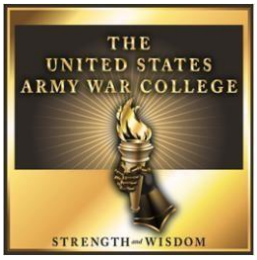
Strategy Research Project

Acquisition Reform: Competitive Prototyping & Incremental Development; The Game Changers

by

Colonel Donald L. Burton
United States Army

Under the Direction of:
Colonel Greg Dewitt



United States Army War College
Class of 2018

REPORT DOCUMENTATION PAGE

Form Approved--OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	**2. REPORT TYPE**	**3. DATES COVERED** *(From - To)*
01-04-2018	STRATEGY RESEARCH PROJECT	

4. TITLE AND SUBTITLE
Acquisition Reform: Competitive Prototyping & Incremental Development; The Game Changers

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Colonel Donald L. Burton
United States Army

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Colonel Greg Dewitt

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
U.S. Army War College, 122 Forbes Avenue, Carlisle, PA 17013

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
Distribution A: Approved for Public Release. Distribution is Unlimited.

I understand this document will be included in a research database and available to the public. Author: ☐

13. SUPPLEMENTARY NOTES
Word Count: 6,117

14. ABSTRACT

To compete in today's increasingly volatile, uncertain, and complex international security environment with great power competition, the US must maintain its superior technological advantage over its adversaries by remaining the preeminent force. Acquisition reform is critical to achieving this end given the current fiscal state of the US and its increasing deficit. More aggressive use of competitive prototyping, coupled with the use of smart incremental development, is essential to secure the US technological advantage over peer and near-peer competitors by providing more effective, efficient, and timely military capabilities given the fiscally constrained environment. DoD can enhance competitive prototyping by improving communication with industry partnerships. DoD should provide desired capabilities and allow competitive prototyping define the detailed requirements based on a known and mature technology. DoD needs to incorporate more user input and feedback into system design and prototyping, and emphasize incremental development to expedite new capabilities delivered to the warfighter.

15. SUBJECT TERMS
Competition, Down-Select, Desired Capabilities

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			**19b. TELEPHONE NUMBER** *(w/ area code)*
UU	UU	UU	UU	32	

Acquisition Reform: Competitive Prototyping & Incremental Development; The Game Changers

(6,117 words)

Abstract

To compete in today's increasingly volatile, uncertain, and complex international security environment with great power competition, the US must maintain its superior technological advantage over its adversaries by remaining the preeminent force. Acquisition reform is critical to achieving this end given the current fiscal state of the US and its increasing deficit. More aggressive use of competitive prototyping, coupled with the use of smart incremental development, is essential to secure the US technological advantage over peer and near-peer competitors by providing more effective, efficient, and timely military capabilities given the fiscally constrained environment. DoD can enhance competitive prototyping by improving communication with industry partnerships. DoD should provide desired capabilities and allow competitive prototyping define the detailed requirements based on a known and mature technology. DoD needs to incorporate more user input and feedback into system design and prototyping, and emphasize incremental development to expedite new capabilities delivered to the warfighter.

Acquisition Reform: Competitive Prototyping & Incremental Development; The Game Changers

> It takes 10, 20 years to go from idea to delivery of a capability. You just can't do that in today's world
>
> —Mark Milley, CSA[1]

To compete in today's increasingly volatile, uncertain, complex, and ambiguous environment, the United States must maintain its superior technological advantage over strategic competitors and adversaries. The United States continues to hold its title as the most powerful military in the world according to the 2017 Global Firepower Index, which also touts the US as the best-equipped military.[2] To maintain this status and preserve its national interests, the US must continue to invest heavily in research & development and modernize its military capabilities. Secretary of Defense James Mattis stated, "The pursuit of global security and stability requires our armed forces to remain the world's preeminent fighting force."[3] He also declared to maintain this unrivaled force Department of Defense's (DoD's) first line of effort (LOE) is to "restore military readiness as we build a more lethal force."[4] This two-part LOE constitutes reestablishing the force's capacity (personnel numbers, operational equipment, and a well-trained force) to address the challenges and missions of today. Increasing lethality in the force has a direct correlation to the acquisition of new technologies and capabilities to ensure the US maintain a power overmatch concerning peer and near-peer competitors.

Additionally, rivals like Russia and China have notably increased financial resources to accelerate their modernization efforts. They intend to counter any US technological advances and level the battlefield,[5] and to "challenge American power, influence, and interests."[6] Due to the impacts of sequestration and budget caps associated with congressional appropriations, DoD elected to prioritize readiness at the

expense of force modernization and science and technology (S&T) efforts. DoD's inability to continue a robust modernization discipline has led to competitors closing the technology gap, creating an urgency to resume an out-pacing methodology in S&T. Because it is impossible to recapture the years lost, it's more imperative for DoD to reform acquisitions to deliver new capabilities faster, better, and more efficient than before.

Research suggests that the evident need to modernize the US force does not come without its share of challenges. Although there has been a slight increase in Defense spending over recent years, the reality of the nation's debt is staggering, and will eventually take its toll on modernization efforts. The President of the Committee for a Responsible Federal Budget, Ms. Maya MacGuineas recently stated, "the country is on a borrowing spree that will lead to the return of trillion-dollar deficits by next year… We've taken fiscal recklessness to a new level, and it's time we begin our recovery."[7]

Acquisition reform is vital to preserving the United States' technological advantages over adversaries who intend to undermine US national interests and disrupt the international rules-based order. More aggressive use of competitive prototyping, coupled with the use of smart incremental development, is essential to secure the US technological advantage over peer and near-peer competitors by providing more effective, efficient, and timely military capabilities given the fiscally constrained environment. The remainder of this paper will briefly describe the DoD acquisition process and previous reform efforts initiated within the department. It will also highlight the congressional impacts related to funding that further complicate the means for

acquiring a materiel solution, and feature critical areas within the development process that are most impactful to the much-needed acquisition reform.

Acquisition Overview

Many may think of acquisitions as seizing possession of goods, services, or maybe even another business entity, but to the DoD, it is much more. The DoD acquisition process begins with a concept and ends with the disposal of a realization; "it also encompasses the design, engineering, constructing, testing, deployment, sustainment, deployment, and disposal of weapons or like items purchased from a contractor."[8] The DoD acquisition structure, also known as "Big 'A'" is a series of three independent systems that interact with one another.[9] The first entity is the Joint Capabilities Integration and Development System (JCIDS), which identifies the requirements.[10] Two entities crucial to the JCIDS process are the Joint Requirements Oversight Council (JROC) and the Army Requirements Oversight Council (AROC). The JROC's responsibility to the Chairman of the Joint Chiefs of Staff (CJCS) is to identify, assess, and approve joint military requirements.[11] Within the Army, the Chief of Staff of the Army (CSA) is the approval authority for warfighter requirements and the AROC advises based on assessments and prioritizations across doctrine, organization, training, materiel, leadership, personnel, and facilities (DOTMLPF).[12] The JROC, AROC and JCIDS processes can be a very lengthy and bureaucratic, which also makes them prime candidates for reform. The oversight councils should pursue the possibility of approving requirements based on the maturity level of the desired technology, and subsequently accepting remaining requirements over time as the technology matures. The approved requirements and capabilities should then be bucketed into a system increment for development, production, and delivery to the force. Implementation of this

recommendation should decrease the time for requirements validation, and provide an increased capability to the warfighter in substantially less time. It would also lower the risk associated with achieving desired capabilities since the technology would be mature and proven.

The second is the Planning, Programming, Budget, and Execution (PPBE) system, used for resource allocation and budgeting. One issue that has continually plagued DoD is the level of uncertainty in regards to funding appropriations, which usually results in at least one Continuing Resolution (CR) annually. In fact, DoD has experienced and had to operate under some form of a CR for the last ten years.[13] The Chairman of the Joint Chiefs of Staff, General Dunford stated, the Department of Defense needs stability and predictability of funding to execute funding efficiently and provide the services their required equipment and training.[14] Other noticeable impacts include the inability to start new contract actions while under a CR, which may warrant additional friction to extend existing contracts to prelude a break in service. There's also the potential for a "stop work" if DoD doesn't have the requisite funding to pay contractors for continuous work. As an example, the Long Range Precision Fires (LRPF) program office is currently pending a “stop work” on an existing contract for two vendors if an appropriations bill is not signed by March 23, 2018.[15] The LRPF program has exceeded its FY17 budget ($36M), which means they cannot meet their contract funding requirements for the remainder of FY18. Until Congress can provide annual appropriations before the beginning of an FY there is little DoD can do to reduce the impacts of realizing a CR. One common practice to mitigate realizing this risk is to build

a program spend plan assuming you will not receive appropriated funds until the second quarter of the FY.

Lastly, there is the Defense Acquisition System (DAS), also known as “Little ‘a’” that develops or buys the item needed[16] (See Figure 1). Each system is comprised of numerous integral components, making the entire Big "A" structure very complicated. Due to the mere size and complexity of the DoD acquisition construct, one can imagine thousands of opportunities to improve a process or reduce time as a mechanism of reform. Careful thought must be given to the change and its intended impact on the system, but more importantly, consider what impact does one change have on another. Compounded changes can produce unintended consequences by reinforcing aspects of the system that are trying to be eliminated. Careful implementation of reform is required to build more cost-efficient and timely systems that are more lethal and capable of maintaining a technological advantage over great power competitors.

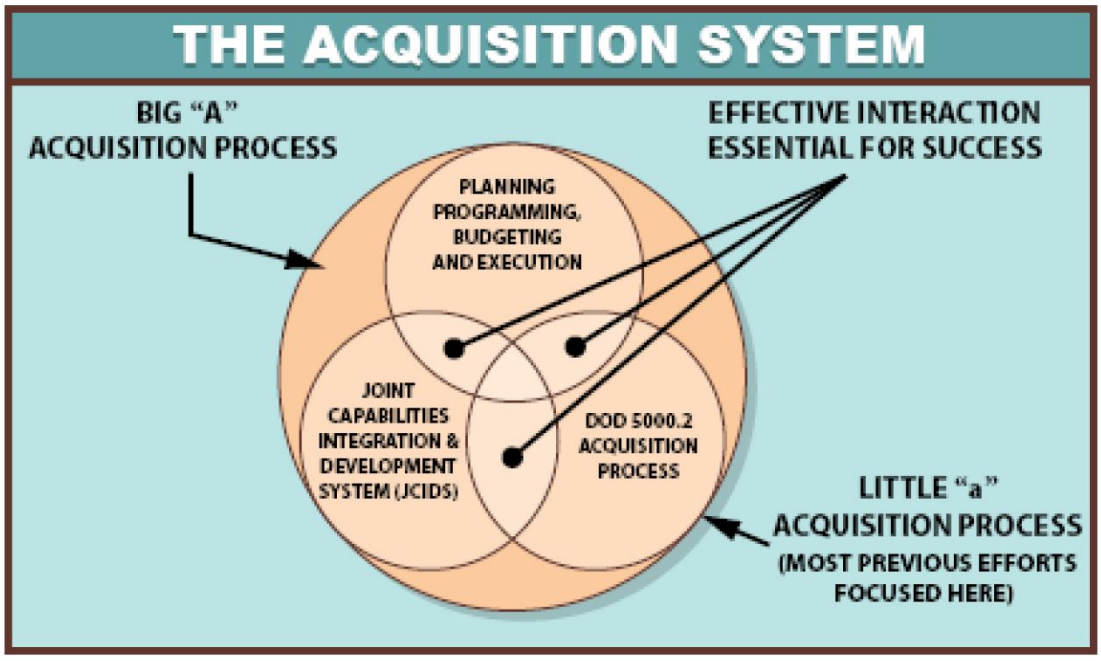


Figure 1. The DoD’s Defense Acquisition Structure[17]

Acquisition Reform Background

Merriam-Webster definition of reform is “to amend or improve by change of form or removal of faults or abuses.”[18] There is no such thing as a perfect process, and the acquisition system is no exception to that rule. In fact, defense acquisition reform initiatives have been exercised for over fifty-five years, and seem to be a major focus with each new administration.[19]

Some of the most notable actions in recent years include the Weapons Acquisition Reform Act of 2009 that focused on improving troubling aspects of engineering and cost estimation in the early stages of weapon system development.[20] There were also the “Better Buying Power” initiatives, which emphasized seven focus areas: achieve affordable programs, control cost throughout the product lifecycle, incentivize productivity and innovation in industry and government, eliminate unproductive processes and bureaucracy, promote effective competition, improve tradecraft in acquisition of services, and improve the professionalism of the total acquisition workforce.[21] The copious attempts to reform DoD acquisitions have undoubtedly improved the process, but there is always more to do. The only thing that hasn't been tried is an overhaul of the entire system.

The Chief of Staff of the US Army, General Mark Milley has initialized a three-pronged approach of simultaneous efforts to streamline Army acquisitions. The first step was a series of eight Army directives on acquisition reform released in November 2017. The guidelines "intended to improve the capability and materiel development process by refining how requirements are generated, simplifying the contracting and sustainment process, and evaluating progress through metrics.”[22] Second, a task force was

established to explore all options for standing up a new Army Future's Command that would model the Special Forces construct of streamlined acquisitions."[23]

The third step was standing up eight cross-functional team (CFT) pilots that are aligned with the Army's six modernization priorities to "provide the unity of effort and command needed to reduce the requirements development process from 60 months down to around 12", said Mr. Mark Esper, Acting, Secretary of the Army.[24] The purpose of each CFT is to "improve the quality and speed of delivery of new equipment and capabilities to the warfighter… accomplished through centralized planning and decentralized execution."[25] The teams are composed of subject matter experts from the major functional disciplines of requirements, acquisitions, test, and evaluation, science and technology, resourcing, contracting, costing and sustainment.[26] Although the CFTs are working distinct efforts, there may be a point for aggregation of the CFT endeavors with existing programs of record. This merger of capabilities would likely occur during risk reduction or engineering development phases of development.

Competitive Prototyping

The government defines prototyping as "a draft version of a product that allows you to explore your ideas and shows the intention behind a feature or the overall design concept to users before investing time and money into development."[27] Prototyping supports DoD acquisition in numerous ways of reducing risk, validating designs, and exploring integration challenges, which have provided a good return on investment.[28] Competitive prototyping (CP) is "when two or more contractors or other entities prototype the same component, subsystem, or system."[29] The process allows for DoD to solicit two or more companies to develop a prototype based on a series of requirements, or desired capabilities. Similar to any competition, the overarching

advantage of CP is receiving the best end product at the best price, resulting from the rivalry and the competitive nature of multiple vendors trying to outperform their competitor(s). The government would then down select the company that provides the most optimized model to receive a development or production contract.

CP is not a new concept; in fact, it is highly recommended as a preferred approach to system acquisition in the DoD since World War II. Notable organizations like the Government Accountability Office (GAO), RAND, and the Packard Commission all of which endorsed this best practice concept.[30] Due to the well-known advantages of prototyping, Mr. John Young who was the acting Under Secretary of Defense (2007) mandated its use in all acquisition strategies, requiring the approval of the Under ``Secretary of Defense for Acquisitions, Technology & Logistics (USD (AT&L)). [31] The DoD Instruction 5000.2, Operation of the Defense Acquisition System, later updated the requirement for prototyping in the technology maturation and risk reduction (TMRR) phase of the acquisition lifecycle, or an explanation for not using. [32]

The defense acquisition system (DAS) is composed of five distinct phases that span development to sustainment of a system (See Figure 2). The first phase is the materiel solution analysis (MSA), which assesses possible solutions to address the needed capability.[33] The technology maturation and risk reduction (TMRR) phase is used to reduce the risk associated with the desired technology, its integration, and the system life-cycle cost.[34] Again, the TMRR phase is the only prescribed phase to utilize CP by DoD. The engineering and manufacturing development (EMD) phase is where the prototype or system is further developed and designed before going into production.[35] The production and deployment (PD) phase focuses on verifying the

system satisfies its operational capability, followed by increased production and deployment to the end user.[36] The operations and support (O&S) phase covers the operational use and support of the fielded system by the users.[37] The two critical phases of system development are TMRR and EMD, which is also where CP is most beneficial to underwrite risk.

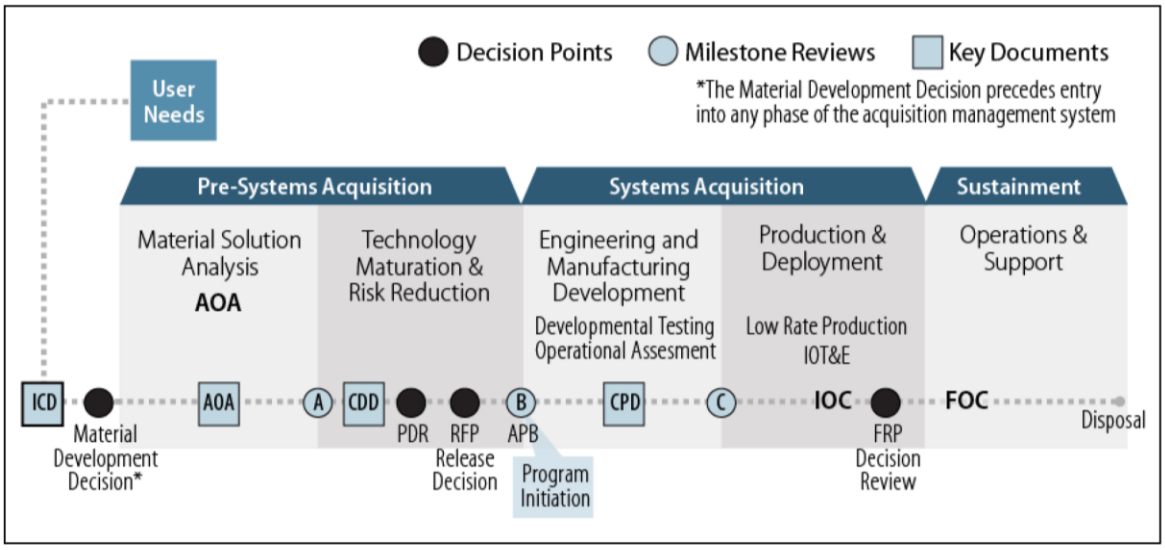


Figure 2. Defense Acquisition Milestones[38]

There are numerous examples of programs that have benefited from the use of CP, which has generated an extensive archive of lessons learned. In fact, a 2017 GAO report examined twenty-two major defense acquisition programs, (MDAPs) and their use or non-use of CP during development.[39] The study investigated the programs' prototyping approaches, the observed costs, benefits, challenges, and lessons learned gleaned from CP.[40] A summation of the report showed seventeen of the MDAPs used some version of prototyping, and it helped them better understand requirements, the feasibility of the proposed alternatives, and the projected cost.[41] In fact, the contractors selected vendors and suppliers and procured materials to construct a version of the

system or subsystem during CP; this data helped inform potential costs.[42] The following sections of the paper will emphasize additional merits of prototyping through cultivating a better relationship with industry to enable a more informed requirements development process, lowering technical risks to development, providing increased innovation, and utilizing operator input to design and develop the best overall system.

Industry Partner Relationship

To magnify the potential for a successful outcome, we must work closely together as teammates to achieve our common goal—the term “industry partners" has a significant meaning. Communication and transparency are critical to establishing the foundation of a partnership; trust. Many companies in the defense contracting industry request insight into the types of technologies and capabilities the DoD is pursuing to understand potential opportunities for business development better. Contractors are willing to invest their internal research, and development dollars (IRAD) in areas they believe will generate future profits for the company through government contracts. In a 2015 Breaking Defense news article Ms. Ellen Lord, then CEO for Textron Systems expressed the need to have better dialogue with the government to understand their needs, which could drive the use of a company’s IRAD dollars.[43] A defense contractor using its IRAD to develop or mature DoD interested technologies before the government request for solicitations would increase their likelihood of winning a contract award based on a prototype competition. The DoD also benefits in this scenario by capitalizing on industry’s research and development efforts without expending government funding.

The DoD senior leadership needs to engage with their defense contractor counterpart similar to the meetings the Chief of Staff of the Army hosts.[44] Articulating the government's interests by a three and four-star flag officers can demonstrate emphasis

to the industry at a level where decisions are made for private company investment. Engagement must also take place at the lowest level with the Program Managers. Defense contractors' business develops divisions actively pursue meetings with Program Management Offices to advertise capabilities and to gather information on future work. Although PMs are very busy trying to manage the day-to-day tasks of running a program office, they should use these sessions to understand what benefits industry may offer to system enhancements and to solicit industry feedback on potential thoughts and ideas they may be contemplating. This feedback can prove beneficial in planning industry days, or possibly develop future contract documentation like a draft request for proposal. PMs should schedule regular meetings with industry on at least an annual basis to nurture a mutually benefiting and effective line of communication.

The acquisition community should conduct regular industry days as an approach to keep the commercial sector informed through communicating a vision for future efforts; telling vendors of existing capability gaps. There are also venues like the semi-annual Association of the United States Army (AUSA) that provides a collaborative environment for DoD to inform industry, and allows the industry to showcase their products to the government. During these events, government hosts should provide a venue for vendors to speak on a one-on-one basis to facilitate a more candid conversation. Due to the competitive nature of the industry, some companies will prefer a closed-door session to try and gain a competitive advantage over their peers.[45]

Although these initiatives can be mutually benefiting, there is a level of risk to DoD and industry. Contractor companies gamble on using their IRAD dollars to pursue those technologies and capabilities of DoD interest to increase their probability of

winning a future government contract, which equates to expanded future revenue. However, DoD always can change its priorities because of the threat or volatility of the international security environment. If DoD redirects its focus away from a technology that industry has invested substantial internal funding, the company could experience disgruntled shareholders influenced by the poor return on investment. For DoD, there is a looming fear shared by most government professionals within the acquisition community that inhibits the practice of open dialogue with contractors. PMs are very cautious about providing any information that may give one company an unfair advantage over another, which could result in legal issues or delays to a program. PMs must be mindful of this stigma, but should not let it preclude needed discourse with industry partners.

Despite the potential risks, regular communication with industry needs to occur, and at multiple levels to enhance the partnership, and to promote a more proactive industry mindset towards future DoD requirements. DoD should also improve communications within government by sharing proven partnerships that may be leveraged by others in the department.

Requirements Development

Developing satisfactory requirements that are attainable, measurable, testable, and meet actual capability needs are not an easy task. Generating proper requirements are the base element for any system; getting them wrong can have catastrophic impacts on the cost, schedule, and effectiveness of the system. A 2015 GAO report noted, “Poor program outcomes can be traced to a culture in which the military services begin programs with unrealistic requirements”[46] The DoD produces suitable high-level requirements at inception, which are approved by the service chiefs, and incorporated

into the Initial Capabilities Document ICD. This is where the actual requirements should be replaced with “desired capabilities," allowing industry the flexibility to research available technology without being restricted by a multitude of DoD requirements. Along with desired capabilities, the government should provide some minimum criteria or expectations to help focus the contractor’s efforts.

The natural progression of the requirements development process after the ICD transitions to "initial objective values," having more operational context.[47] It is during this Materiel Solution Analysis (MSA) phase that lower-level technical requirements are generated. These requirements eventually become the contents of the draft Capability Development Document (CDD), used for constructing a prototype. System issues usually begin during this lower-level development of requirements needed to complete the system’s design[48], occurring during the TMRR phase of the DAS. The problems include introducing requirements that may be difficult to achieve, add risk to the program, or even unrealistic due to the genuinely unknown level of effort to reach them. The more detailed the requirements are, the more time and money is needed to develop the system. Data suggests instead of using specific requirements based on educated engineering inference to construct a prototype; the DoD should utilize CP informed by more general desired capabilities. Implementing this recommendation will facilitate multiple contractors designing and developing their prototypes based on the high-level, "desired capabilities," which will permit the competitors the needed latitude to innovate and deliver the best prototype; not limited by detailed provisions. GAO stated, “Programs with modest requirements and early systems engineering have better outcomes.”[49]

There are a few advantageous prospects of using CP in this manner. First, it allows the detailed requirements developed for the CDD to be constructed based on the known potential and limitations of the technology, which also conveys more empirical data. Competitive prototyping can aid program offices in better understanding their requirements, which can help them make informed performance tradeoffs to meet cost targets.[50] For example, the Joint Light Tactical Vehicle program team discovered both industry prototypes exceeded the vehicle max weight requirement to be airlifted, so they eliminated the need to airlift the vehicles, which generated a $35,000 cost savings per vehicle.[51] Secondly, the competitive nature of the vendors is more focused on achieving the best product (e.g., the maximum effective range of munitions), instead of terminating R&D efforts once the required field is met. Additionally, because multiple contractors are demonstrating the same technology, it adds more credence to the capability and its maturation. Lastly, most contractors will not expend more resources of time and money to improve a capability past the requirement, especially in a competitive environment. The industry competitors will rely on the efficiency of producing their prototype at the lowest price to increase their overall profit and potential of winning the contract. The Joint and Allied Threat Awareness System (JATAS) illustrated this during its CP, where both contractors avoided exceeding planned costs, even on a cost-plus effort, due to the perception of competition.[52] By eliminating detailed requirements and replacing them with desired capabilities, it incentivizes the prototype with the best design, performance, and cost. Furthermore, the actual testing of the competing prototypes will afford the service specific, independent test community organizations an opportunity to gain familiarity with the system, and potentially leverage the collected test data for future use.

Contracting Approach

The contracting process for DoD systems can often be very time consuming due to the understrength number of DoD contracting officers available to support the multitude of government customers.[53] A large workload compounded by manning shortfalls and regulatory requirements deemed by the federal acquisition regulation (FAR) can extend the time needed to award a contract beyond a year. The Long Range Precision Fires (LRPF) program office was told it would take two years to award a FAR contract for EMD.[54] If a program office chooses to pursue a FAR contract, it should start coordinating with the local contracting office as soon as possible to understand any schedule limitations. The program should plan to release a draft Request For Proposal (RFP) for the TMRR prototype contract to inform the contractor community of a pending contract effort. The draft RFP will allow the government team to understand the number of vendors that are interested in competing for the contract, and it also presents an opportunity for vendors to provide feedback before the final RFP is released. The draft and final RFP should offer the mandatory, high-level requirements and the desired capabilities for the prototype solicitation. The RFP should also include the evaluation criteria that emphasize the most important factors the government desires (e.g., performance attributes and cost control).

Once the TMRR phase prototype proposals are received the program office should conduct a source selection board (SSB) to select at least two vendor proposals and award them a prototype contract. If the program office has the requisite workforce, it should allow vendors that did not win one of the two contracts to continue competing at their own expense similar to the JLTV program.[55] The more competitors involved, the more pressure placed on competing parties, which benefits the government, and

increases the likelihood of receiving better prototypes. Before exiting TMRR, the program office will have to evaluate and select at least two of the best prototypes to proceed into the EMD phase of CP. Again, a program should allow contractors to continue at their own expense, and compete for a production contract. The contractor Oshkosh was eventually awarded the JLTV low-rate initial production contact even though they were not selected to receive an EMD contract. Oshkosh continued to compete using its company funding and delivered the best prototype at the end of EMD, which resulted in their $6.7 billion contract award.

There is another option available to program offices if the FAR contract timeline does not meet the program schedule. The program can pursue an Other Transaction Agreement (OTA). An OTA is an acquisition instrument that allows DoD organizations to enter into transactions that are “other than” standard government contracts.[56] OTAs are not subject to the FAR or the Defense FAR Supplement (DFARS), but they are flexible tools authorized by Congress that allows DoD a means to acquire advanced technologies.[57] The primary benefit of an OTA is it can significantly decrease the time needed to commence prototyping. The LRPF program office elected to use an OTA instead of a FAR contract and was able to start their EMD prototyping effort a year earlier.[58] Additionally, the vendors were only required to submit white papers on the requirements at the system level for evaluation instead of submitting comprehensive technical and cost proposals which could take months to develop.[59]

Use of the OTA also allowed the LRPF team to conduct “alpha contracting” activities with the vendors to refine the statement of work describing what the contractors must produce.[60] Alpha contracting is a collaborative process that involves

DoD and contractors conducting activities jointly to improve communications, make revisions to documents, and reduce the cycle time for execution.[61]

The OTA streamlined process provides flexibility to the parties involved, enabling a shorter time for delivering a capability to the warfighter. Program offices should consider all available options at their disposal to expedite development, and an OTA could serve that purpose.

Technical Risk Reduction

Contending with Risk is an inherent part of everyday life, and there is a certain level of risk associated with doing anything. The key is to limit or mitigate the risk where possible to ensure it does not become a reality. Developing a sophisticated DoD weapons system utilizes the same concept to improve the probability of success. In most instances realizing risk equates to additional funding or time needed to correct the problem. A recent GAO study concluded some acquisition programs are completing system engineering design reviews and starting development before fully maturing technologies, which introduce additional risk leading to potential cost growth or schedule delays.[62] Preventing this outcome is the primary purpose of the TMMR phase of systems development, and competitive prototyping should be a fundamental part of that process. The higher the risk, the more CP should be conducted

CP allows the Program Manager (PM), who is responsible for the system development, to focus contractor efforts in areas that present the most risk to his/her program. The PM should identify the riskiest areas within the development process and make it a primary focus for the competing contractors' prototypes, which could be at the system or subsystem level. The Defense contractors have extensive engineering expertise along with the best practices of the industry, which can lower the risks.

Moreover, having at least two vendors on task further increases the probability of mitigating if not eliminating risk. To reduce risk to the system design the PM for LRPF required the CP vendors to provide a critical design review of near-term technologies during the TMRR phase instead of waiting to EMD, where it is usually expected.

Another way to limit technical risk before working with industry is to leverage organizations like the Research, Development, and Engineering Command (REDCOM), and DoD laboratories for early design work and risk reduction efforts before soliciting commercial industry. DoD Labs are organizations with extensive expertise, housing over 40,000 scientists and engineers.[63] Before implementation inadequate knowledge of technical risk, and frail estimates for development and procurement costs plagued programs.[64] Through prototyping of primary system elements, it would reduce the technical risk, validate designs, validate cost estimates, evaluate manufacturing process, and refine requirements.[65]

Innovation

Soliciting multiple vendors from industry to provide their representative items for competition integrates more innovation into the system development. Commercial entities emphasize and promote innovation more aggressively than DoD through actions like developing an innovation strategy, aligning investments with innovation goals, and allocating additional funding for riskier projects.[66] Unlike DoD, the industry thrives on innovative practices, because in the world of competition and market shares they must distinguish themselves from their competitors to profit and survive.

Realizing the need for more innovation, DoD unveiled the its “Defense Innovation Initiative” in 2014, followed by opening the Defense Innovation Unit Experiment (DIUX) near Silicon Valley, California.[67] One significant product resulting from DUIX’s

undertaking is their “Commercial Solutions Opening” (CSO) guidebook illustrating how to create innovative contracting vehicles to deliver more economically innovative technologies in less time.[68] A CSO is a process of working with industry to obtain prototypes of emerging technologies that have military utility.[69] CSOs also use OTAs to fast-track prototype efforts; “on average, it takes no more than 59 days for DUIX to solicit a proposal, award a contract, and deliver a prototype.”[70]

Through CP, DoD can credit from the extensive research conducted by defense contractors like Northrop Grumman who spent $569 million in independent research and development.[71] An ideal outcome from this type of effort would be the realization of new disruptive technologies. Disruptive innovation can be the discovery of a new capability that may be unforeseen by the warfighter that causes a favorable shift in military power, or it could be providing existing capabilities at a largely reduced price, also increasing the advantage.[72] New disruptive technology does not constitute an entire system; it can also be components of a system. An example could be the development of a new microchip that enables better accuracy of precision fires munitions, or a component that improves overall system performance. A GAO report also noted CP for the Space Fence program stimulated contractors to introduce cutting-edge designs and continuing to grow those designs to remain competitive.[73]

In today’s fiscally constrained environment innovation is critical to the US maintaining its technological advantage. Though DoD is pursuing initiatives to garner innovation from the commercial sector, the use of CP incorporates more real-time, focused effort that can benefit DoD.

User Aided Development

The warfighter is at the beginning of every materiel solution. In most instances they are the entity identifying the need or capability gap that is eventually resolved by assessing possible solutions across DOTMLPF that can result in a non-materiel or materiel solution, or a combination of both. The TRADOC Capability Managers (TCMs) and Capability Development Integration Directorate (CDID) personnel are instrumental in determining DOTMLPF implications on providing the solution. TCMs and CDID are both aligned with each of the Army's eight Centers of Excellence. The TCM assumes an additional role as the user representative, maintaining advocacy for the warfighter throughout the development process.

Although the TCMs have the vested interest of the user community and have actual users who provide input, programs need feedback from unit operators that will put the system into execution. A program office can build a system to meet all of the system requirements and demonstrate it is operationally effective, suitable, and survivable, but is it what the soldier wants? Was the system constructed intuitively in the way an operator would conduct their mission? A significant contributor to this outcome is most engineers do not have military experience and are not able to understand a warfighter's thought process or workflows used to employ the system best. Engineers build the system as they think the warfighter would use it, creating a potential wrinkle in the development process. DoD and the competing vendors should utilize a "design thinking" process when building prototypes and systems. Design thinking is defined as an integrative process where the developer seeks understanding from the user to challenge assumptions they may have made during design and development and attempts to identify alternative solutions to remedy problems encountered.[74] Leveraging

the users' feedback on the system will avow valuable information that will aid in system development.

Program offices should convene regular forums to establish and maintain a meaningful dialogue with the users of the future system, and it shouldn't be limited to the final competition of the prototypes. Programs should consult with vendors to determine the most opportune times for user input. The input should come from a broad spectrum of users by unit type, prohibiting the potential catering of development to a specific unit's techniques, tactics, and procedures. They should also solicit feedback from multiple groups of user experience ranging from a "10 level" operator to a super-user to ensure the system will accommodate all operators. The warfighters early use of prototypes not only allows engineers to incorporate a more operational design and development of the system, but it can also help with the prioritizing of requirements. Prioritization enables the program to align resources better and focus the contractors' work efforts. It could also provide the rationale for bucketing requirements into various increments that a contractor could matured and delivered to the force in less time.

The warfighter originates the requirements process and too often doesn't see the product of their requirement for years. So much time has elapsed that the final system no longer meets the expectations of the user, not to mention unwanted changes in the system. The constant communication and feedback with the warfighter will ensure the ultimate product not only meets the requirements, but also promotes the users' ability to employ it more effectively, producing an intangible combat multiplier.

Conclusion

The world's security environment is more volatile than ever, and the DoD acquisition process can no longer afford to take ten years to provide a new capability

laden with cost overruns. There are numerous ways to conduct the much-needed reform of acquisitions, each having benefits and potential unintended consequences. Through the aggressive use of competitive prototyping DoD could circumvent a number of the issues that plague the development systems today.

Multiple companies vying for a lucrative production contract through the design and development of a prototype imparts an incentive to excel, resulting in a more efficient and effective final product. To maximize its efficacy, prototyping efforts should focus at the system or subsystem level where the most risk is perceived. Research suggests DoD should provide contractors desired capabilities with minimum requirements to bolster industry innovation, and refine the requirements based on proven capacity. The government should also pursue OTAs to limit the administrative time needed to establish an agreement to commence prototype production.

DoD must improve communications with its industry partners at various levels ranging from the program manager to the senior leadership to keep them informed. The exchange with industry may facilitate the use of contractor IRAD funds to begin development and maturation of technology well before the government's bureaucratic process, decreasing DoD's time to deliver a new capability. Communications between the programs and the extensive DoD lab network can also exercise improvement. Program offices should regularly collaborate with the government S&T community to better align technology efforts with warfighter needs to introduce new capabilities before soliciting industry.

Engaging the users during CP for critical input and feedback is essential to ensuring the best system is developed to meet their need. Additionally, It provides the

operational insight needed by engineers to design and construct an intuitive system that can be effectively employed, producing complementary enhancements to its lethality. User feedback also provides the prioritization of requirements needed for incremental development and expedited delivery of a new capability to the force.

The DoD acquisition community has a culture that is engrained, and will not be easy to change. Breaking the norm by accepting the risk to realize a greater reward may be a foreign concept potentially, but something that is needed for reform. John Kotter asserts a sense of urgency is required in order to change a culture.[75] The current fiscal state of the US coupled with the great power competition inspired by Russia's resurgence, and China's current rise may constitute the urgency needed.

"We are facing increased global disorder, characterized by the decline in the long-standing rules-based international order – creating a security environment more complex and volatile than any we have experienced in recent memory."[76] This is the needed intensity to reform acquisitions by reinvigorating S&T and modernization investments in order to produce the capability to fight the wars of the future. The universal use of competitive prototyping and incremental develop will enable the warfighter to maintain a competitive advantage over its adversaries by providing increased capabilities more efficiently, and in less time; resulting in ultimate lethality of the force.

Endnotes

[1] Sydney J Freedberg JR, "Milley Announces Biggest Buying Shift In 40 Years: Army Will Get Weapons The SOCOM Way," October 29, 2017, linked from *Breaking Defense Home Page* https://breakingdefense.com/2017/10/milley-announces-biggest-buying-shift-in-40-years-army-will-getweapons-the-socom-way/ (accessed January 17, 2018).

[2] Grinberg News, “Revealed: The Most Powerful Militaries in 2018,” February 10, 2018, linked from *Grinberg News Home Page,* 990—00, http://www.grinbergnews.com/powerful-militaries/ (accessed February 11, 2018).

[3] U.S. Secretary of Defense James Mattis, “Guidance from Secretary Jim Mattis,” Memorandum For All Department of Defense Personnel, Washington, DC, October 5, 2017.

[4] Ibid.

[5] U.S. Congress, Senate, Committee on Armed Services, Special Subcommittee on Budget Submission, *The Posture Statement of the 19th Chairman of the Joint Chiefs of Staff: Hearing before the Special Committee on Armed Services*, 115th Congress (Washington, DC: U.S. Department of Defense, June 13, 2017), 2, https://www.armed-services.senate.gov/imo/media/doc/Dunford_06-13-17.pdf (accessed February 13, 2018).

[6] Donald Trump, *National Security Strategy* (Washington, DC: The White House, December 2017), 2 https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf (accessed January 9, 2018).

[7] Committee for a Responsible Federal Budget, “President’s Budget Doesn’t Meet the Fiscal Realities,” http://www.crfb.org/press-releases/presidents-budget-doesnt-meet-fiscal-realities (accessed February 14, 2018).

[8] Moshe Schwartz, *Defense Acquisitions: How DoD Acquires Weapons Systems and Recent Efforts to Reform the Process* (Washington, DC: U.S. Library of Congress, Congressional Research Service, May 23, 2014), Summary, https://fas.org/sgp/crs/natsec/RL34026.pdf (accessed February 3, 2018).

[9] Ibid., 3.

[10] Ibid

[11] Defense Acquisition University, *Manual For The Joint Capabilities Integration and Development System,* JCIDS Manual, (Washington, DC: U.S. Department of Defense, February 12, 2015), 2, B8, https://www.dau.mil/cop/rqmt/_layouts/15/WopiFrame.aspx?sourcedoc=/cop/rqmt/DAU%20Sponsored%20Documents/Manual%20-%20CJCS,%20JCIDS%20Manual,%2012%20Feb%202015,%20Errata,%2018%20Dec%202015.pdf&action=default (accessed January 9, 2018).

[12] U.S. Department of the Army, *Army Acquisition Policy,* Army Regulation 70-1 (Washington, DC: U.S. Department of the Army, July 22, 2011), 2, https://www.acq.osd.mil/dpap/ccap/cc/jcchb/Files/FormsPubsRegs/Pubs/Army%20Regulation%2070-1.pdf2070-1.pdf (accessed February 12, 2018).

[13] Joseph F. Dunford, *A Statement on the Posture of the United States Forces. 2017,* CJCS Posture Statement presented to the 115th Congress, 2nd session (Washington, DC: U.S. Department of Defense, June 13, 2017), 6, https://www.armed-services.senate.gov/imo/media/doc/Dunford_06-13-17.pdf (accessed January 12, 2018).

[14] Jim Garamone, “Continuing Resolutions Create Uncertainty in Defense Department,” January 16, 2018, linked from *The Department of Defense,* https://www.defense.gov/News/Article/Article/1415656/continuing-resolutions-create-uncertainty-in-defense-department/ (accessed March 19, 2018).

[15] Mr. Mike Wills, Product Manager for the Precision Long Range Fires Program Office, telephone interview by author, March 15, 2018.

[16] Schwartz, *Defense Acquisitions: How DoD Acquires Weapons Systems*, Summary.

[17] Ibid., 3.

[18] Merriam-Webster, “Reform,” https://www.merriam-webster.com/dictionary/reform (accessed February 12, 2018).

[19] J. Ronald Fox, “Defense Acquisition Reform, 1960-2009 An Elusive Goal,” 2011, vii, https://history.army.mil/html/books/051/51-3-1/CMH_Pub_51-3-1.pdf (accessed February 4, 2018).

[20] Moshe Schwartz, *Defense Acquisition Reform: Background, Analysis, and Issues for Congress* (Washington, DC: U.S. Library of Congress, Congressional Research Service, May 23, 2017), 6, https://digital.library.unt.edu/ark:/67531/metadc306467/m1/1/high_res_d/R43566_2014May23.pdf (accessed December 14, 2017).

[21] Frank Kendall, “Better Buying Power 3,” April 9, 2015, linked from *Defense Acquisition University Home Page* http://bbp.dau.mil/docs/BBP3.0ImplementationGuidanceMemorandumforRelease.pdf (accessed December 13, 2017).

[22] David Vergun, “US Army Futures Command to reform modernization, says secretary of the Army,” *Army.mil,* December 8, 2017, https://www.army.mil/article/197886/us_army_futures_command_to_reform_modernization_says_secretary_of_the_army (accessed January 8, 2018).

[23] COL Kip Korth, email with attached briefing, “Acquisition Reform Initiatives; Army Modernization Command Update Discussion,” Briefing slides, December 8, 2017.

[24] Vergun, “US Army Futures Command,” 2.

[25] David Vergun, “Cross-functional Team to Spearhead Modernization, Says McCarthy,” *Army.mil*, October 13, 2017, https://www.army.mil/article/195247/cross_functional_teams_to_spearhead_modernization_says_mccarthy (accessed March 4, 2018).

[26] Ibid.

[27] Usability.Gov, “Prototyping,” https://www.usability.gov/how-to-and-tools/methods/prototyping.html (accessed February 16, 2018).

[28] U.S. Government Accountability Office, *Prototyping Has Benefited Acquisition Programs, but More Can Be Done to Support Innovation Initiatives: Report to Congressional Committees,* GAO-17-309 (Washington, DC: U.S. Government Accountability Office, June 2017), 8, https://www.gao.gov/assets/690/685478.pdf (accessed January 20, 2018).

[29] Ibid., 6.

[30] Ibid.

[31] Acting U.S. Secretary of Defense, "Prototyping and Competition," Memorandum for Secretaries of the Military Departments, Washington, DC, September 19, 2007. https://www.acq.osd.mil/dpap/cpic/cp/docs/AT&L%2019%20Sep%2007%20Memo%20Prototyping%20and%20Competition.pdf (accessed February 24, 2018).

[32] Department of Defense, *Operation of the Defense Acquisition System*, DoD Instruction 5000.2 (Washington, DC: U.S. Department of Defense, January 7, 2015), 16, https://www.dau.mil/guidebooks/Shared%20Documents/DoDI% 205000.02.pdf (accessed January 19, 2018).

[33] Defense Acquisition Made Easy, "Materiel Solution Analysis (MSA) Phase," http://acqnotes.com/acqnote/acquisitions/materiel-solutions-analysis-phase (accessed March 14, 2018).

[34] Defense Acquisition Made Easy, “Technology Maturation and Risk Reduction (TMRR) Phase,” http://acqnotes.com/acqnote/acquisitions/technology-development-phase (accessed March 14, 2018).

[35] Defense Acquisition Made Easy, “Engineering and Manufacturing Development (EMD) Phase,” http://acqnotes.com/acqnote/acquisitions/emd-phase (accessed March 14, 2018).

[36] Defense Acquisition Made Easy, “Production and Deployment (PD) Phase,” http://acqnotes.com/acqnote/acquisitions/production-and-deployment (accessed March 14, 2018).

[37] Defense Acquisition Made Easy, “Operations and Support (O&S) Phase,” http://acqnotes.com/acqnote/acquisitions/operations-and-support (accessed March 14, 2018).

[38] Schwartz, *Defense Acquisitions: How DoD Acquires Weapons Systems*, 7.

[39] U.S. Government Accountability Office, *Prototyping Has Benefited Acquisition Programs*, 8.

[40] Ibid.

[41] Ibid.,14.

[42] Ibid., 20.

[43] Richard Whittle, “CEOs Question DoD’s New IRAD Rule,” *Breaking Defense,* June 30, 2015, https://breakingdefense.com/2015/06/ceos-question-dods-new-irad-rule/, (accessed February 22, 2018).

[44] Leanne Caret, “Boeing Presentation,” lecture, U.S. Army War College, Carlisle Barracks, PA. February 27, 2018, cited with permission of Ms. Caret.

[45] AcqNotes, “Industry Day,” http://acqnotes.com/acqnote/tasks/industry-day (accessed February 20, 2018).

[46] U.S. Government Accountability Office, *Defense Acquisition Process, Military Service Chiefs’ Concerns Reflect Need to Better Define Requirements before Programs Start: Report to the Honorable James Inhofe U.S. Senate,* GAO 15-469 (Washington, DC: U.S. Government Accountability Office, June 2015), 1, https://www.gao.gov/assets/680/670761.pdf (accessed January 12, 2018).

[47] U.S. Department of Defense, *Manual for the Operation of the Joint Capabilities Integration and Development Systems,* JCIDS Manual, (Washington, DC: U.S. Department of Defense, February 12, 2015), 6, https://www.dau.mil/cop/rqmt/_layouts/15/WopiFrame.aspx?sourcedoc=/cop/rqmt/DAU%20Sponsored%20Documents/Manual%20-%20CJCS,%20JCIDS%20Manual,%2012%20Feb%202015,%20Errata,%2018%20Dec%202015.pdf&action=default (accessed February 2, 2018).

[48] U.S. Government Accountability Office, *Defense Acquisition Process,*1.

[49] U.S. Government Accountability Office, *Weapon Systems Requirements, Detailed Systems Engineering Prior to Product Development Positions Programs for Success: Report to Congressional Committees,* GAO-17-77 (Washington, DC: U.S. Government Accountability Office, November 2016, 2, https://www.gao.gov/assets/690/681106.pdf (accessed March 16, 2018).

[50] U.S. Government Accountability Office, *Prototyping Has Benefited Acquisition Programs*, 20.

[51] Ibid.

[52] Defense Acquisition University, “Competitive Prototyping A PMO Perspective,” http://dau.dodlive.mil/2013/04/27/competitive-prototyping-a-pmo-perspective/ (accessed January 20, 2018).

[53] U.S. Government Accountability Office, *Defense Acquisition Workforce, Actions Needed to Guide Planning Efforts and Improve Workforce Capacity: Report to Congressional Committees,* GAO-16-80 (Washington, DC: U.S. Government Accountability Office, December 2015), 1, https://www.gao.gov/assets/680/674152.pdf (accessed February 5, 2018).

[54] Mr. Mike Wills, Product Manager for the Precision Long Range Fires Program Office, telephone interview by author, March 15, 2018.

[55] Jon Harper, "JLTV Program Could Serve as Acquisition Model," *National Defense Magazine,* October 9, 2017, http://www.nationaldefensemagazine.org/articles/2017/10/9/jltv-program-could-serve-as-acquisition-model (accessed January 23, 2018).

[56] Consortium Management Group, "Other Transaction Agreements Frequently Asked Questions," https://cmgcorp.org/otas/ (accessed March 20, 2018).

[57] Ibid.

[58] Mr. Mike Wills, Product Manager for the Precision Long Range Fires Program Office, telephone interview by author, March 15, 2018.

[59] Ibid.

[60] Ibid.

[61] Defense Acquisition University, "Contracting: Alpha Contracting," https://www.dau.mil/cop/contracting/dau%20sponsored%20documents/forms/case%20study.aspx (accessed February 26, 2018).

[62] U.S. Government Accountability Office, *Defense Acquisitions Assessments of Selected Weapon Programs: Report to Congressional Committees,* GAO-17-333SP (Washington, DC: U.S. Government Accountability Office, March 2017), 1, https://www.gao.gov/assets/690/683838.pdf (accessed February 24, 2018).

[63] Defense Science Board, *Defense Research Enterprise Assessment* (Washington, DC: OUSD (AT&L, January 2017), 2 https://www.acq.osd.mil/dsb/reports/2010s/Defense_Research_Enterprise_Assessment.pdf (accessed February 23, 2018).

[64] Ibid.

[65] Ibid.

[66] U.S. Government Accountability Office, *Prototyping Has Benefited Acquisition Programs*, 1.

[67] Byron Callan, "Commentary: For Government and Defense Industry, It's All About Innovation," December 13, 2015, linked from *Defense News* https://www.defensenews.com/opinion/commentary/2015/12/13/commentary-forgovernment-and-defense-industry-it-s-all-about-innovation/ (accessed February 20, 2018).

[68] Rick Docksai, "DIUx Releases Guide for Faster, Less-Costly Technology Acquisition," *Defense Online*, November 30, 2016, https://www.defense.gov/News/Article/Article/1016994/diux-releases-guide-for-faster-less-costly-technology-acquisition/ (accessed March 21, 2018).

[69] Ibid.

[70] Ibid.

[71] Callan, “Commentary: For Government and Defense Industry,” 2.

[72] U.S. Government Accountability Office, *Prototyping Has Benefited Acquisition Programs,* 8.

[73] Ibid., 21

[74] The Interaction Design Foundation, “Design Thinking,” https://www.interaction-design.org/literature/topics/design-thinking (accessed March 24, 2018).

[75] John Kotter, *Leading Change* (Washington, DC: Library of Congress 1996), 37-40.

[76] Jim Mattis, *Summary of the 2018 National Defense Strategy of the United States of America* (Washington, DC: U.S. Department of Defense, January 2018), 2, https://www.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf (accessed January 20, 2018).