be beneficial. If the answer is yes to any of the questions posed in the figure, a joint program should be considered.

Selecting the Type of Joint Program

Once the decision has been made to form a joint program, the next step is to determine what type of program would be most suited to achieving the desired outcome. This is the next part of the framework. How should DHS structure joint programs to manage costs, schedule, and performance more effectively and to avoid cost growth that has sometimes occurred with joint programs? Studies on jointness, specifically in the government space sector, offer some insights and guidance that might be applicable to DHS (National Research Council, 2011; Johnson, Hilgenberg, and Sarsfield, 2001). Before

Components find commonality of requirements. Knowing the jointness, if any, depends on the type of program. For type 1, for example, jointness would be identified early, but, if the program is a type 3, jointness might be identified later. The more joint the collaboration, the earlier the KPPs should be developed.

any joint program can be created, possible synergies need to be determined. These are determined by assessing the needs of potential partners. Components must first independently determine their own, then evaluate those of any potential partners (National Research Council, 2011). Once this analysis is complete, each Component can develop and evaluate multiple conceptual designs.

We identified four major prerequisites:

- requirements
- development resources (which include funding and subject-matter expertise)
- schedule
- KPPs.

The four prerequisites are based on analysis of key inputs for joint programs and previous RAND research on the motivations for engaging in joint activities, as well as the areas in which misalignment has caused undesirable outcomes, such as cost or schedule growth. Although schedule is not one of the three conditions (similar needs or requirements, need to increase resources, and same KPPs) for considering whether to engage in a joint activity, schedule should be factored into the decision for selecting program type. The degree of alignment between Components in the four major prerequisites will determine the type of program the Components should consider. To facilitate joint program type selection, we have devised a notional checklist, shown in Table 3.1. As we have explained, joint programs can evolve over time as requirements, threats, and other considerations change.

The first column in this table lists each type of joint program discussed. Within each type, there are two Component rows. For simplicity, we limit the placeholders for Components under each type to two to represent two Components that could be forming a joint program. The four prerequisites are then listed as columns. A plus sign for a Component indicates that the Component has met the prerequisite. Two plus signs (one for each Component) for a prerequisite indicate alignment, while a plus and a minus sign in either order indicates a lack of alignment. For example, if all prerequisites are met (two plus signs in the two Component rows), a type 1 program should be considered. If one Component has the funding (plus sign) but one

TABLE 3.1
Notional Chart for Selecting a Type of Joint Program

			Resources			
Type	Component	Requirements	Sufficient Funding	Expertise	Schedule	Performance
1	1	+	+	+	+	+
	2	+	+	+	+	+
2	1	+	+	+	+	+
	2	+	–	–	+	–
3	1	+	+	+	+	
	2	+	–	–	–	
4	Technology programs might be more loosely aligned than acquisition programs.					
5	As programs transition from one type to another, alignment between categories might change.					

NOTE: + = the Component meets the prerequisite. Two plus signs (one for each Component) for a prerequisite indicate alignment, while a plus and a minus sign in either column indicates a lack of alignment. We use this table to illustrate a way to organize thinking about selecting a joint program type. But varying degrees of alignment are possible, and a table cannot capture all of the nuances for each case. Joint programs can evolve over time, and how prerequisites are met might evolve as well.

does not (minus sign), this would be a type 2 or type 3. Evaluating the schedule and KPPs would determine which of the two would be more appropriate. If types 1 through 3 do not seem suitable, type 4 or 5 should be considered.

If the prerequisites are well-aligned and benefits are achieved equally, they are *synergistic*. If the prerequisites are poorly aligned with inconsistently or unequally shared benefits, they are nonsynergistic. However, Components can still form a joint program by selecting the appropriate type. Regardless of the synergy, the Components maintain autonomy by sharing authority over the system. In the case of type 1, because they are sharing authority over the system, the system should equally execute both Components' missions, but they must select a system that delivers approximately equal mission benefit to both partners (Dwyer et al., 2014).

Organizational Alignment

Once the program type is known, the program can then be structured to minimize the cost growth that has sometimes characterized past joint programs. Organizational alignment of certain key elements—mission responsibility, decision authority, expertise, and budget—can help reduce the possibility of cost growth (Dwyer et al., 2014). The specific alignment and the order in which they are applied can affect the program's success. The following principles should be applied, in the order listed, to facilitate designing a structure that maximizes success (Dwyer and Szajnfarber, 2014; Dwyer et al., 2014):

1. *mission responsibility and decision authority.* Authority and responsibility should be aligned so that Components have the power to make decisions about the systems that execute their missions. This avoids delay in decisions.
2. *budget and decision authority.* These should be aligned so that Components can consider cost when making decisions.
3. *expertise and decision authority.* This feature provides a system of checks and balances and prevents one Component prioritizing its unique mission over the shared mission of the joint program. This also helps ensure that Components make informed and effective decisions.

If the requirements are nonsynergistic and the potential program uses shared authority, a structure that can be modularized so that Components' missions can be decoupled should be used. This structure should (1) align responsibility and authority, (2) be modularized with each Component having assigned authority over the parts that execute its unique missions, and (3) use the same sets of engineering and mission assurance standards (Dwyer et al., 2014). In addition, prioritizing the joint program will contribute to achieving its goals. When each entity considers the collaboration one of its highest priorities, success is likelier (National Research Council, 2011).

Many considerations are required when deciding whether to form a joint program and then what kind of structure that program should have. The type of program and structure can help limit the possibility of increased costs.

Characteristics of Successful Joint Programs

Looking at literature on lessons learned from interagency collaborations, successful joint programs should exhibit the following characteristics (Drezner, Roshan, and Whitmore, 2017; Johnson, Hilgenberg, and Sarsfield, 2001; National Research Council, 2011):

- a small and achievable list of priorities
- a clear process to make decisions and settle disputes quickly
- clear lines of authority and responsibility for the project
- well-understood participation incentives for each agency and its primary stakeholders
- single and clear processes for acquisition, funding, cost control, and review
- adequate funding and stakeholder support to complete the task.

In addition, a single line of funding is preferable to multiple funding sources from different appropriations. Policy considerations that can be used in a framework for structuring joint programs include the importance of requirements. Participants in certain types of joint programs need to have stable and identical requirements (Lorell et al., 2013). In the next sections, we discuss elements to consider when forming joint programs.

Guidelines for Structuring Successful Joint Programs

In this section, we pull together the elements explained in previous sections to provide an overall view and create a path for forming joint programs. Because joint programs are likely to be formed in DHS, we also outline some general guidelines and principles for the formation of joint programs in two technical appendixes.

- In Appendix A, we list specific questions, drawn from National Research Council, 2011, to answer to guide the decisionmaking process when thinking about forming joint programs.

- In Appendix B, we provide a checklist and questions, based on Johnson, Hilgenberg, and Sarsfield, 2001, for selecting program elements to include in joint programs.

Some best practices (Drezner, Roshan, and Whitmore, 2017; Johnson, Hilgenberg, and Sarsfield, 2001; National Research Council, 2011) determined for space and earth science missions, which involve multiple agencies collaborating, may be applicable to the formation of DHS joint programs. Before forming a joint program, Components should engage in a formal decision process to assess the level of collaboration that would be most suitable. It is important to make strategic decisions before examining the more tactical aspects of the collaboration (Drezner, Roshan, and Whitmore, 2017; Johnson, Hilgenberg, and Sarsfield, 2001; National Research Council, 2011). The following guidelines for forming joint programs, based on lessons learned from the government space sector, might work well for DHS and its Components because they are general enough to be customized to specific missions (adapted from Drezner, Roshan, and Whitmore, 2017; Johnson, Hilgenberg, and Sarsfield, 2001; and National Research Council, 2011):

- *Understand requirements*. Understand fully an individual Component's own requirements.
- *Identify common needs*. Explore where commonality exists with other Components.
- *Develop and document requirements*. Create a well-formed requirements document that allows explicit trade-offs between priorities as necessary and provides a foundation for resisting changes in mission scale and scope.
- *Establish policy*. Create a joint, signed implementation plan and document it in an MOU to provide a foundation for the relationship. The document should define a chain of command, outline roles and responsibilities, and describe measures for dispute resolution. It should also explicitly explain how requirements are to be decided and resource disputes resolved. This implementation plan supersedes individual agencies' policies in the event of conflict, even if the Components change their internal policies.

- *Develop a common CONOPS.* Use a common, agreed-upon CONOPS. It can evolve but needs explicit agreement at the beginning.
- *Identify a single acquisition authority.* Identify a single acquisition authority to be used by Components.
- *Use a single systems-engineering process.* Create a single, well-defined established systems-engineering process with a chief system engineer, if necessary. Avoid redundant milestone review and appeal processes.
- *Include risk mitigation.* Include risk mitigation at every stage of development. This should cover beginning to end—from identification of the potential partners and respective roles to project management and acquisition to working with the administration and Congress to ensure mission success.

Summary

If a Component is thinking about forming a joint program and wants to evaluate its feasibility, it should understand its own requirements before participating in any joint programs with another Component. After this, it can determine whether it has synergy with other Components. If a joint program has been mandated, the next step is selecting the type of program. But if Components are considering whether to form a joint program, they should analyze the alignment of requirements, resources, and KPPs to determine whether a joint program might best meet their goals. If any of the initial conditions is met, Components should consider forming a joint program. But if none of the conditions is met, a joint program should not be formed.

If Components must or have decided to form a joint program, they should select the type of joint program by examining the degrees of alignment of requirements, resources, schedule, and KPPs. Once a program type has been selected, the Components can develop the structure and implement the program. Joint programs within DHS can be successfully implemented with proper alignment of authority, mission responsibility, budget, and expertise between collaborating Components. Successful collaboration is more likely when each agency considers the partnership one of its highest priorities (National Research Council, 2011). By implementing best practices

and addressing policy questions before and during formation of the joint program, DHS can increase the probability of success in joint programs.

CHAPTER FOUR

Conclusion and Recommendations

Because DHS might want—or, in the case of congressional mandate, need—to form joint programs, understanding what makes joint programs successful and how to mitigate challenges and exploring the different types of joint programs along the jointness spectrum could be very useful. Components might be motivated to reduce costs in developing, producing, and supporting technologies to minimize risk by sharing them with other Components, to leverage other Components' expertise, and to augment budgets.

We developed a framework with three steps to help guide DHS in thinking about joint program formation. First, the Components should decide whether to form a joint program. This is determined either by congressional or DHS leadership mandate (i.e., not optional) or by Components. If the Components have similar requirements; need to increase resources, such as funding or expertise; or have the same KPPs, they should consider forming a joint program.

Second, Components decide what type of joint program would suit their requirements. We identified five types along the jointness spectrum. The amount of collaboration varies from fully integrated joint (type 1) to confederated (type 4), with other types in between. There is a "catchall" type called hybrid (type 5). It incorporates various characteristics of the other four types. All five types are detailed in Chapter Two, along with the benefits and challenges of each and corresponding specific examples. Although each type is described separately, many joint programs evolve into different forms over time to respond to changing threats or requirements. Adequate preparation, such as individual Components determining their own requirements prior to forming a joint program, can help realize the benefits while minimizing the pitfalls of unanticipated costs and schedule delays.

Third, there are several guidelines, detailed in Chapter Three, which assist in forming joint programs. In general, strategic decisions should be made before tactical ones because the former would enable the latter. We list decisions in the order in which they should be made:[1]

- Understand individual Components' requirements.
- Identify common needs.
- Develop and document requirements.
- Establish policy with a signed MOU.
- Develop a common CONOPS.
- Identify a single acquisition authority.
- Use a single systems-engineering process.
- Include risk mitigation.

In the appendixes, we list questions to be answered regarding each of these topics. Answering questions about acquisition, program management, program control, requirements management, funding stability, customer responsiveness, cultural alignment, and staffing can help clarify which type of program would be most suitable and how to execute it.

Recommendations

When implementing the framework, consider the benefits and challenges of joint programs. Given a demonstrated commonality of mission and need across the many DHS Components, we recommend considering the full spectrum of joint programs as a way to move forward in acquiring future systems and capabilities. For example, for very high-risk areas, especially those involving advanced technology, such as harnessing artificial intelligence, Components could collaborate in a type 4 joint activity even before official programs of record are put in place. This relationship could serve as a "technology push" across the DHS Components, potentially placing the department ahead of the usual "requirements pull" approach often used to

[1] These are adapted from Drezner, Roshan, and Whitmore, 2017; Johnson, Hilgenberg, and Sarsfield, 2001; and National Research Council, 2011.

address capability gaps. This kind of collaboration could provide the foundation for further joint programs that field capabilities.

If Components decide to form a joint program, we recommend prioritizing the joint program and aligning the missions to increase the likelihood of achieving the intended goal. Successful collaboration is more likely when each entity considers the partnership one of its highest priorities (National Research Council, 2011) and will have the missions of the Components aligned. As threats evolve and the goals change, the new missions must also be synchronized to keep mission alignment consistent throughout a joint program's lifetime. In addition, aligning authority, expertise, and budget maximizes the possibility of success.

Overall, our recommendations can be summarized in terms of the framework. Each Component should understand its own requirements before exploring development of requirements with other Components and considering whether participation in any joint programs with another Component makes sense. After each Component evaluates its own requirements, it can determine whether it has synergy with other Components:

- First, determine whether a joint program is mandated or whether it serves the best interests of participating Components.
- Then select the type of joint program by examining the degrees of alignment of requirements, resources, schedule, and KPPs.
- Finally, by implementing best practices and addressing policy questions before and during formation of the joint program, DHS can increase the probability of successful joint programs.

APPENDIX A

Questions to Determine Elements for Joint Programs

Certain questions need to be answered *before* forming joint programs to determine what elements should be included. They are designed to maximize the program's success by highlighting areas that need participants' attention. The answers can help illuminate whether forming a joint program will benefit the Components individually and DHS overall. In this appendix are high-level questions to consider, derived from National Research Council, 2011, where the complete list can be found:

- evaluation
  - What are the arguments for and against forming a joint program?
  - How real are the potential synergies?
  - What kind of joint program is being contemplated? (See Chapter Two.)
  - Who is advocating for or requiring it (e.g., Congress, Component leaders)?
  - What does each Component bring to the partnership?
  - How will agreement be secured among stakeholders?
  - Who is tasked with building and maintaining consensus?
- funding
  - How much will each Component contribute?
  - How much of each Component's future funding is tied up in the program?
  - How will Components be affected if the program starts to fail?
  - Are any members of Congress supporting the program's funding?

- policy
  - How high does the joint program rank on each agency's priority list?
  - What level of leadership support is available for the project at each agency?
  - How will project decisions be made?
  - Are there clear lines of authority, responsibility, and accountability?
  - Is there an agreed-upon decisionmaking process that includes an effective dispute resolution approach?
  - Are the respective organizations adequately defined and structured in accordance with agreed-upon roles and responsibilities?
- systems engineering
  - Is there an agreement on a single process for systems engineering?
  - Is there an agreement on a single process for requirements definition?
  - How will project decisions be made, and who is empowered to make them?
  - What provisions can be made to ensure clear communication?
  - To what extent do the participants trust and respect each other?
- acquisition
  - Which Component's acquisition process will be used? Which quality assurance process?
  - Are there independent cost estimates at each major milestone, and is there a process for reconciling differences between the project office's estimates and independent estimates?
- operations
  - Is there an agreement on a single operational concept, and, if so, what is it?

APPENDIX B

Selecting Programmatic Elements

Once a joint program type has been determined, specific processes and principles for structuring the program can be addressed. In laying out the structure for joint programs, certain programmatic elements should be considered for inclusion. The following checklist and sample questions, as described in Johnson, Hilgenberg, and Sarsfield, 2001, can be used when determining the appropriate elements that joint programs should have to achieve the desired capability. These questions can help guide decisions about structuring joint programs to maximize benefit to participants:

- *acquisition complexity*. Degree of difficulty involved in acquiring a particular program or capability
  - How important is the proposed program to the missions of the parent organization?
  - What mission requirements does the joint program satisfy?
  - What incentives have been identified?
  - Have common agency goals been agreed upon?
  - How does the program support existing and future doctrine?
- *program management*. Organization, structure, and approach taken within the program to accomplish the objective
  - Has an MOU been developed and implemented?
  - Is the MOU robust enough to ensure DHS support?
  - Are the Components seen as competitors or partners?
  - What is the chain of command?
  - Are agency vision statements similar? If not, are there some goals that can be agreed upon?

- *program control*. PM who monitors and influences the operation of a program
  - Is the joint program management drawing on strengths of partner Components sufficiently?
  - Has an acquisition strategy been developed?
  - Are authority and responsibility colocated to allow accountability?
  - How are disagreements resolved?
- *requirements management*. Adjudication, coordination, and implementation of a common requirements-development process for the program
  - Is there CONOPS compatibility? Can the program satisfy multiple mission requirements?
  - How are potential requirements conflicts resolved?
- *funding stability*. Maintaining funding support among the partners over the lifetime of program
  - Has a funding strategy been developed?
  - Are funding goals shared among participants?
- *customer responsiveness*. Program's relationship with its user base (for example, how supportive the users and stakeholders are of the program)
  - Who are the stakeholders?
  - What is the oversight process?
  - How much time does management spend on "educating" stakeholders and securing support?
- *cultural alignment*. Interaction of and implications for the program of the diverse organizational cultures inherited from parent or partner organizations
  - How does the organizational structure facilitate the development of a joint program culture?
  - Is there a common culture among participating Components that will provide the basis for joint program–specific culture?
- *staffing*. Includes the staffing process of the program and the ability to attract qualified personnel to work in the program
  - Has a staffing strategy been developed?
  - What education and training are required of staff?

- What incentives exist to attract staff?
- What incentives are there for Components to send their best people?

Abbreviations

CAR	capability analysis report
CASP	capability analysis study plan
CBP	U.S. Customs and Border Protection
CONOPS	concept of operations
C-UAS	Counter Unmanned Aircraft Systems
DAU	Defense Acquisition University
DCGS	distributed common ground system
DHS	U.S. Department of Homeland Security
DIMHRS	Defense Integrated Military Human Resources System
DoD	U.S. Department of Defense
DoDD	Department of Defense directive
EMD	engineering and manufacturing development
ERP	enterprise resource program
FSM	Financial Systems Modernization
FY	fiscal year
GAO	U.S. Government Accountability Office
GMR	Ground Mobile Radio
IT	information technology
JLTV	Joint Light Tactical Vehicle
JPEO	joint program executive office

JPMO	joint program management office
JPO	joint program office
JRC	Joint Requirements Council
JRIMS	Joint Requirements Integration and Management System
JTRS	Joint Tactical Radio System
KPP	key performance parameter
LAV	light armored vehicle
MBT	main battle tank
MNS	mission need statement
MOA	memorandum of agreement
MOU	memorandum of understanding
ORD	operational requirements document
OSD	Office of the Secretary of Defense
PM	program manager
S&T	Science and Technology Directorate
TSA	Transportation Security Administration
UAV	unmanned aerial vehicle
USAF	U.S. Air Force
USCG	U.S. Coast Guard
USMC	U.S. Marine Corps
UTTAS	Utility Tactical Transport Aircraft System

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Researchers created a framework for the U.S. Department of Homeland Security (DHS) to determine suitability and structuring of joint activities. The framework consists of a decision aid that incorporates the factors that should be considered when forming joint programs and collaborations, a taxonomy of five types of joint programs along the jointness spectrum, a notional tool for selecting program type, and recommendations for structuring joint programs to increase the likelihood of their success.

Joint programs have been initiated for various reasons, and they are not new to the government acquisition process. Congress has the authority to mandate joint program formation and has sometimes done so for the U.S. Department of Defense. Congress could mandate joint program formation in DHS in the future, and Components could benefit from being prepared in the event of congressional mandate. In addition, DHS leadership could mandate joint program formation, or the Joint Requirements Council could recommend engaging in joint activities. Joint program formation has been used to reduce cross-Component rivalry, and joint programs are often intended to improve cost-effectiveness across programs, both during the acquisition process and throughout the life cycle of a system or capability when acquisition needs are aligned. Beyond cost savings, there are other reasons for pursuing joint programs.

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