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Challenge-Based Acquisition: Stimulating Innovative Solutions Faster and Cheaper by Asking the Right Questions

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Preface & Acknowledgements

Welcome to our Tenth Annual Acquisition Research Symposium! We regret that this year it will be a "paper only" event. The double whammy of sequestration and a continuing resolution, with the attendant restrictions on travel and conferences, created too much uncertainty to properly stage the event. We will miss the dialogue with our acquisition colleagues and the opportunity for all our researchers to present their work. However, we intend to simulate the symposium as best we can, and these *Proceedings* present an opportunity for the papers to be published just as if they had been delivered. In any case, we will have a rich store of papers to draw from for next year's event scheduled for May 14–15, 2014!

Despite these temporary setbacks, our Acquisition Research Program (ARP) here at the Naval Postgraduate School (NPS) continues at a normal pace. Since the ARP's founding in 2003, over 1,200 original research reports have been added to the acquisition body of knowledge. We continue to add to that library, located online at www.acquisitionresearch.net, at a rate of roughly 140 reports per year. This activity has engaged researchers at over 70 universities and other institutions, greatly enhancing the diversity of thought brought to bear on the business activities of the DoD.

We generate this level of activity in three ways. First, we solicit research topics from academia and other institutions through an annual Broad Agency Announcement, sponsored by the USD(AT&L). Second, we issue an annual internal call for proposals to seek NPS faculty research supporting the interests of our program sponsors. Finally, we serve as a "broker" to market specific research topics identified by our sponsors to NPS graduate students. This three-pronged approach provides for a rich and broad diversity of scholarly rigor mixed with a good blend of practitioner experience in the field of acquisition. We are grateful to those of you who have contributed to our research program in the past and encourage your future participation.

Unfortunately, what will be missing this year is the active participation and networking that has been the hallmark of previous symposia. By purposely limiting attendance to 350 people, we encourage just that. This forum remains unique in its effort to bring scholars and practitioners together around acquisition research that is both relevant in application and rigorous in method. It provides the opportunity to interact with many top DoD acquisition officials and acquisition researchers. We encourage dialogue both in the formal panel sessions and in the many opportunities we make available at meals, breaks, and the day-ending socials. Many of our researchers use these occasions to establish new teaming arrangements for future research work. Despite the fact that we will not be gathered together to reap the above-listed benefits, the ARP will endeavor to stimulate this dialogue through various means throughout the year as we interact with our researchers and DoD officials.

Affordability remains a major focus in the DoD acquisition world and will no doubt get even more attention as the sequestration outcomes unfold. It is a central tenet of the DoD's Better Buying Power initiatives, which continue to evolve as the DoD finds which of them work and which do not. This suggests that research with a focus on affordability will be of great interest to the DoD leadership in the year to come. Whether you're a practitioner or scholar, we invite you to participate in that research.

We gratefully acknowledge the ongoing support and leadership of our sponsors, whose foresight and vision have assured the continuing success of the ARP:

- Office of the Under Secretary of Defense (Acquisition, Technology, & Logistics)
- Director, Acquisition Career Management, ASN (RD&A)
- Program Executive Officer, SHIPS
- Commander, Naval Sea Systems Command
- Program Executive Officer, Integrated Warfare Systems
- Army Contracting Command, U.S. Army Materiel Command
- Office of the Assistant Secretary of the Air Force (Acquisition)
- Office of the Assistant Secretary of the Army (Acquisition, Logistics, & Technology)
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Challenge-Based Acquisition: Stimulating Innovative Solutions Faster and Cheaper by Asking the Right Questions[1]

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Abstract

Budget reductions will require the Department of Defense (DoD) to make difficult decisions on how to invest limited resources and make current programs more affordable. Traditional acquisition methods are lengthy, serial, gate-like processes, built around stringent specifications and arms-length relationships. By contrast, Challenge-Based Acquisition (ChBA) utilizes transparent, accessible, concrete challenges to satisfy warfighter needs and stimulate industry innovation. Challenges enable DoD programs to assess actual performance against clearly defined mission objectives and create incentives for industry to innovate. ChBA thus offers a more transparent approach to fielding new capabilities, upgrades, and enhancements to existing systems.

Mandate for Change

It's time to fundamentally change the way that we do business in Washington. To help build a new foundation for the 21st century, we need to reform our government so that it is more efficient, more transparent, and more creative. That will demand new thinking and a new sense of responsibility for every dollar that is spent.

– President Barack Obama (2009)

Fewer than half of the programs in the Department of Defense (DoD) Major Defense Acquisition portfolio have met established metrics for cost or performance (GAO, 2011a). Even worse, the DoD has canceled entire programs for cost overruns under the Nunn-McCurdy Amendment after investing billions of dollars that could have been used elsewhere across the department (GAO, 2011b). According to the Government Accountability Office (GAO), 50 of 74 breaches involved engineering design issues discovered after production had begun.

Traditional DoD acquisition follows a lengthy, serial process based upon a plethora of documentation as required by the DoD 5000 Series of Instructions and Directives (DoD, 2003b) as well as numerous Service-specific acquisition guidelines. In these documents, mission needs become program requirements, which are then quantified as performance parameters, defined as system attributes, tracked through derived technical performance measures, and included in a government/industry exchange of system specifications. Along this serial path, the linkage of program requirements to mission performance typically becomes unclear and often inaccurate. Alternatively, in some cases, system specifications become far too rigid and detailed, thus stifling opportunities for innovation. Despite best efforts by programs to mitigate risk through verification and validation using the systems engineering process, even a perfectly executed program can still produce a quality product that is often "late to the fight," operationally ineffective, or unsuitable even if it addresses the original mission need.

Furthermore, most contracts are awarded using government source selection evaluations based on industry paper proposals rather than "actual" product performance. This creates an incentive for industry to produce flawless documents with highly optimistic cost, schedule, and performance projections that meet or exceed every requirement in the government's request. As a result, performance during program execution often falls short of the government's expectations and cost and schedule overruns become nearly inevitable. These unrealistic proposals become particularly problematic when there is little prospect for additional competition throughout the acquisition life cycle, which may lock the program into a single solution and provider.

The resulting disappointment creates an arms-length relationship between the contractor and the government, limiting trust, communication, and transparency. This can be particularly problematic given the long life cycle of many defense acquisition programs. The impact of this tense relationship can raise costs related to bidding and negotiating contracts and slow the process of coming to acceptable terms and conditions (Crook, Ketchen, Combs, & Patterson, 2012). For example, a recent study concluded that the DoD currently spends roughly $400 billion each year acquiring products and services from its contractors, with about $100 billion of that amount spent on administrative costs alone. By cutting unneeded bureaucracy, defense officials could reduce the department's costs by 20%—or roughly $20 billion each year (Weigelt, 2012).

The complexity of traditional DoD acquisition makes the process difficult for programs with tight budgets or timelines to execute predictably, and virtually impossible to execute when trying to meet an urgent operational need. Given this situation, how can the DoD acquire capabilities both faster and better? The answer includes expressing requirements in terms of general capabilities rather than firm specifications and encouraging industry to respond with applicable product development and innovation that demonstrates best-of-breed solutions.

This paper suggests Challenge-based Acquisition (ChBA) as an approach that could be applied to urgent need situations, could be executed in a more rapid, transparent manner, and would allow program stakeholders to satisfy mission needs. ChBA presents challenges to a set of interested parties, communicates government needs to the private sector, and encourages the creation of innovative products. The challenges are expressed in terms of specific capability criteria that must be satisfied, with the proposed solutions proven by evidence of performance. The ChBA approach leverages practices designed for a rapidly evolving technology environment and meets the real demands of users in the field. It applies acquisition practices and techniques necessary to achieve better outcomes in DoD programs and projects. ChBA is founded on the codification of government needs expressed as concrete performance outcomes. These outcomes are challenges that are issued to a marketplace of competing vendors, rather than needs expressed in paper specification documents that are addressed with unproven paper proposals.

Background

End users have difficulty imagining transformational or inventive solutions when they have a working solution at hand. Soldiers, for example, are good at improvising solutions to address shortcomings of equipment, and using whatever they can find on the battlefield. Similarly, they are experts at assessing the likely success of incremental improvements to devices and techniques. It is hard, however, to extend this innovation beyond the readily conceivable.

Henry Ford supposedly said, "If I had asked people what they wanted, they would have said 'faster horses'" (Ford, 2006). More recently, Steve Jobs said, "You can't just ask customers what they want and then try to give that to them. By the time you get it built, they'll want something new" (Burlingham & Gendron, 1989). Even the brightest equestrians would have had trouble picturing the utility of the Model T. While soldiers, sailors, and airmen are indeed the right individuals to define mission requirements, involving them in the specification process can limit the inventiveness of potential solutions.

But suppose that Henry Ford had heard, "I want to get to my destination faster and with comfort and affordability." In this case, the users would have issued a concrete mission challenge—get there faster with comfort—rather than a specified solution—a faster horse.

Unfortunately, government acquisition agents, like Ford's public, rarely think in terms of mission challenges and instead think in terms of tighter specifications to define solutions.

As early as the 1980s, the DoD recognized that relying on highly rigid specifications can be burdensome and costly. Even in the unusual cases where specifications and standards are perfect, premature application, over-application, and inappropriate application of standards could still cause complex problems (Bergman, 1996, p. 32). The DoD enacted acquisition reforms, deleting many military specifications from contracts, and emphasizing outcome and performance-based acquisitions (Bergman, 1996).

Challenges present an option for achieving these goals. Governments and industry have long used challenges to spur technology advances in areas that include agriculture, aviation, energy, medicine, and navigation. For example, in 1714, an Act of Parliament established the British Longitude Prize (Princeton University, n.d.). The Longitude Board, which administered the prize, did not fund technical research but simply promised monetary awards based on the accuracy of proven results: £10,000 for 60 nautical miles of accuracy, £15,000 for 40 nautical miles, and £20,000 for 30 nautical miles. The prize prompted development of the maritime chronometer, which revolutionized global navigation and solved a problem that had bedeviled seafaring nations for over 150 years.

The Wright Brothers' contract with the U. S. Army (Smithsonian, National Air and Space Museum, n.d.) serves as a 20th century example of ChBA. As a result of their airplane's performance in the 1909 U.S. Army flight trials, they received a contract that strongly incentivized speed, with a 10% bonus for every full mile per hour above 40. The average speed of the Wrights' aircraft was 42.5 miles per hour, earning the inventors a $5,000 bonus and bringing the final purchase price of the airplane to $30,000.

For decades, the aviation industry continued to create ChBA-like opportunities. When aircraft operators abstracted away the details of engine design and simply challenged power plant makers to deliver performance in terms of thrust, weight, and efficiency, General Electric's Jack Welch conceived the idea of performance-based logistics. He sold "power by the hour" (Knowledge@Wharton, 2007), which relieved aircraft owners of the need to inventory, maintain, and repair engines. As a result, the costs of engine inventories, maintenance, and repair declined dramatically.

More recently, the defense and aerospace industries have used challenges to support innovative technology development in areas of information technology (IT), space transportation, and military combat systems, as illustrated by the following examples.

Space Transportation. In 2004 Space Ship One, a suborbital air-launched space plane, won the U.S. $10 million Ansari X Prize by completing the first manned private space flight. Space Exploration Technologies Corporation, also known as SpaceX, made history on May 25, 2012, as the world's first privately held company to send a cargo payload, carried on the Dragon spacecraft, to the International Space Station (SpaceX Corporation, n.d.).

Military Combat Systems. Mine Resistant Ambush Protected (MRAP) vehicles are a family of armored fighting vehicles originally designed under the guidance of the U.S. Marine Corps to survive attacks and ambushes involving improvised explosive devices (IEDs). On July 31, 2007, the Marine Corps Systems Command launched MRAP II pre-solicitation, challenging bidders to develop a new vehicle that offered a higher level of protection than the current MRAP vehicles. The U.S. Army Research Laboratory ensured the technologies used in the Frag Kit 6 (Fullerlove, 2009) armor upgrade project would be available to MRAP II designers. Initial testing at the Aberdeen Proving Grounds disqualified

vehicles that did not meet requirements; the design run-off identified two vendors whose vehicles could pass the demonstration test.

Information Technology. The federal and commercial markets have taken advantage of the highly competitive, fast-paced environment of IT. Most software manufacturers must prove that their software works within an environment and that it can integrate into a larger system. Commercial manufacturers often provide free demonstrations at trade shows and tabletop exercises. To incorporate vendor solutions into its Network Integration Evaluation (NIE) program, the Army conducts semiannual events that bring together three Army communities to evaluate militarily useful technologies in both laboratory and field environments. The Army applies the Agile Process to accelerate the identification, testing, and fielding of relevant networked and non-networked capabilities to the soldier, in concert with capability set fielding and the Army Force Generation (ARFORGEN) cycle.

The government has also set up programs specifically designed to make use of challenges. In addition to the Defense Advanced Research Projects Agency's well-known Grand (DARPA, 2004) and Urban (DARPA, 2008) Challenges, they include the efforts summarized in the following section.

Defense Acquisition Challenge (DAC) Program. The DAC program (Defense Acquisition Challenge [DAC] Program, 2012, § 2359b) annually solicits technology proposals from small- and medium-sized enterprises. The proposals present technologies that could lead to improvements in performance, affordability, manufacturing, or operational capability if introduced into existing acquisition programs (DAC Program, 2012, § 2359b). The new technologies should replace or augment some aspect of a current procurement and must be ready off the shelf. The DAC offers a promising way to encourage innovation and help new companies break into the defense market. However, it centers only on improvements to existing, conventional acquisition programs. Ironically, the DAC impels these programs to expend significant resources in order to expose opportunities for innovation that, if successful, will render parts of the original acquisition redundant. In a sense, the DAC represents an example of ChBA in which the challenges are not explicitly designed by the government but inferred by industry from existing, specification-based acquisitions. However, ChBA has the advantage of permitting entirely fresh approaches and avoids forcing industry to accept the constraints of an ongoing acquisition.

Defense Innovation Marketplace. The Defense Innovation Marketplace serves as a centralized resource to help both government and industry "reinvigorate innovation" and fosters collaboration and communication between government and industry beyond traditional Requests for Information and Industry Days. The program allows industry to learn about the DoD's investment priorities and capability needs, and to submit summary reports on proprietary Independent Research and Development (IR&D) to potential customers. For the government, the Defense Innovation Marketplace functions as a one-stop shop for DoD science and technology planning, acquisition resources, funding, and financial information by providing agencies with search tools to access and leverage industry technology projects (DoD, 2013).

Challenge.gov. Outside the DoD, the Office of Management and Budget (OMB) has established the www.Challenge.Gov website, which helps individuals and companies to compete for prizes offered by various government agencies for solving some of their toughest problems. The website supports the "OMB Guidance Memo on the Use of Challenges and Prizes to Promote Open Government," dated March 2010. That memorandum responded to the President's Directive on Transparency and Open Government, which tasked the OMB Deputy Director for Management with issuing guidance

for the increased use of challenges and prizes to develop new tools and approaches to improve open government. OMB launched the website in 2011 with 17 different agencies posting challenges with prizes, including a recent VA $3 million prize. A progress report published by the White House Office of Science and Technology stated that prizes may be effective in stimulating solutions to government problems (White House Office of Science and Technology Policy, 2012).

ChBA Attributes and Benefits

ChBA creates an efficient division of labor where the government focuses on what it needs (i.e., demand) to achieve its mission and private industry focuses on solutions (i.e., supply). The government could use ChBA to communicate its needs by framing challenges that are analogous or identical to the desired capability. Industry could then respond to the challenges without being confined by extraneous constraints such as highly detailed engineering specifications.

To meet government needs, the challenges must be transparent and understandable. If possible, the government should make the challenge accessible to all parties wishing to address the stated needs. Concrete challenges can permit nuanced levels of control in acquisition not possible with static specifications alone.

As shown in Table 1, the DoD can derive several benefits from applying ChBA in its acquisitions. They include expanding user involvement, leveraging technology, reducing risk through proof of delivery rather than paper-based proposals, accommodating the full life cycle of a fielded system or product, utilizing the most appropriate contracting methods, and engaging industry to obtain competitive advantage.

Table 1. Acquisition Considerations, ChBA Compatibility, and Benefits

Acquisition Priority	ChBA Attribute	ChBA Benefits
Urgent Warfighter Mission Needs / Accelerated Fielding Timeline	ChBA is well suited to meeting urgent and high-priority requirements. These needs are often very specific and amenable to description as acquisition challenges. Additionally, the urgency of the need relaxes most of the DoD Instruction 5000.02 constraints. (FAR 6.302-2 Urgent and Compelling Need).	ChBA allows rapid development of advanced technology, including both military and commercial variants. It can result in fielding the correct solution the first time, and avoiding additional costs of rework and schedule slippage—ideal for meeting urgent warfighter needs.
Technological Maturity	By definition, ChBA requires vendors to offer mature technology in order to participate in a challenge event.	ChBA allows new functionality and interoperability to be tested in a concurrent environment, ensuring a more operationally ready product and thus reducing testing costs and timelines.
System Life-Cycle Support / Upgrade Considerations	ChBA is best suited for technology-intensive acquisitions, which are likely to be short lived given the rapid pace of technology evolution.	ChBA fits well into short-duration programs, where constraints in the Operations and Support phase of the Defense Acquisition Management System process become irrelevant.
Efficient Contracting Processes	ChBA can be executed using Broad Agency Announcements (BAAs), Indefinite Delivery / Indefinite Quantity (ID/IQ) contracts, Single Awards, Blanket Purchase Agreements (BPAs), or Multi-Award Contracts (MACs).	ChBA can employ a flexible, streamlined contracting process suited to a variety of contracting vehicle types. This enables the program manager to leverage the contracting type that best suits the program's needs and individual tolerance for risk.
Enhanced Industry Competition	ChBA is structured to encourage a diverse range of industry members (including nontraditional defense suppliers), to participate, thus making for a highly competitive environment.	Because ChBA lowers market entry barriers to nontraditional DoD suppliers, it provides enhanced opportunities for competition that may not normally arise within the traditional defense marketplace.

Law, Regulations, Policy, and Guidance

Recent acquisition laws, regulations, and policies emphasize the need to invest in design development and prototyping to mitigate performance risk and cost growth in DoD acquisitions. In the Weapon Systems Acquisition Reform Act (WSARA) of 2009 (Office of the Secretary of Defense, 2009), Congress directed the Secretary of Defense to ensure that the acquisition strategy for each major defense acquisition program includes requirements to demonstrate capabilities using competitive prototypes, and that programs consider appropriate trade-offs among cost, schedule, and performance objectives before development begins.

Likewise, the Federal Acquisition System fully supports acquisition challenges, as indicated by the guiding principles in the Federal Acquisition Regulations (FAR 1.102). Specifically, federal acquisitions must satisfy customer needs in terms of cost, quality, and timeliness of the delivered product or service by

- maximizing the use of commercial products and services;
- using contractors who have a track record of successful past performance or who demonstrate a current superior ability to perform;
- promoting competition;
- minimizing administrative operating costs;
- conducting business with integrity, fairness, and openness; and
- fulfilling public policy objectives.

FAR Part 2.101, Definitions, includes the following provision: "Qualification requirement means a Government requirement for testing or other quality assurance demonstration that must be completed before award of a contract." The FAR and the Defense Federal Acquisition Regulation Supplement (DFARS) contain regulatory and policy guidance to allow testing of designs before implementation and fielding. FAR 11.801, Pre-award in-use evaluation, states that "supplies may be evaluated under comparable in-use conditions without a further test plan, provided offerors are so advised in the solicitation. The results of such tests or demonstrations may be used to rate the proposal, to determine technical acceptability, or otherwise to evaluate the proposal."

DoD Directive 5000.01 (DoD, 2003a) requires each military department to establish its own independent Operational Test Agency (OTA) to plan and conduct operational tests, report results, and provide evaluations for effectiveness and suitability. DoDD 5000.01 (DoD, 2003a) further requires the integration of test and evaluation throughout the defense acquisition process. DoD Instruction 5000.02 (DoD, 2008), issued in 2008, requires a Materiel Development Decision prior to a program's entry into the acquisition process, causing program offices to invest more funds to mitigate technical risk. Such requirements support the use of ChBA as a means to improve testing efficiency and effectiveness across DoD OTAs (DoD, 2003a).

The examples described previously show that acquisition law and regulation already allow demonstration testing to ensure contractor performance. Precedents in which the government has successfully applied ChBA techniques to acquisitions exist in several domains, such as IT and space. Thus, applying ChBA-like methods to satisfy critical needs appears both legal and practical.

An initial review of acquisition regulation and policy reveals when and how ChBA may be best applied.

- Research and development: A Broad Agency Announcement (BAA) procedure provides a competitive acquisition process. If the challenge involves seeking innovative solutions, then it almost certainly falls within the area of early exploration or development.
- Components, sub-systems, or items: The smaller an acquisition, the easier it is to adapt to the acquisition process without the multi-layered FAR (2013) or DoD Instruction 5000.02 (DoD, 2008) provisions or constraints.
- Urgent capability: Field commanders who require rapid action express their urgent wartime needs in Joint Urgent Operational Needs Statements or similar documents. These needs are often very specific and amenable to description as acquisition challenges.

- Short life cycle: Technology-intensive acquisitions are likely to be short lived given the rapid pace of technology evolution. This makes the complex guidance regarding the importance of reducing long life-cycle costs during the Operations and Support phase of the Defense Acquisition Management process essentially irrelevant.

Better Buying Power 2.0

Recent DoD guidance has also emphasized a faster approach to adopting solutions by using rapid acquisition or agile techniques. In his "Better Buying Power" memorandum (USD[AT&L], 2010), the Under Secretary of Defense for Acquisition, Technology, and Logistics recognized the need to make DoD acquisitions more affordable through added investment at the beginning of the acquisition process to ensure a cost-competitive result. The Defense Better Buying Power (BBP) 2.0 initiative (USD[AT&L], 2012) covers several areas in which challenges can be well suited to implement current guidance.

Achieve Affordable Programs

Mandate Affordability. Challenges can be used to mandate affordability by requiring that all solutions meet a specific price target as a condition of participation in the challenge and subsequent procurement. For example, a challenge may specify that the chosen solution shall not cost more than X dollars. Challenge participants may automatically become ineligible for a final contract award unless their solutions meet the unit cost and/or total cost requirements. This approach ensures that all solutions that the government procures using ChBA will meet pre-defined program affordability targets.

Reduce Program Cost and Risk. The government can use challenges to reduce risk through "actual" demonstrated performance before the government commits itself to a long-term contract. Furthermore, the DoD can build testing and certification criteria into the challenge event, thereby ensuring that accepted solutions will meet testing requirements and required performance objectives before they are purchased by the government, thus reducing risk, delivery timelines, and cost.

Incentivize Productivity and Innovation in Industry

Incorporate Innovation Into Production at a More Rapid Rate. Challenges can spur industry productivity by guiding efficient application of research and development resources to meet specific requirements for a concrete capability. Furthermore, because the technology purchased must be nearly production ready at the time the challenge takes place, this mechanism provides an additional incentive for industry to establish an efficient production process that drives down costs and promotes efficiency.

Promote Effective Competition

Emphasize Competition Strategies and Create/Maintain Competitive Environments. ChBA directly supports creation of a competitive acquisition environment because it encourages a wide range of solution providers to participate. Challenges must be open to the greatest possible number of potential participants, since traditional requirements for entering the defense market do not apply in the ChBA environment. For example, in a challenge focused on current performance requirements, previous experience may be irrelevant when it comes time to make a contract award. This key difference enables organizations and even individuals who have little/no defense experience to participate, thus enlarging the competitive landscape.

Enforce Open Systems Architectures and Manage Technical Data Rights. The DoD can also use challenges effectively to support the introduction of open system architectures (OSAs) across the DoD. OSAs require a predefined architecture with open

interfaces for easy integration of components (DoD, 2011). Challenges can be used to develop adaptable technology for key components of open systems. ChBA also permits flexible intellectual property arrangements and opportunities for licensing negotiations that support effective management of technical data rights over the program life cycle.

Roles and Responsibilities

Government Role

The government takes on a new role in ChBA. In traditional acquisition, the government communicates its needs in a specification and must assume that fulfillment of the specification equates to meeting mission needs. However, the specification could be appropriately constrained, under constrained, over constrained, or simply wrong. If the specification is under constrained or wrong, the result is unlikely to meet mission requirements. If the specification is over constrained, the solution will likely not be optimal and might be impossible to implement.

Current incentives encourage contractors to propose solutions to meet over-constrained specifications, even if the constraints create a high risk of failure and, in the process, spend large amounts of money on developing solutions that may never be fully realized. The fundamental flaw in this process is the failure to recognize when over-specifying drives design. To avoid these problems and implement ChBA successfully, the government should consider the following:

Decompose Complex Requirements Into Challenges. The government will need to interpret warfighter requirements and translate them into meaningful challenge events that will give industry the latitude for innovation and get users what they need. This requires the government to have a broad vision and a commitment to success beyond that typically needed to issue requests for proposals or BAAs. Furthermore, the government should ensure that technical details are not over specified, but rather generalized into technology-agnostic capability requirements that can be demonstrated in a challenge.

Generalize User Experience and Needs and Communicate Them to Industry. After gathering requirements from the warfighter and translating them into executable challenges, the government should communicate the scope of the challenges to industry. In doing so, the government admittedly assumes risk, because formulating the challenges requires the ability to interpret and translate warfighter experience and needs in a clear and concise manner, thus enabling industry to execute the challenge.

Find Unclassified Analogues to Classified Situations. The government should employ ChBA to identify possible solutions to classified requirements by utilizing unclassified challenge analogues. In these situations, participants may not know the details of the particular setting in which the government plans to use a solution, and instead would only know the general performance objectives to be met. This approach supports an enhanced competitive environment by enabling those vendors that do not possess the required security clearances and facilities to participate in the challenge.

Design and Execute a Concrete Challenge Apparatus. The government should design challenge-specific execution and evaluation processes that include a plan for communicating challenges to industry, a plan detailing how the challenge will be executed contractually, specific requirements for challenge participation, and detailed evaluation criteria to ensure the challenge evaluation will be fair to all participants.

Perform Quantitative and Qualitative Analysis of Challenge Results. The government should use quantitative and qualitative measurements to evaluate challenge results. More specifically, the government may evaluate the challenge participants during or

immediately after the challenge, and/or over a longer term, as defined by the initial challenge notice. Upon completion of the challenge, the government may opt to

- Purchase one or more of the competitors' offerings based on confidence in the product's utility, as demonstrated during the challenge.
- Refine and reissue the challenge based on lessons learned during challenge performance. This can become part of an incremental government strategy that includes challenge-based research projects.
- Do nothing. If the challenge results did not inspire confidence that any of the products would meet government needs, the government has no obligation to let a contract. This prevents a potentially unsuccessful acquisition.

Industry Role

Industry also takes on a new role in ChBA: one that more closely mirrors how industry normally develops and brings a product to the commercial market versus the traditional defense acquisition market. In this case, industry would be responsible for independently developing a solution that addresses a given capability need (e.g., "get to my destination faster and with comfort and affordability"). This approach contrasts starkly with the traditional defense acquisition process whereby the government provides detailed specifications and requirements (e.g., faster horses) to industry. In the former case, industry bears most of the risk, while in the latter case the risk is borne by the government. Thus, in support of ChBA, industry should do the following:

Innovate. ChBA will demand that industry propose innovative solutions. ChBA is by definition technology agnostic—it does not presuppose one specific, ideal technological solution. Consequently, government will not prescribe a specific technological path that industry must follow, but rather will present its requirements in the form of general challenge objectives that must be met. Industry must then apply its expertise to determine the best technical approach to address the objectives within the schedule/cost constraints provided by the government.

Cooperate With Traditional/Non-Traditional Entities. No single company has a monopoly on innovative solutions. ChBA acquisition, by its very definition, seeks the best technology to address the military's toughest problems. Therefore, industry must be willing to cooperate with any individual or organization that could contribute to a solution meeting challenge performance criteria.

Dedicate R&D Funding. ChBA will require that industry dedicate IR&D funding to develop a solution that meets challenge performance criteria. While the government may choose to provide nominal funding to enable organizations to attend and participate in challenge events, it may not necessarily fund any of the initial development effort.

Negotiate Intellectual Property Licenses. ChBA will require that industry be prepared to negotiate potential intellectual property licenses with the government. As a result, it is important that industry properly identify which of its solutions it derived through exclusive use of IR&D funding versus those that may have been developed at partial or full government expense. Such a distinction is important, because the source of funding dictates the type of licensing rights available to the government.

ChBA Within Defense Acquisition

ChBA is well suited to smaller acquisitions, which are usually not controlled by the full DoD Instruction 5000.02 (DoD, 2008) guidance. In large acquisitions, ChBA can

enhance the standard process by efficiently providing many of the 5000.02-specified components, if not necessarily the entire solution.

Since ChBA is grounded in requirements development and the acquisition process, it does not represent a radical or disruptive break with accepted practice. Instead, it generalizes and builds on existing concepts such as the Defense Acquisition Management System (DAMS), which guides the procurement of major military systems. Figure 1 provides a graphical view of the DAMS phases.

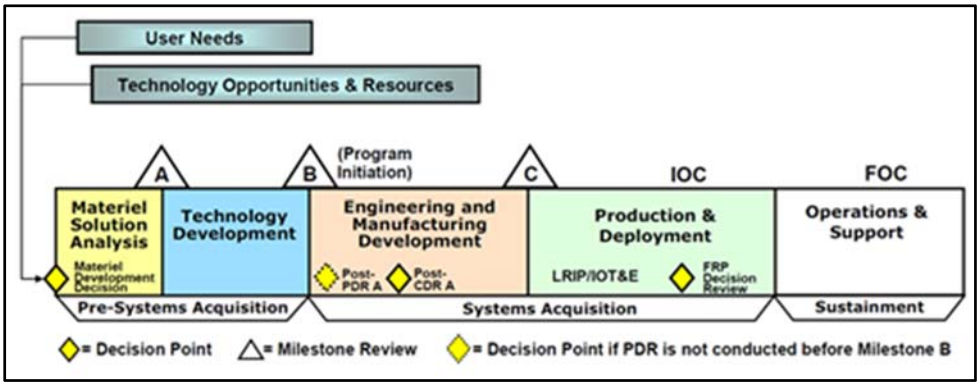

Figure 1. DAMS Phases

The DAMS recognizes the need for an evolutionary approach to acquisition, stating that “an evolutionary approach delivers capability in increments, recognizing, up front, the need for future capability improvements” (DAU, 2011). Increments are managed through repeated application of the Technology Development and Engineering and Manufacturing Development phases. ChBA applies in these early phases of the DAMS and in the general evolutionary approach. Specific opportunities for ChBA application within the DAMS are further described in Table 2.

Table 2. DAMS and ChBA

DAMS Phase	Applicability of ChBA
Materiel Solution Analysis—Assess potential materiel solutions and perform an Analysis of Alternatives. This phase begins when an Initial Capabilities Document is approved that contains an analysis of current mission performance and potential concepts from across the DoD. It ends when the Analysis of Alternatives is complete and materiel solution options, identified in the Initial Capabilities Document, are recommended.	The Analysis of Alternatives enumerates the critical elements needed by each proposed materiel solution. ChBA supplements this step because industry provides the technology needed to create a capability prior to participation in the challenge. If the government does become involved in selecting and maturing technologies, a challenge, based on the needed capability, could be used to explore the range of candidate technologies and assess their maturity.
Technology Development—Determine and mature the appropriate technologies needed for the full system. Critical technology elements, identified in the previous phase, must be demonstrated using prototypes. The Technology Development phase requires the creation of a Technology Development Strategy. For an evolutionary acquisition, the Technology Development Strategy is to include a preliminary description of how the materiel solution will be divided into acquisition increments based on mature technology and an appropriate limitation on the number of prototype units.	A ChBA approach to the Technology Development Strategy is to design a challenge that proves the maturity of each needed technology. The challenge may or may not require a prototype, but will place emphasis on attainment of the technological capability rather than the delivery of a prototype. The acquisition increment requirement of the Technology Development Strategy can be served by a standing challenge that persists through time as multiple challengers demonstrate a range of solutions. A standing challenge gives industry a chance to improve on existing solutions. It also encourages the discovery of game-changing solutions to challenges that have already been solved with more pedestrian technologies.
Engineering and Manufacturing Development—Develop the full system or some increment of the full system capability. This includes full system integration and creation of an affordable and executable manufacturing process.	ChBA potentially eliminates the need for this phase because the technology needed to create a capability is already at or near full capability as a prerequisite for challenge participation. Further, the challenge may specifically require that participants (or their partners) produce fully operational versions of the submissions by a certain point in time following the challenge event.
Production and Deployment—Achieve an operational capability that satisfies mission needs. This includes low rate production for evaluation of major systems and full production or procurement of smaller systems.	Technology acquired using ChBA is by definition nearly production ready; therefore, ChBA can be used to accelerate the LRIP portion of the acquisition process. Furthermore, if operational testing and evaluation criteria are already built into the challenge construct, technology will have met T&E requirements before the government makes a buy decision—again accelerating the IOT&E part of the acquisition process.
Operations and Support—Execute a support program that meets readiness and operational requirements and sustains the system, in a cost-effective manner, over its total life cycle. This phase also includes disposal of the system at the end of its life.	Challenges can be designed to ensure that operations and support requirements are built in from the beginning. As such, a challenge-based demonstration can reenact operational requirements for readiness and sustainment to demonstrate capability before the government makes a commitment to purchase.

The ChBA Process

Figure 2 shows the flow of a hypothetical challenge-based acquisition. The process begins when the government becomes aware of a user's need. The acquiring agency, or its

technical support organization, postulates a capability that can satisfy the user's need. This is a creative process and requires more technical insight than simply recording what the user has requested.

With a desired capability in mind, the government agency creates a set of concrete performance challenges that would demonstrate the ability of the envisioned capability to solve the user's problem. For example, the user problem could be that soldiers need better situational awareness when fighting in urban areas. The envisioned capability could be an information sharing mechanism. A supporting challenge might be to show that solders who use the candidate challenge solution earn better scores in urban combat training than those who do not use the solution.

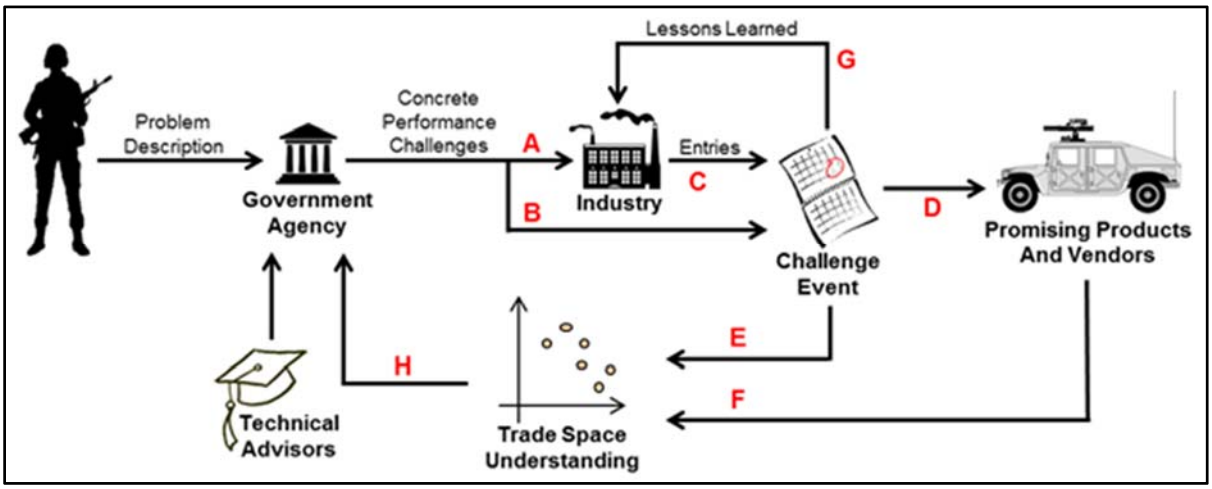

Figure 2. ChBA Process

The challenge event can range from large, periodic, public occasions to private, one-time visits to a testing laboratory.

At Arrow C in Figure 2, industry decides to attempt the challenge. This may produce two results:

- Increased government knowledge of potential solutions and their vendors, depicted by Arrow D.
- Greater understanding of the trade space in which a solution might be found. Arrows E and F show that this understanding comes from both observed performance in the challenge event and information available about promising vendors and their products.

Arrows G and H show that ChBA can be a cyclic process.

- Competitors whose product failed in one challenge may make another attempt after modifying their products. The government may also take this opportunity to fund promising vendors directly. Direct funding rewards vendors for their initiative and incentivizes them to attempt the challenge again, as depicted by Arrow G.
- Based on improved knowledge of the needed capability and the technical trade space, the government can revise the challenge and begin the process again, as depicted by Arrow H. This can be important during the acquisition of complex systems, where multiple steps may be needed to state the challenge correctly or arrive at the appropriate technology.

Case Study—Joint IED Defeat Organization

The mission of the Joint IED Defeat Organization (JIEDDO, n.d.-b) is to "reduce the effectiveness and lethality of IEDs, to allow freedom of maneuver for joint forces, federal agencies, and partner nations in current and future operating environments" (JIEDDO, n.d.-a). In its strategic plan, JIEDDO identifies as one of its enduring capabilities the ability to "employ authorities, flexible resources, streamlined processes, and effective oversight to drive the research and development community to rapidly field C-IED solutions" (JIEDDO, n.d.-a). The computer screen saver depicted in Figure 3 carries JIEDDO's fundamental message to the staff every day. This intensity of purpose and need for rapid action make JIEDDO well suited to apply ChBA.

Figure 3. JIEDDO Organization-Wide Computer Screen Saver

In the summer of 2011, JIEDDO faced the sudden need for a particular class of robot in the war in Afghanistan. JIEDDO demonstrated strength and resolve by issuing concrete challenges that communicated the soldiers' needs rather than reading vendor literature and attending presentations. The challenges were drawn from the suite of Response Robot Performance Standards (National Institute of Standards and Technology, 2011) developed by the National Institute of Standards and Technology (NIST; www.nist.gov). The NIST test method suite includes a range of mobility and duration assessment devices that provide excellent models of the challenges robots face in Afghanistan.

Six vendors accepted the challenge and at their own expense brought their robots to NIST for assessment. Some robots met the challenges as their vendors claimed. Other systems displayed large gaps between promised capability and demonstrated performance. JIEDDO then presented the results of the challenges and the concrete characteristics of the robots to field users in Afghanistan.

JIEDDO discovered that the original request from the field had been over constrained. The challenge performance helped the users to understand the performance trade space and to recognize that one class of robot alone would not meet their needs. As a result, JIEDDO identified two classes of robot that addressed the concerns of two distinct user communities—an important distinction nowhere to be found in the original field request.

In addition to clarifying what the users really needed, the challenge process encouraged vendors to improve their products before the government committed itself to a purchase. The challenge brought transparency and mutual vendor visibility, sparking beneficial competition and product improvement. Within months, vendors asked to return to the NIST, again at their own expense, for another opportunity to confront the challenges and improve JIEDDO's perception of their products' quality. In this way, ChBA enabled JIEDDO to go from the initial request for help to fielded systems in less than a year.

Implementation

Barriers

Barriers to implementation are rooted in the possibility that the government will attempt to manage ChBA in the same way it manages a traditional technology acquisition. While ChBA leverages the DAMS and supporting processes, the acquisition pitfalls that plague these traditional systems could equally undermine ChBA.

Table 3. Acquisition Attributes and Implications for ChBA

Typical Acquisition Pitfalls	ChBA Implications
Mission needs are incorrectly translated through the daisy chain of performance-related documentation, resulting in wrongly defined system performance that is over specified, driving non-optimal solutions.	The DoD may not be able to acquire the most innovative solutions from industry using ChBA if the government dictates specific requirements instead of describing generic capabilities to be demonstrated at a challenge event.
The competitive nature of funding motivates the government to make optimistic predictions of system performance in order to obtain program approval. Likewise, industry is incentivized to propose risky solutions, since this can lead to long-term lock-in and opportunities for contract modifications to address product shortcomings.	ChBA fundamentally does not permit either the government or industry to over-promise system performance. Performance must be proven in a transparent manner prior to the buy decision.
The government often approaches acquisition in a risk-averse manner, requiring extended periods of risk reduction accompanied by documentation requiring multiple reviews. Regardless of risk-reduction efforts, real risk to the government buyer exists due to the late conduct of the Operational Evaluation.	ChBA addresses these risks up front and is ideally suited to high-risk technological solutions. However, ChBA will require cooperation from current document owners and the Operational Test community to avoid this pitfall.

Adopting ChBA

In order for the DoD to adopt and universally implement ChBA across the broader defense enterprise, we recommend that the DoD do the following:

- **Educate acquisition professionals about ChBA.** There is a gap between the latitude allowed by current acquisition law and the state of acquisition practice. Briefly stated, the defense acquisition community culture tends to be highly risk averse even when there are logical arguments to take on additional risk. This cultural dynamic is reinforced as program managers regularly spend money to reduce uncertainty (e.g., risk; Frick, 2010, p. 364). ChBA enables the government to explore potentially high-risk/high-reward solutions in a low-risk environment before vast resources are dedicated to an acquisition effort. This suggests that the acquisition corps needs to be educated on the value of using ChBA in these circumstances.
- **Publicize examples of ChBA success.** The government should publicize working examples of ChBA within the acquisition and supporting professional communities. Acquisition professionals will feel more comfortable embracing ChBA if they can point to other successful programs that use ChBA strategies. Senior leadership must be convinced of ChBA utility so that they will commission a few early adopter programs, and the managers of these early adopter programs must operate under senior leadership imprimatur and

protection. The success of the early adopters will then encourage more cautious program managers to follow suit, provided the results of ChBA are widely publicized across the DoD.

- **Develop a ChBA desk guide as a reference for acquisition professionals.** The DoD should produce a ChBA desk guide to support use of ChBA across the defense enterprise. The guide should be patterned after existing acquisition desk guides to answer day-to-day questions and provide example solutions, practices, and business cases related to ChBA. As ChBA is more widely adopted across the DoD, the desk guide should be updated periodically to document new lessons learned, case studies, and best practices.
- **Consider legislative and regulatory change.** Amend the FAR and revise current acquisition guidance to reflect ChBA as an accepted method to acquire capability for the warfighter. Explicit acceptance of ChBA in published regulatory and policy documents will codify the approach and bring recognition that it represents a sound way of doing business and can achieve high impact in performance improvement.

Conclusion

ChBA can solve a class of acquisition problems defined by industry's tolerance of capital risk and the government's ability to express user needs in terms of concrete challenges. It thus constitutes a logical next step in the current wave of acquisition reforms. ChBA has proven itself in the world of civilian advanced technology acquisition and has been demonstrated successfully in limited areas within the DoD.

Successful application of ChBA demands a renewed government commitment to technical involvement in acquisition, calling upon the acquisition agent to create challenges that, if fulfilled, would also meet the user's requirements. This requires a clear understanding of user need, as well as the creativity, imagination, and technical insight necessary to design the challenge.

ChBA encourages the best performance in industry by freeing companies from constraints unrelated to challenge success. It encourages new players to participate and creates a level playing field for all involved. ChBA adheres to government regulations and is practical to use within the current federal acquisition system. Above all, it offers an efficient means for stimulating industrial innovation and reducing the time and cost of government acquisition programs.

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