2016

Major General Harold J. "Harry" Greene
Awards *for* Acquisition Writing

No One Would Be More Proud

The namesake of the Major General Harold J. "Harry" Greene Awards for Acquisition Writing cherished the talent, creativity and expertise of the defense acquisition workforce.

by Lt. Gen. Michael E. Williamson

The Major General Harold J. "Harry" Greene Awards for Acquisition Writing showcase the tremendous talent, creativity and expertise within the defense acquisition workforce and throughout the larger community of stakeholders with whom we work. Designed to influence the public dialogue about Army acquisition through critical thinking and writing, the thoughtful and insightful articles, essays and opinion pieces that were submitted have been instrumental in shaping our message and driving the discussion, both internally to the Army and DOD and externally to our many audiences.

No one would be more proud of the competition's success than Maj. Gen. Greene. He was an inspirational leader and a scholar who loved the acquisition profession and the Soldiers we serve. I recall vividly his daily walkabout when, in a loud and boisterous voice, he'd ask, "What have you done for the Army today?"

This was an opportunity for members of the workforce to discuss what was happening in their programs or, at times, in their lives, and get his advice and counsel. It was also an opportunity to discuss the latest news about the Boston Red Sox, the New England Patriots or the Boston Bruins, his favorite sports teams.

In 2012, upon his assumption of duties as the deputy for acquisition and systems management in the Pentagon, he wrote a letter to the workforce that is as relevant today as it was then. "Our challenge is to prepare for the future," Harry wrote. "We support the current fight, but can't let the day-to-day challenges prevent us from looking down the road." He instructed his professionals to act "as leaders, not as managers," and to "make the hard calls, as the Army expects of us." Characteristically, Harry wrote, "I love my job. You must have passion to do this business right. Stay positive. Things are never as bad as they seem."

We miss the comfort of Harry's leadership and guidance. His loss on Aug. 5, 2014, while serving as the deputy commanding general of the Combined Security Transition Command – Afghanistan, is still painful. These awards help us to honor Harry's 34 years of distinguished service and his ultimate sacrifice. Through them, we also remember that his contributions to Army acquisition and our acquisition professionals will be everlasting.

This special supplement of Army AL&T magazine includes the 2016 winning authors and those who received honorable mentions in four categories: Acquisition Reform/Better Buying Power; Future Operations; Innovation; and Lessons Learned. Let me extend my sincere thanks to all who have participated in this annual competition, and to their families and teammates who supported them in their writings. I also want to thank our outstanding judges for their expertise, time and energy in making this third competition successful. My congratulations to all.

The winners and honorable mentions are:

Category: Acquisition Reform/ Better Buying Power

Winner: User Requirements: An Enduring Conversation

Author: **Mr. David M. Riel** is professor of acquisition management for Defense Acquisition University's (DAU) Midwest Region, teaching and consulting in the areas of program management and production, quality and manufacturing. After a 20-year U.S. Air Force career and several years working in the defense industry, Riel is part of the DAU team providing mission assistance to program offices and teaching the next generation of DOD acquisition professionals the ins and outs of defense acquisition.

Abstract: As the design for a weapon system matures, an enduring conversation needs to take place between the acquirer and the warfighter, carefully explaining the producibility, maintainability, reliability and subsequent cost impacts of each additional mile of range, or mile per hour of speed desired. In short, the conversation needs to take change from "Can this be done?" to "At what additional cost can this be done?" Policy changes introduced by the January 2015 update to DoDI 5000.02, Operation of the Defense Acquisition System, and the Better Buying Power initiatives have created a pathway to this meaningful, continuous dialogue, but it will take culture change and relationship building between the acquisition and user communities to make the conversation enduring. While policy and methodology for top-level affordability are being institutionalized via such initiatives as Configuration Steering Boards and the U.S. Air Force's "Bending the Cost Curve," small, incremental affordability tradeoff decisions throughout the detailed design phase need to be consistently and persistently pursued. The opportunity management process as defined in the June 2105 DOD Risk, Issue and Opportunity Management Guide for Defense Acquisition Programs can be expanded to include Requirements Tradeoffs Opportunity Management Reviews, where requirement tradeoffs are further characterized and tracked. These Requirements Tradeoffs Opportunity Management Reviews should become integral in driving an affordability culture for defense acquisitions.

Honorable Mention: How Important is Getting It Right the First Time? A Case in Applying Agile Acquisition Management

Author: **Mr. Joe Novick** is the product manager for the Next Generation Personnel Decontamination System and the deputy product manager for the Joint Expeditionary Collective Protection Program in the Joint Program Executive Office for Chemical and Biological Defense. He holds a bachelor's degree in biochemistry from the University of Virginia. He is Level III certified in program management and systems engineering.

Abstract: How important is getting it right the first time? For systems where evolutionary improvements and modernization are not logistically or economically feasible, like a new satellite or a Food and Drug Administration-approved vaccine, "getting it right" may be paramount. But in many DOD systems, program managers and stakeholders should instead ask: How right does it need to be the first time? As warfare

environments and adversaries change, the definition of "getting it right" changes, too. Additionally, human nature is not about perfection; our society thrives on lessons learned. In acquisition, we spend far too much time and resources focusing on absolutely meeting all requirements in our capability documents. We should be coordinating more closely with the user community throughout the acquisition process to focus on meeting the most critical requirements and making key tradeoffs that can be addressed after production. Additionally, as programs progress, the priorities of requirements may change based on performance data, intelligence information and threat information.

Category: Future Operations

Winner: Future Conflict: Adapting Better and Faster than an Adversary

Author: **Maj. Hassan M. Kamara** is an assistant product manager assigned to the Lower Tier Project Office in the Program Executive Office (PEO) for Missiles and Space. He has served on the U.S. Forces Korea Joint Staff (J-3), and prior to that he commanded a Stryker infantry company at Fort Bliss, Texas, and an armor company in Iraq. He holds a B.A. in political science from Arizona State University and an M.A. in security studies and a certificate in defense procurement and contracting from the U.S. Naval Postgraduate School. Kamara is also an honor graduate of the U.S. Naval War College Command and Staff Course.

Abstract: The problem of wartime adaptation has been an enduring challenge for militaries. The U.S. Army cannot predict future wars with certainty, so it should ensure that it can rapidly adapt to the changing realities—such as technological surprise—that are inherent in war. Moreover, as the potential for U.S. involvement in future conflicts with a major power grows, the following question emerges: How can the U.S. Army technologically adapt better and faster than a peer or near-peer adversary in a future conflict? This paper analyzes the process of wartime adaptation to highlight how the Army can adapt faster than a peer or near-peer adversary in a future conflict.

Honorable Mention: Expeditionary Situational Awareness at the Tip of the Spear, Preparing for Future Operations Through Innovation

Author: **Lt. Col. James Howell** is an acquisition officer assigned to the Pentagon as a Department of the Army System Coordinator (DASC) for Defensive Cyber and the Handheld, Manpack, Small Form Fit Program. Previously, he served as the DASC for the Warfighter Information Network – Tactical Increment 1. He also served with the 82nd Signal Battalion, the Red Devils, the 1st Battalion, 504th Parachute Infantry Regiment and with the 3rd Brigade Combat Team, 82nd Airborne Division supporting numerous exercises and missions in Baghdad and Tikrit.

Abstract: Sun Tzu, a Chinese general, military strategist and philosopher, presented a profound principle more than 2,500 years ago, describing the power and importance of information dominance prior to and during combat operations. In "The Art of War," he wrote, "If you know the enemy and know yourself, you need not fear the result of a hundred battles. If you know yourself but not the enemy, for every victory gained you will also suffer a defeat. If you know neither the enemy nor yourself, you will succumb in every battle." In essence, information is power and overmatch. To support this level of understanding, U.S. forces require the most advanced mission command, communications and situational awareness processes and capabilities available as we meet with and engage our nation's enemies. Today's mission command network technologies are helping to provide this level of understanding.

Category: Innovation

Winner: Culture: The Foundation of Innovation

Author: **Maj. Andrew Miller**, a basic branch infantry officer, is the Nett Warrior Fielding and Training assistant product manager in Project Manager Soldier Warrior within PEO Soldier.

Abstract: Innovation is a strategic priority for the Army acquisition community. Unfortunately, our attempts to innovate are hampered by an incorrect understanding of the nature of innovation. On the

whole, we tend to associate innovation with technology. Instead, we should focus our efforts to innovate on organizational culture. Culture is the foundation of innovation and is a prerequisite of incorporating technology. Armed with a culture of innovation, our organizations will break free from the status quo and position themselves to develop and integrate technology. Unfortunately, innovative cultures take effort to create and even more to maintain. Four key actions, which, if coordinated, generally lead to success: empower, vigorously evaluate assumptions, prioritize product over process, and advocate.

Honorable Mention: Inspiring Innovation by Changing My Vantage Point on the Battlefield

Author: **Lt. Col. Rachael Hoagland** is currently a Training with Industry (TWI) fellow at Amazon.com. She has held assistant project management jobs in the U.S. Special Operations Command and Project Manager Tactical Radios within PEO Command, Control and Communications – Tactical. Prior to entering the Acquisition Corps, she taught at the U.S. Military Academy at West Point and held several roles as a military intelligence officer.

Abstract: Changing one's vantage point on the battlefield can provide a competitive advantage over an adversary by providing a unique view on how the enemy is organized, what weapon systems it is using and what decisions it might make. As an active-duty Army acquisition officer working at Amazon.com in the TWI program for the year, I am changing my vantage point on the battlefield. This experience is helping me gain a competitive advantage on how to stimulate innovation for the future of the Army. Amazon's agile project management style saves time by giving teams the ability to make decisions in the moment. Eliminating management control allows teams to shift project focus and priorities as needed. To move fast, you must empower your people to make decisions; to ensure that they make the right decisions, you need to put in place a set of core values that everyone internalizes, and reinforce those values in all your training so the right decision at the right time becomes the norm.

Category: Lessons Learned

Winner: Robots and Deal Makers: Lessons Learned from an Acquisition Officer Serving as a Legislative Liaison

Author: **Lt. Col. Patrick "Josh" Baker** is an Army Acquisition Corps member, and is Level III certified in program management. He holds an MBA in systems acquisition management from the Naval Postgraduate School. He served 2 1/2 years as the Army aviation programs legislative liaison in the Office of the Chief Legislative Liaison. He is currently serving as a TWI fellow at General Dynamics.

Abstract: Engaging members of Congress and their staffs can be an intimidating and mysterious venture. Acquisition professionals must choose how they approach Capitol Hill: as a robot or a deal maker. The paper offers practical recommendations that can produce successful results for acquisition professionals as they interact with Congress. The goal is for acquisition professionals to leverage their ability to manage trade space, negotiations and emotional intellect to be a deal maker who emboldens programs.

Honorable Mention: A BIT* of Advice *Built-In Test

Author: **Lt. Col. Steven Van Riper** and contributing authors **Mr. Jim Griffin** and **Mr. Eugene Buckner**. Van Riper is the program director for an Acquisition Category II program within Special Operations Forces acquisition, technology and logistics; Griffin is the deputy program director; and Buckner is the senior systems engineer in the U.S. Special Operations Command's Program Executive Office Rotary Wing.

Abstract: Reliance on built-in test (BIT) to monitor system performance is now commonplace in all categories of systems. BIT augments human monitoring of systems, performing automated and directed diagnostics and prognostics. BIT planning, development, testing and final implementation are evaluated as critical operational issues influencing overall system suitability and effectiveness. Differentiation between informational or actionable BIT, early activation of BIT functionality and BIT customization can mitigate common risks associated with system-level BIT management.

Major General Harold J. "Harry" Greene Awards
for Acquisition Writing Distinguished Judges

Maj. Gen. Robert E. Armbruster Jr. (USA, Ret.), Defense Acquisition University (DAU) faculty member and former commander, U.S. Army Test and Evaluation Command (ATEC)

Maj. Gen. Charles A. Cartwright (USA, Ret.), DAU faculty member and former program manager, Future Combat Systems

Professor John T. Dillard, academic area chair for acquisition, Graduate School of Business and Public Policy, Naval Postgraduate School

Professor Raymond D. Jones, Graduate School of Business and Public Policy, Naval Postgraduate School

Ms. Mary Miller, then deputy assistant secretary of the Army for research and technology

Maj. Gen. Roger A. Nadeau (USA, Ret.), senior vice president, American Business Development Group, and former commanding general (CG), ATEC

Col. Kurt A. McNeely (USA, Ret.), chief, Warfighter Central, Enterprise and Systems Integration Center, U.S. Army Armament Research, Development and Engineering Center

Mr. Kris Osborn, managing editor, Scout Warrior

Maj. Gen. Dana J.H. Pittard (USA, Ret.), vice president, Defense Programs, Allison Transmission

Lt. Gen. Richard G. Trefry (USA, Ret.), Association of the United States Army (AUSA) senior fellow and former Army inspector general

Gen. Louis C. Wagner (USA, Ret.), AUSA senior fellow and former CG, U.S. Army Materiel Command

Lt. Gen. Joseph L. Yakovac (USA, Ret.), senior counselor, The Cohen Group, and former ASA(ALT) military deputy and director, Army Acquisition Corps

Category: Acquisition Reform/ Better Buying Power

WINNER

User Requirements: An Enduring Conversation

By Mr. David M. Riel
Defense Acquisition
University – Midwest Region

Staring at the Cabinet Shop's quality deficiency report as a senior manufacturing manager for one of our defense industry partners, the spike in quality issues led me to reach for my phone and request an audience with the shop lead, Bobby. As Bobby explained, the new aluminum honeycomb sheets, specifically procured from Germany for their lightweight adhesive and thin-walled siding, were causing the guys "fits." Their conventional handling techniques were proving inadequate to compensate for the material's delicacy. Further investigation revealed a host of other costly design decisions made to meet the weight reduction requirements for the new VH-71 Presidential helicopter. In addition to the thin-walled aluminum honeycomb sheets, cabinet attachments were being milled using long-spindled ⅛ inch tooling versus the standard ¼ inch tooling typical for these applications. Also, painters were masking the backside of every bracket used to hold the fiberglass soffits onto the interior sides in order to avoid the weight of any paint overspray. In short, our design engineers were in hot pursuit of the reduced weight requirements imposed by the prime in order to meet the user's range requirements. Many of these manufacturing impediments were not difficult, such as the milling and painting operations, but the added man-hours from deburring and masking operations were proving pricey. Ultimately, in accordance with President Obama's campaign promise to eliminate the costly VH-71 program, the one-time $6.2B program, which had ballooned to $13B, was canceled.

Similar weight reduction requirements, driven by its range Key Performance Parameter (KPP), drove design decisions on the F-22 Advanced Tactical Fighter (ATF)

program that were costly at the time and still plague the aircraft with higher maintenance costs. As each airframe enters depot maintenance, any corrosion being removed typically requires the prime contractor's engineers to individually disposition each repair, increasing both the time and cost of depot maintenance.

These two examples reflect a necessary, persistent boost to the acquisition and user community conversation from "can this be done?" to "at what additional cost can this be done?" As the design for each of our weapon systems matures, an enduring conversation needs to occur between the acquirer and the warfighter, carefully explaining the producibility, maintainability, reliability and subsequent cost impacts of each additional mile of range, or mile per hour of speed desired. Recent policy changes introduced by the January 2015 update to DoDI 5000.02, Operation of the Defense Acquisition System, and the Better Buying Power initiatives have created a pathway to this meaningful, continuous dialogue, but it will take culture change and relationship building between the acquisition and user communities to make the conversation enduring. DoDI 5000.02 calls for a "systems engineering tradeoff analysis showing how cost and capability vary as a function of major design parameters" in order to "support the assessment of refined KPPs/KSAs in the CDD" as part of the Capability Development Document - Validation (CDD-V) decision point. While this required systems engineering tradeoff analysis is a necessary early step in understanding the cost implications of major design parameters, the devil is often in the details as the program matures from a preliminary design to a detailed design. For major programs, DoD 5000.02 also requires that "program managers, in consultation with the PEO, and the requirements sponsor, will, on at least an annual basis, identify and propose to the CSB (Configuration Steering Board) a set of recommended requirements changes to include descoping options that reduce program cost and/or moderate requirements and changes needed to respond to any threat developments." While the program managers' efforts in bringing tradeoffs before the CSB is also a step in the right direction, reducing costly design decisions by capitalizing on the effects of many small changes, will be difficult to achieve in a once yearly forum.

Similarly, Better Buying Power Initiatives have promoted "should cost" and the enforcement of affordability

caps since BBP 1.0 was initiated in September 2010. Yet, as BBP 1.0 alludes, "Affordability means conducting a program at a cost constrained by the maximum resources the Department can allocate for that capability," which may very well not create the conversation of whether or not the extra 50 miles of range are worth the added 10% cost, only that the cost for those miles fits within the maximum allowable affordability cap. Likewise, "should cost" pursuits have been focused on acquisition-specific practices, such as GFE break-out, increased competition, and multi-year contracting. In 2015, the Air Force announced their "Bending the Cost Curve" initiative, featuring a cost-capability analysis program, which also offers cost-savings opportunities. However, this initiative also only promotes the conversation during the pre-EMD contract award stage.

All of these cost savings initiatives offer valuable contributions to reducing the cost and increasing the affordability of our weapon system programs. But what about after the development contract is signed? What about during the detailed development of the system when decisions are made to chase performance requirements (e.g., weight savings) to achieve already-solidified user requirements?

Requirements Tradeoffs
Opportunity Management Reviews

Two new decision points in the Defense Acquisition System (DAS) framework, the Capability Development Document – Validation (CDD-V) and the Development Request for Proposal Release Decision (DRF-PRD), are designed to ensure solidified, affordable user requirements are established prior to Milestone B, which they do very well. However, the conversation on requirements must not stop there. After the Milestone B decision and the Post-Milestone B contract is awarded, as the weapon system design is progressing, discoveries are made that can greatly impact the producibility and life cycle cost of the program. By providing a consistent avenue for a requirements review by the systems engineering community, the user community can be provided with a better understanding of the optional short and long-term cost avoidance and/or savings potential that may become evident as the design matures. Perhaps the F-22 ATF user community would have reconsidered the requirement for the M61A2 20-mm Gun System, which weighs 378 lbs empty (plus another ~100lbs for the 480 rounds of 20-mm ammunition),

if they had a better understanding of overall life cycle impact of the design decisions made in order to reduce weight elsewhere to accommodate the gun, which is likely unnecessary for combat due to the integrated capabilities of advanced air-to-air missiles (AIM-120 AMRAAM and AIM-9 Sidewinder), stealth, advanced avionics, and supercruise. A systematic process for documenting and pursuing such initiatives is essential.

The first step would be to define the opportunity using solid "tradeoff – benefit" statements adapted from practices promoted in the risk management section of the June 2015 DoD Risk, Issue and Opportunity Management Guide for Defense Acquisition Program (RIO Guide). Next, the RIO Guide's opportunity management process can be expanded to include requirement tradeoffs in order to further characterize and track these tradeoffs. Opportunities are defined in the June 2015 DoD Risk, Issue and Opportunity Management Guide for Defense Acquisition Program, as the "potential future benefits to the program's cost, schedule, and/or performance baseline, usually achieved through reallocation of resources … support Better Buying Power initiatives to achieve "should-cost" as well as "will-cost" objectives." Therefore, while more geared towards investing financially today to gain future benefits, applying incremental requirements tradeoffs today to alleviate current risks and achieve future benefits is certainly within the spirit of the process.

The RIO Guide also elucidates to "not ignore small improvements", which can add up and prove essential to the cost avoidance or savings in the requirements tradeoff process. Using the concepts in the RIO Guide for registry development, requirement tradeoff opportunities (RTOs) can be captured and tracked using the handling options outline in the RIO Guide – pursue, reevaluate or reject. Also, using a similar methodology found in the RIO Guide, a Requirement Tradeoff Opportunity Register should be established that describes the RTO; the likelihood of the user community reducing or eliminating the requirement; its negative impact on performance; and its positive impact on producibility, reliability, maintainability and life cycle costs.

EXAMPLE 1: The opportunity for the removal of the air-to-air gun for the F-22 ATF represented a major requirement change with significant benefits had it been pursued during its early post-Milestone B

development in 1992. (Note: All financial amounts and requirement trade information are for illustrative purposes only and do not represent actual figures).

Step one: Develop a "tradeoff – benefit" statement that captures the requirements tradeoff opportunity.

1. If the requirement for an air-to-air gun (i.e., M61A2 20-mm Gun System) is removed and its weight savings of approximately 478 lb is achieved, then individual components/parts can be designed heavier, enhancing producibility, maintainability and reliability, and resulting in an overall life cycle cost reduction of $1.15B.

Step two: Document opportunity in a Requirement Tradeoff Opportunity Register (see table below).

EXAMPLE 2: The following example from the canceled VH-71 Presidential Helicopter program demonstrates how an extensive weight reduction program can incrementally affect the overall life cycle cost. The re-

duction of the range requirement for the VH-71 Presidential Helicopter provides the opportunity to increase the weight of specific parts of the aircraft's interior resulting in small, yet compounding, cost savings when applied across the program. Each incremental cost/benefit analysis can be managed independent of the others; however, their cumulative effect on range needs to be comprehended. (Note: This example assumes that the range threshold was the determinant factor in weight reduction emphasis. Other possible explanations and potential tradeoffs include equipment and gear.)

Step one: Develop a "tradeoff – benefit" statement that captures the requirements tradeoff opportunity (Range reduction and interior weight figures are for illustrative purposes only).

1. If the threshold requirement for range was reduced by 25 miles and the weight of the interior could be designed 25 lb. heavier, then individual components/parts can be designed heavier; thus, enhancing producibility, maintainability and reliability and resulting in an overall life cycle cost reduction of $2.5M.

Step two: Document opportunity in a Requirement Tradeoff Opportunity Register (see table on page 9).

Opportunity	1A Remove M61A2 20 mm Gun System resulting in approx. 478 lb weight savings
Performance Cost	No gun for close air-to-air engagements
Likelihood	Low
Positive Impact	High
Producibility	Increased weight across multiple components at no cost to range results in many producibility advantages
Maintainability	Airframe edge distance and thickness dimensions more forgiving for standard blending operations in depot maintenance
Reliability	Weight savings allows for added redundancy in critical components
Life Cycle Cost	Gun cost = $1M/aircraft + $2M lifetime repair/replacement. Producibility = $250,000/aircraft; Maintainability = $2M/aircraft; Reliability = $500K/aircraft. Total (Lifetime) = $1.158
Schedule	Positive, but small for RDT&E and production. 4 month reduction in PDM in O&M Schedule
Handling Strategy	Reevaluate: Multiple opinions on gun utility in modern combat scenarios. Await CDD modification. Needed by April 1993 for effective implementation
Expected Closure	Dec-92

Conclusion

While the latest DoD 5000.02 and the Better Buying Power initiatives take steps towards ensuring each requirement is carefully vetted to ensure overall affordability, a more methodical, recurring process must be applied to stimulate an enduring conversation between the acquisition and user communities throughout the development of the program. The requirements tradeoff opportunity process should become integral in driving an affordability culture for defense acquisitions. The continuing analysis of the impact of each additional mile per hour or mile of range will give the user community a better understanding of the life cycle costs driven by those requirements, allowing for better (albeit tough) decisions to be made as the defense budget continues to shrink. Money saved by developing more affordable systems through the RTO process can then be invested in other critical needs for the U.S Army, ensuring that the Soldier is getting their best bang for the buck.

Opportunity	1A- increase aluminum honeycomb wall thickness by 3 mm	1B- Use standard 1/4 inch end mill for bracketry versus long-spindled 1/8 end mill	1C- Do not mask soffet brackets during paint operations
Performance Cost	Interior weight increase of 5 lb resulting in range decrease of 5 miles	Interior weight increase of 2 lb, resulting in range decrease of 2 miles	Interior weight increase of 0.25 lb resulting in range decrease of 0.25 miles
Likelihood	Mod	High	High
Positive Impact	Mod	Mod	Low
Producibility	Increased thickness to standard aircraft honeycomb allows for normal handling procedures and less quality issues	Use of standard 1/4 inch end milling reduces tool breakage, scrap and deburring activities	Reduces paint operations man-hours by 20 man-hours/aircraft for masking and de-masking operations
Maintainability	Increased thickness to standard aircraft honeycomb translates to easier handling techniques in maintenance and more readily available spare materials, likely increasing spares availability and decreasing logistic delay times (i.e., lower MTTR)	None	None
Reliability	Increased thickness to standard aircraft honeycomb translates to less in-use damage	Increased thickness and more rounded corners translate to reduce fatigue cracking	At three spares per aircraft lifetime, reduces man-hours by 60 man-hours/aircraft
Life Cycle Cost	Producibility = $220K/aircraft material + 20% less scrap rate = $240K/aircraft; Maintainability = $50K/aircraft; Reliability = $100K/aircraft; Total (Lifetime) = $10.9M	Producibility = $30K/aircraft Reliability = $100/K aircraft Total (Lifetime) = $3.6M	Producibility = $1K/aircraft Reliability = $3K/aircraft Total (Lifetime) = $112K
Schedule	Positive, but small for RDT&E, production and O&M	Positive, but small for production.	Positive, but small for production
Handling Strategy	Pursue upon CDD modification—Small impact to range reaps significant benefits in producibility, maintainability and reliability. Needed by May 2017 for effective implementation	Pursue upon CDD modification—Small impact to range reaps significant benefits in producibility and reliability. Needed by May 2017 for effective implementation	Pursue upon CDD modification—Small impact to range reaps significant benefits in producibility and reliability. Needed by May 2017 for effective implementation
Expected Closure	Mar-17	Apr-17	Mar-17

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David M. Riel *is professor of acquisition management for Defense Acquisition University's Midwest region, teaching and consulting in the areas of program management and production, quality and manufacturing. After a 20-year U.S. Air Force career and several years working in the defense industry, Riel is part of the DAU team providing mission assistance to program offices and teaching the next generation of DOD acquisition professionals the ins and outs of defense acquisition.*

How Important is Getting It Right the First Time? A Case in Applying Agile Acquisition Management

By Mr. Joe Novick
Joint Program Executive Office for Chemical and Biological Defense

How important is getting it right the first time? For systems where evolutionary improvements and modernization are not logistically or economically feasible like a new satellite or a Food and Drug Administration approved vaccine, "getting it right" may be paramount. But in many Department of Defense (DOD) systems, program managers and stakeholders should instead ask: How right does it need to be the first time?

As warfare environments and adversaries change, the definition of "getting it right" changes too. Additionally, human nature is not about perfection; our society thrives on lessons learned. In acquisition, we spend far too much time and resources focusing on absolutely meeting all requirements in our capability documents. We should be coordinating more closely with the user community throughout the acquisition process to focus on meeting the most critical requirements and making key tradeoffs that can be addressed after production. Additionally, as programs progress, the priorities of requirements may change based on performance data, intelligence information, and threat information.

Last year in my essay, Embracing Requirements Creep and Making Defense Acquisition Agile to Address a Changing World, I described a path forward for the DOD to adopt an agile program management strategy in order to embrace requirements creep that aligned with principles in Better Buying Power (BBP). By embracing requirements creep, acquisition programs would adapt to new threats, new battlefields, and a wider range of enemy tactics and operations. I argued that in order to allow acquisition programs to be more agile, the acquisition and requirements processes would have to become less rigid by developing a better mechanism to allow for tradeoffs between the users and program management offices. Additionally, acquisition leaders and stakeholders would have to take more risks in the initial acquisition and shift some research and development investments after Full Rate Production (FRP) to focus on threat adaptation.

Throughout this essay, I will examine a case that illustrates the implementation of the agile acquisition concept. The defense acquisition community ought to focus on system planning that incorporates product improvements from the onset of the program. This agile approach will accelerate new capabilities to the Warfighter in the field that can evolve as global circumstances and requirements change.

Making Acquisition Agile While Considering New Requirements

Joint Expeditionary Collective Protection (JECP), an Acquisition Category III chemical and biological defense program, is an interesting case study for agile acquisition for several reasons. First, the Services levied new requirements on the program during the staffing of the Capabilities Production Document (CPD). Second, the JECP, as a family of systems, moved forward to multiple programmatic milestones based on each system's maturity. Third, the use of common subsystems, components, and materials across all systems allows for rapid configuration modifications and modularity while reducing costs. Fourth, the program manager leveraged the extensive testing on those common subsystems, components, and materials from the initial acquisition cycle to minimize future testing of new configurations. Finally, the Chemical and Biological Defense Program (CBDP) invested in research and development funds for JECP after the FRP decision.

While JECP used agile concepts, it was limited in its application of agile acquisition due to the rigidity of the existing acquisition and requirements generation processes. Additionally, sequestration and its impacts on the two year budgeting cycle forced the schedule to the right.

At JECP's program initiation, the Services required a lightweight and transportable capability to provide a toxic free area in a wide array of mission sets. This would allow Warfighters to continue operations in a chemical or biological contaminated environment unencumbered by the burden of individual protective equipment. For those of you who have tried

using a computer while wearing protective gloves or sleeping in a gas mask, I hope you can appreciate such a capability. JECP took on a family of systems acquisition approach to address multiple capabilities across the Joint Services. Throughout the Engineering and Manufacturing Development (EMD) Phase, the JECP systems, subsystems, components, and materials went through rigorous chemical and biological agent challenge testing as well as durability, logistics, military standard, and operational testing.

Upon approaching Milestone C – Low Rate Initial Production (LRIP), several Services recognized that the materials and subsystems in JECP could be applied to different mission sets and required new systems that were not developed in EMD. Additionally, the Services determined that several systems developed in EMD systems were no longer needed due to changing warfare environments. The Milestone Decision Authority (MDA), with concurrence from the program stakeholders, recognized these changes and decided to move forward with the lowest risk capabilities to FRP first. The product manager would address the higher risk systems when additional research and development funds became available. This plan allowed for a new capability to move forward into production without being held back by higher risk or slower acquisitions.

Through the Program Objective Memorandum (POM) process, the program secured Research, Development, Test and Evaluation (RDT&E) funds to address the additional Warfighter requirements after the FRP decision. The financial investment of the MDA and the CBDP in such funds was the crucial step that allowed the Product Manager to consider an agile approach. Without the post-FRP funds, the program manager would have to make a decision to either slow down the initial acquisition to allow the development of the new requirements to catch up or not address the new requirements.

Agile acquisition is proving to be successful in JECP. The Program Management Office projects a ~75% RDT&E cost savings and a ~50% schedule savings to address the new requirements when compared to full second increment or new program of record. JECP's agile acquisition approach accounts for useful new ways to use proven technologies, leverage component and subsystem developmental test data, modify existing logistics products such as technical manuals

and training materials, and limit bureaucratic road bumps such as new capabilities documents. Additionally, the CBDP provided the JECP program with Operational Systems Development funding to address key objective requirements and continuous improvements that will expand the Warfighters' capabilities in a wider range of threat environments. Such a funding line allows for the program manager to focus on addressing changing battlefield threats and design for different concepts of operations without being held back by costly and time-consuming and costly options like developing multiple increments or new, full-blown programs of record.

Changing Our Approach

The concept of preplanned product improvements is not new to defense acquisition. The general approach in recent years, however, seems to go in the direction of getting a 100% solution in non-urgent need situations. We should have processes that acknowledge the certainty of changing requirements so that product improvements are built into the acquisition plan. In other words, we should embrace requirements creep as an expectation and incorporate RDT&E dollars after FRP in our initial acquisition planning.

In his article, Better Buying Power Principles – What Are They?, the Under Secretary of Defense for Acquisition, Technology, and Logistics, Frank Kendall, identifies his top principle for BBP 3.0: "**Principle 1**: Continuous improvement will be more effective than radical change." He goes on to say, "It's the reason there have been three editions of BBP." By adopting agile acquisition, the DOD can realize significant cost and schedule savings to improve existing systems, use technologies for multiple applications, and provide new capabilities to the Warfighter faster. It offers a pathway for continuous improvement.

The acquisition community must think differently than it does now. It needs to ask fundamental questions like "How right does this capability need to be the first time?" and "How can we best deliver new capabilities knowing they will require improvements down the road?" Programs like JECP are examples where the DOD can afford to field capabilities that plan for product improvements. Program managers need to have the reassurance that RDT&E funding will be available after FRP so they can confidently make tradeoffs in design and development, and then be capable of meeting

100% of the requirements in the future. If defense acquisition improves its ability to adapt to changing battlefields, the Warfighter will have new and better equipment faster, thereby improving operations.

The last JECP off the production line will be better than the first.

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Category: Future Operations

WINNER

Future Conflict: Adapting Better and Faster Than an Adversary

By Maj. Hassan M. Kamara
Program Executive Office for Missiles and Space

"There are no crystal balls that can predict the demands of future armed conflict. That is

why I believe our ability to learn and adapt rapidly is an institutional imperative."

—Gen. Martin E. Dempsey
(U.S. Army, Retired Chairman
of the Joint Chiefs of Staff)

A. Introduction

This paper studies how the U.S. Army can technologically adapt better and faster than a peer or near-peer adversary in a future conflict. The Army cannot predict future wars with certainty, thus it should ensure that it can rapidly adapt to the changing realities inherent in war. The need for this study is underscored in part by the 2015 National Military Strategy of the United States, which states that the potential for U.S. "involvement in interstate war with a major power" is growing, and mandates that the U.S. military "be able to rapidly adapt to new threats."[1] Technology alone will not suffice to defeat an adversary in a future conflict, but it is vital to doing so. According to Sir Michael Howard, technology is but one of the dimensions in which war has been conducted in the past—the others being operational, logistical and social—"but technology, as an independent and significant dimension" cannot be disregarded.[2]

So how can the Army technologically adapt better and faster than a peer or near-peer adversary in a future conflict? The Army can technologically adapt better and faster than a peer or near-peer adversary in a future conflict by manipulating the process of wartime adaptation. The study uses John Boyd's OODA framework for fast, dynamic transitions—Observe, Orient, Decide and Act (OODA)—as a lens to analyze the process of wartime adaptation and highlight ways the Army can manipulate this process for faster evolution.

This study is relevant because U.S. technological superiority in a potential conflict with a peer or near-peer adversary is not guaranteed. In a 2015 statement underscoring the need for greater Research and Development investment, the acting Assistant Secretary of the Army for Acquisition Logistics and Technology [ASA(ALT)] the Honorable Katrina McFarland voiced concern that U.S. "technological superiority is not assured."[3] In a RAND study, Roger Cliff examined China's military and technological growth, and warned that "the U.S.

military, including the U.S. Air force must prepare for the possibility of conflict…with a Chinese military that by 2020 will be significantly more advanced than it is at present."[4] It is highly possible that in a future conflict with a peer or near-peer adversary—despite current peacetime innovation efforts—the Army could realize it lacks technological superiority, and will have to rapidly adapt to regain a technological edge, or mitigate an adversary's technical advantages. Such was the case with tank technology during Operation Overlord in World War II. According to General of the Army Omar Bradley, the Army had to adapt both tactics and capabilities to compensate for the techno- logical inferiority of its main battle tank—the U.S. M4 Sherman tank—relative to German tanks.[5] According to Bradley, the 50-ton German, Mark V Panther tank with its "long-barreled high-velocity 75mm gun… and its tapered hull was more than a match for our Shermans."[6] This was because the Sherman's 75-mm gun was ineffective against the heavy frontal plate of the Panther tanks, so according to Bradley it was "only by swarming around the panzers to hit them on the flank, could our Shermans knock the enemy out."[7] Bradley wrote that the Army adapted by de- signing and fielding 76-mm guns on its M4 Sherman tanks, as well as dual use long-rifled 90mm guns.[8]

B. Concepts

A brief discussion of military adaptation in war, peacetime innovation, and the OODA framework

is essential to understanding the ensuing analysis. Military adaptation is transformation that occurs amidst war, typically in response to the actions and capabilities of an adversary relative to one's opera- tional objectives. Military adaptation differs from the generally slower-paced innovation that occurs during peacetime. Williamson Murray similarly characterized and distinguished military adaptation and peacetime innovation; he wrote that "while there are similarities between the processes of innovation and adaptation, the environments in which they occur are radically different."[9] Murray explained that while peacetime innovation enjoys the luxury of time to consid- er transformational objectives and challenges, and gradually evolve, wartime adaptation sees less time for transformation due to the "the terrible pressures of war as well as an interactive, adaptive opponent who is trying to kill us."[10] Wartime adaptation is an enduring challenge for militaries. According to Williamson Murray "the problem of adaptation in war represents one of the most persistent, yet rarely exam- ined problems that military institutions confront."[11]

Observe, Orient, Decide, and Act, commonly referred to as the "OODA loop" are interrelated actions of a construct for dynamic and fast transi- tions that can disorient an adversary. According to John Boyd, "without OODA loops…and without the ability to get inside other OODA loops (or other environments), we will find it impossible to com-
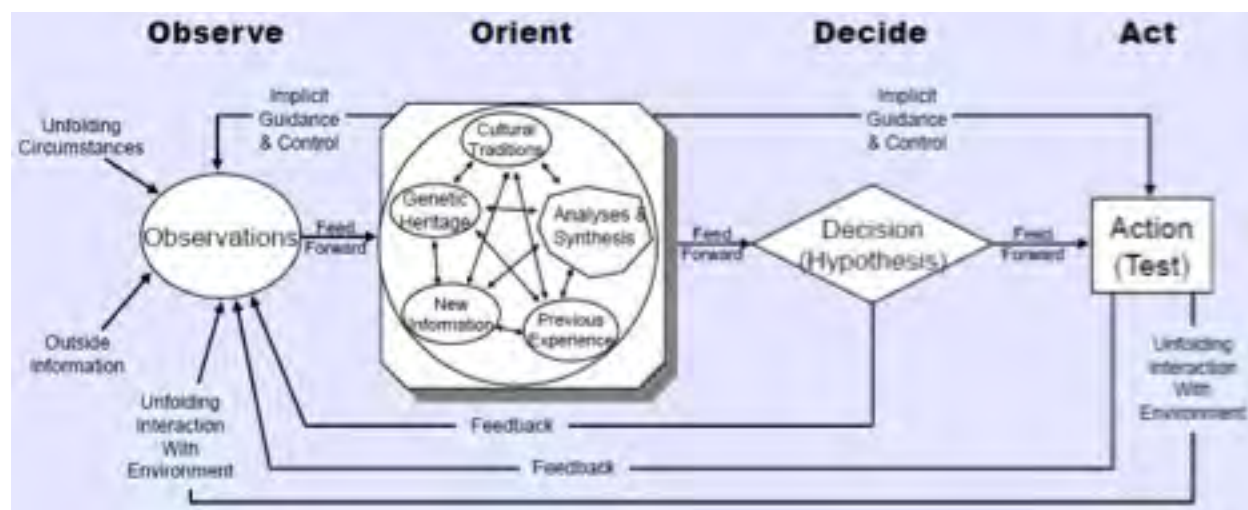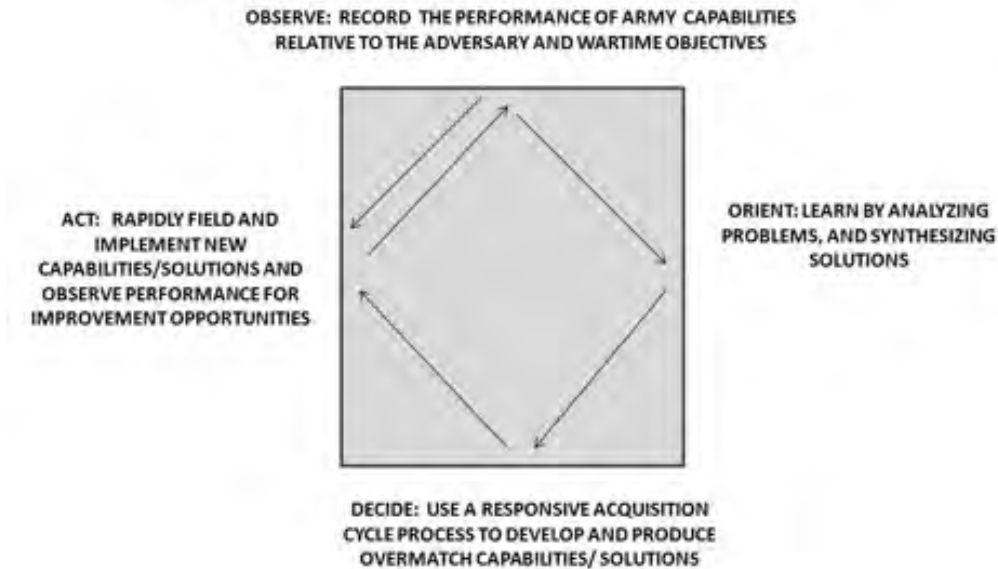
FIGURE 1   The OODA "loop" sketch[12]

FIGURE 2   Wartime adaptation within the OODA framework

OBSERVE: RECORD THE PERFORMANCE OF ARMY CAPABILITIES
RELATIVE TO THE ADVERSARY AND WARTIME OBJECTIVES

ACT: RAPIDLY FIELD AND
IMPLEMENT NEW
CAPABILITIES/SOLUTIONS AND
OBSERVE PERFORMANCE FOR
IMPROVEMENT OPPORTUNITIES

ORIENT: LEARN BY ANALYZING
PROBLEMS, AND SYNTHESIZING
SOLUTIONS

DECIDE: USE A RESPONSIVE ACQUISITION
CYCLE PROCESS TO DEVELOP AND PRODUCE
OVERMATCH CAPABILITIES/ SOLUTIONS

prehend, shape, adapt to and in turn be shaped by an unfolding evolving reality that is uncertain, ever changing, and unpredictable." War is such a reality, which makes the application of OODA to the challenge of wartime adaptation particularly apt. [13]

The OODA is not always a neatly sequenced loop or cycle. It can be compressed with increased understanding of an environment or situation—resulting in direct transitions between observation and action (see Figure 2). According to Robert Coram, "understanding the OODA Loop enables a commander to compress time—that is time between observing a situation and taking an action."[14] This ability to compress time is invaluable in wartime adaptation.

C. Wartime Adaptation and the OODA
The components of the OODA construct correlate to the process of wartime adaptation—reference Figure 2—which makes OODA an excellent tool for analyzing wartime adaptation. There is a sensing and learning component to the wartime adaptation process that correlates to the Observe and Orient components of the OODA construct. The acquisition cycle, and the capability fielding and integration aspects of the wartime adaptation process respectively correlate to the Decide, and Act components of the OODA construct. This fundamental cor-

relation facilitates the ensuing analysis of wartime adaptation using the OODA construct, and underscores the OODA's applicability to comprehending and enhancing the wartime adaptation process.

1. OBSERVE: The Army can adapt faster than an adversary by improving its ability to rapidly record and analyze data from military operations to foster learning. Faster technological adaptation during war requires optimizing the Army's ability to gather equipment performance data and war-fighter experiences during combat operations. The U.S. Navy understood this imperative in World War II. According to Stephen Peter Rosen, the Navy understood that

"scientists also needed to be in the field to measure the combat performance of new equipment and to refine and adjust the new technology and operating practices developed for it…[so] it sent 464 scientists to field commands to help…develop antisubmarine warfare and tactics, and to refine the electronic warfare capabilities of the Army and Air forces."[15]

In lieu of prudently exposing the scientific community to military operations, commercially available telemetry technologies can be leveraged to help the Army gather data on equipment performance during ongoing operations to foster organizational learning.

2. ORIENT: The Army can adapt faster than an adversary by developing and enforcing mechanisms that promote organizational learning. The latter is a central component in the process of wartime adaptation, and requires taking what is being observed in military operations, and rapidly disseminating them to Army decision makers and defense industry partners to synthesize solutions. According to Meir Finkel,

"an important factor in recoverability from technological and doctrinal surprise is the ability to derive lessons while the surprise is taking place…devising immediate solutions and circulating them throughout the Army."[16]

Rapid wartime adaptation requires organizationally supported mechanisms for rapidly disseminating the lessons being learned from the ongoing fight.

3. DECIDE: The Army can adapt faster in wartime by studying, developing, and implementing alternatives to reduce acquisition cycle times. These alternatives should orient on some of the institutionally recognized contributors to long acquisition cycle times. In his work examining Department of Defense, and US Air Force efforts to reduce acquisition cycle times in the 80s and 90s, Ross T. McNutt highlighted some key contributors to slower acquisition cycle times as: lower prioritization of schedule relative to cost and performance by program managers, extensive pre-acquisition Milestone A review processes, poor transition of technology from the scientific, research and development community to the war-fighters, funding limitations based on funding processes, and little to no workforce training on acquisition cycle time reduction.[17]

Some alternatives to counter the above contributors to slower acquisition cycle times include greater emphasis on schedule as a variable, streamlining requirements in the review processes for milestone decisions, and utilizing mature and viable emerging technologies in concert with a modular open system architecture. Consistent with the latter, Dan Ward advocates taking advantage of existing, and mature emerging technologies during design, versus over-relying on longer development of immature technologies (specified as those at DoD and NASA's Technology Readiness Level 6), to help reduce acquisition cycle times and cost, as well as deliver viable capabilities.[18]

Congress and the Defense industry are critical stakeholders in wartime adaptation. Consistent with the spirit of the 2016 Acquisition Agility Act, Congress can institute war-activated provisions that curtail the myriad of funding and bureaucratic regulations that slow the contracting and acquisition lifecycle process. The Army should also build industry partnerships that can rapidly produce the capability solutions vital to overcoming technological surprise, and operational challenges.

4. ACT: In terms of wartime adaptation, this aspect of the OODA construct deals with the rapid fielding, integration and sustainment of new capabilities into army operations. The Army can adapt faster than an adversary by improving its ability to rapidly field, integrate and sustain the paradigm-changing solutions generated in response to the lessons learned in ongoing operations. Adapting to German tanks wielding superior armor and guns, the U.S. Army in 1944 introduced a new Hyper Velocity Armor-Piercing round (HVAP), but according to David Johnson, even by the spring of 1945 the HVAPs were still in short supply to forces in Europe; delaying its benefits to ongoing operations.[19] This underscores the importance of rapidly fielding and integrating paradigm-changing capabilities to the wartime adaptation process.

D. Conclusion

This study—by framing the process of wartime adaptation within Boyd's OODA construct—has highlighted how the U.S. Army can manipulate said process to evolve faster than a peer or near-peer adversary in a future conflict. Meanwhile, as the Army continues to innovate in largely peacetime conditions at home—despite fighting low-intensity conflicts overseas—ensuing studies should focus on ways to expedite the peacetime innovation process to deliver viable, low-cost capabilities.

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Expeditionary Situational Awareness at the Tip of the Spear: Preparing for Future Operations through Innovation

By Lt. Col. James Howell

Department of the Army System Coordinator (DASC) for Defensive Cyber and the Handheld, Manpack, Small Form Fit Program

The U.S. Army's Global Response Force (GRF) remains ready to conduct joint forcible-entry airborne assaults with little or no warning. Flying out to seize an enemy airfield or port facility requires state-of-the-art doctrine, cutting edge leaders, aggressive training, a tailored communications support package, adaptive logistics processes and functions, and rapidly deployable capabilities. The Army is providing the GRF with new highly-adaptable, scalable and tailorable expeditionary technologies, such as Enroute Mission Command (EMC), which provides inflight network connectivity, the Transportable Tactical Command Communications system (T2C2) as well as developing the new Two Channel Leader Radio which will support both early entry and tactical edge operations. Technologies like these enable an advanced mission command network and provide the situational

Paratroopers from the XVIII Airborne Corps and 82nd Airborne Division successfully utilized Enroute Mission Command Capability (EMC2) during the Joint Forcible Entry (JFE) exercise at the National Training Center/Fort Irwin, Calif., August 5-6, 2015.
(U.S. Army photo)

Paratroopers from the XVIII Airborne Corps and 82nd Airborne Division successfully utilized Enroute Mission Command Capability (EMC2) during the Joint Forcible Entry (JFE) exercise at the National Training Center/Fort Irwin, Calif., Aug. 5-6, 2015. EMC2 provides inflight network communications, situational awareness and mission command capabilities to Global Response Force Commanders and Paratroopers, giving them a comprehensive understanding of the potential challenges waiting for them on the drop zone. (U.S. Army photo)

awareness required to rapidly seize an initiative and dominate our nation's enemies on the battlefield.

America's Guard of Honor, the 82nd Airborne Division, is the Army's GRF unit. The GRF must remain ready to adapt to unpredictable security environments, which requires operational flexibility and versatility. To prepare for its unique mission set in support of Geographic Combatant Commanders' urgent operational needs, the GRF continually conducts readiness exercises, mission planning, and rehearsals, while staging combat power at Fort Bragg's Pope Army Airfield in North Carolina.

Joint Forces Make These Exercises Operationally Relevant

After an initial call to duty, Commanders and support units immediately begin to plan an operation. Once on the tarmac at Pope Army Airfield, Jumpmasters load Air Force C-17 Globemaster aircraft in "chalk order." Designing a chalk order supporting an airborne assault requires a great deal of planning and attention to detail. Planners must thoroughly examine the drop zone, understand and plan for potential enemy actions, and comprehend the command and control (C2) network, the mission and its players. Paratroopers with C2 capabilities will be placed in specific positions in the chalk order to ensure they land close to command post assembly areas strategically placed on the drop zone.

The C-17s quickly become airborne, assembling in assault formation. Then Commanders and the GRF staff use their EMC systems to conduct operational coordination and receive the latest intelligence, which they share with other aircraft in the formation. Paratroopers view full motion video from Unmanned Aerial Vehicles of the evolving situation on the drop zone on large LED screens throughout the aircraft. Amid the hum of the C-17s, Commanders and Paratroopers leverage mission command functions and plane-to-plane and plane-to-ground communications for a common operating picture shared throughout the entire brigade and with the rest of the Joint and coalition forces that may be supporting the operation.

Paratroopers stand in their chalk lines in the aircraft as the assault force arrives at the drop-zone armed not only with weapons, but with night vision goggles, radios and early entry network communications equipment. One at a time over the drop-zone, they hand their static lines to the Jumpmaster controlling the door and then jump. The assault force may hear gunfire on the drop zone as they keep a sharp lookout for fellow jumpers, but they know what to expect, having already seen video of the battlespace below and having received mission updates from the Commander through the EMC back on the plane. Once on the drop zone, troops immediately place weapons into operation and move quickly to their

Paratroopers prepare to jump during the large-scale joint Army/Air Force Joint Forcible Entry exercise in December 2015, where Soldiers successfully employed Enroute Mission Command capability (EMC), while en route from Fort Bragg, N.C., to Nellis Air Force Base, Nev. This network communications capability enabled the unit to obtain the inflight mission command and plane-to-plane, plane-to-ground communications needed for a successful parachute assault. (U.S. Army photo by Cpt. Lisa Beum, 1st BCT, 82nd ABN DIV, PAO)

The Army will use two sizes of the inflatable satellite antenna for the Low Rate Initial Production of Transportable Tactical Command Communications (T2C2) Lite (v1) and T2C2 Heavy (v2). During Joint Forcible Entry operations at Network Integration Evaluation 16.1 in October 2015, the 82nd Airborne Division successfully utilized the capability to provide early entry network communications during the mission. (Photo by Jett Loe, Sun-News)

Because the T2C2 solution is inflatable, it can provide a larger dish size with increased capability and bandwidth efficiency in a smaller package. The Army will use two sizes of the inflatable satellite antenna for the Low Rate Initial Production of Transportable Tactical Command Communications (T2C2) Lite (v1) and T2C2 Heavy (v2).
(U.S. Army photo)

pre-designated command post sites. Paratroopers establish a communications link for accountability on their software defined Rifleman Radios, which also provide situational awareness and input into mission command systems and the common operational picture. Accountability following an airborne operation is critical to the assault forces, as the units begin to mass combat power to seize the objective. Soon the Army will employ the Two Channel Leader Radio which will significantly enhance the GRF's ability to C2 to the tactical edge of the battlespace.

The Airborne Assault, Seizing the Initiative, and Dominating the Enemy

Paratroopers, following the initial airborne assault, seizing the initiative, and dominating the enemy on the battlefield, will soon be able to establish an initial command post with communications enabled by the Transportable Tactical Command Communications (T2C2) "jumpable" Lite and "air droppable" Heavy systems. Utilizing an inflatable antenna, T2C2 enables network connectivity, via satellite to the Army's tactical communications network, Warfighter Information Network– Tactical (WIN-T). These early entry forces can obtain the advanced situational awareness and mission command capabilities needed to conduct an early entry operation and set the stage for follow-on forces, with the scalable buildup of additional network infrastructure. In later operations, T2C2 will extend the Army's network to the tactical edge by enabling command post/forward operating base communications.

Once the airfield is secured, giant C-130 and C-17 aircraft scream in to deliver larger equipment so the unit can set up the Army's mobile tactical WIN-T network. This high capacity satellite and line-of-sight network provides advanced mission command, voice, video and data capability, both at the halt in a command post, and on the move in network-equipped vehicles. As the supply planes fly in, the unit builds up the network with WIN-T as well as Joint Capabilities Release/Blue Force Tracking 2 capability, enabling situational awareness of friendly forces and digital command and control down to the platoon and squad levels. These two capabilities complement one another across the Brigade Combat Team (BCT); even though some echelons may not be connected to the WIN-T network, having both capabilities enables the entire BCT to stay connected and operationally informed. Additionally, the Army will soon be fielding Wi-Fi capability to improve command post agility during maneuver, cutting command post set up and tear down times from hours to minutes and reducing interruption of situational awareness.

The GRF represents "the tip of the spear," our first national large-scale combat ready BCT. The U.S. Joint Forces, the Department of Defense and the Army Staff are continually working to ensure this force presents the most lethal, trained, and equipped unit possible, whether they are supporting combat or

Lt. Col. Mark Henderson, product manager for Warfighter Information Network - Tactical (WIN-T) Increment 1, works with his EMC2 Team onboard a C-17 aircraft in flight during a Joint Forcible Entry exercise in December 2015. (U.S. Army photo by Cpt. Lisa Beum, 1st BCT, 82nd ABN DIV, PAO)

EMC2 provides inflight network communications and mission command to increase the situational awareness of the Global Response Force. In this photo, a Soldier prepares for an EMC2 demonstration on May 14, 2015, at Pope Army Airfield, Fort Bragg, N.C. (U.S. Army photo by Amy Walker, PEO C3T)

"If You Know the Enemy and Know Yourself, You Need Not Fear the Result of a Hundred Battles"

In "The Art of War" Sun Tzu writes, "If you know the enemy and know yourself, you need not fear the result of a hundred battles. If you know yourself but not the enemy, for every victory gained you will also suffer a defeat. If you know neither the enemy nor yourself, you will succumb in every battle." In essence, information is power and overmatch. U.S. forces require the most advanced mission command, communications and situational awareness possible as we meet with and engage our nation's enemies. Programs like EMC, T2C2, the Rifleman and Leader Radio will provide these new and emerging expeditionary network technologies. As the tip of the spear combat force, it is imperative the GRF know itself, its mission and the enemy that it faces head-on in battle. Today's mission command network technologies are helping to provide that view.

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humanitarian operations. Joint forces are constantly evaluating, testing, training and evolving the GRF. The Army frequently conducts analysis to ensure the latest and best Doctrine, Organization, Training, Materiel, Leadership, Personnel, Facilities and Policy (DOTMLPF-P) is employed as the GRF prepares to meet, engage and destroy our nation's enemies.

Category: Innovation

Culture: The Foundation of Innovation

By Maj. Andrew Miller
PEO Soldier

The story of Uber versus the Taxi Cab Commissions is a modern parable that teaches the universal truth of innovation. The powerful and proud taxi companies are offered the opportunity to embrace technology and lead their industry into the digital age. However, they are willfully blind to the inevitable and scoff at the thought of deviating from the status quo. Meanwhile, the meek but agile upstart, Uber, sees the writing on the wall. Using commonly available technology, Uber positions themselves to take advantage of the proliferation of smart phones. As a result, Uber rendered the taxis' business model obsolete. Even now, in the ruins of their ivory tower, the taxis refuse to see the faults in their system. Instead of altering their model to take advantage of technology, they work to shoehorn digital capabilities into their existing structure.

The Army Acquisition Community is the Taxi Cab Commissions and we must learn from this parable. We lust for innovation, but when a technological opportunity emerges, we put the onus on it to conform to our rigid structure. The predictable result is a poor track record of effective technological integration. As a community, if we do not take steps to address our addiction to the status quo, we will be dethroned by our more agile enemies.

The Army Acquisition Community knows it needs to innovate. Pick up a professional journal or listen to a senior leader panel and you are bombarded with the concept. Unfortunately, this strategic emphasis on innovation is doing little to improve our ability to leverage emerging technology. One of the major factors in why this initiative does not live up to expectations is how we define innovation itself. In most discussions, we either gloss over the specifics of innovation or equivocate it with technology. These two narrow views ignore innovation's most import-

ant factor: organizational culture. We need to shift focus away from chasing the elusive technological home runs and instead focus on building innovative cultures within our organizations. When we do this, the roadblocks to innovation will dissolve and technological integration will take care of itself.

The two main aspects of innovation, culture and technology, are sequentially related. A culture that encourages innovation is a critical prerequisite to successful technological innovation. This cultural factor is why organizations that cling to status quo reject even the most revolutionary technologies; it is also why organizations with cultures that enable innovation tend to seek out new opportunities and continuously evolve to take advantage of them.

Unfortunately, a culture of innovation is not easy to create and takes deliberate effort to maintain. Effective innovation requires organizations to manage the tug of war between the comfort of the status quo and the uncertainty of constantly changing environments. It is a daily grind that requires risk, trust, openness and hard work. Nevertheless, it is a grind that pays off for the warfighter. Organizations that do not fend off the encroachment of the status quo eventually get consumed by it. In the Army acquisition world, this status quo can take many forms, but it often looks like creeping bureaucracy and aversion to risk.

The fact that the status quo of bureaucracy stifles innovation is not news to acquisition professionals. Most of us can point to instances where the process trumped common sense, obstructed collaboration, or caused us to accept a materiel solution that short-changed Soldiers. Our failure comes when we feel powerless to affect change and, therefore, offer minimal defense. Like a castle under siege, we pull up our gates and protect the area we control. Regrettably, this tactic never works. Given enough time, the invader erodes defenses and storms the castle. When this happens in the acquisition world, we accept the limitations of the system and give up on trying to innovate.

The good news is that yielding to the status quo is not inevitable. Instead of waiting to be consumed, we can go on the offense and take back the acquisition system. Through deliberate action, we can implement a culture that allows us to experiment with emerging technology, confront problems and continually modify

our organizations. Once this cultural foundation is in place, product-focused innovations will come naturally.

There is no golden path to an innovative culture. However, there are four key actions, which, if coordinated, generally lead to success. Those actions are: empower, vigorously evaluate assumptions, prioritize product over process, and ADVOCATE!

Empower

The single most important action in building an innovative culture is empowerment. Empowerment is inherent in the other actions because subordinates that are given a vision, clear boundaries, and the authority to operate will take care of everything else. All too often, we as leaders focus on being personally innovative, when, instead, we should focus on how we can better empower our subordinates to innovate. The Army realized this and introduced the concept of mission command. Put simply, mission command is about empowering. It stresses clear objectives, latitude to operate and accepting prudent risk. Mission Command was written with tactical leaders in mind. However, its principles are universal and apply in the program offices as well as the front line. It is amazing what subordinates can accomplish when they are empowered to influence the organizations' direction, know that risk taking is encouraged and trust that failure is permitted.

Vigorously Evaluate Assumptions

Evaluating assumptions can be one of the most difficult aspects of building an innovative culture. Because environments are constantly changing, this technique often directs organizations away from the perceived safety of the status quo. Innovation is built on identifying emerging trends and having the flexibility to adapt to them. Critically analyzing the status quo to identify these opportunities introduces risk and generates additional work. Despite this, it is a vital component of innovation.

When we look at options, we are quick to point to the risk associated with a new endeavor. However, we often overlook the risk of maintaining the status quo. We can avoid the fate of the Taxi Cab Commissions by deliberately and continually evaluating our environment to look for emerging trends or changing requirements. Success comes to those who can identify the inevitable and re-shape their organization to take advantage of the new opportunities.

Another aspect of evaluating assumptions is called "Don't build on bad." Very rarely is Army equipment built from scratch. Almost every everything has to interface with another product, is governed by MIL-STDs, or contains decades of "this is how we have always done it" baggage. While in most cases these standards and interfaces are absolutely necessary, over time they become obsolete and hinder innovation. The key to removing these constraints is to never accept them at face value. Always question their relevance and, when they no longer make sense, work to change them.

Prioritize Product Over Process

The Army is the biggest bureaucracy in the Department of Defense, which is the biggest bureaucracy in the federal government, which is the biggest bureaucracy in the world. Put more simply, we have a lot of rules. These rules and processes help provide consistency and reduce risk. However, they also smother innovation. Our process-dominated culture shifts the overall focus away from product success in favor of intermediate process wins. We treat the process as a conveyor belt. Once it is started, you cannot slow down or step off: to do so is failure. This "forward at all costs" mentality drives us to a myopic view whose horizon is the next hurdle. Once milestones become our sole metrics, we define success, not by the whole of our product, but by its individual block checks. Our culture makes it so that any baseline deviation equates to failure. Our culture also de-incentivizes us from confronting difficult issues. If our goal was truly to produce the best equipment possible, we would address issues head on. However, we tend to sidestep difficult issues because we are worried that they will affect our march to "Milestone C." This is how products that are no longer relevant, or that only partially meet the needs of the warfighter, end up in the field. With our current culture, it is no wonder we struggle to innovate. The unrelenting drive forward prevents us from incorporating overlooked opportunities, addressing incorrect assumptions, or adapting to evolving environments.

As a community, we need to fight back against the culture that prioritizes short term process. We have to stop viewing the acquisition system as a one way street with a clear road map from product initiation to sustainment. In the real world, things ebb and

flow and not all opportunities pan out. We must empower our project managers and encourage them to experiment without risking the stigma of failure. As leaders, we need to have the courage to address issues, even in the face of personal risk, and we must reward subordinates who are willing to do the same.

Advocate

Of all the actions required to implement an innovative culture, advocating should be the easiest. You simply identify something that does not make sense and you work to change it. The challenge lies in building the persistence and passion to continue when the status quo seems insurmountable. At the end of the day, the motivation is simple. You should never accept anything but the best for our Soldiers. There are many short term reasons that we compromise on aspects of a materiel solution. However, at the end of the day, a short term compromise that doesn't get worked out becomes a long term inefficiency. It is up to us to push these issues past the programmatics and politics of the day.

Conclusion

Our acquisition system needs improvement, but it is not broken. As long as the workforce consists of hard working and passionate professionals, we have the tools to succeed. Taken as a whole, the acquisition system seems massive and impervious to change. However, this is not the case. The acquisition system is not a tightly controlled autocracy. Instead, it is a mesh network made up of hundreds of individual organizations and thousands of departments within those organizations. Each one of these elements is staffed and led by individuals who possess a degree of control and influence. Every person in the workforce has the power to shape the culture to be more innovative. As a whole, if we focus on the cultural foundational of innovation and not the technological end state, we can break free from the grip of the status quo and ensure that we deliver equipment that exceeds the operational force's expectations.

Maj. Andrew Miller, a basic branch infantry officer, is the Nett Warrior Fielding and Training assistant product manager in Project Manager Soldier Warrior within PEO Soldier.

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Inspiring Innovation by Changing My Vantage Point on the Battlefield

By Lt. Col. Rachael Hoagland
Training with Industry
fellow at Amazon.com

Changing one's vantage point on the battlefield can give one a competitive advantage over the adversary by providing a unique view on how the enemy is organized, what weapon systems they are using, and what decisions they might make. As an active duty Army Acquisition Officer working at Amazon.com in the Training with Industry (TWI) program for the year, I am changing my vantage point on the battlefield. I am stepping outside of my comfort zone, putting on civilian clothes, and showing up to an Amazon Web Services office in downtown Seattle. This experience is helping me gain a competitive advantage on how to stimulate innovation for the future of the Army. In changing my vantage point I am learning new ways to inspire future acquisition teams by studying how Amazon organizes project teams, what systems and technologies Amazonians use to execute programs and products, as well as learning about the decision making processes they use.

After a short two months of observation, I see Amazon as a matrix organization. Teams are intentionally kept small, forcing project managers and team members to work across teams to complete the mission. At first, I was shocked to see such a large company be successful with small matrixed teams and I struggled to get my head around how they make it work. It did not take long to notice that there was a common theme among the teams; a set of core values. Much like the seven Army values of loyalty, duty, respect, selfless service, honor, integrity, and personal courage, Amazon has its own set of values or leadership principles.

Amazon has 14 leadership principles: customer obsession, ownership, bias for action, invent and simplify, learn and be curious, earn trust, frugality, think big, dive deep, have backbone, disagree and commit, are right a lot, hire and develop the best, insist on highest standards, and deliver results. These 14 leadership

principles are the thread that ties all the small teams together and gives each the ability to make quick changes to support the company's rapid growth.

Amazon uses a mixture of typical technologies, such as Microsoft Office, along with proprietary tools to support their teams. The tools themselves are useful and certainly support the teams' needs, although they are not as impressive as the guidance for how to use them within the Amazon environment. For example, access to Amazon's internal network means world class training at your fingertips. Amazon Broadcast has thousands of prerecorded brown bags, learning series, leadership courses, tech talks, and so on. They also have an internal training console, similar to Defense Acquisition University, but covering a much wider set of topics. All training is tailored to the "Amazon way," teaching business and leadership consistent with the company's vision. There are also opportunities to attend lectures, brown bag meetings, and discussion panels in person.

I attended ProdCon, which was a full day of lectures and panel discussions on project management. A few of the topics covered were: Types of Product Management at Amazon; The Journey of a Feature: From Idea to Roadmap to Release; Best Practices in Internationalization; Agile at Amazon – How Do You Scrum; Matrix Leadership & Influencing without Authority; Working with Tech Teams; Deliver Results – Measuring How Your Product is Doing; and Writing Good Requirement Documents. As an Army project manager I found listening to VPs and directors talk about how they conduct business extremely informative and perspective broadening.

I would love to see the Army adopt something similar where we replace Amazon VPs with leaders from each program executive office (PEO) covering similar topics. This would not be a particularly difficult stretch, as there are plenty of business practices at Amazon that already closely parallel Army Practices. For example, the concept of working backwards.

Working backwards is the decision making process Amazon uses when deciding to launch a new product or feature, and is very similar to the Army's concept of backwards planning, with one big difference; no PowerPoint. Amazon has all but forbidden PowerPoint because of its spare approach; they have replaced it with detailed press releases, often 10 or more pages long. When starting the working backwards process, you start with writing a 6 to 10 page press release. In keeping with the working backwards process, the composing of a 6 to 10 page press release comes first. The initial press release is meant to simulate an actual launch where you are informing the public of a new product. Amazon believes strongly that spending the time writing such detailed releases will help determine if the product is worth the investment.

Amazon's project management style is best described as agile. This style saves time by giving teams the ability to make decisions in the moment, because they do not have to get approval from management. This lack of management control also allows teams to shift project focus, and priorities as needed. For an outsider used to a hierarchal organization, Amazon's agile style at first appeared chaotic. With everyone empowered to make decisions, shift project focus, and shift priorities, figuring out how anything got done or how risks were managed was difficult at best. After much confusion, I sat back and let my Amazon training and the leadership principle sink in, and suddenly the chaos turned into deliberate, organized chaos and everything began to makes sense. To move fast you must empower your people to make decisions; to ensure they make the right decisions you need to put in place a set of core values that everyone internalizes, and reinforce those values in all your training so the right decision at the right time becomes the norm.

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Category: Lessons Learned

Robots and Deal Makers: Lessons Learned from an Acquisition Officer Serving as a Legislative Liaison

Lt. Col. Patrick "Josh" Baker
Training with Industry (TWI)
fellow at General Dynamics Corp.

Life in the Acquisition Corps offers opportunities for exposure to countless processes, institutions and most importantly, people. Having the opportunity to serve as one of only two Acquisition officers in the Office of the Chief for Legislative Liaison, I observed how the people and the personalities in our Army Acquisition Corps can either hinder or help programs on Capitol Hill. I have seen firsthand a behavioral phenomenon of the individuals that are sent to the Hill. The behaviors are bimodal and distinct and fall into two categories when engaging Congress: Robot or Deal Maker.

We all know that "toeing" the Army party line of directives and initiatives is how we conduct business. Deviating from the Army plan is dangerous in many ways, both with potential legislative impacts and internal threat to career progression. Army directives, initiatives and protocol are established to avoid potential legislative impacts and outline the parameters for success within your program and career. However, I argue that there are creative ways to stay within the confines of Army intent and garner Congressional "buy in" without taking a binary robotic approach when delivering the Army's message.

The Robots

We can't deny that there are some dry, awkward personalities in the Army and that's ok. Everyone brings a skill set to the team. Unfortunately, these types typically do not bode well and are usually not well received since many on the Hill do not have military experience. They are civilians that operate in a civilian based discourse community. They are intellectuals. In fact, I encourage you to research the average education levels of Hill staffers. You will find a highly educated work force.

So why does this matter, and what's the deal with the robots? Well, you can't send a robot that is programmed with one line of binary responses to convey and discuss complex issues. You know, sort of like the old TV show "Lost in Space"…Danger Will Robinson!!!…Danger!!!…THIS IS THE ARMY PLAN!! Believe it or not, we as an Army do that regularly on the Hill. All too often, I witnessed Army Staff officers brief rooms full of twenty something millennials on Army programs with PowerPoint slides, a million acronyms and little ability or desire to discuss dynamics outside of "the Army plan" in a relatable fashion. They were preprogrammed with one robotic response: it's the Army plan, or nothing.

Dialogue matters and nothing aggravates the Hill more than an Army representative that can't provide feedback in an informative and digestible format. The Hill understands we have to "carry the Army message" but they need to know if there are options. The Hill is balancing strategic security requirements, fiscal limitations, partisan politics and constituent based implications. Their "planning calculus" doesn't match ours. So how do you avoid becoming a robot? (Although I'm sure some of our friends in the engineering community would love to become a cyborg…but that's another story). Below are some simple recommendations to avoid the aforementioned pit falls.

1. Break the issue down in to simple, digestible bites that a civilian off the street would understand. Take the time to learn the background of who you are going to brief. The Legislative Liaison should arm you with this information. It will help you gauge how much you can turn up the "military mumbo jumbo" rheostat during your engagement. If a Member or Staff has previous military experience you can use more shop talk. Otherwise, throttle down the "Pentagonese."

2. Keep it clean, concise and to the point, especially with members of Congress. Their time is limited and your program or issue is one of many they will manage in a day's work. Leave them with something they will understand and remember. After all, their follow-on meeting could be with the American Chestnut Foundation. (Yes, that

does exist, and yes, I had to sit in a briefing from them.) The point is they hear from a wide range of groups in a daily period and you are just one.

3. "This is the Army's plan and this is what we are going to do" will get you NOWHERE on the Hill. As a matter of fact it will more than likely blow up in your face. A better approach is to say "here is the plan the Army is considering implementing based off of X, Y, and Z." Honestly helping them understand the rationale of the Army plan will resonate.

4. Remove "Hooah" from your lexicon. Remember, the Hill cares about strategic capability at the end of the day. False motivation doesn't work.

5. Dump your ego and rank in the Potomac when heading to the Hill. Folks on the Hill are highly respectful to Military officials and DoD representatives. Never lose sight of the fact that we answer to them. Trying to leverage your rank, position or authority is never a good move.

6. Do not brief off of PowerPoint slides. You can leave a briefing packet with them but do your best to have a normal conversation during the engagement.

7. Realize that many staff, especially Defense Committee Professional Staff Members, have longevity on programs. They track programs over time and know all of the historical issues. Be prepared and be aware of their intimacy with programs by avoiding prescriptive briefings that could insult their expertise on the issue.

8. They actually want to help. You'd be surprised how energized Member offices and Defense Committees are at helping the Services. Know your "ask" before walking in the door and be confident in delivery. Failure to ask is failure to prepare. Also, inform professional staff members of critical program issues early. Bad news definitely does not get better with time when Congress is concerned.

9. Do not be afraid to provide "your opinion" on potential impacts to the program if asked. Remember, they know you support the Army plan but they desire to understand issues holistically.

10. Strive to conduct informal engagements on the Hill- i.e., have lunch or coffee with the Staff Member if able. Relationships are paramount on Capitol Hill. The most insightful engagements I witnessed occurred during meals. OCLL or SAFM-BUL will pick up the tab!

11. Remain politically agnostic and professional. Defense issues historically receive non-partisan support. That is the reason why the National Defense Authorization Act (NDAA) has been enacted into law for over 50 years.

12. Don't take it personally. The Hill will disagree on issues and programs regardless of how fantastic the plan or substantiation. A personal friend on the Hill stated "the truth don't matter much up here." A true statement in itself. Members will tell you in person that they absolutely agree on the tenets of your plan but ultimately vote/mark against it for political reasons. One of the biggest challenges I experienced with Army briefers was that they became emotionally compromised when the Hill didn't support their program.

The Deal Makers

The goal is to be a "Deal Maker." One that is respected, well received, and that will be welcomed back in the future. Members of Congress like to broker deals and to never be backed into a corner. Guess what, your experience as an acquisition professional has equipped you well in this domain. You understand trade space and negotiations. You operate in a civilian environment and you're not intimidated by intellectuals. Some of the best engagements over controversial issues were executed by acquisition professionals that found ways to work with Congress. The "Deal Makers" listen to the questions, which are often leading, issues and concerns of Member offices and find ways to execute strategies that will keep the Hill satisfied. It sounds dirty, but it is reality.

I can't stress enough the importance of really listening to the questions the Hill is asking. It doesn't take a DAWIA Level III certified acquisition ninja to ascertain the Hill's intent on a program by the context of a question. For instance, this notion transpired early in the Army's sales pitch of the "Aviation Restructuring Initiative." Key Member Offices and Staff were asking

"what if the Army doesn't get what it wants" with the plan. Robots were slamming their fists on tables saying "this is the Army's plan, and this is what we are going to do." Whereas an Acquisition Corps deal maker listened to the question and altered a contracting strategy to prepare for the Army's plan not executing as originally designed. The Army ended up changing its baseline plan following the Commission on the Future of the Army that was mandated by Congress.

The point is to leverage the interpersonal and dynamic abilities you already have as an acquisition professional when you approach the Hill. You can negotiate, you understand trade space, and you know how to work within a complex world of "nay sayers" and unobjective robots. With that, here are a few pointers on leveraging your acquisition ninja skills on the hill.

1. Develop and sustain relationships with key Member and Defense committee staff offices. Relationships lead to mutual trust and confidence. NEVER, NEVER, NEVER compromise someone's trust by leaking privy information. All it takes is for you to burn one relationship to destroy your reputation on the Hill.

2. Never feel like you have to know everything about your program. The Hill understands that program management is not an easy gig. If you don't know the answer to a question, admit it and say you'll get back with them. Take your subject matter expert with you to help field questions. That doesn't necessarily mean the second in command of your organization. I've seen where mid-grade captains and NCOs have provided the best feedback during Hill engagements.

3. Showcase your programs. Encourage and actively support Congressional visits to your Primes and PEOs. Congressional travel is an exceptional opportunity to foster relationships as well as showcase your program in a "captured" environment. All too often organizations dread Congressional visits. They do require a tremendous amount of work but they can pay off tenfold. Oh, and please limit the "death by PowerPoint" when they visit. They enjoy show and tell, meeting with Soldiers and the incredible teams you have working programs. Make a human connection.

4. Team with your Prime. After all, nearly all Prime Defense Contractors have a lobbying arm. They have unbelievable access to Members and Member offices. If your message matches theirs your case is hard to beat. Conversely, it's never a good situation if the Hill receives mixed messages. That includes mixed messages from within the Pentagon and between a PM and their Prime.

5. Take the time to understand their point of view and acknowledge it! All too often Members and Staff discuss their concerns or point of view in meetings and Army briefers fail to acknowledge their understanding of the differing point of view. It's common courtesy and helps in the teaming process to take their position in consideration. After all, their position could/will more than likely be imposed on your program regardless.

I encourage you to take pride in the education, skill sets and interpersonal experiences the Acquisition Corps has instilled in you to position you for success on the Hill. Those strong suits are footing to ensure you are a "deal maker" on the Hill. Interacting with the Hill can appear to be an intimidating and mysterious venture. With adequate education and preparation you will find that it is no different than operating within the acquisition process.

I'm Lt. Col. Josh Baker and I approve this message.

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A BIT* of Advice
*Built-In Test

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"SYSTEM FAIL message on the primary display, running Initiated Built-In Test (IBIT) to fault isolate"

About one minute later, "IBIT complete, no faults."

"OK, check the data log."

"Three faults noted, do you want me to perform a re-boot?"

"OK, so the operational BIT flags at least three faults, IBIT does not detect the same faults, but we expect a reboot to result in a fully useable system, these BIT inconsistencies really reduce my confidence…"

Similar dialogue occurred in the final weeks prior of completion to qualification testing of an ACAT II system. Was the BIT logic not working right (in this case there were over 6,000 discrete and interdependent BIT checks)? Was there a bona fide hardware fault? Or was there a false positive attributable to an incorrect BIT threshold or persistence level? Concern continued to mount until testing was suspended to allow Technical Interchange Meetings (TIMs) to ensure the Combined Test Team, the Engineering Team, and the Program Management Office understood risks associated with these and other anomalous BIT indications.

Although entire books have been written to examine BIT technology, implementation, and interpretation, we will focus on three primary lessons that can be learned based on the BIT experiences of an ACAT II USSOCOM program management team: 1) Walk through the BIT requirement with the end-user and differentiate between informational or action-able BIT, 2) Activate BIT functionality as early as possible, and, 3) Build in BIT customization.

Differentiate Between Informational and Actionable BIT

Soldier: "BIT says we just had a short spike above 65% processor utilization."

Team Leader: "I don't know what that really means, stay focused on the mission."

OR

Soldier: "BIT indicates constant processor loading above 80%."

Team Leader: "Got it, monitor system temperature and check to see if we have any unnecessary apps running in the background."

Let's start with one of the most used acquisition clichés: "It all starts with a requirement - preferably a validated requirement." What is the BIT requirement for your program? Is it written with great precision or does it allow for interpretation? Regardless of specificity or ambiguity, analysis of the requirement must include determination of Informational or Actionable BIT. As illustrated in the dialogue above, acknowledging a user focused actionable BIT differs greatly from response to trivial data.

System complexity, mission assurance criteria, and safety requirements drive BIT integration and implementation. BIT must be considered during all phases of development and checked through Integrated Product/Process Team and Working Groups that include the end user. Maintainers and logisticians must also be included to ensure the BIT is properly nested in the sustainment strategy. Primary considerations in this area should include levels of maintenance (unit, depot, etc.), isolation levels, and required test equipment to support BIT analysis.

Engineers, Testers, and Users! Oh My!

Do engineers, testers, and users have different BIT expectations? YES. Does a user care if inter-processor messaging is delayed by one nanosecond with no observable effect on system performance? No, but an engineer will take note of it when optimizing message handling protocol. Does a user care if embedded guidance figures of merit fluctuate during travel over rough terrain? No, but a tester will record

it in the Position, Navigation, and Timing section of a DT or QT report. Data from these events should be logged but should not be elevated to a fault status unless they result in degraded system performance.

Simply put, in the vast majority of systems, users can't re-code software or perform hardware optimization but they can change Line Repairable Units or downloaded Health and Usage Monitoring data and run diagnostics. You must make every effort to ensure the BIT allows the user to complete relevant tasks and maximize system utilization.

Activate BIT Functionality Early and Test

"That BIT output does not make sense given the Fault Isolation Procedure we just used, we need to call the Field Service Representative…"

After the program management team has carefully analyzed your BIT requirements and delineated between informational and actionable BIT, work with your user to activate BIT functionality as early as possible and allocate resources for testing. The opposite of this approach is what is commonly referred to as 'masking.' This masking isolates BIT functions, not allowing the algorithms to interact with the mission or operational code in a system.

The ACAT II that is the basis for this article used this masking technique due to cost, schedule, and performance pressure. As might be expected, when the BIT was unmasked the system became unusable. Dozens of faults were present as soon as the system initialized. The program was forced to suspend developmental testing, conduct lengthy technical interchange meetings, deploy multiple software version revisions, and absorb significant schedule revisions. Even now, over 24 months after the BIT was unmasked, BIT effectiveness and reliability are still being refined.

It is likely that at the same time you are preparing to evaluate prototype systems, your logistics team is working to develop training material for maintainers that include Fault Isolation Procedures (FIPs). Full activation of BIT will allow verification and validation of the training materials and FIPs while allowing the program management team to assess if your BIT implementation matches the maintenance and sustainment strategy. If your BIT algorithm includes an embedded maintenance system, treat this

as an integrated function so it is not inadvertently excluded from testing, verification, and validation.

In other words, enable BIT as soon as possible to reveal persistence and threshold issues, allow users to 'wring-out' performance, and allow maintainers time to become familiar with FIPs associated with the BIT. Do not be seduced by claims that masking BIT operation is a low risk action that will allow you to better assess system behavior. An effective and reliable BIT is an integral part of the system's performance that cannot be overlooked.

Build in BIT Customization

"I have used this system on two deployments and know that fault does not affect system performance…"

Will your system mature quickly (e.g., frequent direct interaction with the user, an aircraft flight control system, or a logistics management program) or will it age slowly (e.g., a passive guidance system used only if the tactical situation prevents use of active guidance system)? Will the BIT algorithms, persistence levels, and threshold values ever change? Is your software architecture reliant on monolithic or modular code? Do your software and hardware partitions allow for scalability? Your answers to these questions will inform your BIT customization strategy.

One can imagine the scenario surrounding the quote at the beginning of this section. An experienced user knows what the system is supposed to do, how it works, and most importantly, when something is wrong. This user has gained system familiarity though tried and true 'blue-collar' learning. He or she did not need to study use case optimization or Failure Modes, Effects, or Criticality Analysis charts. This is the user you, your engineers, and your logisticians want to meet to hear an unfiltered assessment of system performance.

The question then becomes: Can the program management office help the user? Pre-Planned Product Improvements (P3I) or well defined technology roadmaps are of little use if the hardware and software don't include provisions allowing for changes to compensate for user habits and system maturation. BIT customization can address both of these areas and can pay a very healthy return on investment for your stakeholders.

What about cost? All of this sounds expensive and in

most cases it is. Certainly Program Managers have to carefully balance what occurs during P3I activities to control cost. Division of funding for either BIT customization (or improvement) or a shiny new 'something' requires due diligence. One technique is early allocation of a percent of your total budget to cover developmental non-recurring engineering efforts focused on BIT customization. Include BIT maintenance in as part of your customization. Maintenance may include removal of unneeded BIT or scaling existing BIT to compensate for user familiarity and/or system maturation. Take into low level system architecture and hardware and software performance improvements when planning your effort. Does your system's BIT work the way you advertised? Be careful - any 'lift' your program will experience by integrating the latest gadget in your system may be overshadowed by the negative consequences surrounding degraded usability or waning user support.

Summary

Developing, implementing, and maintaining BIT can quickly snowball and become the pacing tasks for your program.

- Proactively manage BIT efforts by understanding user requirements, system behavior, and opportunities to customize BIT based on system maturation.

- Carefully consider the requests of engineers and testers who will be using the system for a few years against users who may be 'married' to the system for decades.

- Ensure your BIT is nested in the overall sustainment strategy, enabling quick fault isolation.

Suitable and effective BIT is essential, enabling users to employ systems to their full potential.

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A BIT of Advice was compiled by a Special Operations Forces acquisition, technology and logistics team responsible for the development, testing and fielding of an ACAT II joint program: **Lt. Col. Steven Van Riper** and contributing authors **Mr. Jim Griffin** and **Mr. Eugene Buckner**. Van Riper is the program director for an ACAT II program within SOF AT&L, Griffin is the deputy program director, and Buckner is the senior systems engineer within PEO-RW.*