The Change We Need

Making Defense More Future Proof through Adaptable Systems

Maura McQuade & Andrew P. Hunter

It seems like every day, someone in the Department of Defense (DoD) announces that the old ways of doing business are out and that new, better approaches are now available. This dynamic is especially true in the world of defense acquisition, where there is a collective disparagement toward the acquisition system that brought us today’s world-class military gear. There is truth to the argument that defense acquisition must change in the face of a new national security environment, but many current acquisition critiques are strangely incomplete.

You will find a bevy of arguments for why today’s acquisition system has too many rules and too many decision-making layers, inhibiting innovation, market access, and speed as a result. Many critiques of how DoD buys are strong, but meaningful critiques of what DoD buys are much less common. Yes, individual weapon systems are often criticized for excessive cost or not delivering on their promised capabilities. However, the substance of underlying programmatic requirements is much less often meaningfully challenged other than as part of a general critique of the necessity and cost of military modernization. The one-sided nature of the current acquisition critique is problematic. If we allow our diagnosis of the problem in defense acquisition to remain incomplete, we are highly likely to fail in delivering the capabilities the nation needs. Form should follow function. We must ensure that we adapt the acquisition system to deliver the systems we need, rather than simply optimize it to deliver the wrong systems more quickly or more cheaply.

Today’s security environment requires the United States to prepare for defense against a wide range of adversaries. The 2018 National Defense Strategy (NDS) emphasizes that both the prosperity and security of our country face challenges from the reemergence of long-term, strategic competition, a resilient but changing post-World War II international order, and rogue regimes and non-state actors that destabilize regions critical to international security. Each of these challenges is driven in part by the adoption and deployment of technology in new and innovative ways. As the NDS notes, today’s security environment is increasingly complex and defined by rapid technological advancement and the changing character of war,
where “the drive to develop new technologies is relentless, expanding to more actors with lower barriers to entry, and moving at accelerating speeds.” The future threat environment suggests technological superiority or inferiority will not be static; instead, with the rise of peer competitors, defending national security necessitates the ability to quickly and flexibly leverage areas of strength and mitigate areas of weakness. While unpredictability in warfare is not new, this technology-driven rate of change challenges the United States to meet a variety of different threats, which are advancing and adapting by the day. History demonstrates that technological superiority may not always win wars; however, refusal to adapt to changing technology will almost always lose wars. Future success is therefore dependent on our ability to field systems, which can quickly adjust to uncertainties in threats, nimble adversaries, rapidly emerging (and obsolescing) technologies, and new relationships between the domains of war.

As the United States faces these threats, it can capitalize on technology trends that have developed to meet rapidly evolving user-needs and customer demands through the design of adaptable systems. Adaptable systems are systems that have the inherent ability to deliver a wide variety of capabilities from a single basic design (multifunctionality) and can readily add capability over time (growth) at what former defense secretary Jim Mattis would term the “speed of relevance.” Adaptable systems are not new. Traditionally, features such as multifunctionality and growth potential were delivered in defense by very expensive, high-end systems that included excess space, weight, and power in the initial designs to support the later addition of additional sensors and weapons. The classic example of this traditional approach to adaptable systems in defense are Navy ships, which grew ever larger in the twentieth century to support a wide variety of missions and address a wide range of threats.

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The commercial sector has embraced a different approach to adaptable systems, using iterative software-development that can harness technology advances, merge previously separate functions, continuously upgrade features, utilize machine learning, and better leverage user feedback. The classic commercial sector example of an adaptable system is the smartphone, which has evolved to absorb the functions of many previously separate devices, primarily through added software and networking. However, it is becoming increasingly clear that the characteristics of adaptable systems can also be achieved more cheaply and more successfully in the defense sector through writing new software rather than building and adding new hardware. An example of this approach in defense is the Air Force’s Battlefield Airborne Communications Node (BACN), which originally leveraged a commercial aircraft base, relatively simple networking nodes, and software to serve as a critical theater network hub connecting disparate parts of the joint force. BACN is the opposite of the exquisite, expensive multi-functional military platforms of previous decades. It leverages the inherent ability of software-defined systems to deliver multifunctionality and growth by adding new code rather than new hardware. Today’s systems don’t require massive scale and expense to achieve adaptability. Increasingly, they achieve adaptability because the most important elements of functionality are defined in software and can be modified without substantial changes to the hardware.


As a result, a piece of gear that can transmit and receive electrons may be a radio, radar and an electronic warfare asset simultaneously, and it can be rapidly upgraded as the technology evolves.

For DoD, adaptable systems are essential to fully leverage the capabilities of existing technologies to meet future warfighting needs. Software-defined adaptable systems will play an increasingly critical role in defense acquisition going forward. But these types of systems test the limits of the current acquisition system, which is accustomed to acquiring systems in a much more tightly defined and linear manner. As a result, DoD has struggled to evolve at the same pace as commercial technology. The defense acquisition system was originally focused on Major Defense Acquisition Programs (MDAP) with long development cycles, enormous quantities, and tightly defined requirements because the system was designed to provide oversight to high-value hardware systems that were planned to remain in production for decades. The DODI 5000.02 acquisition milestone process is designed to progressively reduce technical risk by proceeding through discreet phases of development, test, and evaluation before entering full-rate production. If upgrade increments are planned, they are usually executed serially, not simultaneously. There are high transaction costs for change and high thresholds for justifying a new increment. Communications between the different elements of the acquisition system are organized around acquisition milestones and toward executing Milestone Decision Authority (MDA) directives. Such events are rare, and the stakes are high because the system is loath to deviate from or reverse these milestone decisions. However, adaptable systems (like other software-oriented development efforts) work best when developed in conjunction with frequent iterative feedback loops throughout the process. Under an adaptable systems approach, acquisition programs would be engaged simultaneously in development, production, and sustainment, which are not easily disentangled for review according to the traditional milestones. Instead, adaptable systems require continuous communication on requirements, budgets, and acquisition benchmarks. Given this contrast between the DODI 5000.02 acquisition system’s need for discreet acquisition phases and benchmarks and adaptable systems’ more fluid development processes, the traditional approach to acquisition hinders the critical elements for success for an adaptable system.

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Current acquisition budgeting also presents roadblocks for adaptable system given the defense acquisition system orientation around MDAPs. Budgets for acquisition programs provide prescriptive funding at levels set years in advance that may be incompatible with the rapidly evolving needs of an adaptable system. Adaptable systems consider multiple new and expanded features for the upgrade cycle simultaneously. They will struggle in a budget process that requires both projections five years into the future for every technology insertion and detailed production and sustainment plans before moving forward on allocating development resources. The multifunctionality of adaptable systems is also a major challenge for a budget process that organizes around distinct program offices and organizational lines of responsibility. A multifunctional adaptable system is difficult to procure in an acquisition and budget system accustomed to handling major functions such as communications, battlespace awareness, and electronic warfare as separate systems, procured by separate offices, using separate budgets.

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Not only are the defense acquisition and budgeting processes misaligned for adaptable systems, but so too are the business incentives within the defense industry. Under the current paradigm, prime contractors derive their return on investment from the integration of known technologies during development and managing anticipated work shares during production. Configuration and design churn from adaptable systems could undermine their profitability and create business uncertainty for first and second tier subcontractors whose offerings may be displaced through upgrades. This complicates the work of prime contractors managing an even more dynamic supply chain. Furthermore, greater adoption of adaptable systems will likely require prime contractors to derive profitability more from innovation, particularly in software, and less from delivering hardware. This means that the industry’s source of profit will need to shift from being mostly reliant on their ability to manufacture complex hardware and toward software design. As a result, intellectual property relating to software will become increasingly important to the industry’s bottom line. Traditional defense contracting vehicles often do not include the mechanisms to properly align incentives, allocate risk, and manage intellectual property at this degree of complexity.

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The good news is that there is a growing list of existing enablers to overcome or mitigate these barriers to the acquisition of adaptable systems. These enablers are critical to designing and managing adaptable systems throughout their lifecycle, and include:

- **Modular Open Systems Approach (MOSA)**

  MOSA enables adaptable systems by easing the process of integrating and replacing subsystems and components, as well as enabling flexibility, competition, and opportunities for distributed development. Architectures that are designed for adaptability from the ground-up make flexibility easier. This includes building hardware that can easily incorporate new software-defined capabilities. MOSA should be a baseline expectation whenever a system requires adaptability as mandated in Section 805 of the National Defense Authorization Act for Fiscal Year 2017.

- **Incremental and Iterative Development**

  A variety of tools for incremental and iterative development can be adopted for software-based systems. These include the adoption of commercial software development techniques, such as agile development, DevOps, and development sprints, which enables adaptable systems by providing a foundation for iterative change, especially if combined with oversight regimes that reduce the rigid predictability demands of the current acquisition system. Software-defined systems, if built for flexibility and adaptability, can prolong the effective lifecycle of their base hardware platforms while lowering the cost of technology currency and potentially simplifying hardware sustainment through reduced obsolescence.

- **Continuous Test and Evaluation/Dynamic User Feedback**

  Better feedback loops will make sure that products delivered are actually what is needed by users in the field. Options including prototyping,
virtual twin testing, beta-testing, and low-risk high-reward pilot projects will allow for creativity and engineer learning. They will also promote innovative and forward-thinking fixes, producing systems that can adapt to new environments/problems that are emerging in real time.

- **Dynamic Marketplace**: A dynamic marketplace approach to working with industry, especially in acquiring technology with strong commercial elements, is recommended by the congressionally mandated Panel on Streamlining and Codifying Acquisition Regulations (aka the Section 809 Panel). The dynamic marketplace approach involves obtaining proposals from industry prior to establishing discrete performance requirements and can increase competition, leverage commercial innovation and non-traditional partners, and place the mission at the center of government/industry dialogue. Industry consortia can be a good enabler for many of these discussions.

- **Budgeting for Adaptability/Creating Programmatic Space outside MDAPs for Maturing Subsystems**: Budgeting for adaptable systems means creating programmatic space outside of MDAPs for maturing subsystem technologies and planning for continuous development. Congress provided a potential framework for this approach in Section 806 of the National Defense Authorization Act for Fiscal Year 2017 by creating funds in each service for subsystem and component development and prototyping. Increased use of portfolio-based acquisition management may also be an enabler for more technology development outside of MDAPs.

- **Flexible Funding**: Greater flexibility in funding allows better support for programs that are iterative and do simultaneous development, production, and sustainment. Helpful measures include clarifying the definition of new starts, reducing the rigidity in colors of money, broadening budget justification language, and providing more readily used mechanisms for adjusting color of money. In some cases, the right solution is providing funding that can take on different purposes as needed.

- **Contracting Mechanisms**: Other Transaction Authority (OTA) agreements and flexible contracting mechanisms, such as multiple-award indefinite delivery, indefinite quantity (IDIQ) contracts, can allow for more flexibility in schedule, encourage the use of consortia and alternative competitive constructs, and enable continuous evolution of requirements throughout the acquisition process.

- **Functionally aligned workforce**: A functionally aligned workforce with increased training in software expertise will also enable leadership to understand the opportunities posed by adaptable systems. With leadership buy-in, DoD can specify technical career tracks, adjust for competitive talent acquisition, promote cross-service collaboration, develop a broader knowledge across the department of technology and offer competitive compensation for potential applicants.

While these enablers already exist and do not necessarily need new authorities to be implemented, combining these tools in an effective and coordinated way remains challenging. It is ultimately essential to understand how these enablers work together and begin a larger environmental transition toward their use. While elements across DoD are taking steps to implement a variety of the enablers listed above, the use of many of them is still comparatively rare, and it is even rarer to see several of them used together.

In order to achieve success in the acquisition of adaptable systems, DoD should consider the creation of a clearly defined adaptable systems lane. DoD currently describes its Adaptive Acquisition Framework as one
that includes a variety of approaches including the Section 804 Middle Tier of Acquisition approach, rapid acquisition, and traditional acquisition. This framework could be expanded also to include an adaptable systems lane. Systems in the adaptable systems lane would default to the use of the enablers described above rather than using them by exception. The traditional approaches that contrast with these enablers could still be used, but they would be the exceptions in the adaptable systems lane. If an adaptable systems lane were created, however, it would be important to ensure that the use of these enablers is not exclusive to a newly created adaptable systems lane. The goal of this effort is to enhance the ability of program managers and other acquisition leaders to use the right tools to acquire adaptable systems, not to impose limitations or straitjackets on them.

Deploying systems that are adaptable and agile is not just a technology strategy but a security imperative. Success will ultimately depend on DoD’s ability to rapidly adjust to uncertainty in threats—nimble adversaries, new domains, and unanticipated applications of technology utilization. Our current acquisition debate fails to directly address the changing nature of what we need to be buying, and as a result, we may be heading towards another round of acquisition reform recriminations in a few years.

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