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Accelerating the Adoption of Emerging Capabilities

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Abstract

The Department of Defense (DoD) is frequently criticized for its slow pace in adopting promising technologies, as well as its inability to field new capabilities rapidly, including those already available in the commercial sector. Despite numerous efforts, including leveraging commercial capabilities, the Department has not been able to implement a systematic means of adopting new technologies, instead relying on one-off cases and special organizations outside the traditional acquisition supply system. The National Defense Industrial Association's (NDIA) Emerging Technologies Institute (ETI) pursued a research effort to address these challenges. The research team used the resulting lessons-learned to explore how technologies, developed within DoD or commercially available, can be quickly and effectively provided to meet critical defense needs.

The report considers past case studies and interviews to develop a schema of six attributes of successful rapid development and adoption efforts. In short, these attributes are 1) high-level support, 2) reduced bureaucratic/regulatory hurdles, 3) available and steady funding, 4) mature technology, 5) manufacturable technology, 6) operational suitability. The report proposes a variety of recommendations including a new acquisition pathway in the Adaptive Acquisition Framework (AAF) as well as a variety of changes to DoD policies, budgeting rules and practices, and the requirements process.

Introduction[1]

Acquisition reform is not new to the Department of Defense (DoD). Although reform efforts such as the "Better Buying Power" initiative and the development of the Adaptive Acquisition Framework have improved aspects of Pentagon acquisition processes, some perennial organizational, political, policy, and behavioral challenges that prevent the efficiency required to rapidly deploy new technological capabilities to the warfighter persist (Baldwin & Cook, 2015). Critiques of the acquisition process range from rigorous discussions of issues such as program structures, contracting mechanisms, the so-called "colors of money,"[2] requirements that limit program offices' options, and an acquisition culture that does not incentivize well-planned risk taking.

Even while these barriers persist, to the frustration of policymakers and operators alike, it is striking that DoD has a history of "moving quickly" when it seems to matter most. When confronted with a true crisis or emergency warfighting need, the DoD can rapidly move through the design, development, testing, and fielding processes. Yet, despite numerous efforts, including leveraging existing commercial capabilities, the Department has not been able to implement a systematic means of adopting new technologies, instead relying on one-off efforts and special organizations outside the traditional acquisition system.

Several examples of DoD rapid acquisition success during emergencies are especially notable. For example, in the early preparation for the 2003 invasion of Iraq, DoD officials suggested that the development of a powerful "large-yield" gravity bomb would be of significant value in operations against the Taliban. In a matter of a few months, the GBU-43/B Massive Ordnance Air Blast (MOAB) bomb was developed by the Air Force Research Laboratory, and promptly delivered to the theater of operations. It is the most powerful conventional bomb ever built in the United States. Although building on the legacy of weapons that were first developed during the Vietnam war, the MOAB demonstrated that a new weapon could be researched, developed, manufactured, and deployed in record time under urgent need. Separately, the rapid development and fielding of the Mine-Resistant Ambush Protected (MRAP) vehicle in response to the crisis posed by improvised explosive devices (IEDs) also highlights that urgency can translate to rapid fielding.

Though inspiring, these examples are the exceptions that "prove the rule" and do little to dispel widely-held perceptions of the pace and responsive of traditional defense acquisition processes. The dominant theme in defense acquisition today has been programs running over budget, behind schedule, and delivering capabilities to national defense that often lag behind commercially-available products. As just one example, the USAF KC-46 Pegasus tanker was based on an existing commercial jetliner—the Boeing 767—yet still required more than eight years from selection to first delivery and has been plagued with operational deficiencies. Even at the smallest scale, the DoD is generally using microelectronic components in its weapon systems that are two generations behind the state-of-the-art available in commercial products. Many also feel that the Department's incorporation of artificial intelligence/machine learning technology lags behind parts of the commercial sector even for similar uses and applications, despite the fact that much of the early work in AI was funded by the DoD.

What actually happens within DoD organizations during emergencies that enable them to deliver results? Do organizations leverage acquisition systems during crises, or break them?

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[1] This report is an abridged version of an upcoming NDIA ETI report, to be published on our website: www.emergingtechnologiesinstitute.com

[2] The term "colors of money" in the DoD context refers to the different categories of financial appropriations made for distinct purposes: Research, Development, Test, and Evaluation (RDT&E), Procurement, Operations and Maintenance (O&M), and Military Personnel (MILPERS).

Are there any attributes of successful rapid capability adoption efforts that can be incorporated into the standard development, acquisition, and deployment process?

Methodology

To characterize the DoD when it's able to develop and transition new technologies, ETI conducted a series of interviews with leading stakeholders across the public and private sector. These individuals included senior-level acquisition professionals, technical development experts, and those who succeeded in rapidly delivering new technologies through programmatic or leadership positions. In total, these interviews provided the foundation for this report. ETI used these findings to explore how available technologies can be quickly and effectively provided to meet critical defense needs and to identify examples of capabilities that are suitable for rapid development and adoption.

In addition to ETI-led interviews, this report reviews two examples of the DoD's rapid development or deployment of new technologies, which provide historical precedent for successful rapid technology adoption. These are the Massive Ordnance Air Blast (MOAB) program and the Mine-Resistant Ambush Protected (MRAP) Vehicle program.

The interviews and research also helped ETI synthesize broad attributes of these programs' success into six principles that can be used as a framework for current and future programs. Both the interviews and internal research help set the stage for ETI's proposal of a new acquisition pathway as well as a multitude of recommendations across the legislative, policy, financial management, and acquisition dimensions that can enable more rapid and effective technology development and deployment.

Case Studies

Overview

The ETI team looked at two examples of past rapid development and deployment efforts since the turn of the 21st century, including the Massive Ordnance Air Blast (MOAB) program and the Mine-Resistant Ambush Protected (MRAP) Vehicle program. Each case study demonstrates a time when the DoD wanted to rapidly develop and transition a new technology at three different scales: the service, theater, and global levels.

Case Study #1: GBU-43/B Massive Ordnance Air Blast (MOAB)

The GBU-43/B program built on existing Air Force Research Laboratory (AFRL) research on larger ordnances. Originally based on modifications to the older, Vietnam-era BLU-82, research efforts intended to build a larger ordnance that could navigate to its target using GPS. The program's inception came in the wake of the September 11 attacks and before Operation Iraqi Freedom, when senior leaders sought more powerful ordnance.

The capability was developed in-house at Eglin Air Force Base by the AFRL Munitions Directorate in response to a Joint Urgent Operational Need (JUON) notice, which provided substantial resources and alleviated bureaucratic hurdles in order to pursue the work. The project was able to use existing parts and infrastructure and effectively work with contractors to integrate new components, such as navigation fins and GPS systems. Ultimately, the quick development of the MOAB demonstrated is one example of the DoD—at the service level—finding ways to transition new technologies.

Urgency: The MOAB program was viewed as highly urgent in the lead-up to Operation Iraqi Freedom; the DoD was committed to producing a heavier ordnance on a rapid timetable to fulfill a needed operational capability. Secretary of Defense Donald Rumsfeld stated the MOAB was created to put pressure on Iraqi dictator Saddam Hussein to surrender prior to, or soon

after, the invasion. The issuance of a JUON indicated this urgency and bolstered efforts to provide both funding and bureaucratic resources towards the effort.[3]

DoD Leadership Support: Direct support and regular communication with the immediate office of the Secretary of Defense served as an instrumental piece to the development of the MOAB. In fact, the Secretary of Defense approved a DX rating for the MOAB program in 2007, enabling it to receive the highest priority for material delivery.[4] Additionally, funding was quickly allocated to development efforts, leadership was encouraged to expedite operational tests, and waivers were issued to permit rapid testing.

Broad Technical Requirements: The MOAB program's requirements included an ordnance weight (approximately 18,500 pounds) and GPS navigation. Beyond these two criteria, the program team responsible for work retained wide latitude to use any existing components that could achieve this goal quickly. For example, the MOAB program office leveraged existing components and designs from the BLU-82 and was able to quickly sign a contract with Dynetics for GPS guidance and navigation fins.

Mature and Well-Understood Technology: The primary reason for MOAB's rapid technology development was due to the MOAB program office's decision to leverage existing technology. The MOAB program office intentionally limited the number of "science projects," wanting to minimize the amount of development for every single component. The only truly new parts were the navigation fins and bomb casing. The main difference between the MOAB and previous munition experiments was the attached navigation system. To do this, the AFRL team leveraged existing control actuation kits from the Joint Direct Attack Munition (JDAM), as they did not want to develop an actuator.

Identified Critical Material and Component Needs and Assigned Team Leads Early: Based on the urgency and available resources provided by the JUON, leadership was able to rapidly break down the project into parts and delegate more authority to team leads to move different parts of the project concurrently. These team leads were able to quickly identify key parts of the system (e.g., wiring) and engage contractors for these parts. This helped the system be ready for deployment at a moment's notice after testing was complete.

Leveraged Existing Components: The MOAB program office knew that only a small number of the bombs would be produced, and therefore was able to procure many existing components from other systems without needing to spend time on dedicated contracting. Additionally, because so many parts were used by predecessors, little manufacturing was required.

Rapid Operational Testing: Combined with the high-level political support available to the program, the first operational test took place less than a year after formal program inception. The ability to rapidly gain approvals and gain testing data immediately supported rapid fielding.

The BLU-82 System and C-130 Delivery Provided a Baseline for Rapid Transition to Operational Use: Because a significant part of the system was drawn from the BLU-82, and because of the small number of weapons built, the U.S. Air Force was prepared to deliver the

[3] Joint Urgent Operational Needs are primarily identified by Combatant Commanders to designate the need to accelerate a capability being developed for ongoing joint operations. See Joint Chiefs of Staff (2021) or Defense Acquisition University (n.d.-a).

[4] All prime contracts, subcontracts, or purchase orders in support of an authorized program are given a priority rating; a DX rating is given to programs that are the highest national priority. The Secretary of Defense has the authority to approve a program DX rated, whose orders must be fulfilled before non-DX rating programs. See Defense Contract Management Agency (n.d.).

MOAB to the theater using its existing procedures for transporting, operating, and deploying such a munition.

Streamlined Authorities: Because MOAB was identified as a JUON, several authorities were rapidly streamlined (Joint Chiefs of Staff, 2021). For example, a typical capability's path through the Joint Capabilities Integration and Development System (JCIDS) requires reviews of program requirements for compliance with key performance parameters (KPPs), key system attributes (KSAs), and additional performance attributes (APAs). Capabilities identified as JUONs do not require these reviews. The MOAB program was also able to avoid other activities, such as analyses of alternatives (AOAs) which typically provide program offices important yet time-consuming opportunities to evaluate alternative capabilities, schedule plans, or contracting options.

Used Existing Research Budgets: Funding to develop and test was provided through the existing AFRL research budget, and existing Air Force procurement funding was allocated to purchase the initial units after successful testing.

Case Study #2: Mine-Resistant Ambush Protected Vehicle Program

The MRAP program was a DoD initiative that aimed to rapidly develop and deploy heavily armored vehicles to protect military personnel from the threat of roadside bombs, IEDs, and ambushes in Iraq. Because 75% of casualties were attributable to IEDs and other explosive devices in the mid-2000s, MRAP became the DoD's highest acquisition priority. With the goal of developing and delivering better vehicle platforms rapidly, the DoD's effort required significant participation and collaboration between OSD, the services, and various defense contractors. It took strong leadership and a coordinated effort to design and manufacture specialized vehicles with enhanced protection against explosions and ballistic threats at an accelerated pace.

Between February 2007 and October 2009, the program successfully developed and fielded more than 16,000 MRAP vehicles to both Iraq and Afghanistan (Feickert, 2008). The outcome of the MRAP effort was a dramatic reduction in casualties, providing enhanced protection for military personnel and improving their mobility and operational capabilities in hostile environments. The MRAP effort is one of the most well-known recent examples of the DoD fielding a new solution on a theater-wide scale.

Urgency and Focus: The MRAP program was driven by a sense of urgency to protect military personnel from the increasing threat of roadside bombs and ambushes. This urgency created a focused environment that prioritized rapid technology adoption and deployment. Additionally, focusing on an operational outcome mitigated the creation of detailed technical requirements that would have added complexity, thereby increasing time to delivery.

Leadership Support: The MRAP program received strong support from the highest levels of leadership, including the White House and Congress. The crisis-driven nature of the program, coupled with the recognition of its importance, led to dedicated support, enabling rapid decision-making and resource allocation.

Active leadership attention enabled urgency, public-private partnerships, expedited funding, streamlined acquisition processes, ensured leaders could choose experienced personnel for the project team, external support, which were key elements that contributed to the program's effectiveness. These attributes are crucial for adopting new technologies rapidly and effectively, but require senior leader attention.

Clear Demand Signaling: The DoD was effective from the beginning in its pursuit of an armored infantry vehicle, which can be attributed to its understanding of the threat environment: warfighters needed a vehicle to better withstand IEDs. The DoD shaped the acquisition process to fit this operational challenge. Recognizing that no one company possessed the capacity to

produce MRAPs in the required quantities, the DoD awarded Indefinite Delivery, Indefinite Quantity (IDIQ) contracts to nine different commercial companies and agreed to buy at least four vehicles from each. The criteria for awarding a contract were simple: if the company could produce a vehicle that met the minimum operational requirements, they were given a production contract. An important aspect of the MRAP acquisition process was the clear communication of contract parameters to vendors. The DoD thoughtfully shaped the market for the MRAP by continuously communicating its needs throughout its development process, while also preserving competition. Ultimately, five different truck manufacturers were awarded contracts (Bulkley & Davis, 2013).

Broad and Responsive Requirements: The ability of the DoD and industry to deliver the capabilities needed by warfighters was aided by requirements that defined a broad mission objective rather than specific technical performance criteria. That mission objective was to limit deaths resulting from IED attacks on operational forces. Two requirements which significantly drove program activities were: 1) the ability to withstand an underbody blast caused by the IEDs used in-theater, and 2) be able to operate on a slope, such as a hill, between a 45- to 60-degree angle without tipping over.

The simplicity of the overall set of requirements influenced how the acquisition process was shaped. For example, the initial requirements document was only a few pages long, which provided the program with more decision trade space. This is unlike most programs, whose requirements documents can reach up to hundreds of pages (Browne, 2017).

Those responsible for the MRAP's engineering were also in continuous communication with the requirements and operational communities as the MRAP systems evolved, allowing for direct feedback on system performance from operational users to design engineers. For example, initial vehicles were structurally rigid, but quickly received hardware modifications based on feedback from warfighters in theater submitted to an MRAP Executive Committee. The committee consisted of the acquisition, requirements, and in-theater warfighter communities to evaluate program's challenges and successes. Problems were identified by warfighters in-theater, who were in daily contact with the program office as well as MRAP manufacturers. The program office also participated in the medical autopsies of the killed-in-action to understand the physical effects of blasts. A team analyzed the weight and detonation patterns of every IED blast in theater. This information was shared with the manufacturing and engineering teams to ensure that system vulnerabilities were quickly identified and addressed. As soon as a new MRAP variant was developed, it was immediately put into production, oftentimes overnight.

Lead Service Identified Based on Mission Needs: Although the Army is historically the DoD's executive agent for tactical wheeled vehicles, or combat service support vehicles, the Joint Program Office (JPO) for the MRAP program was placed within Marine Corps Systems Command based on its history of taking calculated engineering risks and history of moving quickly when adapting vehicles for prior emergencies (Blakeman et al., 2008). The Marine Corps also had design and operational experience with the Husky route clearance vehicle used by Marine Combat Engineers. This non-traditional program management decision was another example of prioritizing actual operational needs over standard bureaucratic practice.

Mature Technology: The program was able to leverage technical expertise from existing V-shaped hull vehicles such as the South African Casspir. The knowledge and experience gained from the Casspir, specifically regarding the armor and shock absorption designs, supported the construction of initial MRAP models. Additional existing technologies were used to iteratively improve MRAP vehicles based on operational feedback from warfighters. For example, the MRAP Buffalo version received a rear-door assist mechanism

based on commercial-off-the-shelf hardware to improve crew survivability while reducing cost and not impacting production schedules.

Managing Potential Engineering Risks: The severity of the need for a new infantry support vehicle led to strategic decisions regarding engineering risk-taking, the speed of deployment, and the funding allocated for the MRAP program. There was expedited testing and granting of safety certifications to quickly bring *any* benefit to the Iraq and Afghanistan theater rather than *perfect* capabilities. The MRAP program office understood that this speed, and engineering decisions that were made to fit that process, could result in more risk to the warfighter. System improvements were deployed in increments because the need for new, more survivable vehicles improved the operational situation and outweighed potential engineering risks.

Early Identification of Supply Chains: Due to the urgent need to produce MRAPs, the DoD identified gaps in the supply chain early and quickly began to address them. There were several key sub-systems for which the DoD and Congress worked to identify foreign suppliers to alleviate domestic production shortfalls—such as for steel and vehicle tires. Identifying supply chains early is atypical for a program office in the research and development phase. The DoD was successful in addressing its supply chain issues for the MRAP program through clear and constant communication with industry. During the development process, the DoD kept in regular contact with the manufacturers to ensure they received timely information to support preparations for full-rate production.

MRAP Program Received a DX-Rating: To accelerate the manufacturing process, the Secretary of Defense approved a DX rating for the MRAP program (Sullivan, 2009). By giving the MRAP program a DX rating, the DoD assured priority access to available material for MRAP manufacturers, enabling industry to respond more rapidly and meet production requirements.

Experienced Acquisition Workforce: The success of the MRAP program was facilitated by a highly experienced acquisition workforce. These professionals possessed deep knowledge of the acquisition process, understood the urgency of the situation, and navigated through the various authorities and procedures efficiently. In addition to the rotation of professionals from Marine Corps System Command, the Army Tank-automotive and Armaments Command (TACOM) supported the program office.

Streamlining Traditional Acquisition Steps: The Secretary of Defense generally has legal authority to waive various contract requirements related to design, production, delivery, and performance, and did so for the MRAP program (U.S. GSA, 2024). For example, the MRAP was allowed to begin procurement before a systems engineering management plan was in place. In some cases, standard program documentation processes were also reduced. Not all processes were waived, such the Technical Readiness Assessment (TRA; Blakeman et al., 2008).

Transparency with Congress: The MRAP program received significant funding and support from Congress, who recognized the critical need for enhanced support vehicle protection in theater. The speed and level of funding provided was in response to the perceived operational need. The transparent relationship between the MRAP program and Congress helped minimize delays and ensure continued support of the streamlined acquisition process. When provided with a clear request and explanation, Congress was consistently willing to ensure the project had full support.

Appropriate Contract Types Selected to Meet Program Goals: Recognizing that one producer did not possess the capacity to produce MRAPs in the required quantities, the DoD awarded Indefinite Delivery, Indefinite Quantity (IDIQ) contracts to nine different commercial

companies, and agreed to buy at least four vehicles from each. The IDIQ contracts allowed the rapid delivery of a small number of prototype units for evaluation at an agreed-upon price to the government.

Based on the evaluations, the follow-on contract vehicles used for the MRAP program were Undefinitized Contract Actions (UCAs) so contractors could immediately begin delivering supplies and performing services with full expectation of reimbursement before the terms and conditions of the contract were finalized (DAU, n.d.-a). In the case of MRAP, UCAs enabled multiple companies to begin work on many aspects of the program in order to rapidly field the systems.

"Colorless" Money: In addition to providing both expedited and continuous funding for the acquisition and fielding of MRAP vehicles, Congress also made the funding "colorless." This allowed the program office to allocate funds to research and development, procurement, operations and maintenance, and upgrades as required, with appropriate congressional notifications.

Discussion

Across these and other case studies, six overarching attributes of successful rapid acquisition emerge that meaningfully contributed to their rapid and successful development and deployment. They provide a methodology for identifying suitable technological candidates for rapid acquisition.

Six Principles for Rapid Acquisition

High-Level Support for Moving Funding and Bureaucracy: When efforts receive high-level bipartisan support from Congress and from across Services and agencies within the DoD, they are much more likely to succeed. First, prioritized and widespread support from senior officials and their staff can often enable more rapid reallocation of resources to meet program needs. This allows program managers to make decisions to address schedule and performance issues and take advantage of technological opportunities that may normally be more constrained by cost. Second, high-level support is essential for addressing sometimes time-consuming processes and standard practices that develop in all bureaucracies, especially those that are risk-averse in nature. That could include expediting decisions to move personnel between teams or departments, expediting acquisition decisions or processes, and waiving appropriate statutory and regulatory requirements.

Few Major Policy or Regulatory Hurdles: Even with the acceleration of program's funding and acquisition processes, rapid technology efforts can also be slowed if other policy or regulatory hurdles stifle program managers. These could include financial management practices, laws governing reprogramming decisions, requirements processes, or laws and regulations governing competition in the acquisition process. These could also include other issues inside or outside the typical defense sphere, such as those addressing environmental, ethical, economic, or even treaty obligations. In cases where these barriers do exist, high-level and broad support will be required to overcome them expeditiously. Transitioning the capability to a full program of record is eased by using more outcome-based requirements during development rather than stringent and specific technical requirements.

Funding Can be Provided for Transition Effort: Programs require responsive access to funding to enable rapid development and deployment of new capabilities. Program offices and industry suppliers are prone to work stoppages and other uncertainties when they are not provided access to early and steady funding sources throughout the development process. Additionally, funding that can be used for a spectrum of potential program needs (research, prototyping, testing, production, maintenance, and upgrade) supports rapid development and

adoption. The use of flexible contract vehicles to quickly fund program or industry activities, or vehicles that guarantee reimbursement for industry outlays, can shorten the time from design to fielding.

Technology is Mature Enough to Warrant Rapid Adoption: Rapid acquisition programs are most successful when the underlying technology is already sufficiently mature by the time the effort has begun. Using mature technologies allows program offices to significantly reduce the development activities and time needed before testing and fielding. Simultaneously, supply chains and supporting infrastructure can be engaged and expanded more easily as production requirements grow.

Technology is Manufacturable at Required Scale: Rapid capability efforts are more successful when programs have access to prioritized manufacturing and supply chain capabilities that are already capable of producing required systems and technologies, as well as suppliers willing to contract with the government. This is critical for developing and adjusting supply chains, including optimizing sub-tier suppliers arrangements, in support of both operational prototypes and rapidly scalable manufacturing for production.

Suitable for Operational Use: When technologies are easily transitioned into operational use, they are typically characterized by requiring limited new training of personnel, few disruptions to existing logistical processes, consistency with current concepts of operations, and existing supply chains. Where possible, common parts from the existing inventory can be used to reduce logistics tails and enable rapid delivery to operational customers.

Recommendations

A New Acquisition Pathway

Outside of an emergency or a requirements "pull," even in a situation consistent with the six principles a mechanism would likely be required to enable an emergent capability to be "pushed" to operators.

1. As such, the Secretary of Defense should create a new acquisition pathway and associated efficient resourcing processes, which bypasses the typical requirements validation stage and Planning, Programming, Budgeting, and Execution (PPBE) process, and instead offers opportunities to "push" prototypes into the acquisition process without a stated requirement. This "Immediate Opportunity" Pathway would enable a ready commercial or DoD-developed prototype to enter limited production for short deployments to relevant operators for field assessment. Then, the prototype would follow the typical adaptive acquisition framework guidance and move into the existing rapid fielding path of the middle tier of acquisition (MTA) pathway. The creation of this new pathway and all necessary authorities would require Congressional authorization.

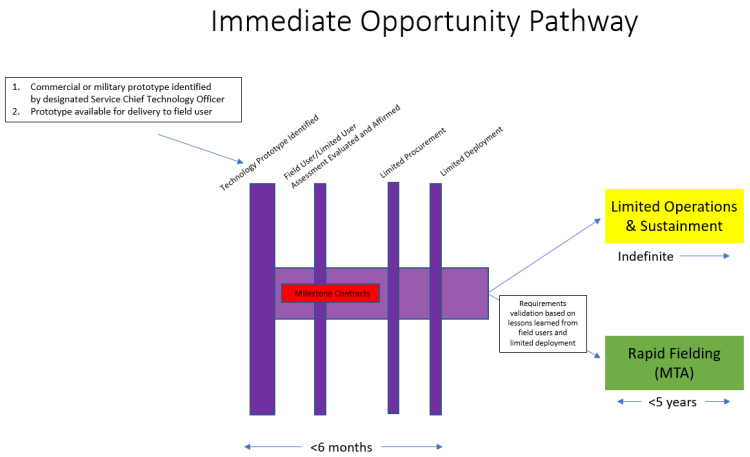

Figure 1. Immediate Opportunity Pathway

The end-users of capabilities—such as combatant commanders via the Joint Capabilities Integration and Development System (JCIDS) system—are chiefly concerned with developing requirements that address an operational or mission need. This can lead to prototypes that could improve mission performance, even incrementally, from entering the acquisition system. The use of the Immediate Opportunity Pathway would require the early identification of technologies to "push" a capability into the acquisition system.

2. This should be conducted by a designated individual, perhaps the Principal Technology Transition Advisor established by Section 806 of the FY24 NDAA within each Service (U.S. Congress, 2023). This designation could be provided to an existing or new office. CTOs should proactively identify advanced commercial or military prototypes, or systems and subsystems actively used in the commercial world, that could be immediately provided to operators for field assessment, regardless of whether or not a requirement has been formally established. These CTOs should be represented on the Functional Capabilities Boards (FCBs) or the Joint Requirements Oversight Council (JROC) to remain apprised of joint needs and to inform the requirements community about emerging capabilities.

To be eligible, the technology in question should possess a technology readiness level (TRL) at or above TRL 4 (AcqNotes, n.d.). It should also be assessed as readily manufacturable by the vendor. A number of authorities exist to access experimental prototypes including Cooperative Research and Development Agreements (CRADAs), Basic Ordering Agreements, and Procurements for Experimental Purposes (DAU, n.d.-c). These authorities can allow the DoD to buy the initial field prototypes from the vendor for validation. Vendors should then be provided with milestone contracts, a series of contracts based on the achievement of technical and performance milestones, to support the limited production and MTA phases as efficiently as possible if their capability is assessed and affirmed by field users. As a result of this process, vendors should be retained and funded along the MTA pathway as long as they continue to achieve agreed upon technical milestones.

Next, field users would have the opportunity to assess the prototype and affirm mission value. These activities should be funded via a line item within either Budget Activity 7 (Operational System Development) or Budget Activity 5 (System Development and Demonstration) within each Service's Research, Development, Test, and Evaluation (RDT&E) account.

Upon affirmation of value to operators and ability to be integrated into mission activities, the CTO and Service leadership should be authorized to immediately enter into a limited procurement contract to support a condensed deployment of the capability. These activities, including reduced operations and sustainment, could be funded by several sources depending on the timing of the capability discovery. First, if the immediate opportunity is discovered during the annual build of the President's Budget Request, authorities should be provided to allow the DoD to request funding within the appropriate appropriation titles ("colors of money"). Second, if the opportunity is discovered after the budget has been sent, a mechanism should exist to tailor the budget request through dialogue between the DoD and the Congressional authorizing and appropriating committees to request money via the Service's Other Procurement appropriations category. Alternatives, existing mechanisms such as reprogramming authorities could be used to transfer money into the desired program. Finally, if the opportunity occurs outside those windows for modification, the capability should be prioritized for funding through rapid development and procurement initiatives, such as the Accelerate the Procurement and Fielding of Innovative Technologies (APFIT) program.

The service CTO should simultaneously work with the appropriate requirements authorities and combatant commanders to formalize and validate requirements and begin the rapid fielding path of the middle tier of acquisition pathway. This process would provide opportunities to iterate on the original technology—incorporating operator feedback—that was provided to the field and allow the capability producer to scale up production based on the already agreed upon milestone contract. Ideally, this market-shaping activity has already enabled the vendor to ready its supply chain and scale up production in a manner that allows MTA rapid fielding to take place.

This pathway should be evaluated as part of the DoD's modernization of the requirements development process mandated by Section 811 of the FY24 NDAA (U.S. Congress, 2023). This pathway broadly matches the intentions of that provision, and 811(b)(3) calls for re-aligning pathways to fit the mission of a more flexible, technology-forward requirements process.

Other Recommendations

1. Ensure that the existence of, and use cases for, a series of underused authorities is clearly described in DoD policy and instructions. Where appropriate, provide additional guidance or training to acquisition professionals and senior leaders' teams across OUSD(A&S) and the offices of the service acquisition executives.

The DoD possesses a substantial number of authorities that it can use to rapidly develop and/or deploy capabilities, both during times of crisis and whenever various stakeholders encounter a capability that would provide value to a component or the joint force. Some options especially relevant to rapid capability adoption include:

- 10 U.S.C. § 3458 (Legal Information Institute, n.d.-a): Authorizes the Secretary of Defense and service secretaries to rapidly acquire innovative commercial products using fixed-price contracts as a result of a competitive general solicitations known as commercial solutions openings (CSOs). Section 813 of the FY24 NDAA requires the DoD to use CSOs no less than four times per year on behalf of geographic combatant commands, though guidance should recommend the use of CSOs on a more regular basis.
- 10 U.S.C. § 3601 (Legal Information Institute, n.d.-b): Provides authorities for the urgent capability acquisition AAF pathway. These authorities allow for rapid development and contracting decisions once a JUON or JEON has been validated after its introduction by

combatant and component commanders. As of FY24, this has been extended to the secretaries of the military departments (see section 229 of the FY24 NDAA).

- 10 U.S.C. § 4004 (Legal Information Institute, n.d-c): Contracts awarded by competitive selection may include a provision allowing for the development and production of system prototypes, including options to procure additional prototyping units as needed.
- 10 U.S.C. § 4022 (Legal Information Institute, n.d-d): Provides authorities to competitively contract for prototyping projects, and to immediately convert successful projects into production contracts with the original contracted parties without the need for a competitive solicitation.
- 10 U.S.C. § 4023 (Legal Information Institute, n.d-e): Authorizes the Secretary of Defense and service secretaries to procure capabilities from any source for the purpose of experimenting with, or testing, these capabilities for use in national defense.
- 10 U.S.C. § 4025 (Legal Information Institute, n.d-f): Authorizes the Under Secretaries of Defense for Acquisition & Sustainment and Research & Engineering, as well as service acquisition executives, to execute prize competitions for advanced technology development. Competition winners may receive cash prizes or procurement contracts, inducing innovation.
- 15 U.S.C. § 638(r) (Legal Information Institute, n.d-g): As part of a Phase II SBIR/STTR funding agreement, this provision authorizes program offices and prime contractors to agree to sole-source Phase III work from the small business award recipient upon its successful completion of Phase II contract activities. This funding can enable small, innovative companies to more rapidly scale their prototypes into finished systems that otherwise may or may not have been commercialized.

Several new authorizations in the FY24 National Defense Authorization Act (NDAA) are also notable (U.S. Congress, 2023):

- Section 806: Requires the designation of a principal technology transition advisor (PTTA) within each military department. The PTTA will be a member of the senior executive service or general officer charged with identifying promising technologies funded by RDT&E, especially Science & Technology research and development programs, that could transition into military operations. The PTTA will also review technology developments in the private sector, research institutions, and university ecosystem.
- Section 811: Mandates that the DoD modernize its requirements development process through revisions to the JCIDS system. The effort must streamline documents and reviews, especially for programs that are not major defense acquisition programs (MDAPs). It must also re-orient requirements language to avoid "prescriptive language," focusing instead on "mission outcomes and assessed threats."
- Section 813: Requires that the DoD use commercial solutions openings (CSOs) at least four times per year on behalf of geographic combatant commands. CSOs function similarly to broad agency announcements (BAAs) but allow for the procurement of innovative commercial technologies to meet mission needs.

DoD guidance must ensure that these authorities are well-understood by the appropriate decision makers, their offices, and acquisition professionals across program offices. Where applicable, DoD guidance should provide avenues to push interesting innovations across the S&T enterprise to the appropriate program offices to determine applicability for prototyping or procurements using one of these authorities.

2. Ensure that the existence of, and use cases for, the wide variety of budgeting and appropriation mechanisms available to the DoD widely used and clearly communicated in the President's Budget Request and other communications with Congress to support intentional efforts to rapidly field capabilities. Additionally, request new authority as-needed and modify internal DoD management practices in order to expedite allocation of funds to priority efforts.

Rapid technology capability adoption can be supported through a variety of sources of funding that are faster than traditional PPBE processes. Ideally, the funds are provided in such a way that they can support required activities in a timely manner. Not all of the sources need to be traditionally requested and appropriated funds, as this represents one of the slowest methods for providing funding for time-sensitive activities (PPBE Commission, 2024). Examples of sources of funding include specific appropriations for rapid procurement and fielding pots, working capital funds, supplemental appropriations, reprogramming actions, mid-year budget adjustments, Congressional adds, accelerating funding through UCAs, procurement prizes, and private capital investment. These mechanisms will more efficiently and responsively fund industry and government developers, manufacturing capacity, or the support of maintenance for upgraded fielded systems.

Additionally, Congress should raise the threshold for below-threshold reprogramming (BTR) for research, development, test, and evaluation programs to increase program manager's flexibility to respond to changing circumstances. In line with the PPBE Commission's recommendations, the BTR threshold for RDT&E should be raised to $25 million (PPBE Commission, 2024, p. 246).

As the PPBE Commission described, program managers often struggle to "ingest new technology and innovation" without substantial disruption to existing funds. Raising the BTR threshold would, in addition to generally increasing programmatic flexibility, allow for certain rapid procurements of promising commercial technologies for immediate deployment through the new acquisition pathway, or the purchase and testing of new prototypes via RDT&E.

Congressional appropriations and subsequent DoD financial management guidance should allow low-rate initial production (LRIP) to be funded by RDT&E appropriation accounts. Currently, funding within procurement accounts support low-rate initial production efforts. This means that program offices must often request a reprogramming to begin receiving units for test and evaluation, or wait until a future year's appropriation. Currently, the lack of flexibility creates some scenarios where leftover money is unnecessarily spent based on "use-it-or-lose-it" practices at the end of a fiscal year for potentially unnecessary R&D activities, even when the underlying technology has reached TRL 6 and would have benefitted from proceeding to LRIP ahead of schedule. Allowing programs to immediately use their existing resources to procure testable units would allow promising technologies to be tested and validated for warfighting use in a shorter period of time.

3. The Under Secretary of Defense for Research and Engineering should create and maintain a database for DoD stakeholders which documents successful S&T and SBIR programs and initiatives and relevant performers.

This database should be accessible to stakeholders across the DoD. The database would offer potential solutions for the immediate opportunity pathway described above. At the same time, the availability of well-documented success stories emerging from internal S&T activities can be an asset for decision makers willing to commit resources to reacting to emerging threats and developing capabilities based on previous investments. This database could be matched with operational and technical gaps, such as those identified in urgent needs statements and unfunded requirements lists.

4. Congress should also require the secretary of each service to solicit from the labs a number of items that are suited for rapid capability development effort. These materials should be released roughly on schedule with the submission of the President's Budget Request.

A greater view into the promising, early-stage work conducted by the service laboratories would provide the DoD with an annual exercise allowing it to take greater inventory of its projects, enabling it to recognize technology that could be transitioned into prototyping sooner. The report would also support service programmers' analysis of areas where more funding is required for transition of promising technology efforts, as well as to inform congressional appropriations processes. The information in the database recommended under recommendation 4 would likely be used to support this congressional mandate.

5. The Services should program, within their RDT&E accounts, funding to transition promising S&T concepts into the prototyping process. These funds are most appropriately placed under the control of the program executive officer responsible for acquisition and fielding of relevant systems. OUSD(R&E) and OUSD(A&S) should perform oversight to ensure that the Services are programming money for transition of their own successful S&T projects.

At present, defense-wide programs like the APFIT program rapidly transitions prototypes from small businesses into procurement and the Rapid Defense Experimentation Reserve (RDER) program both expeditiously tests and funds initial production. These programs are beginning to fulfill their role in bridging a particular "valley of death." However, similar sources of funding within the services outside of PEOs face bureaucratic challenges to transition technologies into programs of record.

6. The Office of the Assistant Secretary of Defense for Industrial Base Policy (OASD[IBP]) should conduct studies on the efficacy of market shaping modalities for national security purposes. Where appropriate as a result of these studies, the DoD should request funding for pilot programs to explore innovative contracting arrangements and market signals to the private sector.

The DoD has many of the tools traditionally classified as "market shaping" available to it. These include progress payments, prize competitions, and various types of contract provisions to reward technology developers who reach certain technical milestones. However, OASD(IBP) is well-positioned to look across the industrial base towards promising sectors or companies that would benefit from a more coordinated regime of market-shaping push- and pull-mechanisms to rapidly move a compelling warfighting capability from an early TRL to the field. Market signaling by the DoD entails clear intent and visible funding by a government customer to demonstrate the existence of a real and addressable technology market. Such market signaling should appear in publicly available budget documentation, which would be better received than high-level documentation, strategic plans, or official statements.

7. The Under Secretaries of Defense for Research and Engineering (R&E) and Acquisition and Sustainment (A&S) should create a joint program to increase temporary transfers and details of personnel with the DoD between technical, acquisition, and operational organizations.

New exchange programs between program offices, S&T laboratories, warfighting components can ensure that acquisition professionals are aware of ongoing developments and needs that are not recognized by an official requirement. Experiential knowledge of the state of commercial industry can help contracting officers determine what incentive structures are

correct to incentivize further system development, or to reach a deal for procuring an existing innovative commercial capability.

8. Increase the use of commercial solutions offerings (CSOs), including making use of the expanded authorities provided by the FY2024 NDAA. The USD(A&S) and the service acquisition executives should work to exceed the requirement to use CSOs four times per year on behalf of geographic combatant commands, and Congress should require an annual report on opportunities for CSOs.

CSOs represent a form of solicitation that is well suited to fund the rapid transition of commercial technologies to operational use. Although their use is growing within the DoD, including by the Small Business Innovation Research program, they are still used infrequently relative to their potential utility. CSOs could be used by the principal technology transition advisor, or another designated individual as part of the new acquisition pathway recommended in this report, to rapidly procure high-TRL commercial or defense technologies for warfighter use.

Conclusion

The DoD is frequently criticized for its slow pace in adopting promising technologies, as well as its inability to field new capabilities rapidly, including those already available in the commercial sector. At the same time, there are examples of rapidly-fielded technologies delivered in extremely short order to meet some critical need. Many authorities exist to enable rapid capability development and adoption, but these tend to go underused. In fact, many analysts have opined that the DoD has all of the authorities that it should need to move capabilities into operational use quickly.

This research does find underused avenues in the existing acquisition system. However, these authorities are not sufficient. This report finds six conditions that appear necessary in past cases when the DoD did succeed in rapid development efforts. These attributes—high-level support, limited policy and regulatory hurdles, available and steady funding, mature technology, manufacturable technology, and operational suitability—enable programs to move programs to fielding at a higher rate, both by creating an environment which permits the standard use of more innovative acquisition authorities and removes other barriers to success across the acquisition life cycle.

Outside of an emergency, there are exceedingly few situations where these six principles apply at the same time. However, various changes to the acquisition system would make it more likely to maximize as many principles as is feasible. The creation of an immediate opportunity pathway, for example, would align funding, manufacturability, and operational suitability to allow stakeholders in the DoD who see a promising technology to “push” it to a limited number of operational users by bypassing certain policy hurdles, such as the need for an urgent requirement to be issued. In other cases, various systems could be implemented that would increase information-sharing and, as a result, create new high-level advocacy to support development efforts of promising capabilities. A deliberate and sustained effort to seek promising capabilities—mature or emergent—will ensure that the United States retains a technological advantage and maximizes the outputs of its highly productive innovation ecosystem.

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