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MODERNIZING DOD REQUIREMENTS

ENABLING SPEED, AGILITY, AND INNOVATION

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Executive Summary

The world is accelerating into the future, but the Department of Defense's (DoD's) requirements system is stuck in the past. The current approach to generating requirements is too slow to produce results when they matter most, too inflexible to account for an unpredictable environment, and too narrowly focused to satisfy joint warfighting needs across all domain operations.

This paper proposes a three-pronged approach to reforming the requirements process. First, the DoD should refine what it means by "requirements." Defining enduring, enterprise-level requirements within major mission areas allows for management at the portfolio level, improving alignment across systems and enabling more flexibility and innovation at lower levels. Next, the DoD should establish an Adaptive Requirements Framework that parallels the new Adaptive Acquisition Framework and provides new pathways for generating and validating requirements. Finally, the DoD should rethink how programs progress through each of the new pathways.

The DoD should adopt Warfighter Essential Requirements (WER) and a portfolio management approach. As opposed to ideal or 'perfect world' requirements for unique platforms, WER express what the warfighters need to accomplish the mission at an acceptable level of risk. They do not focus on individual systems but apply at the portfolio level. As such, they represent a practical level of effort that can serve as the starting point or "aim point" for architects to build system-of-systems or enterprise solutions. Armed with WER, architects empowered to manage a portfolio of programs can conduct rigorous systems-of-systems analysis and deliver capabilities at speed. The WER then become the yardstick with which to measure the resilience and effectiveness of potential enterprise architecture options. Moreover, measures of how a specific force mix performs against these requirements provide a feedback signal, impelling the portfolio to iteratively deliver capabilities to maximize performance. In this way, foundational warfighter needs become enduring and will not be pared down if they drive unacceptable acquisition risk in any individual program.

Adopting and codifying an Adaptive Requirements Framework would help formally align requirements with the new Adaptive Acquisition Framework. While many of the pathways within this proposed framework already exist, they must be modified to better align with recent acquisition reforms and to reflect the realities of a modern world. For Middle Tier of Acquisitions, the Services have imposed overly burdensome requirements bureaucracies for what were intended as rapid prototyping and rapid fielding efforts. The Joint Staff and the Office of the Secretary of Defense (OSD) should clarify how these authorities should be used and what requirements processes should apply. For software acquisitions, the "IT Box" model represents some progress toward providing needed flexibility but is still not enough to enable the speed and agility required for modern software development practices. The Department should formalize the requirements process in the new Software Acquisition Pathway within a comprehensive Adaptive Requirements Framework.

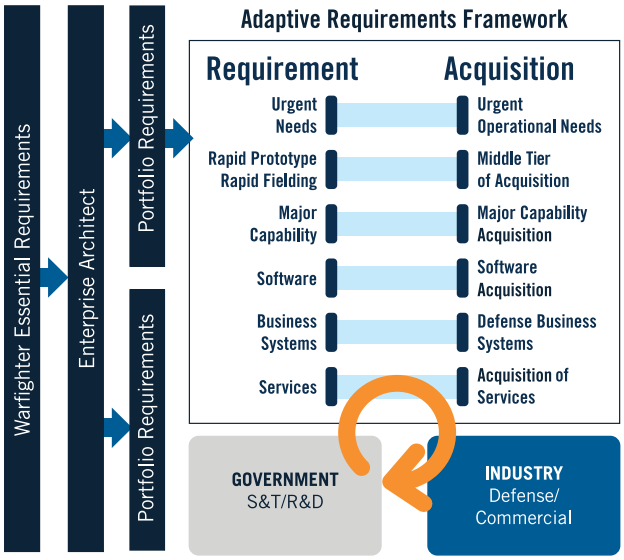

Figure ES-1: Key Elements of a Modern Requirements System

To ensure requirements accurately reflect changing operational needs, threats, and technologies the Department should adopt an iterative, flexible approach to requirements definition and validation. Such a cyclic approach to requirements ensures each new prototype or system provides a capability that is aligned with current operational needs and informs the next round of requirements documents and development efforts.

2020 presents a unique opportunity to transform the DoD's requirements system into one that meets the needs of the future force. Acquisition reforms have produced results, the Vice Chairman of the Joint Chiefs of Staff champions change, and Combatant Commanders are tired of waiting for the capabilities they need. The WER, Adaptive Requirements Framework and an iterative approach are just a few of the solutions needed to enable the speed, agility, and innovation required for 21st century national defense.

Recommendations to Modernize DoD's Requirements System

1. **Organize and empower for change/ Experiment and learn.** Ensure that requirements team members are passionate about reform, and represent a diverse spectrum of experience and roles, including experts in organizational transformation. Give the team broad direction, clear priorities, and aggressive timelines.

2. **Experiment and learn.** Start with the Adaptive Requirements Framework. Then, adopt WER. Select a strategic portfolio to work across Services and/or a portfolio within each Service and develop a set of overarching, enduring requirements and performance measures. Allow these pilot acquisition portfolios greater flexibility to achieve portfolio objectives by shaping program requirements.

3. **Revisit boards, documents, and staffing.** Review the structure, membership, and alignment of the Joint and Service boards. Start with a clean sheet for new and legacy requirements documents and staffing flows.

4. **Codify decisions and make information accessible.** Using the Adaptive Acquisition Framework as the guiding structure, collaboratively rewrite the extensive CJCSI 5123.01H and JCIDS Manual from a clean sheet. Provide simple, clear policy direction in the CJCSI with supporting guidance in the manual.

5. **Build a bridge.** Ensure a smooth evolution to the new model by developing a clear, organized, and comprehensive transition plan. Address how to deal with the thousands of programs worth billions of dollars already making their way through the system as well as new programs. Outline how to mitigate the impact on workforce execution.

6. **Address the human element.** Develop a strategy for a more formalized Requirements Management profession. Ensure this strategy includes the billets; education, training, and certification; targeted recruiting; career paths; and engagements with the Research and Development community, industry, and innovation organizations across the defense community.

7. **Spread the word.** To effectively implement the new processes, provide roadshow briefings, workshops, and just-in-time training for the key roles and teams.

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Introduction

"THERE'S NO SUCH THING AS SECOND PLACE IN OUR BUSINESS. WE HAVE TO BE IN FIRST PLACE, WHICH MEANS THAT WE HAVE TO PUT SPEED BACK IN THE PROCESS."

Gen Hyten
Speaking at CSIS Event, January 17, 2020

When it comes to reforming the requirements system, Gen Hyten is right. The Department of Defense (DoD) must move faster: it must shrink the time that elapses between idea and initial operational capability (IOC). As the rate of change of operations, threats, and technologies increases, the time between an operational commander's identification of a need or opportunity and the delivery of a solution to the warfighter must decrease.

But speed by itself is not enough. Take the story of Joint Tactical Radio System (JTRS) as an example. JTRS was conceived as a 'one size fits all,' omni-purpose communication suite. Despite spending $6 billion over 15 years, the program never delivered its Ground Mobile Radio and was canceled in 2011. Failure was almost inevitable; requirements for the program violated some fundamental rules of physics, testing delays piled on top of one another, and development was disconnected from the end users' real-world needs (the 'mobile' radio weighed 207 pounds, took 10 minutes to boot up, and didn't work in the heat). Faster is better, but in order to quickly deliver effective capabilities, DoD must also reexamine how requirements are built and managed in the first place.

Effectively managing requirements in today's dynamic environment requires a new approach which recognizes that – like a failed universal radio – one size cannot fit all programs. New policies have allowed the acquisition community to move toward a more customized model, focused on increasing adaptability and encouraging critical thinking. The DoD should apply same kind of model to the requirements process.

This paper proposes a three-pronged approach to reforming the requirements process. First, DoD must redefine what it means by 'requirement.' Siloed, system-specific, directive requirements lead to capable, but isolated platforms. To improve interoperability and integration, as Gen Hyten has often said publicly, "The key is to focus on capabilities." Defining enduring, enterprise-level requirements within major mission areas – independent of individual procurements – enables management at the portfolio level, improving alignment across systems and enabling more flexibility and innovation at lower levels. Next, DoD must reexamine the types of pathways requirements take as they travel from concept to fielded capability. Just as the new Adaptive Acquisition Framework established different pathways for different types of programs, an Adaptive Requirements Framework will create a process that helps appropriately balance risk and speed. Finally, DoD must rethink how programs progress through each of those pathways. Sequential, requirements-driven procedures may work in many cases, but in others - especially in areas such as software, but even for many hardware systems - early prototyping and iterative development can help ensure technology insertion and closer alignment with operational users. Instead of applying the linear model (design – development – production – delivery), more can be done to demonstrate mature commercial and government solutions, perform rapid prototyping and experimentation, and quickly deliver a minimum viable product to shape scope and requirements.

Challenges with the Current System

Air Force Chief of Staff General Goldfein is fond of telling the story of how the F-117 came to be. In his accounting, Ben Rich, then head of Lockheed's Skunk Works, came to visit the Secretary of Defense and the Chief of Staff of the Air Force to deliver an

important message. He sat down to start the meeting and promptly rolled a marble across the table. Secretary Perry asked, "What's that?" Rich replied, "That's the radar cross section I'm going to build you."

Goldfein's point is simple: the military does not have a monopoly on good ideas for future capabilities. In fact, many insiders admit the DoD's ability to predict future wars is poor at best. Echoing very similar comments from Gen Mattis and Secretary Gates, GEN H.R. McMaster once noted, "We have a perfect record in predicting future wars — right? … And that record is 0 percent."

Despite this acknowledged lack of prescience, the current acquisition system is built around the assumption that DoD can accurately create a set of comprehensive requirements that will carry a program through years of development. The Joint Capabilities Integration and Development System (JCIDS) attempts to achieve this high standard by coordinating across numerous stakeholders to produce detailed and definitive guidance approved at the highest levels of the Department. Unfortunately, JCIDS is too slow to produce results when they matter most; it is too inflexible to account for the unpredictable nature of the environment; and it is too narrowly focused to satisfy truly joint warfighting needs.

Too Slow

The current requirements process does not move fast enough to protect our relative military advantage or to exploit leading commercial and government technologies. Lengthy JCIDS documents are designed to lock in requirements for billion-dollar platforms that will operate for decades. Reviews of these documents pass through dozens of stakeholders with varying degrees of interest and often conflicting agendas, adding time at every step along the way, but not always adding value. As a result of this "one size fits all" approach, three to five years may elapse from the time an operational commander initially identifies a capability need before a finalized Capability Development Document is approved. While this process may succeed in minimizing the chances of individual program failure, it effectively transforms reduced development risk into increased operational risk (see Figure 1). Delay in delivering capability leads to a decay in the warfighter's relative advantage.

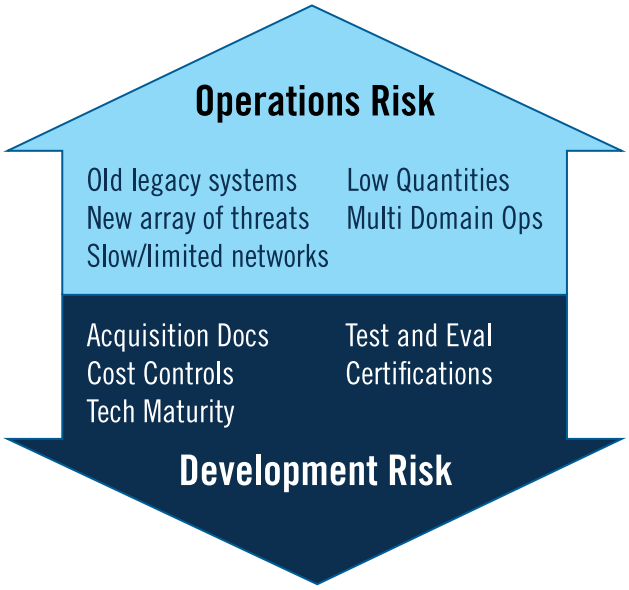

Figure 1: Excessive time spent reducing development risk ultimately increases operational risk

As the requirements process plods along, the world of technology continues to accelerate forward. Rapid advances in enabling technologies, such as artificial intelligence, 3D printing, and autonomy, create tipping points which can trigger sudden and profound changes in areas critical to defense. But the center of gravity for progress in these areas is in the private, not the public sector. This mismatch between Pentagon processes and private sector urgency makes exploiting leading-edge technology difficult. While some recent efforts such as Middle Tier of Acquisition authorities and the fast track of Joint Urgent Operational Needs can deliver capabilities faster than the standard processes, they apply only to a limited subset of requirements and circumstances.

Too Rigid

JCIDS is simply too inflexible to deal with an ever-changing operational and technological environment.

Two attributes of the system lead directly to this rigidity. First, changing established requirements is very difficult; the process was built to help resist unneeded fluctuations and "requirements creep." Some of this rigidity makes sense, as it helps control costs and suppresses the appetite for continuously adding new and exquisite capabilities. But the optimal balance between consistency and change might not be the same for every type of program. Because updates almost always require a lengthy coordination process and high levels of approval, programs routinely proceed under guidance that either demands too much or too little. A program in which anticipated technology developments have not materialized may spend excessive time and money trying to deliver the last 10% of requirements. Another may underdeliver because easily provided technical upgrades are not already codified in requirements guidance. Second, prototyping and experimentation with actual technologies do not typically occur until relatively late in the requirements process. During the "Technology Maturation and Risk Reduction" phase, competitive prototyping is intended to help acquisition professionals make sound business decisions as the program proceeds. In this model, requirements are "refined" by testing, not "defined" after experimentation. Prototyping is driven almost entirely by a "requirements pull." Government and industry have few opportunities to demonstrate new capabilities or novel solutions to a given operational problem. Thus, there is little room for a "technology push." As General Goldfein puts it, there was never a requirement written for the iPhone.

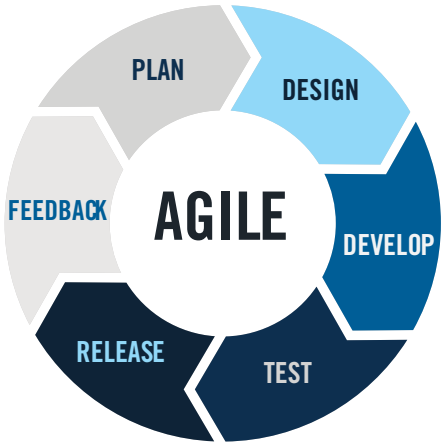

Figure 2 Agile Software Development Model

While the process of defining detailed specifications before experimenting may be suitable for some acquisitions, it is completely inappropriate for developing software. In leading software development practices—such as Agile (see Figure 2) and DevOps—users, acquirers, developers, and other stakeholders iteratively define, prioritize, and change program scope and requirements. They begin with a "hypothesis" of the desired functionality and iteratively build, test, and demonstrate capabilities in close coordination with users. Users and engineers provide feedback on interim developments to shape future iterations. Some changes to JCIDS, such as the "IT Box," have attempted to move toward a less restrictive model for software. Even these processes, however, are hamstrung by excessive paperwork and approvals for each incremental software iteration.

Too Narrow

JCIDS is optimized to develop individual systems that integrate into closed and maybe even proprietary architectures, usually within a single domain. No one is responsible for architecting or incentivizing enterprise interoperability in contested environments. There are countless examples of well-developed programs unable to work together, even within the same domain and Service. Because no one is responsible for developing or achieving enterprise-wide requirements, DoD programs have only limited ability to make tradeoffs between complementary capabilities.

Today independent systems are procured to attempt to meet a warfighter's need from a single domain. But those warfighter needs are frequently watered down as requirements are adjusted to mitigate domain-specific technology or acquisition risks before development documents are finalized. The original warfighter's desired level of capability can be lost and go unfulfilled in the program acquisition, even though the program technically meets "requirements." This weakened and program-specific approach often leads stakeholders to tack additional, lower level attributes onto systems without analyzing

the impact on the program as a whole or considering other potential domain or portfolio solutions. The result of such narrow focus can be bloated programs, with unnecessary and constraining specifications.

On top of these issues, very few individuals are able to gain the proficiency needed to effectively capture and shape requirements. There is no trained, professional requirements management cadre. Warfighters typically serve in ad-hoc roles working on requirements for 18–24 months. They receive some instruction from the Defense Acquisition University (DAU), but in 2017 only two-thirds of them were fully trained. To make matters worse, certification standards are inconsistent across the Services and, once they're trained and experienced in requirements, military operators rarely return to work within the requirements system.

Solving these problems will require reforming not only what requirements ultimately look like, but the paths those requirements travel and how they proceed along those paths. The following sections address the principles that should guide this reform and offer detailed analysis on how to help DoD achieve speed, agility, and innovation.

Guiding Principles

Before undertaking detailed reform, the Department should adopt a set of guiding principles it can use to shape a modern requirements system. Here are a proposed set of principles to consider.

1. **There is more than one way to generate a requirement.** Multiple JCIDS requirements pathways should be available based on urgency, size, mission, and type of capabilities needed. Just as it drives the development of new technologies to fulfill defined mission needs, JCIDS should also allow rapid exploitation of leading technologies for military applications.

2. **There are no facts about the future.** DoD should use prototyping and experimentation prior to defining requirements in order to better understand technology and operational tradeoffs. Flexibility should be built into the system to adapt to a changing environment without ballooning budgets and requirements. Decisions should be delegated to the lowest possible level, while keeping key stakeholders informed.

3. **Integration happens at the front end.** Requirements documentation should focus on integrated suites of capabilities. Enterprise architectures should be developed first, with individual systems leveraging modular open systems approaches to drive integration and interoperability. Operational sponsors should capture high-level objectives and users should then iteratively define and prioritize lower level requirements.

4. **Design with the end user in mind.** Delivering mission-impactful solutions requires active and continuous collaboration among operators, acquirers, developers/technologists, sponsors, testers, and sustainers to define effective requirements. DoD Components should tailor and execute most JCIDS processes, while the Joint Staff should limit its intervention to strategic or joint areas.

5. **Total cost matters.** Requirements should be affordable within available budgets with alternatives to scale up/down as priorities and budgets change. Tradespace analysis should consider costs of the holistic environment beyond the system itself as well as lifecycle operations and sustainment costs.

Warfighter Essential Requirements (WER)

Reforming the requirements system must start by examining how DoD thinks about requirements themselves. Today, independent systems are procured to attempt to meet a warfighter's need from a single domain, leaving no one responsible for

demonstrating to the Joint Requirements Oversight Council (JROC) how weapon systems from any domain will fight together. As Gen Hyten wrote to the House Armed Services Committee in January 2017, "JCIDS today, especially as it relates to Analysis of Alternatives, puts a premium on individual platform or components which focuses on the systems vice the system-of-systems level. This inevitably prioritizes upgraded, but like-kind replacements, stifles innovation and creates false imperatives for urgency with higher costs."To address the JCIDS problems outlined earlier, the DoD requirements system must adopt an enterprise approach, which will require establishing capstone-style enterprise requirements in lieu of individual ones. WER are enterprise-level requirements which specify the level of capability warfighters need to enable success throughout a conflict, at a level of risk acceptable to the Combatant Commander. They capture the essential (acceptable risk) capability versus desired (no risk) warfighter needs to rapidly and affordably outpace the projected threats. WER are founded on operation plan (OPLAN) force structures, schemes of maneuver, and future threats and are designed to describe the essential performance needed from a joint force in anticipated contested environments within a certain time frame. They are not domain or platform specific. Instead of focusing on individual requirements meant to optimize isolated platform performance, the JROC should adopt WER to enable DoD Components to visualize and build enterprise architectures that span multiple domains.

Because they apply at a broader level than program-specific requirements, WER are enduring but can be updated and iterated based on future force postures, new schemes of maneuver, or improved warfighting methods. Adopting an approach that emphasizes WER offers several clear advantages.

Advantages

Implementing WER and the associated architecting reforms can provide, among other benefits, enhanced mission assurance, increased combat power, better JROC effectiveness, speed and agility, improved mission capability, force optimization, and new cross-domain operational risk measures.

Mission Assurance

With WER in place, the JROC would designate a lead 'enterprise architect' for a capability area or portfolio. The architect's job would be to explore multi-domain solutions, ensure system interoperability, and enhance mission assurance. The architect may be a Service, who would incorporate program contributions from other Services, agencies or even commercial or international partners into the target architecture. The enterprise development team established by the architect will perform early system-of-systems analysis; give guidance to product centers to leverage prototyping and innovations; determine common standards, interfaces and protocols; and allocate individual system requirements to contributing organizations. Failure to perform this kind of enterprise architecting creates overpriced, siloed solutions and inevitably results in costly efforts at retroactive integration between systems.

Combat Power

Incorporating the Services, Agencies, and Allies early in the process of building the enterprise solution architecture creates enormous flexibility by incorporating contributions from and between multiple domains. This flexibility can expand the architectural trade space and enable economy of force, potentially generating previously unrealized force-mix options and combining effects to increase combat power and likelihood of campaign success.

JROC Effectiveness

Enterprise architectures capture how various contributing systems, from any domain or partner, complement one another in a joint fight. This gives the JROC the broader view it needs to execute its Title 10 missions, especially its mandate to ensure interoperability. Moreover, when a proposed enterprise solution architecture is compared to the WER, the JROC can more easily identify gaps and validate whether component capabilities fill those shortfalls.

Speed and Agility

As the JROC focuses on enterprise-level capabilities and architectures, Services, Agencies, or Allies and their program managers should be empowered to define and develop individual system requirements within the enterprise architecture. In this way, the architect can make tradeoffs within the program portfolio without a return to the JROC, provided the enterprise architecture continues to satisfy the WER. This inclusive approach to determining architectures and tradeoffs can diminish or eliminate stakeholders' needs to insert new lower level attributes that create program bloat and competing requirements. Also, incorporating Services, Agencies, and Allies early in the process of building enterprise solutions removes the need for extended joint coordination after the fact. In both instances, integration of component needs happens up front and most of today's delayed joint staffing timelines are avoided altogether. Finally, integrating early prototyping during architecting expedites developing and allocating program-level requirements.

Enhanced Capability

Allowing enterprise architects to make tradeoffs within their portfolio enables DoD to rapidly exploit leading technologies and iteratively adapt to changes in the operational and technical environment. For example, threats in cyberspace may rapidly advance while a weapon system is progressing through the development and acquisition phases. The ability to modify individual hardware and software system requirements, overcome deficiencies, and incorporate innovations, lessons learned and enhanced cyber protections should be available without requiring joint staffing and revalidation, so long as those changes remain within the overall approved architecture.

Force Optimization

Adopting WER would allow for optimization not just of individual systems, but of an entire joint force. This can be accomplished by measuring the effectiveness of an overall force mix, not just of a single platform. Along with WER, the JROC would use Measures of Force Effectiveness (MOFEs) and mission threads to evaluate and continuously optimize the solution architecture.

MOFEs are specific measures of how a force mix (a system of systems consisting of sensors, weapons, communications systems, etc.) performs against the WER. MOFEs represent the culmination of the Measures of Effectiveness and Measures of Performance currently captured in Interface Control Documents (ICDs) and Capability Development Documents (CDDs). Integrating and applying MOFEs would be a significant challenge, but they are critical to optimizing enterprise solutions and investments. This would impel the Portfolio Acquisition Executive to iteratively deliver capabilities to maximize performance against MOFEs, focusing investment on the highest mission impact. (Source: Section 809 Panel Vol III report)

Mission Threads or Effects Chains are representative vignettes that illustrate specific operational scenarios. The vignettes would expand upon the Mission Engineering work within OSD, Joint Staff, and the Services to identify a series of effects chains and would focus investments to strengthen any "weak links" in the chain, holistic integration, and strategic outcomes. (Source: Section 809 Panel Vol III report)

Operational Risk Measures

WER and the associated Force Optimization measures would allow Combatant Commanders to understand and balance operational risk across domains and theaters of operation.

WER Development

The first step in the WER development process would be for the JROC to decide what strategic mission capability areas it wishes to affect and oversee. For example, they might select protection of forces from missile threats as an area. Contributing capabilities would include global detection and tracking from the space domain and missile defense from other terrestrial domains. A Combatant Command or a contributing Service that had Combatant Command representation on the architecting team would then collaboratively develop a proposed WER.

As a next step, Combatant Command staffs and/or their components would conduct a risk analysis of their Operating Plan and propose a WER in plain language that describes only key driving aspects of the capabilities necessary to outpace threats and enable OPLAN success by a specified time frame, say 2025. Specifying a WER as an enterprise requirement opens the trade space and doesn't preconceive any domain or system solution. With the risk analysis in hand, the Combatant Commander would make a final risk determination and select a WER that balances operational, or OPLAN, risks across all domains. The originator – a Combatant Commander or Service Chief — would then capture the WER in a Mission Needs Statement (MNS) along with MOFEs and mission threads and send them to the JROC. The JROC would validate the MNS and designate a Service, Combatant Command, or other agency as the lead enterprise architect, tasking contributing organizations, including other Services, Combatant Commands, agencies, partners, or allies.

Next, the validated WER would become the "aim point" for the lead architect and contributing organizations to build enterprise, or system-of-systems, solution architecture options for the capability area directed by the JROC. The architecting team would use MOFEs and WER as a yardstick to measure the resilience of enterprise architectures under consideration, enabling the lead architect to make an appropriate architecture selection, and allocate system requirements to contributing programs.

Finally, in exercising new authority to manage and trade requirements below the JROC level, each contributing organization headquarters would deliver streamlined documentation to its acquisition agency, capturing its individual requirements allocated by the lead enterprise architect. In the missile defense example, the US Space Force, Missile Defense Agency, US Army, and others would now understand their allocated role in the overall architecture and would have greater authority to manage acquisition programs at the Service and Agency levels. The lead organization/architect would capture the enterprise architecture in an Enterprise Capability Document or Operating Concept and share it with the JROC. The lead architect would now have the flexibility to make trades as necessary within the enterprise to address difficulties in any program acquisition. Only if a feasible architecture cannot meet the WER would a return to the JROC be required for a new risk determination.

In this way, the foundational warfighter needs will be solidified and will be met by an enterprise architecture, rather than being pared down if they drive unacceptable acquisition risk in the individual program requirements and acquisition model represented in JCIDS today.

These improvements can be accomplished within current statutes, direction, and authorities. The JROC would transition from validating very detailed requirements for individual programs, which do not reflect actual mission resilience during war, to validating enterprise requirements clearly stated in warfighting-language. These would focus on interoperable, multi-domain, resilient enterprise architectures that can outpace threats and provide mission assurance.

PORTFOLIO EXAMPLE: In the early 1990s, NASA's *Stardust* spacecraft was part of a larger portfolio of exploration missions. *Stardust's* design included a Motorola radio originally designed for an earlier spacecraft in the same portfolio, the *Mars Surveyor*. However, under the *Surveyor* contract, Motorola's production line was scheduled to close before the *Stardust* funds became available to purchase the necessary hardware. Keeping the production line going was financially unviable, and redesigning *Stardust's* overall architecture to incorporate a different radio was similarly unaffordable. Fortunately, a third program in the portfolio (*Near Earth Asteroid Rendezvous,* aka *NEAR*) had experienced a budget underrun and had funding available. The portfolio manager was able to temporarily transfer funds from *NEAR* to *Stardust* so the portfolio could purchase the radio from the *Surveyor* contract. *Stardust* was able to reimburse the *NEAR* program the following year.

Adaptive Requirements Framework

Managing requirements at the enterprise and portfolio levels is critical to delivering an integrated suite of capabilities to meet strategic objectives. At a lower level, the process to capture and manage requirements should be streamlined and tailored to the operational needs, urgency, mission, and notional acquisition pathway(s) used to meet them. Requirements should move at the speed commensurate with the urgency of the need for the capabilities to be delivered. While JCIDS is often viewed as a single monolithic process for how all requirements are managed across the Services and Joint Staff, an array of processes and flexibilities are already built into the system. Unfortunately, they are not clearly outlined, nor are they aligned with new acquisition processes.

The Under Secretary of Defense (Acquisition and Sustainment (USD(A&S)) developed the Adaptive Acquisition Framework in 2018 to offer the acquisition workforce a variety of pathways to acquire and deliver capabilities. Most of these acquisition pathways already have a unique requirements processes. Each pathway requires tailoring the documents and constraining coordination based on the size, risk, urgency, complexity, and integration to enable speed with rigor. Further codifying and tailoring the requirements processes via an **Adaptive Requirements Framework** would help align these two critical DoD enterprises (see Table 1).

Need	Requirements Process	Acquisition Pathway
Urgent or emerging need <2 years, identified by Combatant Commander, Chairman/Vice Chairman of Joint Chiefs, or Warfighter Senior Integration Group	Sponsor drafts document, Joint Staff coordinates within 30 days. Component reviews add to or take place in lieu of Joint Staff coordination.	**Urgent Operational Need**
Fielding of rapid prototypes of innovative technologies and/ or rapidly produce mature technologies within 5 years	Sponsor develops and coordinates requirements via Component processes for approval within six months.	**Middle Tier of Acquisition**
Software capabilities for standalone IT system or embedded in weapon system(s)	Functional sponsor develops Capabilities Need Statement to begin, with iterative backlogs of user stories or related needs.	**Software Acquisition**
IT systems that support DoD business operations	Functional sponsor authors Capability Requirements Document, CMO validates needs and aligns to BEA and process reengineering.	**Defense Business Systems**
Services from private sector (e.g., knowledge, IT, R&D, facilities)	Sponsor and contracting officer captures contract requirements in a performance work statement or statement of objectives.	**Acquisition of Services**
All other needs – major weapon systems, capabilities	Sponsor develops new requirements documents through new streamlined processes for Service/Agency approval.	**Major Capability Acquisition**

Table 1: Notional Adaptive Requirements Framework

Each of these requirements processes can be continuously improved based on new statutes and policies, best practices and lessons learned by those using them, and by addressing the key barriers and enablers. The intent of these refinements is to achieve a delicate balance of speed and rigor. The rapidly evolving national security environment does not allow the DoD to spend two or more years defining and coordinating requirements for most systems. Conversely, the DoD cannot afford to move so fast that it forgets to consider interoperability, cybersecurity, or sustainment factors.

While many of the pathways within this proposed framework already exist, they must be modified to better align with recent acquisition reforms and to reflect the realities of a modern world. For Middle Tier of Acquisitions, the Services have imposed overly burdensome requirements bureaucracies for what were intended as rapid prototyping and rapid fielding efforts. The Joint Staff and the OSD should clarify how these authorities should be used and what requirements processes should apply. For software acquisitions, DoD must modernize its requirements process for greater speed and agility to enable modern development practices.z

Middle Tier of Acquisition Requirements

As it sits between the two extremes of major capability acquisition and urgent needs, the Middle Tier of Acquisition pathway warrants some additional examination. In the FY16 NDAA Section 804, Congress granted the DoD the authority to establish Middle Tier of Acquisition pathways for Rapid Prototyping and Rapid Fielding. Rapid Prototyping is intended to demonstrate innovative capabilities in an operational environment. Rapid Fielding is used when a mature solution exists, and DoD can move straight to producing and fielding capability with minimal development. The statute explicitly exempted Middle Tier of Acquisition programs from JCIDS and simply directed the Services to develop an "approved requirement in less than six months."

Even when given direction and flexibility from Congress to move out fast, the Service requirements organizations imposed bureaucratic processes and extensive documentation for these rapid pathways. This was done in part because of uncertainty regarding the true purpose of Middle Tier programs. While the Middle Tier of Acquisition pathway was intended to be used to rapidly prototype and produce innovative technologies, some viewed the new authority as a means to circumvent JCIDS, DoD 5000 policies and oversight, thus enabling delivery of major capabilities within five years. The significant documentation and reviews the Services put in place make sense only if the intent is to develop a major weapon system that will cost over a billion dollars. If, however, the purpose is to rapidly prototype an emerging technology in order to explore its military utility or to rapidly produce mature solutions, then more streamlined processes are warranted. If speed is part of the equation, the number of offices listed on the staffing summary has to be cut.

While historically the Services have complained about excessive oversight and bureaucracy imposed by OSD and the Joint Staff, this is a rare occasion where Joint Staff leadership may be needed to streamline Service-imposed bureaucracies.

The US Navy's Acoustics-Rapid COTS Insertion (A-RCI) program office structured their requirements to allow for rapid adoption of mature technology as it becomes available on the commercial market. Rather than trying to control, define, or predict the trajectory of computer technology development, their acquisition plan instead points to advances in commercial computing solutions and establishes an iterative series of technology insertions to enhance submarine signal processing capabilities. These requirements do not follow the typical pattern of requiring specific processor speeds or other related attributes. Instead, the requirement is simply to integrate the available commercial capabilities. This is a long-term strategy and has been providing operational updates of COTS systems since 1997.

Modernizing Software Requirements Processes

"WHEN IT COMES TO 21ST CENTURY CAPABILITIES, ALL HEAVILY DEPENDENT ON SOFTWARE, THE JROC PROCESS AND THE CURRENT PROCESS THAT WE HAVE FOR BUILDING SOFTWARE IS HORRIBLE."

Gen Hyten
Speaking at CSIS Event, January 17, 2020

The procurement of software also merits some additional discussion. Policymakers have already recognized that traditional requirements processes do not fit well with software acquisitions. For example, the IT Box model detailed in the JCIDS manual was intended to offer greater flexibility for IT than traditional JCIDS processes. This change, however, is still not enough to enable the speed and agility required for modern software development practices. The JCIDS manual focuses on documenting software requirements for each software version iteration, imposing tight constraints and longer timelines to coordinate and approve requirements. While the IT Box model was intended to provide some flexibility while still scoping program boundaries, instead it simply added confusion, constraints, and disconnects with the budgeting processes.

The Defense Innovation Board, a SECDEF-chartered group of executives from Silicon Valley and leading universities, recommended a series of strategic reforms via a Software Acquisition and Practices (SWAP) study. The board highlighted "The ability to develop, procure, assure, deploy, and continuously improve software is thus central to national defense. The current approach to software development is broken and is a leading source of risk to DoD: it takes too long, is too expensive, and exposes warfighters to unacceptable risk by delaying their access to tools they need to ensure mission success." The board recommended that DoD "Replace the JCIDS, PPBE, and DFARS with a portfolio management approach to software programs, assigned to "PEO Digital" or an equivalent office in each Service that uses direct identification of warfighter needs to decide on allocation priorities."

In the FY20 NDAA Section 800, Congress directed DoD to modernize how it acquires and delivers software. It directed DoD to develop streamlined and coordinated requirements, budget, and acquisition processes to support rapid fielding of software applications and upgrades. Furthermore, it exempted software acquisition or development under this authority from JCIDS regulations unless the VCJCS, in consultation with USD(A&S) and Service Acquisition Executives (SAEs), develops a new modified process for software requirements.

In response, USD(A&S) published an Interim Policy Memo on a Software Acquisition Pathway in December 2019 with a new DoD Instruction planned for 2020. In coordination with the Joint Staff, agreement was reached on exempting software acquisitions from JCIDS. Instead, sponsors and program managers will now develop a Capability Needs Statement (CNS) and a User Agreement (UA) to capture "requirements" and commit to frequent end-user engagements during development. The CNS and UA documents are meant to be flexible products, periodically updated to reflect the capabilities baseline, and will be developed and approved via expedited component or joint validation processes. To guide the software development, a Product Roadmap and dynamic program backlogs will shape the planned functionality and specific needs of near-term releases. Operational sponsors will also provide a written value assessment at least annually on capabilities delivered.

This type of light touch requirements structure is exactly what the DoD needs. It enables modern software development practices and should progress from an interim policy memo on acquisition to official codification in JCIDS.

Innovative, Iterative Approach

Adopting a more flexible approach to individual system requirements might prove beneficial beyond just software acquisitions. Locking in requirements at the start of a program and then resisting all further change is a sound strategy only if the system under consideration exists in a stable environment. As long as the threat does not change over the course of a system's development, as long as there are no significant technological advancements in the field, and as long as budgets, strategies and leadership all remain stable during the program's projected duration, DoD can be confident the requirements approved at the initiation of the program will still be valid at the end.

However, in a time of dynamic change, where threats and budgets and technologies are constantly evolving, requirements must have the capacity to evolve as well. This evolution is necessary to ensure the requirements accurately reflect the changing operational needs, as well as the financial and technical realities of the domain in question.

Rather than dismissing such adjustments as "scope creep" to be prevented or as undesirable "requirements changes" to be resisted, they are better understood as corrections, updates, or improvements to be pursued. Regardless of the label, failing to make these changes increases the risk that the delivered capability will be technologically obsolete, operationally irrelevant, financially unsupportable, or all three. The key to addressing this risk is to adopt an iterative, flexible approach to requirements definition and validation, and to be clear and honest about what is known and what is unknown.

In today's world, programs should not be surprised to discover that previously useful technologies have become obsolete or that previously unknown technologies have entered the market. Similarly, no one should be surprised if previously unknown threats enter the battlefield. The timing and particulars of these future changes may be impossible to *predict*, but DoD cannot *deny* that they will occur.

Based on these realities, Figure 3 illustrates three potential methods for generating and validating a requirements document. Which method to choose is determined by what is known and what is unknown, by what is fact and what is theory.

The first method is the traditional **User-Driven** approach, most suitable for a stable environment where an operator has a clear and demonstrable

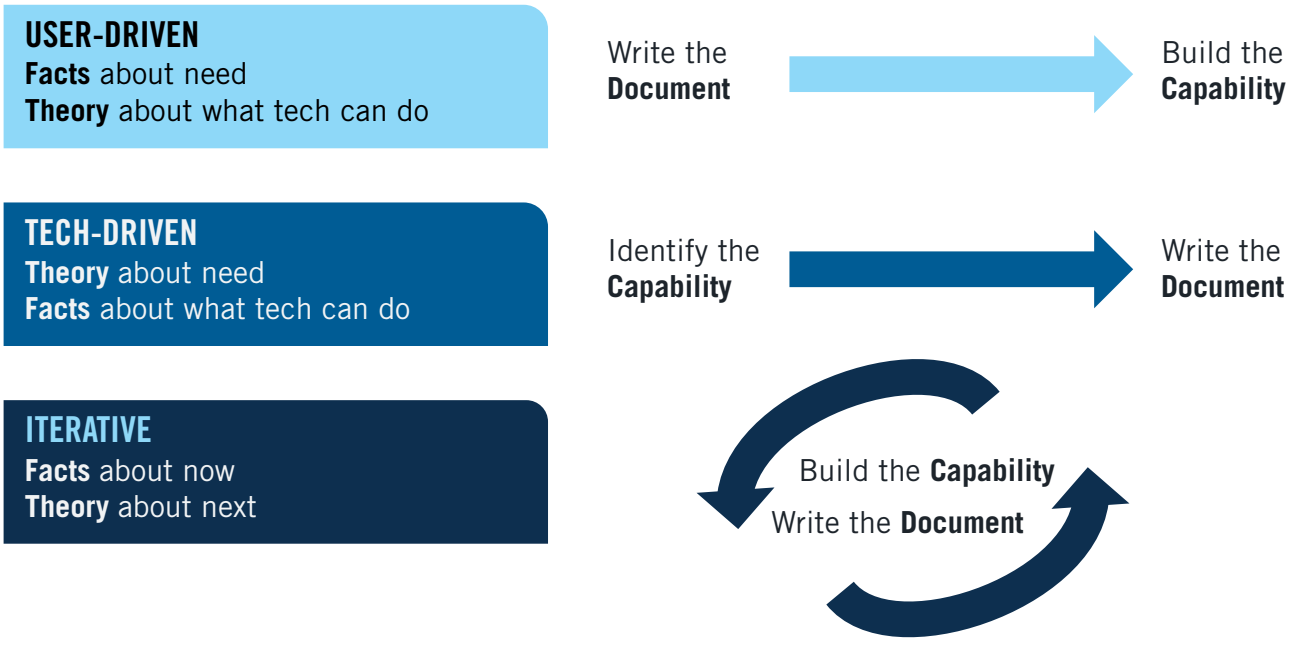

Figure 3: Methods for generating and validating requirements documents

need for a specific capability but may have less certainty about the technology environment. The user's specific need can be written into a requirements document based on a theory that technology exists (or can be developed in a reasonable timeline) to address the need. Developers then test the theory by building a capability that addresses the stated requirement. In this situation, requirements drive development.

The second method is **Tech-Driven**, where a capability is developed that is initially unconnected to a user's need (for example, a COTS product or a laboratory prototype). The capability provides evidence of what technology can do and leads to the hypothesis that these capabilities would address a user's needs. The requirements document in this scenario would be built on the capabilities demonstrated by the product or prototype, rather than starting with an operational need. In this situation, technology informs requirements.

The third method is **Iterative**, where users and developers have facts about the present situation (technology, operational needs, budgets, etc.) and theories about how things will change in the future. Rather than relying on uncertain predictions about future needs and technologies, this method involves a cyclic approach where each new delivery and document incorporates information gleaned from previous iterations. In this model, each new prototype or system not only provides a capability that is aligned with current operational needs, but also serves to inform the next round of requirements documents and development efforts. In this situation, requirements and technologies influence each other.

The first two methods typically rely on extensive and lengthy review processes to validate the requirements document. In contrast, the iterative approach relies on a rapid cycle of user interactions to confirm that the demonstrated capability is actually aligned with operator's needs.

The iterative method requires different mechanisms than the first two methods. The primary mechanism required for this third method is **frequent information exchange** between developers and users. This ensures both communities are operating with facts about current technologies and current mission needs and are able to recognize when threats or technologies change. Organizations such as Special Operations Command (SOCOM) and Kessel Run accomplish this by physically co-locating users and developers. This enables regular conversations about operations and technologies as they unfold and change.

Both users and developers also require clear procedures for quickly **revisiting previous agreements**, assessments, and commitments. These revisions may include adding, removing, or modifying the system's requirements, as technologies emerge or become obsolete or as mission needs evolve.

Finally, the requirements system must provide **budgetary flexibility**, since responding to changes generally influences how much money is needed. These budget changes may include increases or reductions in the amount of money required, as well as shifts in the timing for when the funds must be available.

A portfolio management approach is one way to help achieve this budgetary flexibility. It allows funding and requirements to seamlessly transfer between related programs within the portfolio.

All of this becomes easier if each effort adopts a **modular approach** to the overall program structure, including everything from design to contracting. Modular system architectures combined with modular contracting methods help increase the odds that the overall portfolio delivers systems that enable users to take full advantage of the latest technical developments.

MODULARITY EXAMPLE: The US Navy's Virginia Class submarine development program used a flexible, iterative approach to requirements, at one point modifying three previously approved "critical requirements" to make them less demanding. According to a GAO report, the Navy correctly determined the requirements "were unrealistic and would not be worth the cost needed to achieve them… [and] the change will not affect operations." Further enabling flexibility in requirements, the Virginia was designed with a modular physical architecture and a block approach to delivery. This allowed later blocks to incorporate new capabilities as technology matured and new requirements emerged. The modular architecture of the submarines also ensured the changes were backwards compatible, with the earlier submarines able to incorporate capabilities developed later in the program.

Recommendations for a Modern DoD Requirements System

1. **Organize and empower for change.** The VCJCS must be the champion for change. How Gen Hyten organizes and empowers the team responsible for developing recommendations is critically important. First and foremost, team members must be passionate about reform. They should represent a diverse spectrum of experience and roles; and should include operators, acquirers, technologists, financial experts, innovators, and industry representatives as appropriate. Experts in organizational transformation and change management should complement a minority of the team intimately familiar with the system as it exists today, who would be drawn from the Services and Joint Staff. Give the requirements development team broad direction, clear priorities, and aggressive timelines.

2. **Experiment and learn.** Start with the Adaptive Requirements Framework. Outline the notional pathways to capture, review, and approve requirements aligned to the six acquisition pathways in the USD(A&S) Adaptive Acquisition Framework. Include Joint Staff and Service-unique processes, documents, and reviews. Test the framework on a realistic example. Organize structured discussions, capturing current approaches, pain points, best practices, and continuous improvement opportunities. Then, tackle ways to implement WER at the portfolio level. Select a strategic portfolio to work across Services and/or a portfolio within each Service. Gather the requirements community and develop a set of overarching, enduring requirements; include measures that enable focus on the key priorities/impact/value of the new model. Ensure dedicated operational representatives serve as key advisors to the portfolio manager. These advisors should serve as bridges between operations, acquisitions, and developers. Their insights into CONOPS, TTPs, operational environments, and threats will enable them to provide critical and continuous feedback. Moreover, these representatives can help coordinate demonstrations with end-users. Provide these pilot acquisition portfolios greater flexibility to achieve portfolio requirements by shaping program and system requirements below the Key Performance Parameter level. Test how portfolio requirements can shape research budgets and projects, rapid prototyping efforts, etc.

3. **Revisit boards, documents, and staffing.** Review the structure, membership, alignment, and need for the Joint and Functional Capabilities Boards, and related Joint and Service boards. Start with clarity of purpose and expected outcomes of each board. Solicit and incorporate feedback from key stakeholders and identify opportunities to shape these boards to align to the new guiding principles. Overhaul requirements documentation, starting with a clean sheet for new and legacy requirements documents. With the guiding principles and objectives of each document in mind, create a new set of requirements documents tailored for each requirements pathway. Analyze staffing flows with an eye toward eliminating steps which may not provide value. Produce accompanying templates and outlines and publish them separately from a new CJCSI.

4. **Codify decisions and make information accessible.** Using the Acquisition Requirements Framework as the guiding structure, collaboratively rewrite the extensive CJCSI 5123.01H and JCIDS Manual from a clean sheet. Provide simple, clear policy direction in the CJCSI with supporting guidance in the manual. Accompany the new CJCSI with revised requirements policies and guidance for the Services. Iterate on requirements elements of the Software Acquisition pathway interim policy and align with the planed DoD Instruction for Software Acquisition Pathway in 2020. Host content on a website, similar to and aligned with the USD(A&S) AAF site, to provide DoD personnel with integrated policy, guidance, and resources for each requirements pathway. Enable users to understand what is required and how to quickly and effectively navigate the right pathway to capture users' needs.

5. **Build a Bridge.** Thousands of programs worth hundreds of billions of dollars are already progressing through the existing requirements system. Ensure a smooth evolution to the new model by developing a clear, organized, and comprehensive transition plan. Classify all programs within the ARF framework. Determine which will continue with existing requirements and which will change to WER immediately. For those transitioning to WER, assign each to a specific strategic capability area. Address how operating with two standards for a limited period may impact workforce training and execution."

6. **Address the human element.** Develop a strategy for a more formalized Requirements Management (RM) profession. This strategy should include the RM billets; education, training, and certification; targeted recruiting; career paths; and engagements with the R&D community, industry, and innovation organizations across the defense community. Allocate additional resources to RM, to include extending military tours in RM positions and increasing the number of civilian billets. This will ensure DoD is investing in the right capabilities and effectively laying the groundwork to develop and produce capabilities that have the greatest mission impact.

7. **Spread the word.** To effectively implement the new processes, provide roadshow briefings and workshops, and updated lessons at DAU, National Defense University, and other schoolhouses. Deliver targeted just-in-time training for teams about to use a major pathway process to ensure a common understanding. Short videos can cover lessons across the JCIDS processes, tailored for the various roles (e.g., operator, acquirer, tester) of those using the processes.

Authors

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