2023

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

A Champion of Enduring Professional Growth and Development

by Lt. Gen. Robert M. Collins

"You must have passion to do this [acquisition] business right. We need to work toward win-win solutions to our challenges."

—Maj. Gen. Harold J. Greene (Feb. 11, 1959 – Aug. 5, 2014)

This special supplement of Army AL&T magazine showcases the 2023 winning and honorable mention authors in the 10th Annual Major General Harold J. "Harry" Greene Awards for Acquisition Writing. Their selections in the categories of acquisition reform, future operations, innovation and lessons learned were determined by our distinguished panel of judges.

When my predecessor, Lt. Gen. Robert L. Marion, USA (Ret.), announced the opening of the annual competition in June 2023, he wrote, "Through these awards, we honor Harry's 34 years of distinguished service to our Army and the nation, remember his significant contributions to Army acquisition, and pay tribute to his ultimate sacrifice. We have seen, through the years, the tremendous talent and creativity within the acquisition community, and I know that Harry would be extremely proud of the operational capabilities and processes that we have improved because of the competition in his honor."

Harry worked tirelessly to make the Army and our nation better. His service, sacrifice and tragic death on Aug. 5, 2014, while serving as the deputy commanding general of the Combined Security Transition Command – Afghanistan, reminds us of the dedication, commitment and risk our men and women in uniform take to ensure our nation's security. His distinguished career as a Soldier and leader in the United States Army is solemnly remembered not for how it ended, but for what it achieved.

A hallmark of Harry Greene's leadership was the professional growth and development of his team and the greater Army Acquisition Workforce. He was their champion, and his legacy endures. Each year there are many submissions to the competition from those who worked for Maj. Gen. Greene, were mentored by him, or simply remember his lasting commitment to provide Soldiers with the most advanced capabilities in the world.

With these awards, we remember a leader who left an indelible mark on us all.

My sincere congratulations to our winning and honorable mention authors and to all who participated in the 10th annual Major General Harold J. "Harry" Greene Awards for Acquisition Writing. We deeply appreciate your support. I also want to express my gratitude to our distinguished judges who carefully reviewed and assessed the submissions.

Again, my congratulations and best wishes to all.

2023 Major General Harold J. "Harry" Greene Awards for Acquisition Writing

The winners and honorable mentions are:

Category: Acquisition Reform

Winner: Rethinking Acquisition from Left of Requirements: DEVCOM Chemical Biological Center's WILE-E Pilot Project

Authors: **Alan Samuels, Ph.D.**, is a research chemist in the Research and Operations (R&O) Directorate of the U.S. Army Combat Capabilities and Development Command (DEVCOM) Chemical Biological Center (CBC). He has supported the Chemical and Biological Defense program by advancing the technology readiness of a host of sophisticated technologies and systems that enhance situational understanding of chemical and biological threats in the battlespace. In addition to his Ph.D. in physical chemistry from New Mexico State University, Samuels served 28 years in the Army Reserve as a chemical officer, including two active-duty assignments in support of Operation Enduring Freedom.

Jennifer Weeks Sekowski, Ph.D., is a molecular toxicologist in the R&O Directorate of the DEVCOM CBC. She has led multiple Army, DOD and international cooperative research and development (R&D) programs in chemical and biological defense R&D, primarily focused on the environmental detection of or host-response diagnostics of exposure to chemical and biological materials and was the lead for WILE-E 3.0. She holds a Ph.D. in cellular and molecular biology from the University of Maryland School of Medicine, and a B.A. in biological basis of behavior from the University of Pennsylvania.

Brian B. Feeney, Ph.D., is a public affairs specialist at the DEVCOM CBC, where he writes news and feature stories on the science and engineering achievements of the center's researchers. He has written for the center since 2014, and wrote stories, fact sheets and strategic communications plans for the U.S. Army Chemical Materials Activity and for the U.S. Army Environmental Command since 2000. He holds a Ph.D. in risk communication from Temple University, an M.A. in communications from Cornell University, and a B.A. in history from Colorado College.

Abstract: The Defense Threat Reduction Agency (DTRA) challenged the U.S. Army Combat Capabilities and Development Command Chemical Biological Center (DEVCOM CBC) with a question: Could the center develop the technology for a family of miniature chemical, biological, radiological and nuclear sensors that could be distributed ahead of frontline Soldiers to warn maneuver commanders? No requirements, just, "What can you do?" That was DEVCOM CBC's opportunity to employ a new methodology for technology development. Known as WILE-E, this method calls for assembling a small, cross-functional, multidisciplinary team and using design thinking principles to develop solutions to a complex challenge. Using WILE-E, in just over one year the project team delivered a technology prototype that was directly used to codify a formal requirement for what is now a program of record. WILE-E overcame the technology development "Valley of Death" and provided warfighters with exactly what they asked for, advanced warning for CBRN threats.

Honorable Mention: Cybersecurity in a Rapid Capabilities Environment

Author**: Bo Taylor** is the current Cyber Lead for PM Integrated Fires Rapid Capability Office (IFRCO), PEO Missiles and Space. He has nearly 30 years' experience in information technology and cybersecurity as both an

Army officer and Army civilian. He has served in a variety of leadership and staff assignments across the Army and Joint Combatant Command communities.

***Abstract*:** The lengthy and arduous acquisition process fails to account for systems transitioning from rapid acquisition authority to the less flexible Program of Record (PoR) process. Countering the threat from small, unmanned aerial vehicles is a rapidly evolving challenge and should not be limited to normal acquisition processes. The Army currently lacks a well-defined cybersecurity framework for rapid acquisitions and their possible transition to a longer-term acquisition strategy. This gap in the acquisition process causes confusion for cybersecurity professionals and program managers attempting to apply traditional "enterprise" cyber accreditation standards to extremely truncated timelines. Within rapid acquisitions, the product would be chosen, engineered, tested and deployed in such a compressed timeline that traditional cyber methods for testing and evaluation are not possible. The Army must learn to adapt its cyber processes to ensure anything deemed as a rapid capability has defined boundaries and timelines. Army cyber processes also must have the flexibility to adjust their restrictive rules to support those deployed and in harm's way.

Category: Future Operations

Winner: Playing 'Small Ball': How the Defense Department Will Win Against Future Known and Unknown Biological Hazards

***Author:* Lt. Col. Edwin LaVell Kolen** is the joint product manager for Biological Defense Pharmaceuticals, within the Joint Project Manager for Chemical, Biological, Radiological and Nuclear Medical (JPM CBRN Medical), a component of the Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense (JPEO-CBRND), headquartered at Aberdeen Proving Ground, Maryland. Lt. Col. Kolen is responsible for the development and fielding of biological defense pharmaceuticals. In this role, he is responsible for providing research, development, acquisition management and joint service integration for products transitioning from the technology base through full life cycle management of U.S. Food and Drug Administration (FDA)-approved medical countermeasure pharmaceuticals against biological threats.

Abstract: This article contends that future operations requirements documents should list Investigational New Drug application, Clinical Practice Guideline updates and Emergency Use Authorization and/or Expanded Access Protocol approvals as key knowledge points that provide data for delivery to the services. The article further contends that each of these enhances preparedness by informing warfighters of the confidence in the drug products safety and effectiveness against biohazards.

Honorable Mention: Army Facilities Components System – A New Standard for Contingency Bases in Future Operations

***Author:* Caitlyn Hall** has been with Army Facilities Components System for about five years, and with DOD for almost 10. She is stationed at Redstone Arsenal, Alabama, serving as a provisioner at U.S. Army Aviation and Missile Command and matrixed with U.S. Army Corps of Engineers. She has an M.A. in reverse logistics management from American Military University, an M.S. in logistics management from Florida Institute of Technology and a B.S. in family studies from the University of New Mexico. Outside of being a U.S. Army civilian, Caitlyn is a childless millennial who fosters children and kittens.

Abstract: The Russo-Ukrainian war highlights the importance of logistics in a global conflict. For the U.S. to maintain its place as the dominant global power requires superior logistics readiness capabilities. The U.S. military has 11 combatant commands and nearly 800 bases globally. The staffing, operation and maintenance costs for maintaining these bases costs billions of taxpayer dollars annually. Regardless of size or location, base camps require logistical support to safeguard and secure people, facilities, equipment, supplies, transportation modes and information. As tensions continue to rise in Eastern Europe and the Indo-Pacific, the U.S. will need to consider the strategic consolidation and relocation of deployed troops to high-risk zones.

Category: Innovation

Winner: Technologically Advanced Response System to High Consequence Biological Threats

Authors: **Dr. Christopher G. Earnhart** is the chief technology officer for the Enabling Biotechnologies Office within the Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense (JPEO-CBRND). He earned his doctorate from the College of William and Mary/Virginia Institute of Marine Science studying comparative immunology and completed postdoctoral training in bacterial pathogenesis and vaccine research at the Medical College of Virginia.

Lana A. Hopkins, Ph.D., is the pharmaceutical development subject matter expert with Joint Research and Development Inc. (JRAD), which provides contract support to the Joint Project Lead for the Chemical, Biological, Radiological and Nuclear Defense Enabling Biotechnologies (JPL CBRND EB) within JPEO-CBRND. She completed her Ph.D. in biological sciences at the Research Institute of Pharmacology of the Russian Academy of Medical Sciences followed by two postdoctoral fellowships at the U.S. National Institutes of Health and Tokai University School of Medicine (Japan). She also holds a master's degree in business administration.

Abstract: The COVID-19 pandemic demonstrated the tremendous impact that an infectious disease can have on warfighter operational availability, but that pales in comparison with the potential impact of a biowarfare attack. The vision of a response capability agile and rapid enough for operational relevance in the face of an unanticipated outbreak or attack is now possible due to lessons learned from the pandemic, but more to remarkable technical advances in computational drug design. A system-of-systems approach is being used to operationalize computational design of medical countermeasures coupled with rapid candidate down-selection, drug product manufacturing, and pre-clinical and clinical testing. This system must be fully integrated and finely tuned for rapid advancement of critical medical countermeasures for the warfighter. This system is technologically challenging and, importantly, also requires a highly strategic and disciplined acquisition approach to manage capability-building activities and large academia, industry and interagency collaborations to ensure all activities are oriented toward meeting end goals and warfighter needs.

Honorable Mention: Shop 'til You Drop: Introducing the Tradewinds Solutions Marketplace

Author: **Bonnie Evangelista** is the acquisition policy director and Tradewinds execution lead for the Chief Digital and Artificial Intelligence Office (CDAO), leading efforts to design and build a rapid acquisition environment aimed to accelerate the pace of digital, analytics and artificial intelligence delivery to the Department of Defense. In her previous role, she served as the deputy product lead for Applied Cyber Technologies within Army Program Manager Defensive Cyber Operations (PM DCO), leading efforts to provide the infrastructure and environments necessary for defensive cyber innovation and integration in the Army.

Abstract: The Department of Defense (DOD) faces a rapidly changing battlefield and emerging threats, demanding transformative approaches to technology acquisition. Traditional, lengthy procurement processes hamper innovation and fail to keep pace with technological advancements. The Tradewinds Solutions Marketplace tackles this challenge head on, offering a revolutionary approach to acquisition for warfighter technology. By reducing acquisition timelines and fostering collaboration, the Tradewinds Solutions Marketplace is transforming the DOD's perception of procurement. It fosters a culture of innovation, rapidly equipping warfighters with cutting-edge technology. This initiative is a beacon of change, demonstrating how rapid procurement can deliver a competitive technological advantage for the DOD.

Category: Lessons Learned

Winner: Operationalizing Discovery: Lessons Learned from a DEVCOM Science Adviser

Author: **Lt. Col. John M. Wiliams II** currently serves as the product manager Forces Training Systems in Orlando, Florida. Williams was commissioned into the air defense artillery and has served in the Army Acquisition Corps since 2011, earning DAWIA certifications in both program management and engineering, gaining Acquisition Corps membership in 2019. Lt. Col. Williams' formal education includes advanced degrees in leadership and biomedical engineering, earning his Ph.D. in material science in 2022.

Abstract: Science advisers at the U.S. Army Combat Capabilities Development Command (DEVCOM) play a critical role in discovering, maturing and transitioning technology to the warfighter. No place is that mission more clear than in the Indo-Pacific theater, where unique challenges and extreme conditions create novel gaps for Army forces. This article shares lessons learned from a year of leading DEVCOM science advisers within the theater, including a systemic approach to discovery. Applying these lessons may offer insight on the role of people in transitioning technology and achieving critical modernization aims.

Honorable Mention: Lessons Learned: The Need for Best Practices for Coding Diagnostics and Troubleshooting in Army Technical Publications

Author: Robert H. Sullivan received a master's in library and information science from Wayne State University in 2015. From 2016 to 2020, he was a technical writer-editor with various product support integration directorates in the U.S. Army Tank-automotive and Armaments Command Integrated Logistics Support Center. Since 2020, he has been a logistics management specialist with the Publications Services Team's E-Pubs Mission.

Abstract: While converting technical publications into Extensible Markup Language (XML) data sets compliant with Interactive Authoring Display Software (IADS), the Electronic Publications (E-Pubs) Mission of the U.S. Army Tank-automotive and Armaments Command (TACOM) Integrated Logistic Support Center's (ILSC) Publications Services Team has been able to review the authoring strategies used by technical writers and contractors to meet the requirements of MIL-STD-40051-1/2, identify issues with these authoring strategies, and recommend improvements. No aspect of these data sets has given the E-Pubs Mission more difficulty than troubleshooting and diagnostics. MIL-STD-40051-1/2 provides technical writers and contractors with a surfeit of options for developing troubleshooting and diagnostic content, but writers, lacking the guidance to effectively choose between these options, often produce bloated work packages of dubious usability. A close reading of MIL-STD-40051-1D suggests that linear diagnostics with user-determined entry to the IETM use the simple diagnostic mode, while all other diagnostics functionalities use the complex diagnostic mode. Depending on the diagnostics functionality, the complex mode may be two to five times as complex, resulting in higher costs and increasing the time needed for development. The E-Pubs Mission was able to demonstrate the possibility of rewriting certain overwritten work packages to the simple diagnostics mode without compromising the underlying troubleshooting logic by converting an interactive diagnostics work package to a troubleshooting work package. The results of this experiment suggest that improvements in training and regulatory guidance could reduce costs while improving product functionality.

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

Vincent E. Boles, Maj. Gen. USA (Ret.), Defense Acquisition University (DAU) professor of Life Cycle Logistics

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

John T. Dillard, former senior lecturer, Department of Systems Engineering, Naval Postgraduate School

Raymond D. Jones, chair, Department of Defense Management and professor of practice, Naval Postgraduate School

Roger A. Nadeau, Maj. Gen. USA (Ret.), senior vice president, American Business Development Group and former commanding general, U.S. Army Test and Evaluation Command

Gary Martin, president of GPM Consulting LLC and former program executive officer for Command, Control and Communications – Tactical

Ken Rodgers, Col. USA (Ret.), director, Strategic Defense Systems and C4I, Cypress International

Michael A. Santaspirt, Ph.D., deputy chief of staff, G-2, and chief futures officer, U.S. Army Combat Capabilities Development Command Armaments Center

Rickey E. Smith, Senior Level (Ret.), Col. USA (Ret.), former deputy chief of staff, G-9, U.S. Army Training and Doctrine Command

Category: Acquisition Reform

WINNER

Rethinking Acquisition from Left of Requirements: DEVCOM Chemical Biological Center's WILE-E Pilot Project

By the following authors:

Alan Samuels, Ph.D.

Jennifer Sekowski, Ph.D.

Brian B. Feeney, Ph.D.

Introduction

In 2019, the Defense Threat Reduction Agency's (DTRA) Joint Science and Technology Office Diagnostics and Detection Division challenged the U.S. Army Capabilities and Combat Development Command Chemical Biological Center (DEVCOM CBC) with a question: Could the center develop the technology for a family of miniature chemical, biological, radiological and nuclear (CBRN) sensors that could be distributed ahead of frontline Soldiers to provide actionable situational awareness to maneuver commanders? No requirements, just, "What can you do?"

DEVCOM CBC scientists and engineers had been working on miniaturizing and networking chemical biological sensors for years and were working on making them more mobile by mounting them on unmanned aerial and ground vehicles to report back to command and control. The center was game for the challenge and saw not only an opportunity to advance sensor science and technology (S&T), but an opportunity to perform a pilot study on a new strategy for improved S&T acquisition.

Even before this challenge, the center had been working on an altogether new spin on traditional acquisition that defines capability needs more rapidly and precisely and develops new and more responsive technologies faster, and with more upfront warfighter collaboration. DEVCOM CBC calls it the Warfighter Innovation Leveraging Expertise and Experimentation (WILE-E) method of science and technology development. Here was a perfect opportunity to put it to a real test and achieve a real warfighter benefit.

What is WILE-E?

DEVCOM CBC first conceptualized WILE-E in 2018. The idea was to introduce a technology under development to the warfighter very early in the process to get real-world practical feedback long before any formal requirements were established. One of its creators, DEVCOM CBC's deputy director of Engineering, wanted to get to the left of what he termed "the acquisition horse blanket" process, by which he meant the poster-sized illustration containing every element of the formal acquisition process, which are resistant to change over the course of a technology's development.

WILE-E is a methodology that employs a small, cross-functional, multidisciplinary team that applies design thinking principles to develop solutions to a complex challenge. In practical terms, that means having an interdisciplinary team of DEVCOM CBC scientists and engineers work with each other and with warfighters to conceptualize and refine the possibilities for a new technology under development before the effort becomes subject to the Integrated Defense, Technology and Logistics Life Cycle Management System.

The idea is to help requirement writers establish requirements that are both achievable and incorporate the practical needs and wants of the warfighter through iterative Soldier touch points.

The intention of the design thinking process, depicted in Figure 1, is to get the team to experiment and learn cheaply—much like the "Fail Early, Fail Often" ethos of Silicon Valley—before the formal acquisition process truly begins.

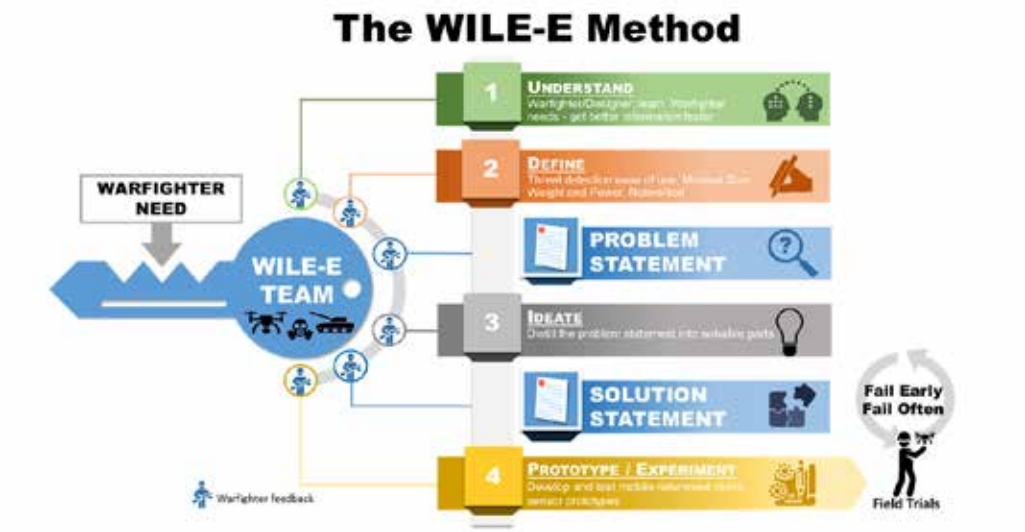

FIGURE 1

WILE-E BASICS

The WILE-E methodology employs a small cross-functional team of DEVCOM CBC scientists and engineers working with warfighters to apply design thinking principles and develop solutions to complex challenges. (Graphic courtesy of the authors)

In its third iteration as a team with a project, WILE-E (3.0) consisted of a molecular toxicologist, a chemist, a chemical engineer, a mechanical engineer and two general engineers who specialize in engineering acquisition. Its project was to meet DTRA's challenge to DEVCOM CBC—maximize the warfighter value of a new concept for CBRN microsensors.

The WILE-E 3.0 Focus: Maximizing the warfighter value of a new Concept for CBRN Microsensors

Understanding the problem

The WILE-E 3.0 team began by establishing a problem statement. We have this concept of a family of small, deployable CBRN Microsensors (C-MS), and we have the subject matter experts and infrastructure needed to further develop it. What is the full scope of possibilities? What is the best way to develop and field a system that delivers actionable CBRN situational awareness to maneuver commanders?

Starting with that question set, the team began breaking down the research and development effort into manageable pieces to be addressed by S&T over a six-month, two-year, and 10-year timeframe. The WILE-E team worked closely with the Maneuver Support Capability Development and Integration Directorate (MS-CDID) at Fort Leonard Wood, Missouri, as well as the wider community of interest including representatives from DTRA, the Department of Homeland Security (DHS), the United States Special Operations Command (USSOCOM) and the intelligence community over the course of several workshops held at the USSOCOM's innovation and agile acquisition organization known as SOFWERX.

Soldier feedback

DEVCOM CBC had two liaison officers attached to the Maneuver Support Center of Excellence (MSCoE) at Fort Leonard Wood. They were able to arrange for the members of the WILE-E team to put microsensor prototypes into the hands of Soldiers, including forward operating chemical personnel. The Soldiers and the center researchers talked extensively about the practical benefits and shortcomings of the concepts, and together they brainstormed new possibilities. Among the insights this collaboration produced were:

- **Reduce Size Weight and Power (SWaP)—**The warfighters' pack burden is already high. They didn't want something that added significant weight. Battery needs were a particular concern.
- **Leave in place—**Users wanted the option to place the sensors out in the field and leave the sensors behind as retrieval distracted from their primary mission and put their safety at risk.

- **Low training burden**—Users wanted "plug and play" equipment that didn't require much special training to use.
- **Simple Go/No Go**—Users wanted sensors that indicated if a hazard was present in the environment or not. Identifying the specific type of chemical was significantly less important.

In addition to speaking to Soldiers and other stakeholders, the WILE-E team sought inspiration from experts outside of the Chemical Biological Defense Program. They held discussions and field visits with relevant technology developers both in industry and other DOD organizations. They even visited the Smithsonian FUTURES exhibit to explore where technology is heading in many sectors of our world, including examples of energy scavenging, multifunctional materials, autonomy in robotics, and generative artificial intelligence.

Arriving at a concept

In under a year from being first challenged, the WILE-E team was able to deliver a demonstration of a C-MS concept that will provide situational awareness of chemical threats in and ahead of a warfighter maneuver mission. The team discovered that a system-of-systems approach will be needed and should include five integrated modules—sensing, processing, communication, power and deployment. System modularity is a key element of the team's concept as it allows for three important elements:

- The technology can advance without impacting the ability to integrate upgraded components.
- It allows for the use of multiple types of sensors within a common architecture.
- It minimizes the training burden required to use the microsensors.

To aid in communicating the C-MS concept architecture, they worked with DEVCOM CBC's Maker Space within the Additive Manufacturing Facility to create fully articulated 3D-printed concept prototypes.

Recognizing that C-MS is a system of systems, the WILE-E team members believed that the best way to communicate a functioning C-MS concept was to showcase it in the field to an audience of chemical and biological technology developers, stakeholders and users.

DEMONSTRATION CONCEPT
The WILE-E team showcases the C-MS concept to members of the chemical and biological defense community at an integration experiment held at the Edgewood M-Field Range at Aberdeen Proving Ground, Maryland. (Photo courtesy of the authors)

The team planned an integration experiment at the Edgewood M-Field Range at Aberdeen Proving Ground, Maryland, and invited members of the chemical and biological defense community to attend.

The integration experiment showcased a UAV-dropped C-MS functional prototype, a hand-emplaced C-MS, and a C-MS concept model projected forward by a hand-rocket or grenade-launcher. All three were designed to meet the specific needs that the Soldiers at MSCoE expressed. The sensors in these prototypes were networked to command and control, were interchangeable and, taken together, formed a system of sensor systems.

True to the WILE-E design thinking process, these deliverables were not an end, but a beginning. Each part of the modular system can be improved and adapted to meet the operational needs of the warfighter as they evolve. New chemical sensors, radiological sensors, seismic sensors and many other modes of sensing can be used in the same system. Communication needs may change. If, for example, sensor data needed to be relayed to the front-line warfighter and beyond line of sight using encrypted transmissions to higher headquarters, this system can adapt to that need. Power demands and capabilities may also change over time. In the future, new technologies will be

developed to allow for even smaller form factors and more efficient energy use. DEVCOM CBC will be ready with its WILE-E design methodology to talk to the warfighter and subject matter experts at other organizations and rapidly adapt.

Conclusion

The real validation of the WILE-E concept as applied to CBRN microsensors is the fact that, in just over one year, what they delivered was directly used by the Maneuver Support Capability Development Integration Directorate to codify a formal requirement for what is now a program of record. WILE-E overcame the technology development "Valley of Death" and provided warfighters with exactly the improved situational awareness and advanced warning for CBRN threats they asked for. It did that by revolutionizing how requirements are conceived and established.

ACKNOWLEDGEMENTS *The authors would like to thank WILE-E 3.0 team members Robert Wahl, Nathanael Tchamanbe, Charles Harris and Neel Bhardwaj for their continued support, and WILE-E architect Lowry Brooks for his steadfast and continued support of the program at the center.*

HONORABLE MENTION

Cybersecurity in a Rapid Capabilities Environment

By the following author:
Bo Taylor

"Hey cyber, when are we going to get an ATO for this system?" That is a standard question posed to most cyber professionals within the acquisition community. There is very little thought given to the intricacies or difficulties an Authorization to Operate (ATO) can be to obtain. Cyber defense encompasses more than just the compliance documentation that is normally associated with obtaining official authorization for a new or modified system to connect to other government-owned systems. The ability to electronically secure a weapon system includes different facets, from ensuring its survivability and resiliency to building technical safeguards into the weapon system itself. All these protection measures are in place to ensure the weapon system will function properly to protect the Soldiers' lives who depend on it and to safeguard the data and imagery vital to mission accomplishment and national security. In the past few years, these formal cybersecurity protections and compliance requirements have taken on added importance within the standard acquisition process due to evolving threats and potential vulnerabilities. As more and more systems become integrated with each other, we must ensure cyber protection measures are moved to the forefront.

However, the lengthy and robust Program of Record (PoR) acquisition process fails to adequately account for systems transitioning from rapid acquisition authority actions to a PoR. Rapid capabilities are usually commercial-off-the-shelf (COTS) systems or prototypes with an already mature Technology Readiness Level in need of a little more technology maturation before fielding. Programs procuring these systems are not required to incorporate and test robust cybersecurity features based on the product's commercial origins, applications and lengthy test and evaluation timelines. While most weapon systems or other programs can take years to develop, test and field, most rapid capabilities are purchased, quickly tested, and then fielded within a short timeframe. In addition, the

lifespan of a rapid capability system does not lend itself to certain life cycle upgrades that occur with a normal Program of Record. For the benefits of this article, the acquisition process has been simplified.

The assessment of gaps within operational or protective capabilities is an ongoing process across the DOD. Once a gap in a particular capability is identified, it must be prioritized for funding and fielding based on the needs of the requestor. At that time, a requirements document (normally generated through the Joint Capabilities Integration and Development System (JCIDS)) is created and provided to the program management office for execution. The process for obtaining a rapid capability acquisition usually appears in the form of a Capabilities Development Document (CDD), Joint Urgent Operational Needs Statement (JUON), or a Directed Requirement (DR). Timelines associated with these acquisitions are sometimes years shorter than the traditional acquisition milestone timeline. For example, programs executed under the Urgent Capability Acquisition (UCA) pathway of the Adaptive Acquisition Framework (AAF) must complete pre-development activity, production and deployment to users within two years.

The Army lacks a well-defined cybersecurity framework for rapid acquisitions and for how they transition to PoRs if that transition becomes a longer-term acquisition strategy. This causes confusion for cybersecurity professionals and program managers trying to apply traditional Army cyber accreditation and system survivability processes. In many cases, the cyber community cannot react to the fielding timelines and cannot meet either the standards of a "normal" cyber accreditation cycle or confirm certain technical safeguards are built into the system for cyber survivability.

For instance, once the Army selects a product or device for rapid procurement, it may be one to two years before that product or device is operational in a deployed location. The standard accreditation cycle for cyber is typically longer than a year and in most cases requires independent review and validation of the system's security controls. Within rapid acquisition, the product or device would be chosen, engineered, tested and deployed in a compressed timeline.

This leaves virtually no time for any sort of traditional cyber testing and evaluation. All assessments would have to be compressed. Another major issue with many of these rapid acquisition programs is that they are commercially procured and cannot be protected with traditional cyber protection measures such as the Security Technical Implementation Guide (STIG) or any type of a security scan of the hardware or software being used. This type of deficiency causes issues for cyber reviewers throughout the ATO cycle. Additionally, there is an issue with the ever-changing regulatory guidance for obtaining a system accreditation or meeting technical vulnerability protections. Army guidance on accrediting a system changes so frequently that they have stopped providing regulatory guidance. The Army has instead chosen to use Tactics, Techniques and Procedures (TTP) to enforce the rapidly changing directives and protective measures. All of which is difficult to enforce contractually with what should be provided as an Army regulation. This seemingly simple change in guidance has limited our ability to hold non-Program of Record contract vendors to a particular standard. Often, the product is commercially based and cannot meet the documents' standards or requirements. The rapid acquisition process might soon become more prevalent in future Army acquisitions and the cyber community must quickly adapt. Here are a few suggestions.

First, there must be a specific definition of what constitutes a rapid acquisition within cyber policy (which can differ from acquisition policy). Is it going to be defined by cost, schedule or performance boundary? Schedule is probably the best way to define a rapid capability. For instance, if it is going to be based on schedule alone, there must be something that distinctly spells out a timeline from the "go buy it" to "deliver to the field." Basing a rapid capability on cost or performance is too difficult to define and there are way too many performance parameters that could impact using this as a single definition. Using schedule as the parameter has enough flexibility to ensure that the product can be delivered to the field in enough haste to meet operational requirements. This would also allow for a determination to be made on the future of the system. Schedule as the parameter places milestones for the system life cycle and provides "go/no-go" indicators for the system to be extended and transitioned to a Program of Record.

Next, within the Army accreditation process there is a tool known as a Rapid Capability Overlay. This tool is used within the Army Enterprise Mission Assurance Support Service (eMASS) accreditation structure as a quick way to approve security controls where time is

of essence. However, the Army has placed an arbitrary timeline of one year on this overlay regardless of what the program's acquisition strategy describes as that program's acquisition pathway(s) and schedule. We can only keep a system in a rapid capability status for one year or less. This presents a major problem if the product is neither on track to be a PoR nor has a shelf life beyond a year or two. For example, if a product is going to transition to a PoR, there are certain activities that must take place to accredit the product. This product must be acquired, tested and properly integrated long before any sort of cyber testing or external assessor reviews can be completed. This task is nearly impossible since rapid acquisition systems are in a constant state of flux and may not be released for a final product until just before fielding. Therefore, traditional cyber assessments are often not performed. To fix this problem, the Army must agree to continue allowing program management offices to use the rapid acquisition overlay until the product is officially transitioned to a PoR or decommissioned. A one-year timeline is not the best measure for a rapid capability system. Ultimately this presents undue strain on the program management offices and their cyber teams to make compliance decisions that are most often beyond their ability to impact.

Finally, cyber survivability and resiliency must be more than just buzzwords. Both measures must tie into the larger picture of cyber risk protection. Operational resiliency and cyber survivability go far beyond the boundaries of typical Risk Management Framework (RMF) compliance controls. However, most engineers believe RMF and resiliency are one and the same. If they have an ATO, they can field and operate the system without ever relooking at technical updates and engineered cyber protection measures. Today, we see out-of-life cycle support and maintenance service agreement hardware being used and software solutions that use open-source data coding as a starting point for their proprietary software code. All of this is prohibited and should never be approved for system accreditation. Critical cyber hardware and software protection measures must not be overlooked. Any attempt to shortcut these protection measures to specifically meet rapid capability timelines will ultimately fail and could cause significant impact to operational missions. Program managers must commit to engineering their systems for today's contested cyber and rapid capabilities environment. Cyber threats continue to be on the rise, we must start engineering our weapon systems to counter this from the onset and not allow it to be an afterthought.

In conclusion, cyber is now one of the largest domains that warfighters must operate within. We must do all that is possible to ensure their safety and mission success. As the entire spectrum of threats, including cyber, continues to evolve, the need for rapid acquisition fieldlings will continue. The Army must adapt its cyber processes to ensure that anything deemed as a rapid acquisition has defined boundaries and timelines. Army cyber processes must also have the flexibility to adjust restrictive rules, like the one-year rule for a rapid capability overlay. Lastly, we must ensure that our rapidly fielded systems are properly designed, engineered and updated as early as possible to protect against cyber threats so that Soldiers and missions are protected.

Category: Future Operations

WINNER

Playing 'Small Ball': How the Defense Department Will Win Against Future Known and Unknown Biological Hazards

By the following author:
Lt. Col. Edwin L. Kolen

In baseball terms, "small ball" is a type of gameplay that involves getting runs by hitting singles, rather than home runs (HRs). It involves a focus on incremental gains rather than big hits. The Defense Department (DOD) must focus on consistent incremental gains and wins rather than swinging for HRs occasionally. Focusing only on big hits leads program offices and leadership to believe they haven't achieved anything of significance and downplays their contributions. Each contribution made by program offices, especially in drug product development, provides information that increases the overall preparedness of the nation. When you are only focused on HRs and getting to home plate, you forget that you need to touch first base before you get to home plate, even if you hit a HR!

In this essay, the author will demonstrate that advanced development of a drug product should have logical

points that clearly demonstrate increased preparedness. The author contends that the logical points should be documented as operational requirements, as each point reduces the required response time to a biological hazard. The author also asserts that service requirements should provide flexibility between threshold and objective requirements and not solely have thresholds equal objectives, as is the trend. Additionally, the author will argue that these logical points provide data that can and should be considered deliverables for the services, as the information increases preparedness. Finally, this essay will provide a graphic depicting how each possible suggested end state will still provide a product that assists with biodefense preparedness.

Within the DOD, the end state of drug product development is to field a product that can be used by humans to prevent or treat biological hazards. The 2023 biodefense posture review defines a biological hazard as: "…a biological agent or biologically active substance, regardless of origin (e.g., naturally occurring or biologically engineered), that represents an actual or potential danger to humans, animals, plants, or the environment."

All drug product Capability Development Documents (CDD) list U.S. Food and Drug Administration (FDA) approval as a key performance parameter threshold requirement. For any drug product to be used, the FDA must approve the product. They must have confidence that there is enough evidence to demonstrate that the drug product is safe and effective for its intended use and that the product can be manufactured to federal quality standards. This process can take years, and when achieved, ensures that joint warfighters are postured to respond to biological hazards.

However, the number of known biological hazards is too great! How can the DOD ensure we are prepared for the unknown? The answer is simple: Our long-term plans have to be prioritized by the amount of risk we are willing to take against specific biological hazards. For example, while FDA approval allows for the immediate use of a drug product, there are other options that provide for drug product use under emergency circumstances or with the sound judgement of a clinical physician. Each of these options requires specific conditions and increases the time to react to a biological hazard.

Given the FDA and service requirements, the author proposes that requirements for drug development have three logical points that demonstrate an increase in preparedness. An easy way to understand the importance of each logical point is to refer to the game of baseball. In baseball, a batter will have to get to first, second and third base before being able to cross home plate and score. The author considers an FDA approved product as crossing home plate. The logical points that will be highlighted in this essay get the DOD to first, second and third base, which gets it closer to home plate or an FDA-approved product.

There are key activities that must have occurred prior to these logical points. The first being a Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, Facilities and Policy (DOTMLPF-P) assessment that supports a materiel approach to fill a gap or mitigate the biological hazard. Second, that there is a sponsor and required funding to attain each logical point. Each logical point should be listed in requirements documents as they provide information that support the preparedness against specific biological hazards.

The first logical point (first base) is the Investigational New Drug (IND) application with the FDA. When approved, the IND application provides information that the drug product demonstrates enough safety data to assure that research subjects will not be exposed to unreasonable risk.

The second logical point (second base) is updating a Clinical Practice Guideline (CPG). The Institute of Medicine (IOM) defines clinical practice guidelines as "statements that include recommendations, intended to optimize patient care, that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options." In other words, a CPG update provides clinicians with the latest review of evidence against a biological hazard. This update gets the DOD closer to achieving an FDA approved product if the CPG update provides favorable information for the drug product.

The third logical point (third base) is an approved Emergency Use Authorization (EUA) or Expanded Access Protocol (EAP) from the FDA. Each of these provides the ability, under very specific criteria, to utilize drug products that do not have an FDA approval. This may be utilized under compassionate use or when an emergency is declared. Each of these demonstrates that the FDA believes the drug product have adequate safety and

effectiveness data to be utilized under an EUA or EAP criteria, but not enough for full licensure. This logical point brings the DOD within a few years of achieving an FDA approved product based on developmental testing results.

Finally, home plate is reached when the drug product the DOD is developing achieves full licensure. This means that the FDA believes that the drug product is safe and effective for its intended use. Once this is achieved, the DOD is postured for immediate response to the specific biological hazard the drug product is approved for.

Because there are multiple points that demonstrate maturity and provide information to the services, it is imperative that in the future these points are listed in DOD requirements documents. This ensures a common understanding that this information is a product deliverable and can be utilized to enhance preparedness. Preparedness is enhanced with each of these points because it informs the DOD of the current safety and effectiveness data and the timeline and work required to allow warfighters to use the product, should a biological hazard occur.

In conclusion, future operations requirement documents should list IND, CPG updates and EUA/EAP approvals as logical points that provide data for delivery to the services. Each of the aforementioned points get the DOD closer to full licensure, or in the terms of baseball, get the DOD to home plate. Again, you can't cross home plate without touching first, second and third base first!

HONORABLE MENTION

Army Facilities Components System – A New Standard for Contingency Bases in Future Operations

By the following author:
Caitlyn Hall

Imagine …
It's the year 2030, we are seven years into the Russo-Ukrainian war. Putin has replenished his forces through the exploitative recruitment of immigrants, human trafficking and enforcement of compulsory military service. The agricultural and humanitarian impacts of the conflict continue to strain the relationship between Ukraine and her NATO neighbors, leaving the U.S. to continue being the largest contributor of military and humanitarian aid to Ukraine. Continued U.S. military involvement and proximity in the area leads to the further deterioration of Eastern and Western relationships. Rising tensions and perceived provocation lead to a series of treaties and arms deals between the anti-NATO global powers, Russia, China and North Korea. Escalating conflict in the Indochina and the Baltic regions demands increased U.S. military presence in both theaters, which will require military leaders to prepare for contingency base planning; the life cycle process of planning, establishing, constructing, operating, managing, transferring and transitioning or closing a contingency location (CL).

Traditionally, CLs are identified on a spectrum of initial, temporary or semipermanent, and are chosen based on anticipated mission and time requirements. Tents are the traditional method of housing troops for short-term deployments. Depending on the climate, the lifespan of a tent may be only months, while under other conditions, tents are unsuitable. Modern advancements in environmental awareness, improved quality of life and construction standards, and inflated life cycle cost present modern contingency basing challenges for leaders and engineers. These and other challenges created a demand for modern and innovative base camp design technology and methods. Military planners could greatly benefit from a decision support tool that optimizes the facility layout for a base camp location while providing flexibility

for modification, expansion and substitutability.
The Army Facilities Component Systems (AFCS) is an innovative site selection and base planning system that provides military leaders access to advanced recognizant technology and engineering data. AFCS intends to minimize engineer and logistic effort while providing facilities of a quality consistent with the mission requirements, personnel health and safety standards, and the expected availability of construction resources. The AFCS designs are based on general conditions and requirements anticipated in the Joint Operations Area (JOA) and allow for site adaptation. AFCS facilities are intended for construction by engineer troops with materials furnished through the Army supply system, commercial off-the-shelf (COTS) items, and locally available materials.

AFCS includes the software Joint Construction Management System (JCMS). JCMS is an interactive facilities component system database that allows planners to roll up facilities, BOMs and construction man-hours for each construction mission. JCMS capabilities include site selection, master planning, and design and construction modules. The site selection module allows the user to identity and evaluate potential airfield and basecamp locations via satellite imagery. This capability allows military leaders and planners the ability to greatly reduce the risks in basecamp planning. JCMS can be used to ease the selection of facilities and basecamps while considering theater priorities, standards of construction, resource constraints and climate. Through the design and construction module, the user has access to design drawings for readily accessible, current, flexible, adaptable and scalable standard facilities for the construction of contingency bases; as well as estimates for labor, equipment, and bills of materiel. This data is used by leaders and engineers to plan and build initial, temporary and semipermanent construction in theater. JCMS has more than 800 designs that are UFC compliant and troop buildable. The extensive inventory of designs includes individual buildings in a series of standard sizes that can be used for lodging, kitchens, latrines, training areas, medical, office, storage, etc. There are also designs for roads, culverts, entry control points, airfields and basecamps.

In the event we deploy troops to East Europe and Asia, AFCS offers many advantages over traditional recognizant, base planning and contingency construction methods. Site selection and master planning can be done for a deployment zone before boots ever hit the ground. This means the warfighter will spend less time without protection or facilities, reducing their risk of injury or illness, improving their quality of life and morale. AFCS's design and construction module provides military planners with construction-level designs and bills of materials to support accurate planning and construction. The advantages of AFCS also include reduced building time, up to an eightfold reduction in man-hours, and overall construction cost savings.

Consolidating forces to the highest risk areas, including the Indochina, Baltic and Arctic regions, would require extensive logistical support and planning. Logistical support would include the transportation of the personnel and supplies and the construction of an initial base camp. Initial base camp construction may involve environmental challenges such as overgrown runways, limited space, inclement weather or existing outdated infrastructure that does not meet standards. AFCS can fulfill these challenges, enable leaders to quickly and efficiently establish a contingency base camp that will provide the warfighters an elevated standard of living and safety and improved moral.

Notes:

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Category: Innovation

WINNER

Technologically Advanced Response System to High Consequence Biological Threats

By the following authors:

Dr. Christopher G. Earnhart

Lana A. Hopkins, Ph.D.

The response to the COVID-19 pandemic demonstrated remarkable technical progress in medical countermeasures (MCM) development technologies and unprecedentedly short fielding timelines, both of which had direct positive effects on warfighter readiness. It also taught important lessons about the serious operational impacts of biological threats. As significant as was COVID-19, when those impacts are projected to the anticipated effects of biological weapons, devastating consequences to operational availability and force lethality are possible. Technical progress has ushered in a new era where biological warfare agents could be strategically and specifically designed. In response, our defense posture requires a level of agility and speed for countermeasure development far exceeding that demonstrated during COVID-19. This necessitates a significant shift in strategic thinking when planning future acquisitions.

Historically, biological warfare threat space was limited by the requirement for large, well-funded state programs staffed by highly trained scientists. This led to a tractable number of targets for MCM development and made possible their full FDA licensure (which can require $1 billion to $2 billion and 10-plus years). The advent of broadly available molecular and synthetic biology tools and artificial intelligence and machine learning approaches has substantially reduced barriers to the generation of viral, bacterial and toxin threats tailored for specific effects and able to subvert existing MCMs. It has even enabled development of novel threat categories. This creates a dynamic, growing and potentially unpredictable threat space.

While acquisitions are still needed for MCMs that address known biological weapons, increasing investments are being made for broader capabilities-based approaches that enable a highly innovative response system to rapidly counter both known and unanticipated threats. Capability building does not fit neatly into typical requirements development mechanisms, so systemic changes to the requirements process may be needed to stabilize funding for capabilities establishment and maintenance. This strategic shift in our biowarfare defense posture toward capability-based solutions has been slowly unfolding for several years but is now rapidly evolving to maintain parity with our adversaries' potential to rapidly design and field novel weapons.

The Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense (JPEO-CBRND) is operating with a clear vision of the end goal. Operational effects and casualties resulting from a biological warfare event should be significantly limited by both physical and MCM layers of protection, and the warfighter should be able to effectively operate in a biologically denied environment. MCM development technologies and approaches are just now reaching the potential for operational relevance early in a response—something that wasn't thought possible even a few years ago. The envisioned response in the near future might look like this:

- A biological attack is confirmed against forward deployed warfighters and pathogen DNA sequence is sent with a request for rapid MCM development.
- The sequence is processed, critical targets for MCMs are rapidly determined.
- Using an advanced integrated computational MCM design system, and leveraging some of the world's fastest supercomputers, several hundred MCM candidates are generated in a matter of days versus the traditional months of discovery efforts.
- Computational candidates are produced and tested in a dedicated rapid response lab that has full automation to accept inputs from the computers and

FIGURE 1

COUNTERMEASURE QUALITY

GUIDE computationally designs MCMs to meet design specifications for the critical quality attribute categories of safety, efficacy, manufacturability (MFG) and pharmacokinetics (PK; how long the drug lasts) and pharmacodynamics (PD; where the drug goes in the body). There are many subfactors of each quality attribute category. The goal is to computationally simultaneously optimize all quality attributes at the earliest timepoint, reducing developmental risk and providing an optimal MCM candidate. (Graphic courtesy of the authors)

execute 24/7 laboratory testing using automated systems.

- The final selected MCMs, having been computationally optimized for a target production process, require no process development and are manufactured in a biomanufacturing facility using pre-negotiated priority access rights, which accelerates entry into clinical trials by months.
- The drug product undergoes accelerated pre-clinical and clinical testing and is deployed to the warfighter with all appropriate Force Health Protection and Food and Drug Administration oversight.

To achieve this vision, a revolutionary acceleration of drug development is required that necessitates a fundamental and difficult shift from traditional, lengthy, physical experimentation toward innovative computational approaches, integrated rapid response laboratories, aligned biomanufacturing facilities, as well as accelerated regulatory pathways and contracting solutions.

The JPEO-CBRND is currently funding initiatives to enable MCM rapid response to a biological attack on the warfighter. One major effort is the Generative Unconstrained Intelligent Drug Engineering (GUIDE) program, which is a large interagency collaboration that uses advanced computational approaches (e.g., molecular simulation, machine learning, deep learning, large language models) to strategically accelerate drug development and reduce developmental risk. The goal of GUIDE is to fully computationally design MCMs that are highly effective/potent, safe, manufacturable, and that minimize logistical burden on military forces. GUIDE will accomplish these ambitious goals through a highly integrated set of computational tools that simultaneously optimize a multitude of MCM critical quality attributes (Figure 1). As they come online, these integrated tools will replace much of the trial-and-error experimentation approach to MCM development to achieve optimal candidates. This will significantly reduce development timelines and substantially decrease the risk of MCM failure during development, which frequently occurs because of safety, efficacy or manufacturability issues.

GUIDE requires a broad interagency collaboration due to its aggressive programmatic goals, interdisciplinary nature, system complexity and national security focus. While funded through the JPEO-CBRND, the Depart-

ment of Energy National Nuclear Security Laboratories provide not only technical expertise but also a significant cost share in GUIDE program implementation and use through access to the robust high-performance computing facilities at Lawrence Livermore National Laboratory. Lawrence Livermore, Los Alamos and Sandia National Laboratories as well as the Department of Homeland Security have critical roles in MCM testing and generation of machine learning training data for GUIDE models and tools. GUIDE also heavily leverages expertise across academia to develop and improve computational subsystems and provide threat and MCM expertise. Industry is contracted to assist in providing threat-specific computational model training data as well as the materials and high throughput methods critical for MCM testing following computational design campaigns. These necessary and complex partnerships require significant acquisition oversight to ensure appropriate intellectual property management, data integrity, streamlined communications, program protection and operational availability routinely and especially during crises.

As described in the envisioned response sequence, GUIDE is only one component of an overarching MCM rapid response system. The JPEO-CBRND is strategically assembling acquisitions into a system of systems. For example, GUIDE is collaborating with designated biomanufacturing facilities to develop computational methods to design MCMs specifically tailored for target manufacturing processes. This "design-for-process" approach could decrease fielding time by several months by eliminating the need for process development. Critically, priority access has been negotiated for these facilities as part of the acquisition plan, thus stabilizing both ongoing access and the ability to collaborate on, and benefit from, the design-for-process activities. Similarly, all MCM development contracting actions are negotiated with response options whereby the MCM developer response can be activated by the simple exercise of a contract option, saving significant time on contracting. This system-of-systems response framework is actively exercised through routine MCM development activities, but also through a series of "live fire" exercises simulating a response to a biological warfare event and creating MCMs against an actual target pathogen or toxin. These exercises are increasingly coordinated with geographic combatant commands to ensure all approaches are tailored to end user requirements.

The timeline goal for rapid response MCM delivery is 100 days or less—in stark contrast with the more typical timeline of several years. This is a very ambitious and currently unrealized goal, but with well-reasoned and strategic acquisition plans and mileposts, an emphasis on system integration and a dedication to funding, managing and operationalizing highly innovative solutions, it is increasingly likely that goal will be met in the near term. The increased parity of our defensive response capability with adversary weapons development timelines may be a significant deterrent to the use of biological weapons, which is the best-case scenario for warfighter protection. If that deterrent fails, it is critical that we are prepared to the highest possible degree to respond with safe and effective MCMs to limit casualties and ensure that the warfighter can achieve all mission objectives.

HONORABLE MENTION

Shop 'til You Drop: Introducing the Tradewinds Solutions Marketplace.

By the following author:
Bonnie Evangelista

Technology advancements are happening at a rate not seen before and are "changing the character of war."[1] This is an undeniable truth and has a significant impact on military operations and the technology required to support the future battlefield and Department of Defense (DOD)'s response to the emerging threats.

Artificial intelligence (AI) is rapidly changing how we live and do business, and national security is not exempt from this trend. The DOD has placed significant focus on AI adoption and delivery by establishing the Joint Artificial Intelligence Center (JAIC)[2] in 2018, which was later reorganized into the Chief Digital and Artificial Intelligence Office (CDAO) in 2021.[3] The creation of these entities is a significant organizational change, arguably reinforcing the fact that AI can and will have a substantial influence on the DOD enterprise.

The magnitude of change required to embrace new technology, and ultimately new ways of doing business, is

not an easy feat. Realizing a future that embraces Deputy Secretary of Defense Kathleen Hicks' "urgency to innovate"[4] philosophy requires an organizational culture evolution and a technological transformation. The July 2021 Biannual Report to Congress of the JAIC reaffirms this notion, stating, "Long standing traditions, processes, and methods must be reshaped to reflect the realities and opportunities of a modernized security apparatus."[5] The imperative to materialize change within current acquisition processes and support rapid delivery and adoption of cutting-edge warfighter capabilities could not be more profound.

Critics recognize that DOD acquisition processes, regulations and culture pose certain difficulties to rapid procurement and delivery. The traditional procurement process has a reputation for being lengthy, overly burdensome and rigid to the extent acquisition professionals seek strategies to avoid contracting all together. The United States cannot respond to the emerging threats or the changing battlefield if the acquisition process is not accelerated. Contracting professionals must be able to buy technology solutions before they become obsolete. To do this, they require streamlined acquisition strategies to rapidly scale solutions that deliver the best outcomes for the warfighter.

Practitioners charged with delivering cutting-edge technology are now faced with the reality that the status quo is unacceptable. Change is required to meet the demands of national security and it needs to be done with a sense of urgency. With these objectives in mind, the CDAO implemented the Tradewinds Solutions Marketplace initiative.[6] Created to offer a low barrier to entry point for industry and academia, the Tradewinds Solutions Marketplace identifies technology solutions, ongoing research efforts and proposed development activities that are relevant to the DOD. The Marketplace initiative is one of the ways in which CDAO is bridging the gap between industry providers and the government customers seeking solutions. Providing access to solutions in one centralized location allows DOD customers to acquire AI, digital and data solutions quickly.

In November 2022, the CDAO released a long-term, open call general solicitation on the System for Award Management (SAM) platform, formally implementing the Solutions Marketplace.[7] Some key features that make the Solutions Marketplace initiative unique are:

1. Industry respondents submit short video pitches instead of white papers or technical proposals, lowering the barrier to entry when doing business with the DOD. The video format aligns with commercial business practices via "shark tank" style presentations.
2. Videos are assessed by a peer panel made up of government, industry and academic subject matter experts against published criteria in the solicitation before being placed within the Marketplace. Feedback is provided immediately to the submitters after each assessment, maintaining fair and transparent evaluations.
3. All videos placed on the Marketplace feature capabilities that are awardable at any time, by any DOD customer, for any amount, under any procurement contract or other transaction agreement. Essentially, streamlining the process by which a DOD customer can view an array of technology solutions and accelerate the contracting process.
4. The Marketplace provides an opportunity for companies with either a groundbreaking technology but are struggling to get in front of the right DOD customer or companies that have identified prospective customers but lack a contracting pathway. This addresses a major barrier to small businesses and nontraditional defense contractors as they no longer will have to hunt for pathways to contracts.
5. The Marketplace is agnostic to buyers and buying activities. Awards resulting from the Marketplace can be made through the CDAO or any contracting activity. This includes programs such as partner intermediaries, other transaction-based consortia, multiple award indefinite delivery-indefinite quantity programs, and public-private partnerships.
6. All DOD and military service customers can use the marketplace for their relevant requirements, which encourages the exploration and adoption of technologies across the DOD enterprise.

The Tradewinds Solutions Marketplace showcases solutions for DOD in a simple to search platform. Once an industry video is submitted and assessed against predetermined criteria, it is assigned an "awardable" or "not awardable" rating. "Awardable" solutions are placed in the

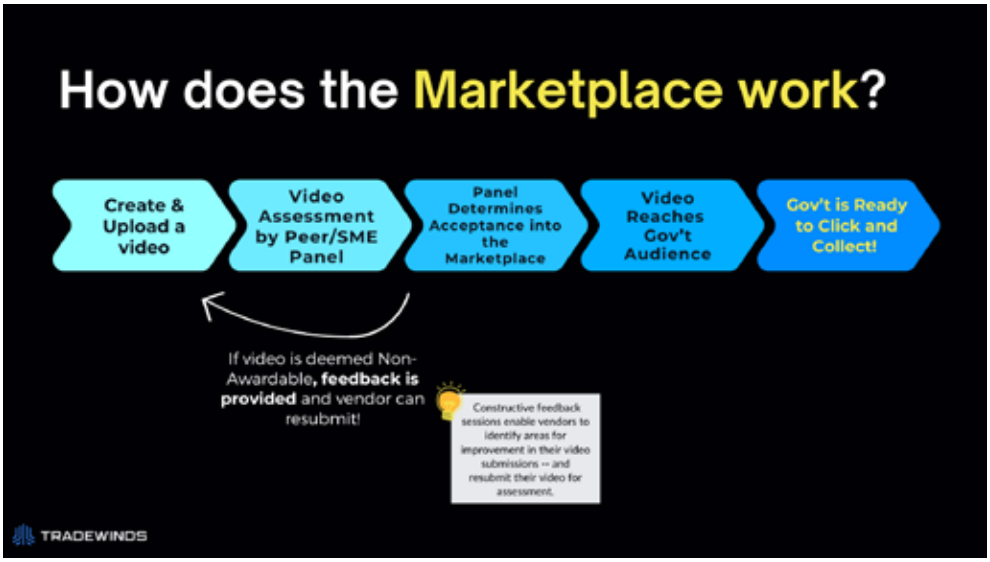

FIGURE 1

MARKETPLACE PLATFORM

The Tradewinds Solutions Marketplace features solutions for DOD in a simplistic, searchable platform. (Graphic courtesy of the author)

Marketplace for viewing. From there, a government buyer can choose to have a one-on-one discussion, request a pitch or demo, or initiate a project award with providers within the Marketplace that have "awardable" solutions (See Figure 1).

How is this possible? Upon identifying compelling solutions, the Marketplace has already established the competitive environment to comply with Federal Acquisition Regulation (FAR) requirements and non-FAR-based authorities for entering a procurement contract, other transaction agreement or assistance agreement. The Marketplace general solicitation conforms to the competition requirements of 10 United States Code (USC) 4021 and 4022 Other Transaction Authorities (OTA), FAR and Defense Federal Acquisition Regulation Supplement (DFARS) Part 35 Broad Agency Announcement procedures, and Class Deviation 2022-O0007 Commercial Solutions Opening (CSO) procedures, implementing Section 803 of the Fiscal Year 2022 National Defense Authorization Act (NDAA). Thus, capabilities showcased in the Marketplace are readily available to be viewed, selected and awarded by DOD activities using any of the applicable authorities and regulations.

The most notable feature of the Marketplace is that it was designed to be a mutually beneficial tool. It accelerates and streamlines the assessment process and search for solutions for the DOD customer, but it is a game-changing opportunity for industry trying to increase exposure for their product or service among government buyers and end users. The Marketplace offers a unique opportunity to showcase their solution and pitch their value proposition all in a simple five-minute video. Simply put, the Marketplace enables industry innovators to get their solutions quickly and easily in front of government buyers. No more time spent in lengthy source selections and down-selects—just shop for a solution and buy it.

Reducing the time required for both DOD customers and industry to find and display solutions is a culture shift in itself. The creation of the Marketplace has changed the way both parties view government procurement and technology adoption and created an environment that fosters a new level of collaboration and creativity not seen before within the DOD.

To date, using a long-term, open call general solicitation to satisfy multiple competitive standards and authorities, which is the underpinnings of the Marketplace execution, is something that has been infrequently used (if at all). Implementing this type of solicitation aligns with the Tradewinds objective of deviating from doing business as usual and creating different pathways to enable rapid

procurement and adoption of technologies.

Further, since the Marketplace is contract activity and instrument agnostic, it supports scalability. By leveraging the statutory authorities available, the Marketplace provides a technology transition pathway from idea to research, research to prototype, prototype to test and evaluation, production, fielding and sustainment of a given technology solution.

Additionally, awards can be made from the Marketplace leveraging a new contract action or leveraging an existing program, by any contract activity or program. This includes existing partner intermediary agreements, Other Transaction Consortia, University-Affiliated Research Centers (UARCs) and similar programs. When it comes to contract execution, the TSM team can provide direct contract solutions, or it can support activities in leveraging their own existing pathways.

Developed and officially launched on Nov. 1, 2022, the Marketplace has gained both attention and traction among the target communities of cutting-edge technology firms and government organizations. Since launch, the Marketplace team has assessed 407 video solutions and placed 173 video solutions into the Marketplace as "awardable." The CDAO has executed more than 10 project awards leveraging this methodology over the last six months. Forward-leaning organizations, such as the Air Force Digital Transformation Office, are executing multiple awards in support of their Fiscal Year 2023 requirements as well.

The Marketplace's success outlined above and continued positive momentum is indicative that both industry and DOD customers are eager to accelerate the procurement and adoption processes for innovation technologies to support best-of-breed warfighting capabilities. More importantly, the Tradewinds Solutions Marketplace is helping change the perception of contracting with the government, which will have a larger impact on overall technology adoption across DOD. The organizational and cultural changes that are required to provide the U.S. with a competitive technology advantage will go hand in hand with the technology that enables a faster acquisition process. The Tradewinds Solutions Marketplace is sparking that change. The Marketplace embodies the culture change DOD must embrace to provide the DOD with the best technology as quickly as possible.

Notes:

[1] Department of Defense, Summary of the 2018 National Defense Strategy of the United States of America (2018).

[2] Deputy Secretary of Defense Memorandum, Establishment of the Joint Artificial Intelligence Center (Jun. 27, 2018).

[3] Deputy Secretary of Defense Memorandum, Establishment of the Chief Digital and Artificial Intelligence Officer (Dec. 8, 2021).

[4] Deputy Secretary of Defense Kathleen Hicks Keynote Address: 'The Urgency to Innovate', https://www.defense.gov/News/Speeches/Speech/Article/3507156/deputy-secretary-of-defense-kathleen-hicks-keynote-address-the-urgency-to-innov/.

[5] Joint Artificial Intelligence Center, Biannual Report to Congress of the Joint Artificial Intelligence Center (June 2021) (CUI).

[6] https://www.tradewindai.com/solutions-marketplace.

[7] https://sam.gov/opp/80ed1dcab9304fc0bb5095531cc3f0d9/view.

Category: Lessons Learned

WINNER

Operationalizing Discovery: Lessons Learned from a DEVCOM Science Adviser

By the following author:
Lt. Col. John M. Williams II

Much has been written about the need for acquisition reform. The topic is regularly addressed in opinion pieces and studies, and it is generally agreed that the DOD must adapt in order to adopt new and innovative technology more regularly. Otherwise, that technology will end up within "the valley of death," and we will be behind our adversaries. While most of the articles focus on policy, funding and training, very few discuss the role of people in both maturing and transitioning new technology. All services currently provide senior scientists and engineers as special advisers to major commands, who play a critical role in defining technical requirements as well as leading experimentation. The U.S. Army Combat Capabilities Development Command (DEVCOM), the Army's largest science and technology (S&T) formation, currently provides Field Assistance Science and Technology (FAST) advisers across the globe as part of their three forward elements. These advisers are either senior researchers from one of the eight DEVCOM centers, or field grade acquisition officers in a developmental role. Over the last year, I was privileged to serve as the FAST director for DEVCOM Indo-Pacific, leading a team of eight advisers in Hawaii, Korea, Japan, Alaska and Joint Base Lewis McChord, Washington. In that role, our team learned some critical lessons that help demonstrate how the right people, serving at the interface between the warfighter and the modernization enterprise, can shepherd technology maturation and adoption.

Lesson 1: Understand your role

The role of the FAST adviser has its origins in the early days of the Global War on Terror, where acquisition officers with STEM backgrounds were forward-deployed to quickly find solutions to warfighter needs in combat. As the war changed, the role of the FAST adviser changed as well. As part of my initial counseling, the DEVCOM commanding general was clear on the role of FAST advisers as his "scouts," out looking for opportunities for DEVCOM to make a difference for the warfighter, looking for emerging gaps, and looking for new technologies that will matter. But it was not enough to simply find new technology. As the forward representatives of the modernization enterprise, FAST advisers have an implied responsibility to connect capabilities to the needs of the warfighter and leverage their knowledge of the Army acquisition process to mature technology. Our team called this process "Operationalizing Discovery."

The systemic approach would first categorize the new technology as an incremental improvement on a current capability (modernization) or a transformational change in our approach (innovation). This classification helps to distinguish the challenges the technology will need to overcome and the audience to prioritize engagement. The challenge for modernization technology is ensuring the effort of upgrading a product is worth the cost, and the audience is the acquisition community responsible for that product. In contrast, the challenge for innovative technology is getting buy-in on a novel approach to accomplishing the mission, and the primary audience is the warfighter. Next, the team asks a series of questions: What mission does this technology attempt to accomplish? Who is responsible for that mission? How is the mission being done now? These questions help focus the technology to a mission gap and allow the adviser to communicate the concept of the technology in an effective way. Lastly, the adviser uses their knowledge of different funding opportunities and programs to mature the technology and demonstrate the concept. The process has been an effective methodology for our FAST advisers to address gaps within the Indo-Pacific theater with cutting-edge technology.

Our team shared this concept in engagements across the theater, including trade shows, conferences and accelerators where we had the opportunity to interact with industry leaders. Understanding the current mission of the FAST adviser and taking a systemic approach to that mission was a part of the success our team observed in the Indo-Pacific theater. It also opened the door to several other critical lessons learned through the past year that speak to the role of the FAST adviser in maturing technology.

Lesson 2: Knowing is half the battle. Learning is so much more

One key lesson was the importance of learning. While our team of FAST advisers included a number of subject matter experts in fields like arctic warfare, artificial intelligence and electronic warfare, no team of advisers can know everything about all fields necessary to support the warfighter, especially warfighters with such varied and complex needs as those in the Indo-Pacific theater.

Over the last year, challenges ranged from data sharing with allies, to tactical nuclear power plants, to leopard snails and more. Beyond that, we were often asked to understand the bleeding edge of technology coming from industry and academia, as well as new projects being led by advanced government agencies. Our team learned early that our job was not to be the expert in the room. Instead, it was to be able to quickly learn about topics and translate complex ideas into terms that matter to the warfighter. This is also true of the various DOD programs and tools being used to mature technology. While many of the advisers have experience with one or two different programs, none of us knew them all, so we relied heavily on our connections with program leads at the Army and DOD staff to learn what we did not know. This was a critical realization, as it reduced the pressure on the FAST adviser to be an expert, and instead leveraged our backgrounds learning STEM fields to practice asking the right questions and communicating the answers.

Our team also knew how to research topics and reach back into the right pools of experts within DEVCOM, where over 28,000 scientists and engineers could supplement our knowledge. Last year, we took this approach to address a demand signal where the theater was looking for better tools and understanding of the networks planned for theater operations. While none of the eight FAST advisers were network experts, our team funded experts from the DEVCOM C5ISR Center to come and provide direct support for six months, meeting with key leaders, answering questions, and developing tools to meet their needs. In short, for new FAST advisers working to mature technology outside of their field, knowing is great, but the ability to learn and communicate is better.

Lesson 3: Innovation is a team sport

Another key lesson was the importance of the team. There are so many entities, both public and private, that exist for the purpose of helping the military meet its technical needs. While each of these organizations are unique, with different resources and priorities, their efforts need to be synchronized to be effective. Our team often served as the first stop for many of these organizations that wanted to have a meaningful interaction with the warfighter.

The FAST adviser needed to be able to understand the differences and similarities of each organization, whether Army, DOD, federal, state or private, and help them to understand the best ways to impact the mission. Over the last year, our team drastically increased our interactions with various agencies and worked to understand their programs to transition new technologies. Our team was able to coordinate and support multiple new events, like the RCCTO Industry Day and the National Security Innovation Network (NSIN) Propel Accelerator, to better connect these agencies with the needs of the theater. Understanding the capabilities of the different organizations working on modernization was critical to building an effective team, and that team can be a key asset in adopting new technology.

Lesson 4: Great ideas come from everywhere

While the acquisition processes are traditionally driven from the top down, leaning heavily on requirements from senior leaders and technology from large companies in the defense industry, great ideas are found everywhere. Our team of FAST advisers invested our time interacting heavily with small businesses, academic institutions, foreign companies and tactical units to get new perspectives on both the gaps and the possibilities. That time allowed our team to advocate for ideas that do not often bubble to the top. We also worked to codify the avenues for great ideas to flow and be recognized, such as educational partnership agreements with local universities, the xTech Pacific competition for small businesses, and most critically, the DEVCOM Catalyst Pathfinder Program. Through the Catalyst Pathfinder program, Soldiers throughout the theater can nominate problems and propose solutions for the modernization enterprise to address by accessing the 11th ABN, 25th ID, or USARPAC tenant pages (https://www.usarpac.soldierinnovation.com). Those nominations are curated by unit innovation officers as well as the FAST advisers, and if selected for a project, are shared with academia, industry and government labs. This program is already paying dividends in developing meaningful technology that Soldiers want and demonstrates another key role of the FAST adviser to champion ideas from nontraditional sources and the bottom up.

Lesson 5: Control what you can control

Finally, it is important for FAST advisers to understand their span of control. Advisers do not command any units, control any funding lines, nor hold any acquisition charters. Their primary function is to advise and influence. That influence is rooted in the value of their advocacy, their ability to deliver expertise, their ability to communicate effectively, their access, and most importantly their earned trust. Many of the accomplishments seen in the Indo-Pacific theater FAST team were based on the trust between the advisers and the various commands. While each of the advisers are DEVCOM assets first, their close relationships with the host commands are what empowered them to be successful in the role. During the most recent Land Forces Pacific Conference, the FAST Team was able to leverage relationships with local authorities, the Navy Space and Naval Warfare Systems Command (since renamed Naval Information Warfare Systems), the University of Hawaii Advanced Research Lab and the 25th ID to host the first live fire demonstration of a foreign counter-UAS system in front of delegations from four different countries. The team had neither the funding nor authority to make the event happen; however, they were able to leverage relationships to create this opportunity to mature and transition the technology.

Conclusion

As we continue to propose reforms in organizations, policies and authorities to improve the acquisition processes, we must recognize the role of people to shepherd technology over the valley of death. People who understand both the needs of the warfighter and the bleeding edge of capability. People who can communicate effectively in the lab, with the acquisition community and with the warfighter. People who are empowered to advocate, advise and advance capabilities. Ideally, these people would receive STEM education, the acquisition training, the senior leader access, and programmed funding to be effective in this role. My hope is that DEVCOM FAST advisers can leverage these lessons learned to better perform their duties, and that leaders across the enterprise recognize how advisers operationalizing discovery can make a difference.

HONORABLE MENTION

Lessons Learned: The Need for Best Practices for Coding Diagnostics and Troubleshooting in Army Technical Publications.

By the following author:
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Background

The Electronic Publications (E-Pubs) Mission of the Tank-automotive and Armaments Command (TACOM) Integrated Logistic Support Center's (ILSC) Publications Services Team has been given the responsibility to convert all Electronic Technical Manuals (ETMs) and Interactive Electronic Technical Manuals (IETMs) for which the ILSC has ownership to data sets compliant with Interactive Authoring Display Software (IADS). This is pursuant to chapter 13, section 5 of AR 750-1, Army Material Maintenance Policy, says, "Effective First Quarter, FY24, IADS will be the only authorized viewer for all ETMs and IETMs."

During this effort, the E-Pubs Mission has had the opportunity to review Extensible Markup Language (XML) developed by a variety of technical writers and contractors, and the many authoring strategies they have developed for meeting the requirements of MIL-STD-40051-1/2 and other regulations governing technical publications development. The E-Pubs Mission has also been able to identify problems with these authoring strategies, as well as possible improvements.

No aspect of these data sets has given the E-Pubs Mission more difficulty than troubleshooting and diagnostics. Technical writers and contractors have a surfeit of options for developing this content but lack the guidance to effectively choose between these options. This often results in bloated work packages of dubious usability, unwieldy for the Soldier who must consult them and unreadable for the writer who must revise them.

The paper will elaborate on these issues, describe best practices for correcting them, and propose a path forward.

Diagnostics development regulations

Part of the problem with developing troubleshooting and diagnostic work packages is how the guidance is presented in the regulations. This section attempts to sort the regulatory guidance into something more linear.

Diagnostic work packages can be ruled out entirely if the manual is a page-based ETM. Diagnostic work packages are only permitted in IETMs, and therefore the regulations outlining their development are covered only in MIL-STD-40051-1D, Preparation of Digital Technical Information for Interactive Electronic Technical Manuals (IETMs).

MIL-STD-40051-1D defines two types of troubleshooting models:

- Simple diagnostic mode (D.4.14.1): The simple diagnostic mode is defined as being linear, using binary logic. The simple diagnostic mode could just as easily be presented in a page-based ETM as in an IETM.
- Complex diagnostic mode (D.4.14.2): The complex diagnostic mode is defined as being able to support everything the simple diagnostic mode can, while also allowing for user input (both manually and through interfacing with test equipment/hardware) and manage it linearly or non-linearly through a state table. The complex diagnostic mode can only be used in an IETM.

The complexity of a troubleshooting procedure is determined by the Complexity Factor columns in Table A-XVII, the functionality matrix. Complexity is measured with a baseline of one, with each higher number representing a multiplication of complexity (e.g., "2" is twice as complex as "1"). The complexity factors assigned to the six functionalities in the diagnostics and prognostics category in the functionality matrix are listed in Table 1.

What functionalities are required by the IETM will depend on the system and the Failure Mode, Effects, and Criticality Analysis (FMECA) conducted on it, in accordance with ANSI/AIAA-S-102.2.4, per AR 700-127, Integrated Product Support.

While MIL-STD-40051-1D does not say this explicitly, it may be surmised from the functionality table that linear diagnostics with user-determined entry to the IETM use the simple diagnostic mode, while all other diagnostics functionalities use the complex diagnostic mode. The simple diagnostic mode may therefore be said to be the baseline for complexity, with the complex diagnostic mode being two to five times as complex.

MIL-STD-40051-1D authorizes two different methods for authoring diagnostic work packages: Test without state, for simple tests (D.5.6.3), and test with state, for complex tests (D.5.6.4). But as of Document Type Definition (DTD) 6.3, the <testwithoutstate> element is no longer supported. It may therefore be inferred that all diagnostics in the simple mode should be written as troubleshooting work packages (<tswp>), as in a page-based ETM, while all diagnostics in the complex mode should

Complexity Factor		Functionality
Linear	Non-Linear	
1	1	Diagnostics – User-Determined Entry to IETM
2	2	Diagnostics – Software-Driven Entry to IETM
NA	5	Dynamic Diagnostics
NA	5	Prognostics
4	4	System Simulation
4	4	Wire/Fluid System Tracing

Table 1. Complexity factors for diagnostics and prognostics.

Manhours	1	2	3	4	5
Cost	$72.95	$145.90	$291.80	$583.60	$1,167.20

Table 2. Cost of a technical writer per manhour.

be written as diagnostic work packages (<diagnosticwp>). Assuming manhours scale with complexity, for every one manhour needed to develop a troubleshooting work package, a diagnostic work package would require two to five manhours. Table 2 illustrates this, assuming a GS-12 technical writer costing the program $152,265.19 per annum and calculating the cost per manhour using the Office of Personnel Management's (OPM) 2,087-hour divisor.

A revision effort for an operator technical manual was recently contracted for $2,093,789.62; a new manual can cost twice as much. Given these numbers, there is clearly an incentive to cut costs wherever possible, and opting, where appropriate, to develop troubleshooting work packages instead of diagnostic work packages is an easy way to do so.

Dome lights diagnostics: A case study

One experience during the E-Pubs Mission's IADS conversion effort demonstrates well the differences in complexity and required effort between troubleshooting work packages and diagnostic work packages.

In one data set being converted by the E-Pubs Mission to an IADS-compliant format, 62% of the remaining errors in the book, according to IADS's internal Source Verify system, were found in the 183 work packages that used <diagnosticwp> as a root element.

One work package, which covered diagnostics for the vehicle's dome lights, had 110 Source Verify errors alone. The work package took about fifteen minutes to load each of the branches of the diagnostics tree, perhaps because it consisted of 41,386 lines of XML code. The E-Pubs Mission thought it would be a worthwhile experiment to rewrite the work package using root element <tswp> to see if this could be done while still representing the same underlying troubleshooting logic.

The experiment was successful. The new troubleshooting work package used 3174 lines of code, only 7.7% of the original diagnostic work package, while preserving the underlying logic. Admittedly, certain elements, including entity declarations, initial setup information, and graphics, were not included in the troubleshooting work package, since they were not necessary for testing the logic of the troubleshooting procedures and would only have added to the scope of the effort. But these would only have added at most another thousand or so lines of code, and the work package would still have been significantly smaller than the original work package.

The experiment also revealed errors in the logic of the original authenticated source code. A number of choice buttons in the original diagnostics work package did not actually alter the state table, making them essentially non-functional.

The results of the experiment led the E-Pubs Mission to the conclusion that further study of the issue was needed, beginning with an analysis of the regulations governing the development of troubleshooting and diagnostics work packages. The issues in the dome lights diagnostic work package were representative of the issues found in other diagnostic work packages within the technical manual for this vehicle, as well as those found in diagnostic work packages in other manuals.

Conclusions

The issues in the dome lights diagnostic work package were representative of the issues found in other diagnostic work packages in the technical manual for this vehicle, and in other technical manuals for other systems.

Due to the way the DTD works, technical writers have the option of coding a work package as a diagnostic work package even when this is not the recommended course of action. While MIL-STD-40051-1D provides guidance for when to choose between troubleshooting and diagnostic work packages, understanding and applying this guidance is made difficult by the way the information is organized and presented. Technical writers do not receive as much formal training in the specifics of their

profession as they ought to (a gap the E-Pubs Mission has attempted to fill) and often default to following the practices they have observed working with legacy manuals. As a result, there seems to be a widespread assumption that IETMs, being interactive, require their troubleshooting procedures to be coded as diagnostic work packages with state table manipulation, something the experiment with re-coding the dome lights work package and a review of MIL-STD-40051-1D demonstrates is not the case.

The dome lights diagnostic work package demonstrates that coding state table manipulation into a system greatly increases the size of the work package, making it slower for users to load. Worse, since the complexity of diagnostic work packages makes them more difficult to review for errors, it is possible for non-functional work packages to slip through the verification process.

To resolve these issues, the following course of action is recommended:

- First, training must be developed to allow technical writers to better navigate the regulations already contained in MIL-STD-40051-1D.
- Second, guidance should be developed for applying the functionality matrix in MIL-STD-40051-1D to the output of the FMECA for a system to determine which method should be used at the earliest possible point in the publication's development.
- Third, the next revision effort for MIL-STD-40051 should improve the navigability of the regulations governing the development of troubleshooting and diagnostic work packages.
- Finally, it should be required that all technical publications undergoing change package or revision efforts should have their diagnostic work packages reviewed to see if they were developed in accordance with regulation and if they can be re-coded as troubleshooting work packages.

The IADS conversion effort is the perfect time to begin implementing these recommendations to make sure that Soldiers can perform the necessary troubleshooting and diagnostics for their equipment.