



NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

CAPSTONE APPLIED PROJECT REPORT

**ANALYSIS OF RAPID PROTOTYPING
WITHIN THE DOD**

June 2023

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ANALYSIS OF RAPID PROTOTYPING WITHIN THE DOD

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

In support of the Defense Acquisition System and the objective to innovate, the Adaptive Acquisition Framework (AAF) was implemented. The AAF consists of tailorable pathways, which are categorized by the type of acquisition effort. These pathways, when applied effectively, assist in the program management and delivery of the acquired systems. Within the Middle Tier Acquisition (MTA) pathway, there are two areas: rapid prototyping and rapid fielding. The research herein reviews literature and analyzes available data pertaining to rapid acquisition efforts by the Department of Defense (DOD). Upon reaching the end of the prescribed rapid timeline of 5 years, most of the reviewed projects either transition into the next life-cycle phase or mark the development cycle complete. This research discovered, though, that there is a lack public visibility for MTA program metrics, but also an increased interest in oversight of the MTA pathway. While most of the programs analyzed are operating within the 5-year time frame, the most common risks to programs are cost and schedule. On top of that, there are challenges in garnering industry buy-in on acquisition reform and clarifying the pathway management strategy. It is recommended that programs tailor their required reports to alleviate administrative burdens and increase industry education of DOD acquisition strategy to improve partnerships.

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LIST OF ACRONYMS AND ABBREVIATIONS

AAF	Adaptive Acquisition Framework
CAP	Capstone Applied Project
CNO	Chief of Naval Operations
CSIS	Center for Strategic and International Studies
DAS	Defense Acquisition System
DAU	Defense Acquisition University
DAVE	Defense Acquisition Visibility Environment
DOD	Department of Defense
GAO	Government Accountability Office
IG	Inspector General
JCIDS	Joint Capabilities Integration and Development System
MDAP	Major Defense Acquisition Program
MTA	Middle Tier of Acquisition
NDAA	National Defense Authorization Act
PPBE	Planning, Programming, Budgeting, and Execution
RDT&E	Research, Development, Test, & Evaluation
SECNAVINST	Secretary of the Navy Instruction
OASA(ALT)	Office of the Assistant Secretary of the Army (Acquisition, Logistics, & Technology)
OUSD(A&S)	Office of the Under Secretary of Defense for Acquisition and Sustainment
USD(A&S)	Under Secretary of Defense for Acquisition and Sustainment

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I. INTRODUCTION

A. PROBLEM STATEMENT

Over the past decade, there has been a significant push towards rapid prototyping and fielding. This push coincides with the exponential rate of technology advancement, which was predicted by Gordon Moore in 1965 (Britannica, 2023). Moore's law states that approximately every two years the number of transistors on an integrated circuit card will double (Britannica, 2023). This exponential relationship has proven true and significantly impacted technological advancements. While 50 years ago the U.S. government may have been the leaders in technology, that is not true today. Adversaries across the globe are learning from the U.S. military's discarded, broken, and stolen technology. This has closed the technology gap between nations, thus putting the U.S. national security and technical advantage at risk. Streamlining government acquisition will allow acquisition agencies to design, develop, and field new technologies to fill warfighter capability gaps.

Within the Defense Acquisition System (DAS), there is an Adaptive Acquisition Framework (AAF) comprised of six acquisition pathways, as shown in Figure 1. The AAF is implemented to support the DAS in creating a more lethal force through innovation (Office of the Undersecretary of Defense for Acquisition & Sustainment [OUSD(A&S)], 2019). These pathways are designed to manage the incumbent schedule, cost, performance baseline requirements, as well as risks of the capabilities to be acquired. The pathways include urgent capability acquisition, middle tier of acquisition (MTA), major capability acquisition, software acquisition, defense business systems, and acquisition of services. The Department of Defense (DOD) may use a combination of these pathways to organize and manage their acquisition efforts to support the delivery of capability at the speed of relevance. The MTA pathway is one new pathway that focuses particularly on both the speed of acquisition and technology development; however, few studies exist analyzing the effectiveness of the MTA acquisition pathway. This capstone applied project fills that research gap.

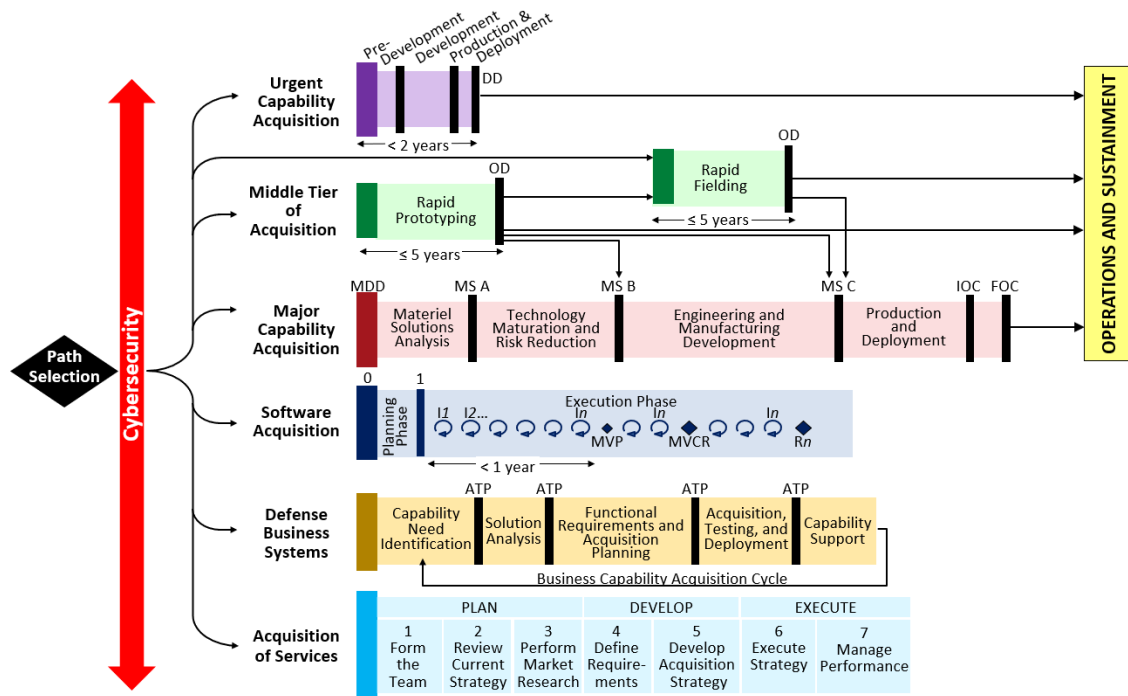


Figure 1. Adaptive Acquisition Framework (AAF) Pathways. Source: Defense Acquisition University (n.d.a).

B. RESEARCH QUESTIONS

The MTA pathway consists of rapid prototyping and fielding, which encourages innovation and rapid development to fill warfighter capability gaps at the speed of relevance. As more projects are utilizing the MTA pathway, their final metrics become available for analysis of effectiveness. The intent of this research is to answer several programmatic research questions about the MTA pathway. The research questions include the following:

1. With a schedule-based MTA pathway, are projects adhering to the rapid timeline of 5 years?
2. While working within the construct of rapid prototyping, what are the highest risks experienced by programs?
3. In addition to risks, are there any barriers to implementation?

4. Are projects successfully transitioning to other efforts, such as rapid fielding?

C. RESEARCH OBJECTIVES

This research endeavors to determine the effectiveness of rapid prototyping projects, which are specifically utilizing the MTA pathway of AAF. Aside from gathering existing reports and the conclusions drawn therein, individual projects and their metrics are analyzed against the requirements of the rapid prototyping pathway. An important metric for the MTA project is schedule because the mere idea of rapid prototyping indicates a sense of urgency. However, the schedule metric must be balanced against cost, performance, and risk constraints. If the projects cannot adhere to the timeline constraint of 5 years maximum, then the project does not fit within the MTA rapid framework. This does not mean to say that the rapid prototype cannot transition into a longer effort or even into a rapid fielding effort, but the segment where the program is conducting rapid prototyping must have a duration of 5 years or less. With such a heavy importance on the schedule, the next factors to consider are the risks to the program. From program management theory, cost, schedule, and performance are interrelated metrics in a balanced triangle, where each corner represents a metric, as in Figure 2. If a corner of the triangle is forced to change, then the other two corners must compensate for the effects. The causes of such changes are risks to the project and the program manager usually prepares mitigation plans. With an immovable schedule, rapid prototyping programs must consider effects to cost and performance, and then subsequently of the effectiveness of transitioning to rapid fielding or to a program of record in the major capability acquisition pathway. This research will address the research questions and provide recommendations for improvement in the effectiveness of the rapid prototyping efforts within the MTA pathway.

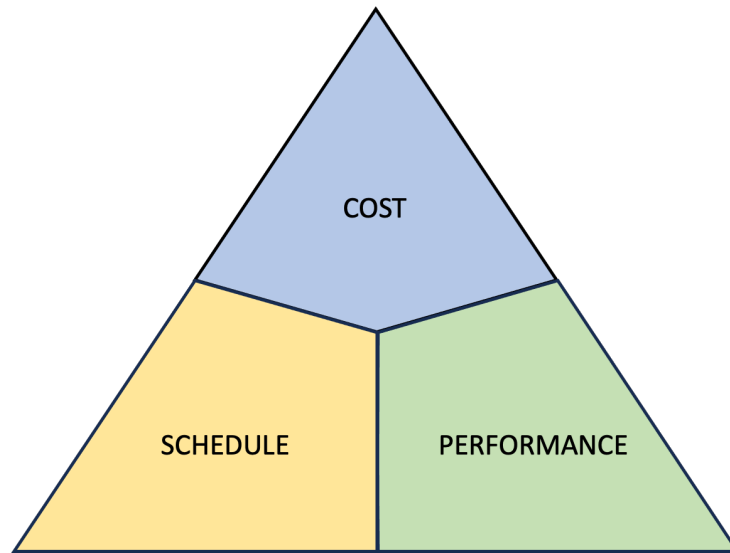


Figure 2. Triple Constraint Diagram

D. METHODOLOGY

Using a comprehensive qualitative literature review, this research analyzes the risks and effectiveness of rapid prototyping projects, considering their immovable time constraint. Furthermore, root cause analysis is leveraged to determine the root causes to barriers and failures of project implementation in 5 years are identified. Finally, the analysis concludes with looking at the average number of rapid prototyping projects, which are transitioning to programs of record or fielding capabilities.

E. SCOPE AND LIMITATIONS

The data collected to conduct research and analysis was restricted by non-disclosure agreements, which did not allow for project metrics to be released publicly. Projects reviewed herein had their metrics publicly reported through government reporting agencies, such as the Government Accountability Office (GAO), RAND corporation, Defense Acquisition University (DAU), Inspector General (IG), and Center For Strategic And International Studies (CSIS). This research focuses only on rapid prototyping projects because there is a larger quantity of rapid prototyping projects, from which data can be analyzed, as compared to rapid fielding projects.

F. SUMMARY

This capstone applied project (CAP) is organized to provide a thorough background for the reader, providing enough information for someone without a background in acquisition. The background chapter is followed by a literature review chapter, which summarizes research and reports already conducted on the MTA pathway and its projects. Chapter IV is an analysis of rapid prototyping program metrics. Concluding this research project is Chapter V, a summarization of the contents, conclusions drawn from the data herein, and recommended actions for the future.

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II. BACKGROUND

This CAP strives to provide enough information, so that anyone may read and understand the topic of rapid prototyping acquisition. For the intent of this research, the topic focus is the MTA pathway within the DOD framework. Government acquisition differs from industry through the prescribed set of regulations and procedures laid out in laws/statutes and the DOD 5000 series of directives and instructions. The federal Defense Acquisition System is laid out in DODD 5000.01 titled *The Defense Acquisition System* and the subcategory of the AAF is defined in DODI 5000.02 titled *Operation of the Defense Acquisition Framework* (OUSD[A&S], 2022a, 2022b).

A. “BIG A” ACQUISITION

Within the DOD, the overarching acquisition process is colloquially referred to as “Big A” acquisition. Inside of this construct, there are 3 processes that work together throughout a program’s life cycle: Joint capabilities integration and development system (JCIDS); planning, programming, budgeting, and execution (PPBE), and DAS (referred to as “little a” acquisition). In Figure 3, the relationship of the 3 processes is shown. JCIDS is a requirements definition process. PPBE applies to resource management. The Defense Acquisition System is tailorable management for acquisition.

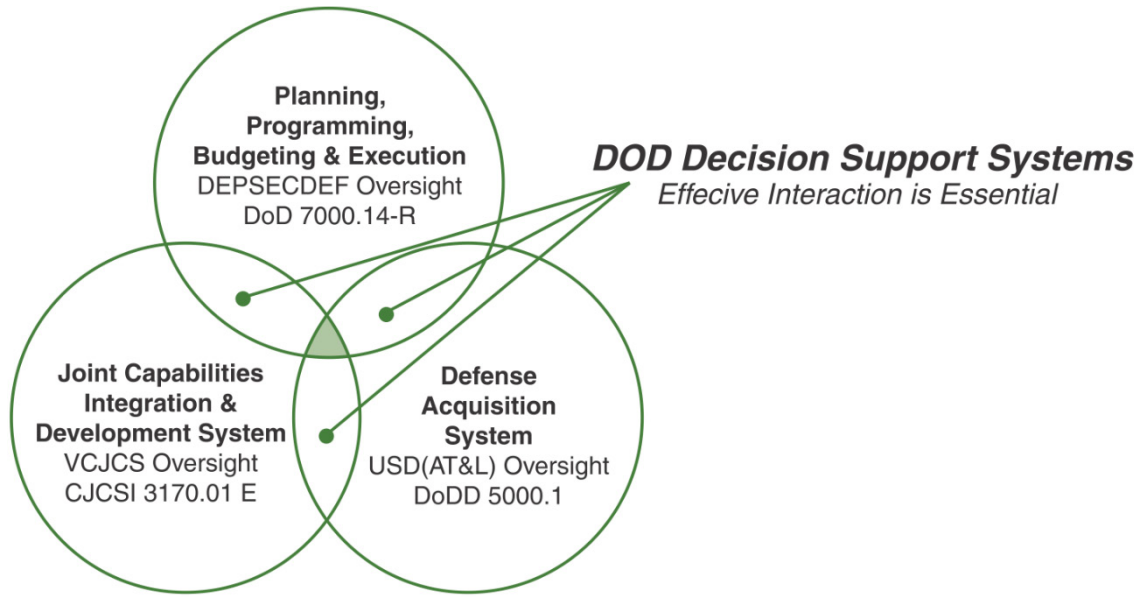


Figure 3. Three Interacting Systems in “Big-A” Acquisition. Source: Moran (2008).

When combined, JCIDS, PPBE, and DAS work cohesively to create an interdisciplinary system, which can effectively manage acquisition programs and provide the necessary oversight (Moran, 2008). “Big A” is set up to accommodate all type of programs and programs use the 3 “Big A” processes in their planning, scheduling, and costing efforts. However, the utilization of the 3 processes of “Big A” varies across acquisition efforts, especially as it applies to management processes and oversight. For example, software acquisition is iterative in nature. Using the traditional waterfall software development methodology, where requirements are defined early and development occurs after design completion, software acquisition was hindered rather than supported. Keeping with this example of software acquisition, software development efforts are generally difficult to estimate in complexity and schedule, as there are requirements that arise throughout the development process. While hardware programs often have a definitive design and completion milestone, software development efforts are fluid and try to deliver minimal viable products on an incremental schedule. Sustainment and logistics of a software program also differ, in that updates to the existing configuration are generally pushed at regular intervals, whereas a hardware platform might roll out a brand-new system

after obsolescence. As more and more development efforts strayed from the traditional path of acquisition used for major capability development, it became apparent that acquisition policy reform was needed. The sequential method of requirements definitions, design, development, production, and sustainment no longer benefit all types of government acquisition.

B. ADAPTIVE ACQUISITION FRAMEWORK

In Fiscal Year (FY) 2016, Title VIII of the National Defense Authorization Act (NDAA, 2015) mandated a review of the acquisition policy and management. These reviews would be across all Services at the highest level. This resulted in an effort to revise and rewrite the DOD 5000 policy series. The revisions to the DOD 5000 series included the Adaptive Acquisition Framework (AAF) (OUSD[A&S], 2019). The AAF is colloquially referred to as “little a” acquisition, as it is a sub-process to the larger “Big A” acquisition described in the previous section. The AAF has six pathways, which a program manager can tailor to their program’s needs. By making the acquisition pathways customizable, government policy and management are hoping to better support the warfighter needs through strategic management. In order to fully benefit from the policy transformation, program managers need to adopt the new mindset of tailoring-in, thinking critically, emphasizing sustainment, and actively managing risks (OUSD[A&S], 2021b). The goal of transforming the policy is to simplify and streamline acquisition, while improving efficiency of the process.

C. MIDDLE TIER OF ACQUISITION – RAPID PROTOTYPING

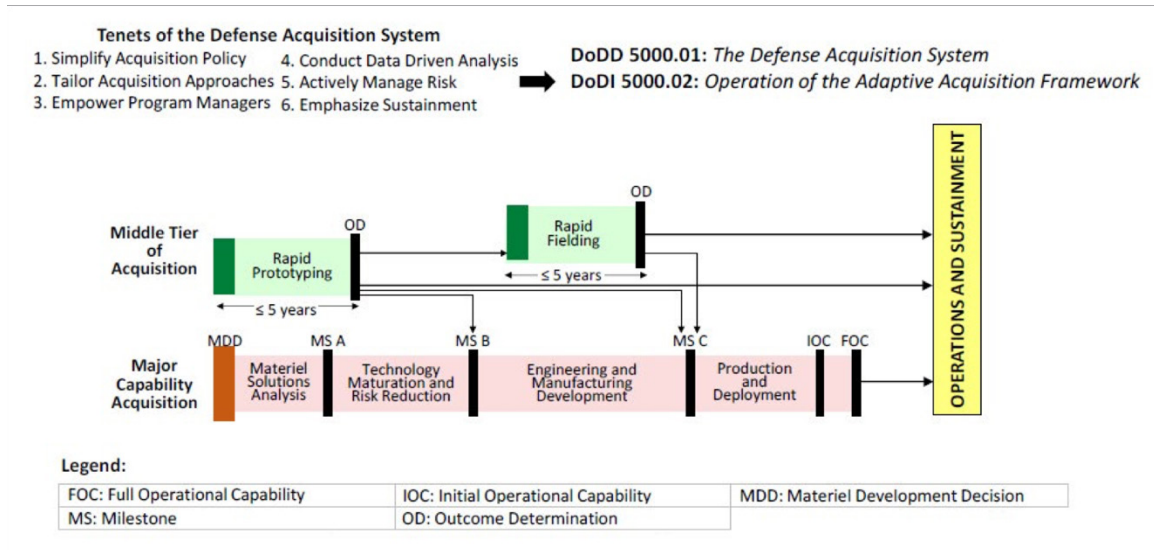


Figure 4. Middle Tier of Acquisition Compared to Major Capability Acquisition. Source: IG (2021).

The MTA pathway in AAF, as defined in DODI 5000.80 titled *Operation of the Middle Tier of Acquisition (MTA)*, contains the two paths for rapid prototyping and rapid fielding, as shown in Figure 4. Rapid prototyping is intended to create fieldable prototypes and mature technology, which could then transition to another pathway in the AAF. The purpose of rapid prototyping is to prove that a technical capability will meet emergent warfighter needs (OUSD[A&S], 2019). The main constraint for rapid prototyping and fielding are that each effort, prototyping, or fielding, must be completed in 5 years or less. There must be an existing level of technical maturity for a programmatic effort to enter these pathways, and their acceptance into the MTA path is merit-based (OUSD[A&S], 2019). Knowing this timeline is compressed, some acquisition requirements have been lessened for projects on this path. The MTA pathway removes the requirement for a program to abide by the traditional JCIDS requirements like a capability development document (CDD) (OUSD[A&S], 2019). Financially, an MTA project does not have a limit; however, if the funding reaches the threshold for a major defense acquisition project (MDAP), then a waiver must be applied for through the Under Secretary of Defense for

Acquisition and Sustainment (USD[A&S]; OUSD[A&S], 2019). The thresholds for the acquisition categories within major capability acquisition are defined in Figure 5.

ACAT	Reason for ACAT Designation	Decision Authority
ACAT I	<ul style="list-style-type: none"> • MDAP¹ (Section 2430 of Title 10, U.S.C.) <ul style="list-style-type: none"> ○ Dollar value for all increments of the program: estimated by the DAE to require an eventual total expenditure for research, development, and test and evaluation of more than \$525 million in Fiscal Year (FY) 2020 constant dollars or, for procurement, of more than \$3.065 billion in FY 2020 constant dollars ○ MDA designation • MDA designation as special interest³ 	ACAT ID: DAE ACAT IB: SAE ² ACAT IC: Head of the DoD Component or, if delegated, the CAE
ACAT II	<ul style="list-style-type: none"> • Does not meet criteria for ACAT I • Major system (Section 2302d of Title 10, U.S.C.) <ul style="list-style-type: none"> ○ Dollar value: estimated by the DoD Component head to require an eventual total expenditure for research, development, and test and evaluation of more than \$200 million in FY 2020 constant dollars, or for procurement of more than \$920 million in FY 2020 constant dollars ○ MDA designation (Section 2302 of Title 10, U.S.C.) 	CAE or the individual designated by the CAE ⁴
ACAT III	<ul style="list-style-type: none"> • Does not meet dollar value thresholds for ACAT II or above • Is not designated a “major system” by the MDA 	Designated by the CAE ⁴
Footnotes		
<p>1. Unless designated an MDAP by the Secretary of Defense (SecDef), AIS programs⁵, Defense Business System programs, and programs or projects carried out using rapid prototyping or fielding procedures pursuant to Section 804 of Public Law (PL) 114-92, do not meet the definition of an MDAP.</p> <p>2. ACAT IB decision authority is assigned pursuant to Section 2430 of Title 10, U.S.C. Paragraph 3A.2.b. provides DoD implementation details.</p> <p>3. The Special Interest designation is typically based on one or more of the following factors: technological complexity; congressional interest; a large commitment of resources; or the program is critical to the achievement of a capability or set of capabilities, part of a system of systems, or a joint program. Programs that already meet the MDAP thresholds cannot be designated as Special Interest.</p> <p>4. As delegated by the SecDef or Secretary of the Military Department.</p>		

Figure 5. Description and Decision Authority for ACAT I–III Programs.
Source: OUSD(A&S) (2021a).

There are three main benefits to the MTA pathway, which are identified by the Defense Acquisition University (DAU) website. Firstly, there is usually a cost saving and risk reduction (Defense Acquisition University [DAU], n.d.b). Because a program is not making a large investment, either monetarily or time-based, then the program can pursue innovative technology that may or may not be adequate. Rapid prototyping also finds a result quickly, which decreases the cost of manpower. Risks will decrease because the effects of a failed or inadequate technical product are resultant of a smaller investment effort. Secondly, MTA opens the door for newer business partners and innovative solutions (DAU, n.d.b). Because these project efforts are smaller than traditional MDAPs and programs of record, the MTA pathway opens the door for potential partners from niche or

small business areas, which are more difficult to connect with on larger program efforts. With incentive for small business innovation and partnership, more creative ideas and solutions can be developed. In complement to the new partnerships with small businesses, there are different contracting methods that could be leveraged in these instances: other transaction and procurement for experimental purposes (DAU, n.d.b). Finally, the third benefit is the acceleration of capability development (DAU, n.d.b). The MTA pathway can use rapid prototyping to kick-start development of technology, which is too immature to join a program of record. Overall, MTA is meant to focus project efforts on specific tasking within a short timeframe, thus minimizing risk to performance and maintaining innovation. The MTA pathway avoids presenting an end-to-end solution, rather zeroing in on integrable parts fulfilling warfighter needs.

D. MIDDLE TIER OF ACQUISITION – RAPID FIELDING

The second pathway withing the MTA pathway is rapid fielding, which boasts the same benefits and risk reductions as rapid prototyping. The intent and end result of a rapid fielding effort differs. Rapid fielding utilizes already proven technologies that require minimal development to create production-level units, which can be used by the warfighter (OUSD[A&S], 2019). Rapid fielding can also be used to kick off integrations and demonstrations of proven technology into more mature defense systems. Just like with rapid prototyping, rapid fielding must conform to the 5-year timeline for project completion. Any projects that transition from rapid prototyping to rapid fielding restart their timeline once the transition is complete.

E. MIDDLE TIER OF ACQUISITION – GUIDANCE

Prior to the DOD establishing their own policy for the middle tier of acquisition, interim guidance was disseminated through a memorandum (OUSD[A&S], 2018). From the interim guidance within the DOD, Services developed their own guidance. In September 2018, the U.S. Army was one of the last Services to establish their interim MTA policy (Office of the Assistant Secretary of the Army [Acquisition, Logistics, and Technology; OASA(ALT)], 2018). The Army referenced the NDAA for FY16 and the memorandum for MTA interim authority and guidance, which was sent out in April of

2018 (OASA[ALT], 2018). With these documents and a couple more, the Army created a document, which designated proper authorities to program offices and program managers in relation to the implementation of the MTA pathway. Aside from granting authority, the Army elaborated on how this pathway fits into “Big A” acquisition. While the MTA programs would still be responsible for adhering to the PPBE process, the JCIDS process would only be used as specifically expressed in the implementing guidance (OASA[ALT], 2018).

A year and a half after the interim policies were created by the Services, the DOD released their official DOD Instruction 5000.80, *Operation of the Middle Tier of Acquisition* (MTA). The purpose of this instruction was to officially delegate authorities, finalize policy, and instantiate processes for the management of the MTA pathway (OUSD[A&S], 2019). As with the interim guidance, Services began to tailor and establish their own policies in reference to the DOD instruction 5000.80. In 2021, the U.S. Air Force released their policy for the operation of the MTA pathway. The Air Force published their document as a supplement to the DOD instruction, which added positional responsibilities specific to the Air Force and common guidance (Secretary of the Air Force, 2021). While the Air Force released policy specifically for the MTA, the U.S. Navy released a policy in 2022, Secretary of the Navy Instruction (SECNAVINST) 5000.2G titled *Department of the Navy Implementation of the Defense Acquisition System and the Adaptive Acquisition Framework*, targeting implementation of all pathways within the AAF. The section of SECNAVINST 5000.2G related to MTA discusses acquisition positional responsibilities, acquisition category designations, and reporting requirements (Secretary of the Navy, 2022). Across all Services, there are standard reporting requirements, but within the MTA pathway the requirements are tailorable, usually at the discretion of each program. With the proper guidance in place, programs across the DOD understand the responsibilities and expectations of an MTA program and how to implement projects within the MTA pathway.

F. SUMMARY

DOD acquisition is composed of 3 different decision support processes: JCIDS, PPBE, and AAF. Combined, these processes form a system colloquially referred to as “Big

A” acquisition, in which each process looks at a different area of acquisition management. JCIDS is a process that focuses on requirements definitions. PPBE focuses on the continuous management of resources, either financial or personnel. The AAF, or “little a” acquisition, implements tailorable pathways to better manage program efforts based on the type of acquisition. Some examples of pathways include software acquisition, urgent capability acquisition, and MTA. Considering that the MTA is a direct result of the NDAA for FY16 and subsequent acquisition reform, there has been a level of interest in understanding the effects of its establishment. With more recent release of policies by the DOD and military Services, more programs are requesting to use the MTA pathway. As more projects utilize this path, there is more programmatic data, which can be analyzed for effectiveness and recommendations for improvement. The next chapter will review literature and available program data to analyze the MTA pathway.

III. LITERATURE REVIEW

While conducting research on the MTA pathway, different reports and articles were found that discussed varying perspectives on the policy, process, and the future of MTA. This chapter reviews those articles, viewpoints, and recommendations.

A. DAU REPORTS

According to the DAU presentations, the budget for MTA projects more than doubled between 2019 and 2021 (LaCamera, 2019; Shepherd, 2021). In 2019, there were 40 programs utilizing the MTA pathway, with a combined budget of approximately \$27 billion (LaCamera, 2019). As shown in Figure 6, the Air Force had the largest budget and number of MTA programs out of all the services.

Type	# Programs	Total \$B
Rapid Prototyping	34	\$26.59
Rapid Fielding	6	\$0.44
Total	40	\$27.03

Component	# Programs	Total \$B
Army	8	\$6.33
Navy	5	\$0.85
Air Force	17	\$18.90
USSOCOM	9	\$0.18
DISA	1	\$0.77
Total	40	\$27.03

Figure 6. MTA Programs and Funding as of April 25, 2019. Source: LaCamera (2019).

Two years later, there would be 74 MTA programs with a combined budget of approximately \$58 billion (Shepherd, 2021). While USSOCOM did not see an increase in MTA programs, the Army, Navy, and Air Force doubled, if not tripled their MTA participation (LaCamera, 2019; Shepherd, 2021). Table 1 shows data reported by Shepherd in his DAU presentation, which directly reflects numbers reported by LaCamera, but updated in 2021. This growth in both budget and number of projects exemplifies the push for rapid development within the government over the last few years. Developing

capabilities at the speed of relevance is a constant battle and plays an important role in filling warfighter capability gaps.

Table 1. MTA Programs and Funding as of January 2021. Adapted from Shepherd (2021).

Type	# Programs	Total \$B	Component	# Programs	Total \$B
Rapid Prototyping	57	\$46.92	Army	16	\$8.93
Rapid Fielding	17	\$11.40	Navy	17	\$6.74
			Air Force	31	\$41.99
			USSOCOM	9	\$0.16
			DISA	1	\$0.50
Total	74	\$58.33	Totals	74	\$58.33

B. RAND CORPORATION REPORT

As more projects utilized the MTA pathway, the RAND Corporation sponsored research into information management for these programs in 2020 in a report titled *Issues with Access to Acquisition Information in the Department of Defense*. The research was based off interim policy and guidance from the DOD and component commands. Using these policies, the RAND Corporation concluded that government information management would face four main challenges and they provided recommendations on how to move forward (Drezner et al., 2020). The four challenges included the volume of information, uncoordinated reporting requirements, a lack of standardization, and overburdening the unburdened path. The referenced interim guidance documents discussed tables of regulatory reports, which could be tailored to the individual program. Unfortunately, the volume of reports poses an initial challenge, as it could lead to a lack of data continuity across programs, thus creating a challenge for information management (Drezner et al., 2020). The RAND Corporation found the second challenge to be that

reporting requirements reviewed were uncoordinated, in that there was not enough detail for specificity of reporting at the component command level. For example, terminology was uncoordinated, which led to the Air Force deviating from common acquisition terminology. The third challenge is a lack of standardization, for example with defining project initiation. To continue with this example, the unstandardized definition of project initiation led to the Navy and Air Force defining this term in their own, differing ways. The final challenge is overburdening the MTA pathway with reporting and regulations. While the MTA pathway removes the requirement to incorporate the traditional JCIDS process, MTA guidance lists numerous required reports and regulations that can be tailored to each program (Drezner et al., 2020). The RAND Corporation discovered that tailoring has proven to be a challenge though (Drezner et al., 2020). If tailoring isn't conducted properly, the administrative reporting burden on a project could outweigh the savings of removing the JCIDS requirement.

As MTA has been adopted by more and more projects in the past 5 years, the DOD is trying to determine how to standardize reporting and project information. Firstly, guidance provided by the Air Force and Navy lists a significant amount of specific data requirements (Drezner et al., 2020). While the information requirements can be tailored, just like the AAF pathways, the data collected will be unique to each program. Furthermore, those requirements are dictated by each military branch, so the guidance between the Air Force, Army, and Navy may differ in terminology, metrics, and level of detail (Drezner et al., 2020). Standardizing the information and terminology within the MTA reporting requirements benefits all services and the DOD reporting system. With standardization, the programs could be compared within the MTA pathway across all services for their cost, schedule, performance, and risk management. Ultimately, the DOD could analyze the benefits of the MTA pathway and provide the Services with recommendations for improvement, but only with data that is similar enough to provide trustworthy comparisons. With the talk of reporting requirements, the bureaucracy and administrative burden that affects all government programs must also be addressed. The MTA pathway is specifically relieved of the requirement to utilize the joint capabilities integration and development system (JCIDS) and there are waivers available if a tailored

set of reporting requirements would benefit the cost, schedule, and performance of a program (Drezner et al., 2020). An example of tailored reporting requirements is shown in Figure 7. Within the figure there are three sections separated into the management plan, statutory requirements, and regulatory requirements. Within each of these sections, all reporting requirements are listed; however, the lighter grey font indicates that some requirements have been tailored-out of the given program’s planning and management. As a result, Figure 7 depicts an overarching view of how the list of reports referenced in MTA operational guidance can be reduced to only include necessary reporting, shown in black and green font. Quantitatively, the statutory and regulatory requirements, in this instance, were reduced from 33 reports to 10. Removing reporting requirements is believed to alleviate the administrative burden on projects, which take up more time and ultimately increase schedule. Because MTA is a schedule-based approach to acquisition with an intent to move rapidly, it was decided to remove certain reports from the requirements to assist programs with their rapid endeavors. With the current structure, it will become a DOD challenge to balance the level of reporting for MTA and the ability to meet the 5-year goal for rapid (Drezner et al., 2020).

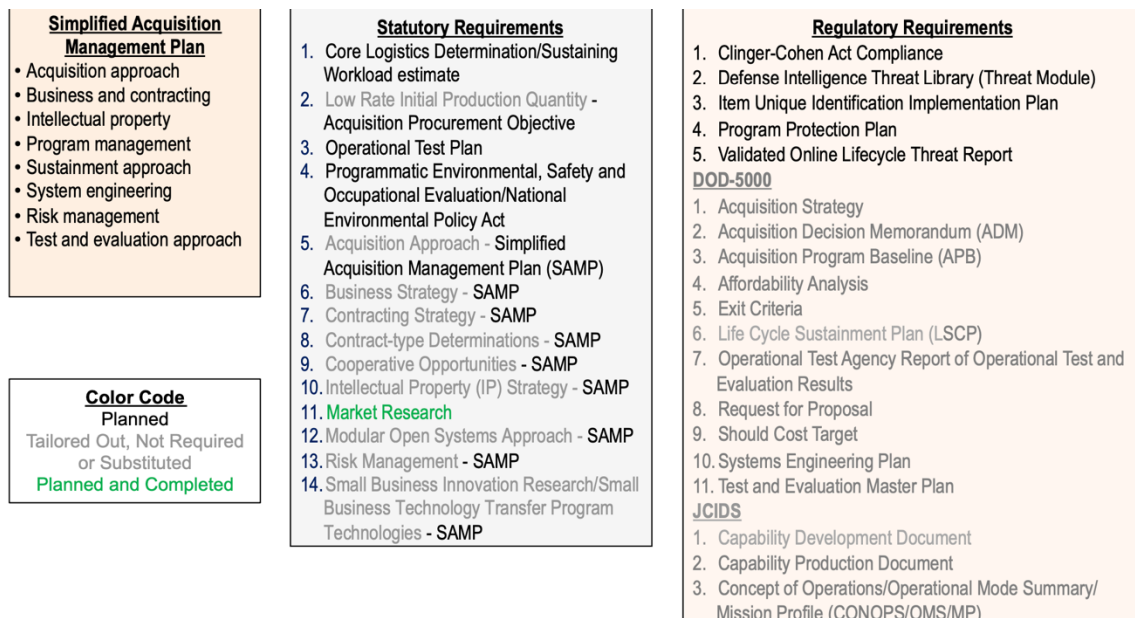


Figure 7. Tailored Documentation Example. Source: LaCamera (2019).

The RAND Corporation provided recommendations for moving forward with the MTA pathway. The four recommendations include letting decision making drive data requirements, minimizing reporting requirements, standardizing where possible, and capitalizing on existing structures (Drezner et al., 2020). By letting critical decisions drive reporting requirements, reports would be minimized to only those necessary by the program management (Drezner et al., 2020). Finally, a core framework of information reporting and collection should be established, which would encourage communication and information sharing across the DOD (Drezner et al., 2020). To establish this core framework, it would be prudent for the DOD to leverage existing information systems and structures, thus increasing the likelihood of successful implementation (Drezner et al., 2020).

C. INSPECTOR GENERAL REPORTS

A conclusion from an Inspector General (IG) audit report, titled *Audit of Department of Defense Middle Tier of Acquisition Rapid Prototyping and Rapid Fielding Programs*, states that the programs have embraced the new culture of acquisition and are effectively utilizing the MTA pathway (Inspector General [IG], 2021). Their findings show that leadership officials are supporting the transition to MTA pathways for those projects that could benefit. While the Office of the Under Secretary of Defense for Acquisition and Sustainment (OUSD[A&S]) provided their DOD official instruction in 2019, interim guidance on rapid acquisition was provided by USD(A&S) and military component commands quickly following (IG, 2021). While the requirement of component commands to create their own processes was straightforward, the documentation and reporting of projects to their oversight authorities was not clearly defined. According to the IG report, MTA information was not consolidated prior to the publication of the DOD Instruction 5000.80 *Operation of the Middle Tier of Acquisition (MTA)* (IG, 2021). There is currently a centralized government system for MTA and other project reporting, called Defense Acquisition Visibility Environment (DAVE) (OUSD[A&S], 2019). Because of DAVE, oversight of MTA projects has improved (IG, 2021). From research gleaned by the IG, time savings were estimated from the use of the MTA pathway instead of a more traditional

path, as shown in Figure 8. Some programs attribute this time savings to the tailorable reporting requirements and decreased documentation allowed within MTA (IG, 2021).

Program	Action	Estimated Time Savings Using the MTA Pathway (in Months)
Counter-Small Unmanned Aerial Systems Phase 0	Developed a rapid fielding requirements document instead of going through the Joint Capability Integration and Development System process.	6
	Used acquisition strategy PowerPoint slides as an acquisition plan and used guardrails, (thresholds that trigger a notice to, or review by, the milestone decision authority) for the program and PEO to monitor instead of creating an acquisition program baseline.	5
Capability Set 21 Integrated Tactical Network	Tailored documentation such as the test and evaluation strategy, acquisition baseline, abbreviated capability development document, and sustainment strategy. Tailoring reduced the amount of required documents from approximately 38-42 documents to 10.	6-12
F-15EX	Developed a rapid fielding requirements document instead of going through the Joint Capability Integration and Development System process.	24
	Tailored documentation such as the program strategy document which combines statutory and regulatory documentation requirements into a single concise document.	6
	Accelerated production by contractor.	12
Next Generation Squad Weapons	Used a simplified requirements document and Army approval.	24-36
Marine Corps Wideband Satellite Expeditionary	Used non-developmental mature commercial off-the-shelf technology instead of developing technology through a traditional Defense Acquisition Systems program.	12
Rapid Opioid Countermeasures System	Used a modified capability development document instead of going through the Joint Capability Integration and Development System process.	12

Figure 8. Examples of Estimated Time Saved by Using the MTA Pathway.
Source: IG (2021).

While the group of MTA projects reviewed by the IG show effective usage of the MTA pathway, there are concerns about increased oversight and documentation, which could affect the effectiveness of MTA. In 2020 and 2021, Congress was unsatisfied with the reports provided by component commands about their MTA projects and,

consequently, requested more detail than what was required by the MTA pathway (IG, 2021). The IG stresses the importance of balancing “oversight of these programs with the risk involved to ensure the efficient delivery of needed, useful, capabilities, at a fair and reasonable cost” (IG, 2021, p.28). While MTA projects are getting more visibility with DAVE, their reports are being scrutinized because they do not fit the standard reporting requirements of the Defense Acquisition System.

D. GOVERNMENT ACCOUNTABILITY OFFICE REPORTS

As implementation of the MTA pathway is still relatively new, most literature focuses on the oversight and transparency of MTA project execution. A recent Government Accountability Office (GAO) report, titled *Middle Tier Defense Acquisitions: Rapid Prototyping and Fielding Requires Changes to Oversight and Development Approaches*, specifically recommends updating the documentation requirements for MTA, as the current policy is unclear (Government Accountability Office [GAO], 2023). The GAO spent most of their analysis and recommendations from February 2023 on documentation, reporting, and implementation principles. Their reasoning for increasing visibility and reporting of MTA projects is that there should be reliable data, from which the DOD can improve their oversight and processes to better serve MTA programmatic efforts (GAO, 2023). Furthermore, GAO compares current MTA project efforts by component command against previously identified principles that leading companies use when developing innovative solutions. Based on these successful principles, none of the component commands had satisfactory implementation of iterative design, closed-loop feedback, creating a business case, and trimming scope as necessary, as shown in Figure 9 (GAO, 2023). Because of previous GAO research from 2022, the GAO recommends all component commands adopt the industry principles, thus moving towards efficient and successful implementation of the MTA pathway.

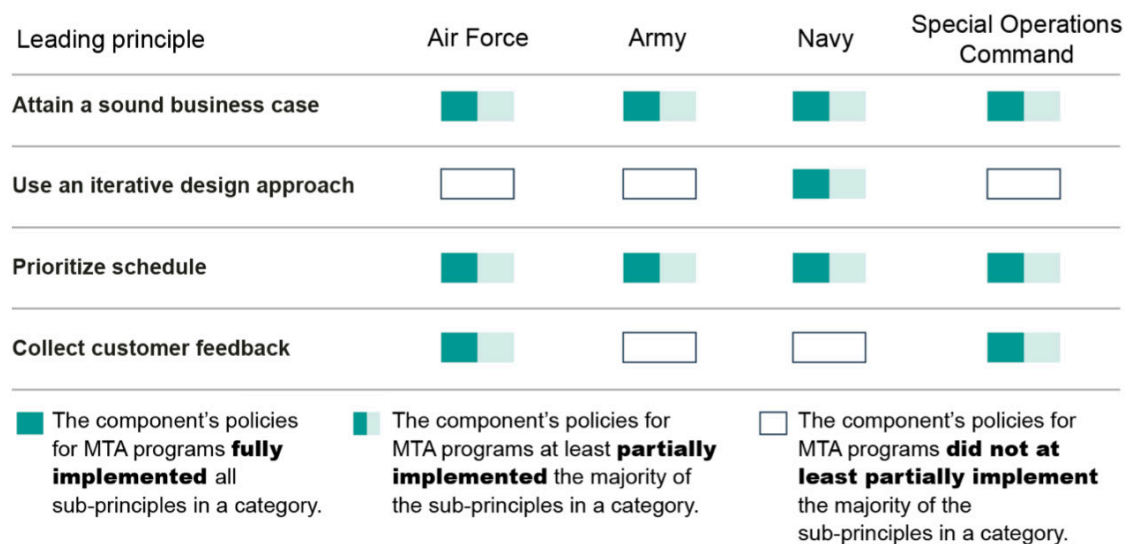


Figure 9. Component Policies Reflect Some Leading Product Development Principles. Source: GAO (2023).

E. CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES REPORT

While previously discussed research focuses on the acquisition projects and how the government is managing them, the Center for Strategic and International Studies (CSIS) conducted research from the industry perspective. GAO provided recommendations on how to adopt industry principles, but CSIS researched industry on their perspective of government operations. For their report, CSIS conducted unstructured discussions with industry officials from different firms to garner qualitative data and feedback (Cook, 2023). The conversations concluded that industry has a general feeling that acquisition reform is either unnecessary or not being implemented at all. Furthermore, there is minimal industry understanding of the AAF and the various pathways, with which their government projects are being managed (Cook, 2023). A couple of challenges identified by industry included a lack of transparency and inflexible appropriations processes to coincide with AAF (Cook, 2023). Industry officials also perceived lower-level government officials to have a lack of understanding of the industrial base, unlike government senior leaders. A final note from an industry expert expressed frustration with ever-changing government regulations and requirements, which do not allow enough time for the industry base to adapt to the set processes (Cook, 2023). While acquisition reform is unlikely to cease, the government

could delve into potential training opportunities for both industry and government officials. Training would assist in bridging the communication gap and provide a better understanding of operations, thus improving government-industry relations.

F. SUMMARY

Since interim guidance was implemented for the MTA pathway, more interest developed in the utilization of the MTA pathway. Within 2 years, the number of programs in the MTA pathway nearly doubled and the funding allocated more than doubled. As the number of programs grew, as did the amount of information reported. In 2020, the RAND Corporation provided some insight into challenges facing the government information management team and recommendations for improvement. In 2021, the IG reviewed and analyzed the MTA pathway. Within 3 years of interim guidance being published, the IG found component commands effectively adopting the MTA pathway and estimated there to already be time-based savings for several acquisition efforts. In 2023, two organizations, GAO and CSIS, conducted research on how to improve MTA pathway acquisitions from the government and industry perspectives, respectively. While GAO recommended that the government adopt principles from industry to improve acquisition, CSIS implored for less government acquisition reform and a higher level of transparency to industry partners. In addition to reviewing previous research and recommendations, the next chapter will analyze available MTA information to answer specific research questions and derive conclusions and recommendations.

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IV. ANALYSIS

This CAP analyzes available rapid prototyping program data to determine some of the risks and barriers to rapid prototyping projects, considering the immovable time constraint for rapid acquisition. In addition, the probability that a program will transition to a follow-on effort is analyzed. The intent was to conduct a statistical analysis of project data available for public release. A statistical analysis consists of an accumulation of data, which would be representative of the whole. In this case, it was intended for a limited sample size of 30 programs to represent all programs using MTA specifically for rapid prototyping. The sample size of 30 was chosen because it holds statistical significance in ascertaining a level of confidence for derived conclusions. The data and analysis would be limited to rapid prototyping projects, as there is a higher quantity of rapid prototyping programs than rapid fielding. Unfortunately, there is an overall scarcity of MTA project metrics publicly available. A non-disclosure agreement is in place for accessing information in DAVE, thus limiting information accessible for public consumption and research. As a result, the data collected to conduct research and analysis was restricted to publicly accessible data. Project metrics reviewed in this CAP are publicly reported through reporting agencies, such as the IG and GAO. To access these reports, databases and websites were utilized, including the acquisition research program defense acquisition innovation repository and RAND, GAO, and IG reports. Using this information, recommendations and conclusions are derived.

A. RAPID PROTOTYPING SCHEDULE AND RISKS

Between 2019 and 2023, 3 different reports and articles reviewed 9 of the same MTA rapid prototyping programs. These 9 programs only make up part of the 34 in 2019 and part of the 59 in 2021 (LaCamera, 2019; Shepherd, 2021). While both DAU presentations highlight the contracting capabilities of these projects, the 2019 DAU reference focuses on schedule and the 2021 DAU reference focuses on funding (LaCamera, 2019; Shepherd, 2021). As seen in Figure 10, LaCamera presented that five rapid prototyping programs were borderline non-compliant with the rapid timeline of 5 years,

has been marked as non-compliant in Table 2. This program is the uppermost in the graph, which lies in an orange-red risk area. The program has been marked non-compliant in the table, to signify it as an outlier and indicate its tendency is leaning towards non-compliance. Overall, 7 out of 18 (or 39%) small programs are incurring schedule risk, whereas – MTA projects that exceeded ACAT I funding threshold had 5 out of 11 (or 45%) programs either at risk or non-compliant. From this data, it can be concluded that most rapid prototyping projects are not incurring schedule risks and are operating within the 5-year time frame.

Table 2. Rapid Prototyping Schedule and Funding Risk

	# Rapid Prototyping Programs		# Rapid Prototyping Programs
	Below ACAT I	ACAT I	
Schedule Compliant	11	6	17
Schedule Risk Watch Area	7	0	7
Schedule Risk & Funding Watch Area	0	4	4
Schedule Not Compliant	0	1	1

B. RAPID PROTOTYPING PROJECTS TRANSITIONING

In 2 years, more programs joined the MTA pathway and consequently, so did funding obligations. In 2021, there was approximately \$58 billion dedicated to the 74 MTA programs (Shepherd, 2021). Depending on the size of the program, their funding allocation varied from little over \$1 million to around \$7.6 million (IG, 2021). While LaCamera mentioned a risk to funding and schedule, the IG audit from 2021 reports some programs are within their original cost estimates (IG, 2021). Specifically, the next generation squad weapons program was able to stay within budget and on schedule, thus leading to its successful transition to a rapid fielding effort within 4 years of initiation (IG, 2021). While this is just one success story within the MTA pathway, there are other programs not as fortunate. The small multipurpose equipment transport program, for example, was reported to be on a spending path over the initial budget estimate (IG, 2021). The small multipurpose

equipment transport program was impacted by a government engineering change proposal that delayed production, but the program office stated it had no impact to the overall MTA requirement of 5 years (IG, 2021). This is a prime example of the triple constraint requiring a give-and-take relationship between cost, schedule, and performance in order to maintain a balance.

The IG reviewed a total of 11 projects in 2021, 5 of which were rapid prototyping and 6 of which were rapid fielding (IG, 2021). Out of the 11 projects, 3 will transition to sustainment or fielding and 1 project, the Capability Set 21 Integrated Tactical Network Program, previously transferred successfully from rapid prototyping to rapid fielding (IG, 2021). From the 8 remaining projects under review, 5 have plans to complete their pathway and 3 have transition plans in FY23 and FY24 (IG, 2021). The breakdown of the reported transitions is shown in Table 3. The sample size is limited to a non-statistical quantity provided by the IG report in 2021.

Table 3. Report of MTA Projects Transitioning

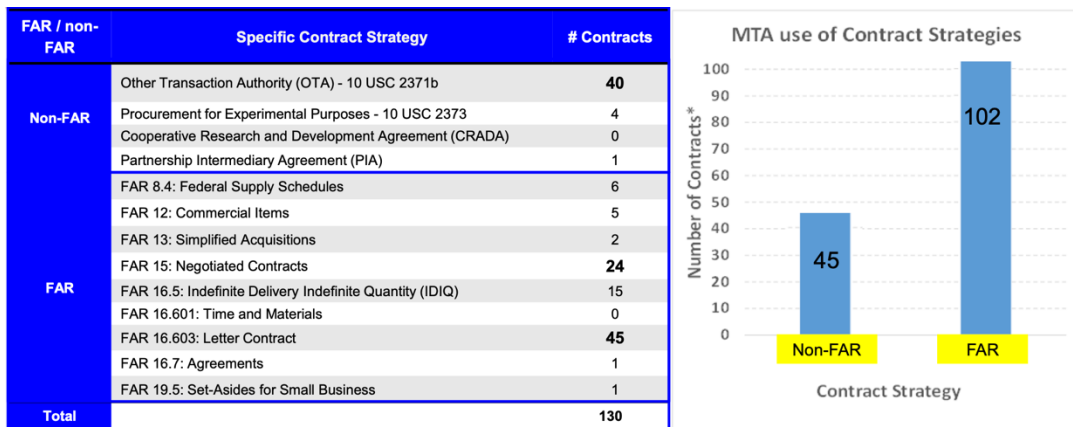
	# Rapid Prototyping Programs	# Rapid Fielding Programs	Total
Projects Reviewed by IG	5	6	11
Projects transitioning to follow on efforts	2	1	3
Plans to transition in FY23/FY24	2	1	3
Plans to complete	1	4	5

From this sample, the majority of MTA programs reviewed successfully transition towards follow-on efforts of either rapid fielding or sustainment. One project within the grouping of rapid fielding programs was also a historically successful transition from rapid prototyping to rapid fielding. A trend can be seen that the rapid prototyping efforts are more likely to transition, whereas fielding efforts are more likely to aim for project completion. Because of the limited sample size, these conclusions cannot be generalized

across all MTA programs and a recommendation would be to delve further into this analysis.

C. RAPID PROTOTYPING CONSTRAINTS

To enable projects to move faster, different contract strategies were utilized in the MTA pathway. Contracting options available to programs include strategies within the federal acquisition regulation (FAR) and those outside of the FAR. Some examples of FAR contract strategies include small business, negotiated, and commercial items (LaCamera, 2019). Non-FAR options include, but are not limited to, other transaction authorities and partnership intermediary agreements (LaCamera, 2019). By 2021, it was reported that 102 FAR contracts and 45 non-FAR contracts were in place for the MTA programs (Shepherd, 2021). Figure 11 shows the specific strategies used within the FAR or non-FAR construct for MTA pathway programs, as of January 2021. While the FAR encompasses several contracting strategies, it is a prescriptive regulation for the procedure of requesting proposals, selecting sources, and awarding contracts.



As of 11 January 2021 using the latest PB21 submissions.
 * Components reported relevant primary and secondary contracts. Programs may have more than one contract and more than one Contract Strategy. All contracting strategies reported are shown.

Comparative use of FAR types and non-FAR strategies can be used to assess appropriateness of contract strategies across portfolios.

Figure 11. MTA Contract Strategies. Source: Shepherd (2021).

By using more non-FAR strategies, programs can minimize the burden and potentially speed up the contracting process, when appropriate to the program effort. Other transaction authorities are a popular option outside of the FAR and are usually well advertised options within the acquisition community. From discussions with industry partners, CSIS learned that industry partners appreciate the speed and flexibility of OTAs as well (Cook, 2023). It would be practical for rapid prototyping programs to consider non-FAR strategies, which would minimize contracts posing a risk to schedule. Non-FAR strategies would also mitigate any barriers to rapid implementation due to contract processes. Innovative management strategies accompanying innovative technologies help improve warfighter capability at the speed of relevance.

The most recent review of programs within the AAF, specifically using the MTA pathway, was in 2023 by the GAO. The GAO has been conducting regular reviews of select MTA programs since 2019, when it was marked that the DOD was increasing their program participation in that path. GAO's initial insights in 2019 marked a lack of oversight implemented by the DOD (GAO, 2023). This was presumably rectified upon the finalization of the MTA policy and the program data metrics (GAO, 2023). The following year though, GAO reported a challenge with information reliability from reports on MTA programs (GAO, 2023). While DAVE is an example of the DOD implementing guidance on oversight and reporting, there has yet to be a formal guidance on reporting schedules (GAO, 2023). In the past year, there have been challenges noted within MTA programs, who delayed interim milestones and implied that initial schedules were a bit optimistic for the reality of the work (GAO, 2023). A lack of standardized reporting affects program analysis results because the causal factors of delays are not clearly communicated. As shown in Figures 12 and 13, without proper reporting, programs could be incurring unnecessary risks or facing process-driven barriers, which could be minimized through higher leadership intervention. If decision makers are unaware of issues down the chain, they are unable to provide assistance and remove barriers to success.

In Figures 12 and 13, fishbone diagrams depict the causes of risks and barriers to implementation of projects in the MTA pathway. In FY16, the NDAA mandated acquisition reform, resulting in the acquisition policies, including AAF. In 2018, the

interim guidance for the MTA pathway was published and disseminated and was followed with initial policy release in 2020. With a trend of updates every 2 years, the MTA pathway has undergone revisions to policy, which pose a risk to project success. The unchanging characteristic of the MTA pathway is the strict requirement of 5-years to completion. This requirement poses both a risk and a barrier. Larger projects may be at risk or deterred from the MTA pathway due to concerns to adhering to a rapid schedule, yet still being burdened with administrative processes. One such process is the government contract process. There are two avenues a project can take: FAR or non-FAR strategies. While MTA projects utilize both, most contract strategies used by MTA projects are within the FAR, as seen in Figure 11. The FAR strategies can be time-consuming and pose both a risk and barrier to MTA projects.

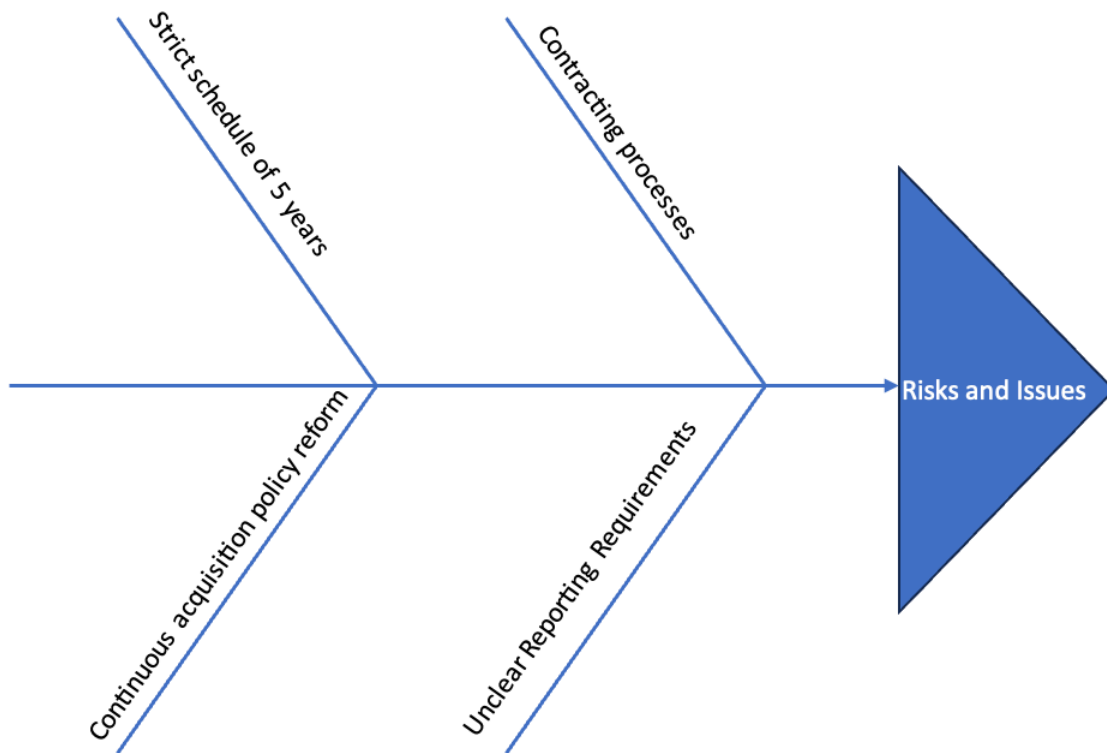


Figure 12. Risks and Issues Fishbone Diagram

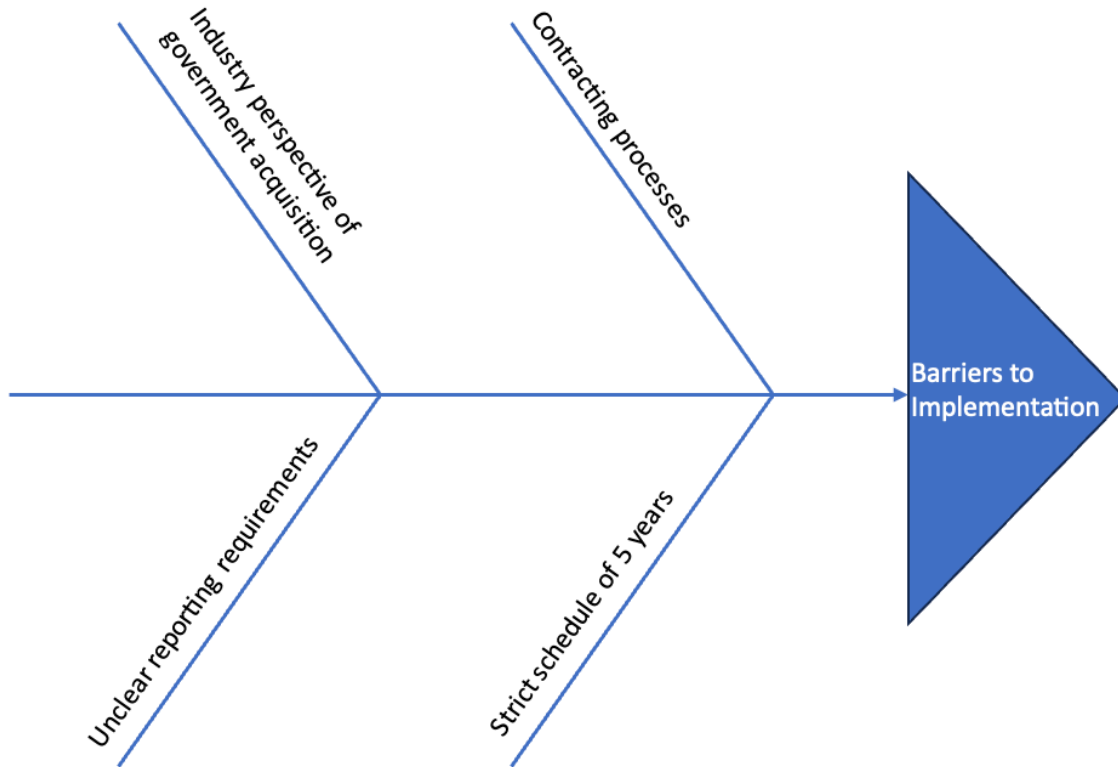


Figure 13. Barriers to Implementation Fishbone Diagram

Finally, another barrier to implementation is the industry perspective of government acquisition. While the contract process alone may pose a risk on an MTA project, the interaction with industry partners can also be challenging. From interviews, CSIS concluded that industry partners are frustrated with continuous acquisition policy changes (Cook, 2023). CSIS also identified a lack of transparency from the government about how MTA initiatives transition to more long-term efforts (Cook, 2023). If a project puts out a request for proposal and industry partners are hesitant to bid, then projects could experience delays along with other challenges.

D. SUMMARY

The collected analysis of this CAP covers MTA reporting requirements, program risks, program transitions, and contracting strategies. The source information used to conduct this analysis was from publicly available reports and references. MTA project data was limited due to a restrictive non-disclosure agreement with the DAVE website. From

the limited data groups, it can be concluded that larger acquisition programs tend to face schedule risks within rapid acquisition. Per the triple constraint theory, the research shows that the cost of a project usually bears the weight of schedule risk mitigation. To further minimize schedule risk, different contracting strategies can and should be utilized within rapid acquisition. The FAR process can be lengthy, whereas non-FAR strategies could support rapid acquisition efforts in a timely manner. While it cannot be generalized across all MTA programs, out of the 11 projects, whose plans were reviewed, most included plans for transition to follow-on efforts. None of the available information showed trends of MTA program failures, implying a successful adoption of the MTA pathway by the Services.

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V. SUMMARY, CONCLUSIONS, RECOMMENDATIONS

A. SUMMARY

The intent of this research was to analyze the effectiveness of rapid prototyping within the MTA pathway. The analysis answered the following 4 research questions:

1. With a schedule-based pathway, are projects adhering to the rapid timeline for 5 years?

From the set of projects reviewed, 17 out of 29 (or 59%) of rapid prototyping projects were complying to the 5-year schedule. The rest of the projects (or 41%) faced schedule and, potentially, funding risks.

2. While working within the construct of rapid prototyping, what are the highest risks experienced by programs?

The highest risks reported were schedule risks, quickly followed by risks to funding. Specifically, ACAT I projects that incurred schedule risk also tended to be in a funding watch area.

3. In addition to risks, are there any barriers to implementation?

This capstone applied project discovered barriers related to the MTA pathway, including burdensome oversight and processes. While certain aspects of MTA are tailorable, like reporting requirements, processes pose a barrier to implementation. For example, contracts require use of the time-consuming FAR process. While there are non-FAR options, not all projects have utilized those methods. Through interviews with industry, there was also a lack of clarity for industry partners on government acquisition policy.

4. Are projects successfully transitioning to other efforts, such as rapid fielding?

From a non-statistical grouping, it is apparent that the majority of those rapid prototyping programs are transitioning to follow-on efforts. Because

the number of projects reviewed was limited, this conclusion cannot be generalized for all rapid prototyping projects.

A significant limitation to conduct this research was that only secondary source material available publicly was utilized for analysis and review. This is due to the restricted availability of source material for public and research use.

B. CONCLUSIONS

The limited source data publicly available affected the ability to derive generalized conclusions for all MTA programs, specifically for program performance effectiveness and probability of transitioning to follow-on efforts.

From the project data available, the risks reported in the early adaptation of MTA programs were to schedule and cost (LaCamera, 2019). During the acquisition research program symposium of 2023, the GAO presenter stressed the fact that the 5-year timeframe for the MTA pathway is a ceiling, not a floor. This comment implies that some programs were not placing the highest priority with meeting the schedule. Within a schedule-based program management style, there is inherent risk to a schedule given any instance of force majeure or emergent issues. Per the triple constraint theory, there must be a give and take between the cost, schedule, and performance in order to maintain balance. If the schedule is at risk and is an immutable fact of the project, then the cost and performance must bear the weight of the risk mitigation. From LaCamera's presentation, it is apparent that cost risk usually accompanied schedule risk (LaCamera, 2019). Due to limited metrics publicly available, the effects of schedule risks on project performance requirements could not be determined.

Aside from risks, some barriers that programs faced working with the MTA pathway include burdensome oversight requirements and industry misunderstanding of AAF pathways (Cook, 2023). In a 2023 presentation by the center for strategic and international studies, industry partners observed that policy was in place for rapid development pathways, yet the intent or define pathways were not defined by their government partners. Industry representatives could not identify the path they were working within. By educating contracting and industry partners, the DOD can better

manage their programs and contract relations. In addition, industry noted that the financial processes and contracting options were not updated or expanded to support the AAF management construct (Cook, 2023). While programs attempted to leverage the different types of contracting routes available to them, administrative processes and procedures posed a risk (LaCamera, 2019; Shepherd, 2021). The fine balance of cost, schedule, and performance is on-going, but the metrics cannot be compared across the Services. Since 2019, GAO has been recommending updates to MTA oversight requirements (GAO, 2023). While guidance has been updated and implemented, there has yet to be a standardized set of terminology and metric definitions provided across the DOD. Each service uses its own versions and tailorable documentation requirements.

From secondary source data available, most programs enter the MTA with a plan to transition either directly to sustainment or fielding efforts (IG, 2021). There is a general perception that the government has adopted the AAF pathways and encouraged a culture of innovation (IG, 2021). In addition, these projects operated within the construct of a rapid timeline, 5 years. A couple projects noted challenges with scope and design changes, which resulted in cost increases, but that is the nature of the triple constraint (IG, 2021).

In conclusion, the majority of MTA projects show risks are generally attributed to cost and schedule, where some projects incurred larger costs than initially estimated, but maintained their rapid schedule. The barriers include industry buy-in on the acquisition reform and balancing the oversight burden. With limited data, the probability of a project transitioning to a follow-on effort cannot be derived or generalized for all MTA programs; however, out of the 11 projects reviewed, there was a higher tendency for those programs to plan for transitions rather than just aiming for completion.

C. RECOMMENDATIONS

Industry inclusion in acquisition pathway conversations and training benefits both government and industry management strategies. The key moving forward will be balancing oversight requirements with schedule. With an increased interest in reviewing MTA projects, managers will need to tailor those reporting requirements to ensure that the schedule doesn't incur undue risk through extraneous administrative burden. It is also

recommended to standardize terminology across the services. For phrases such as project initiation, it is important to define those uniformly for all, especially with the schedule-based management approach of rapid acquisition. Metrics and levels of effectiveness cannot be accurately measured if project initiation isn't standardized. Finally, while reporting requirements are tailorable to each project, other government processes have not been adapted to work within a rapid framework. Adapting time-consuming processes, like the contracts process, would mitigate MTA project risks.

D. RECOMMENDED AREAS FOR FUTURE RESEARCH

With the ever-growing interest in the MTA pathway, determining pathway effectiveness will enable analysts to review benefits to the warfighter. The intent of rapid prototyping and fielding is to develop and deliver equipment to warfighters at the speed of relevance, so that they may better combat adversaries. It would be prudent to review a statistical sample of programs to derive general conclusions representative of all MTA programs. For example, determining whether customer needs are being met in the limited timeframe for rapid prototyping and fielding should be based off enough data for generalized conclusions. The following are potential future research questions that should be addressed:

1. What is the probability that a middle tier of acquisition program will transition to a follow-on effort?
2. While schedule is the highest priority of a rapid acquisition effort, what are the effects on cost and performance? If performance is decreased to meet schedule, does the program still meet warfighter needs?
3. Considering the challenges in reporting, how can a project estimate time-savings, if any, by using the middle tier of acquisition pathway?

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