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JANUARY-MARCH 2019

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ASA(ALT)'s xTechSearch narrows competition for $200,000 award

INDUSTRY INSIGHT
We asked industry what our readers need to know

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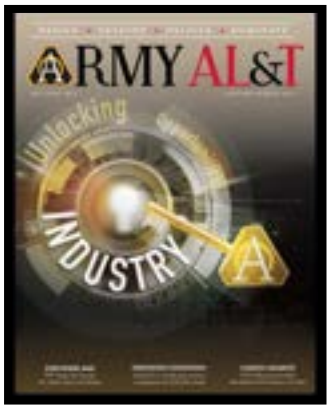
ARMY AL&T

JANUARY-MARCH 2019

FEATURES



ON THE COVER

Understanding how industry works—what its motivations are, what an appropriate profit margin is, how much overhead should cost and what challenges it faces—is key to Army acquisition professionals developing the skills and knowledge needed to do their jobs.

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ARMY AL&T

JANUARY-MARCH 2019

FEATURES

SCIENCE & TECHNOLOGY

? CRITICAL THINKING

COMMENTARY

WORKFORCE

THEN & NOW

To the Editors:

I read the article ["If It Ain't Broke...," Army AL&T, October-December 2018].

The 25th Transportation Company from Schofield Barracks, Hawaii, reported that switching from an "every X months" schedule to an as-needed maintenance schedule seriously sharpened the diagnostic skills of the unit's vehicle doctors and kept the fleet running just as well as the more expensive previous schedule.

This is not a new maintenance effort or philosophy or system in the Army.

I can go back to Schweinfurt, Germany, in the 2nd Battalion, 64th Armor Regiment in the 1960s-70s, and visualize IROAN (Inspect and Repair Only as Needed) being painted on the maintenance company's concrete floor and stenciled on the outside of the front of the building.

The result was a reduction of maintenance time-hours spent having equipment turned in to battalion maintenance per the TM [technical manual], and having a higher density of troops with their equipment in a ready-to-go status.

We had daily operator checks, and in the battalion motor pool, all crews had stand-to on Friday afternoon. With levies for troops to go to Vietnam, that left a vacancy in unit personnel strength.

Jon W. De Armond
Logistics Management Specialist
U.S. Army Materiel Command Logistics Support Activity
Redstone Arsenal, Alabama

Army AL&T welcomes letters to the editor. All letters are edited for style and length.

From the Editor-in-Chief

@ Email Nelson McCouch III
ArmyALT@gmail.com

Years ago, when I was a communications director with a major defense firm, I remember a meeting where the president of my line of business was frustrated with the status of major contracts. The issue was the seemingly constant changes in requirements, cost and schedule. My boss at the time said, "If they would just tell us what they want, we can build anything!" And there's the rub.

As you probably know, the government often isn't familiar with all the capabilities available on the commercial market, as new technology and production processes are popping up all the time. Conversely, industry isn't in the business of spending billions building weapon systems in the hope that the government will like them.

It's the government's job to identify what our Soldiers need to fight and win on the battlefield. However, like technology, the battlefield for national defense and what is needed to secure victory are ever-changing. With our old industrial-age acquisition process, the government can take two years or more just to develop the requirement, then another five years or so to field the system. By that time, the technology could easily be out of date. That, in turn, means that requirements, costs, performance and schedule have to change.

Now, layer on top of that the sometimes conflicting needs of industry to actually make a profit, and for the government to get a meaningful return on its investment of hard-earned taxpayer dollars, and you can see that acquisition is fraught with turmoil even on a good day.

In addition to streamlining our bureaucracy, for the Army to maximize its investments and provide meaningful materiel solutions to the warfighter, we need to better understand industry, its capabilities, market conditions and its key driver—profit! We need to make the acquisition process easier for them, and for us.

A critical task for the Army acquisition community is to communicate clearly with industry not only about our requirements, but about its requirements, and to develop "a policy that carefully balances the goals of fostering private innovation with long-term sustainment considerations," as the Hon. Dr. Bruce D. Jette, the Army acquisition executive, states in his column ("Intellectual Property Lines," Page 6).

In a recent article on LinkedIn about game theory, author, educator and supply chain entrepreneur Kate Vitasek summed up the issue well: The Army and its legions of contractors, she wrote, "must have a mutual commitment to each other—and each other's success—over the long haul" to create win-win agreements.

How the Army tells industry "what we want" and creates win-win conditions is the focus of this issue. Read Dr. Jette's column and learn about initiatives that he and the secretary of the Army are taking behalf of acquisition reform. Find out which companies are in the running to receive a $200,000 award by virtue of the innovative capabilities they can offer, as part of the Army's Expeditionary Technology Search ("Innovation Countdown," Page 46). Finally, gain insights about industry and government partnerships from senior executives at Accenture Federal Services, Bell, General Micro Systems and PacStar in our "Industry Insight" section, starting on Page 106.

As always, if you have ideas, comments or even an article you would think would be of interest to our readers and the acquisition community as a whole, please contact us at **armyalt@gmail.com**. We look forward to hearing from you.

Nelson McCouch III
Editor-in-Chief

FROM IDEAS TO CAPABILITIES

The new policy on managing IP is the latest step in the Army's modernization and acquisition reform initiatives, all aimed at developing and delivering new capabilities to warfighters faster and more cost-effectively. (Image by Getty Images)

FROM THE ARMY
ACQUISITION EXECUTIVE
DR. BRUCE D. JETTE

INTELLECTUAL PROPERTY LINES

Army's new policy seeks cost-effective solutions for managing IP that balance the interests of government, industry and the warfighter

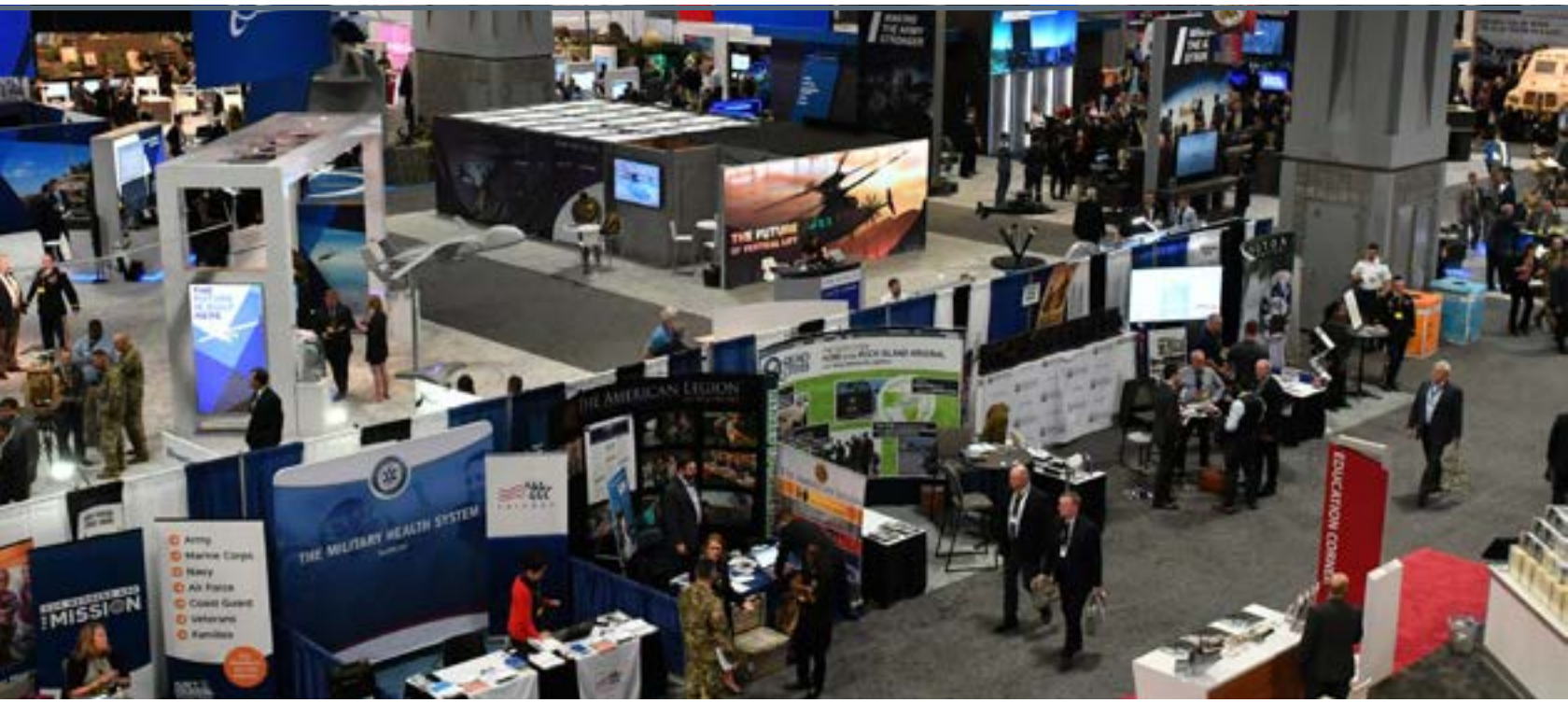
"We must be careful to ensure that the policies and practices governing intellectual property provide us with the necessary access to effectively support our weapons systems, but do not constrain delivery of solutions to the warfighter and do not dissuade commercial innovators from partnering with us."

—Secretary of the Army Dr. Mark T. Esper
Dec. 7, 2018

The Army continues to advance on a number of modernization and acquisition reform initiatives designed to develop and deliver new capabilities to warfighters more rapidly and cost-effectively than ever before. The latest is a new policy on the management of intellectual property (IP) signed by Secretary of the Army Dr. Mark T. Esper on Dec. 7. More than ever, IP is playing a critical role in our ability to modernize our weapon systems and maintain technological overmatch against our peers and near-peers.

IP is defined as "creations of the mind"—inventions, unique manufacturing processes, discoveries—for which owners are granted exclusive rights to control the use and dissemination. When discussing IP in the context of a weapon system or business system, we are often referring to technical data, like blueprints, drawings, technical specifications or computer software used in the system.

As a scientist, patent holder and former small business owner, I know that IP is the lifeblood of any company. It must be protected and fairly compensated, especially if we



MEETINGS OF THE MINDS
Through a continuous dialogue with industry, the Army can better articulate its technical and software data requirements, rights and intentions early. The Association of the United States Army (AUSA) Annual Meeting and Exposition is a major forum for such interaction. (Photo courtesy of AUSA)

plan to attract the cutting-edge innovations of nontraditional companies that are so necessary in today's environment. I also understand, however, that some IP is critical for the Army to be able to sustain its weapon systems over their long life cycles.

Through early planning for sustainment and appropriate investment in IP, we will give ourselves options. These options may improve readiness, reduce sustainment costs and increase availability—all critical factors in an Army facing unprecedented challenges from emerging threats, proliferation of technology and rapid innovation by our adversaries.

A BALANCED APPROACH

Developing a policy that carefully balances the goals of fostering private innovation with long-term sustainment considerations was my direction to Dr. Alexis Laselle Ross, deputy assistant secretary of the Army for strategy and acquisition reform, who spearheaded this entire effort and worked across all stakeholders to make the Army IP policy a reality.

This new, balanced approach represents a significant change in the way we manage IP. Historically, we have defaulted to one of two scenarios. We either demand more data and rights than required, which is costly and can drive away companies, especially nontraditional innovators not accustomed to working with DOD. Or, we wait until late in the acquisition process to negotiate IP rights, which may lock us into long-term, costly, sole-source arrangements with original equipment manufacturers.

The new approach is much more nuanced. It discourages a one-size-fits-all attitude and requires that we consider the unique needs of each weapon system and its components as we develop the IP strategy. Four key principles underpin the new policy:

Foster open communication with industry.
The Army must be transparent and open with industry, early and often. With a continuous dialogue, we can better articulate our technical and software data requirements, rights and intentions early, so that both parties are on the same page regarding mutually beneficial license arrangements. Most importantly, we want to ensure that these early discussions are protected. The new policy requires that extra steps be taken to protect all IP-related discussions.

Plan early and develop a customized IP strategy.
No two acquisition programs are alike. As such, data requirements and rights should not be treated the same. Each system will have different sustainment and modernization needs across

IT'S ALL IN THEIR HEADS

IP, which encompasses "creations of the mind" and grants owners exclusive rights to control use and dissemination, often refers to technical data, like blueprints, drawings, technical specifications or computer software, that support weapon and business systems. (Image by Getty Images)

A CONCEPT TAKES OFF

Bell Helicopter engineer Levi Hefner adjusts the propellers of a micro unmanned aircraft system in the wind tunnel control room during a visit to the U.S. Army Research Laboratory (ARL) at Aberdeen Proving Ground, Maryland. In the information sharing that underpins such government-industry collaborations, it is critical that the Army balance both parties' IP interests. (Photo by Jhi Scott, ARL Public Affairs)

its life cycle. Therefore, it is important that we train all of our workforce professionals, especially in program management and contracting, to assess these short- and long-term needs and develop a customized strategy aligned to those needs.

Negotiate custom data licenses.
After carefully assessing the needs, we must negotiate for the appropriate—not all—IP to support them. We should seek to develop creative and flexible approaches to IP so that we don't overpay for or stifle industry innovation. We will look to industry to help us develop such custom licenses.

Negotiate early in the process for competitive prices.
As good stewards of taxpayers' dollars, we must leverage economic principles when negotiating prices. To that end, the new policy encourages setting prices as early as possible in the process so that they are competitive.

CONCLUSION

This new policy is the first step in a cultural change within the Army. The next step is more detailed implementation guidance to the field, which we are developing for release in early 2019. We also assembled a team of experts from across the Army to identify what additional processes, guidance and training may be required to ensure that the policy is having its intended effect.

My objective is to empower and enable our workforce professionals to think differently and act appropriately to ensure that our organizations, policies, processes and tasks that consume time, money and manpower deliver real value.

In closing, I wish you and your loved ones a happy and healthy 2019!

WE **HEARD**, WE CONFERRED, WE **CONCURRED**

Thanks to everyone who took the time to complete Army AL&T's reader survey. Here's what we learned.

Contributing to Army AL&T lets you broadcast the work of your organization to a diverse network of print and digital subscribers, and might put you in contact with someone whose perspective or experience could further enhance your work.

Ever wonder about the origin of the Army phrase "hooah?" Some claim it dates back to the Civil War, and others think it started on Omaha Beach in 1944. Another group argues that it comes from the acronym HUA, which stands for heard, understood and acknowledged. We know as well as anyone just how crazy the Army is for initials (we do our best to edit them out), and that's how we're going to think about the results of the 2018 Army AL&T readership survey: HUA. Heard, understood, acknowledged. But it doesn't end there.

More than 800 people responded to the anonymous survey, significantly more than previous surveys, and the responses reflect a thoughtful, engaged and serious-minded workforce—people who are committed to Army acquisition, have a deep sense of service and really want to see their missions succeed. They also show that Army AL&T is making good on its commitment to provide readers with the information they need: Roughly half indicated that something they've read in the magazine has helped them do their job better. That's a statistic that makes us deeply proud. We helped with updated or improved business practices, helped our colleagues understand a specific aspect of acquisition, enabled folks to make changes based on lessons someone else learned, and offered updates on best practices, new technologies or key priorities of the assistant secretary of the Army for acquisition, logistics and technology.

The survey also showed us that when it comes to which format our readers like—hard copy, e-magazine, app or blog—there's a range of preferences. We know that readers like to share articles and would share them more often if there were fewer hoops to jump through. We're working on providing everyone with the best online experience possible and will update readers as changes are made. (In the meantime, if you need to change or add a subscription, go to **https://asc.army.mil/web/subscribe/**.) Unfortunately, we cannot do anything to change the security settings of the networks that many have to deal with to access the magazine.

With respect to content, we received all kinds of great ideas on what readers would like to see in upcoming issues, which are graphically represented in the word cloud. The full list is too long to include here, so we've posted it on milSuite with two goals:

learning more—and more frequently—about what you'd like to see in these pages, and identifying experts who'd be interested in providing their perspectives in a future issue.

This can't be stated often or strongly enough: Anyone in the Army Acquisition Workforce can write for Army AL&T. We urge everyone to do so. You don't have to be a writer.

If you see a topic in the list that you're interested in and knowledgeable about, write something up or run it by us. If you have an idea for a series, call us and tell us about it. Readers told us they'd love to see more how-to articles, checklists, short tutorials and case histories. And, if you do decide to write something up, don't pull punches or just give us the rose-colored-glasses version: Readers want to know more about projects that went off the rails and how they got back on track.

Contributing to Army AL&T lets you broadcast the work of your organization to a diverse network of print and digital subscribers, and might put you in contact with someone whose perspective or experience could further enhance your work. Oh, yeah, and it can earn you continuous learning points. We do our best to make the submission and editorial process as easy as possible, and you can find our writers guidelines by going to **https://asc.army.mil/web/publications/army-alt-submissions/**.

Since the last survey, in 2016, we've made a lot of changes. We've been working on making articles more compelling and easier to read by all stakeholders, not just acquisition insiders. With the results from 2018, we'll be making more changes: shorter, quick-hit pieces; roundups of developments at program executive offices (PEOs); and more on the roles of contractors and Army civilians. We're also looking at ways to make it easier for PEOs and other organizations to tell us what they're up to so we can share that information with our readers. We see the survey as the beginning of a conversation that we'd like to keep going, and to that end, we'll be expanding our presence on milSuite to provide a forum for communicating with our readers and our contributors.

We're grateful to those of you who took the time to respond to our survey and made solid suggestions for areas of improvement. We're energized by your enthusiasm and your ideas, and we look forward to working with you to figure out the best way to implement them.

—ARMY AL&T STAFF

SHOW AND TELL

The RDECOM Ground Vehicle Systems Center highlights emerging science and technology capabilities in the Mission Enabling Technologies Demonstrator at a demonstration in 2018. The modified Bradley Fighting Vehicle is used to test emerging capabilities for manned-unmanned teaming. (Photo by Jerome Aliotta, RDECOM Ground Vehicle Systems Center)

RDECOM'S ROAD MAP TO MODERNIZING THE ARMY:

NEXT GENERATION COMBAT VEHICLE

Second in a series of articles about RDECOM's support for the Army's six modernization priorities.

by Maj. Gen. Cedric T. Wins

Soldiers in the field need the right equipment to be successful. A tank that is too heavy to cross a bridge or maneuver through rough terrain and high altitudes can have a serious impact on mission success.

To meet the challenge of keeping Soldiers the best-equipped in the world and to prepare for the battlefield of the future, the Army has refocused its modernization efforts on six priorities: long-range precision fires, Next Generation Combat Vehicle (NGCV), Future Vertical Lift, the network, air and missile defense, and Soldier lethality.

To support the second priority, the U.S. Army Research, Development and Engineering Command (RDECOM) has aligned its science and technology ground portfolio to directly support the NGCV effort and created a team-of-teams approach, led by the RDECOM Ground Vehicle Systems Center in Detroit. Other teams include our six research, development and engineering centers and the U.S. Army Research Laboratory, the Army's corporate lab, along with domestic and international academic and industry partners and the cross-functional teams developed as part of the U.S. Army Futures Command.

As RDECOM moves from the U.S. Army Materiel Command to the U.S. Army Futures Command, the command's centers and laboratories are working closely with the eight cross-functional teams to develop a concept of operations and to provide technical analysis, portfolio alignment, proposal

and program briefings and a coordinated modernization strategy.

MODULAR ACTIVE PROTECTION SYSTEMS

The Army is changing the way it protects its forces as the velocity of battle, the lethality of potential adversaries and the range of threats increase in multidomain operations. Historically, the Army countered the impact of the enemies' more powerful and lethal vehicles by adding armor to combat vehicles. While this provided additional protection, it also increased the weight of the vehicle, reducing its speed and increasing the need for fuel.

The Modular Active Protection Systems (MAPS) is a multiyear RDECOM program led by the Ground Vehicle Systems Center in collaboration with the acquisition community and industry. The overarching goal of the MAPS program is to produce a modular and open approach for developing technologies that will be used to enable agile, layered protection against current and future threats in demanding environments.

The MAPS science and technology program has established a community of interest that ensures maximum participation by government and industry experts to help shape products and establish the right solution for the Army. This community is shaping and driving development of the MAPS products by leveraging industry partners to inform and fortify products to ensure their success. Community of interest members help frame the future of active protection systems (APS), and they leverage their knowledge of MAPS to update or develop technologies that are compliant with the MAPS Framework. The community is made up of 55 members of industry and academia from the computing technology, vehicle platform integration and vehicle protection systems communities.

The Ground Vehicle Systems Center has been leveraging the Mission Enabling Technologies Demonstrator to demonstrate various emerging science and technology capabilities for manned-unmanned teaming.

FOLLOW THE LEADER

Soldiers test leader-follower technology with semiautonomous trucks during operational training at Fort Bliss, Texas, in 2016. Semiautonomous systems like this one could be fielded as early as summer 2019. (U.S. Army photo)

Numerous industry partners have driven and fortified the development of MAPS products. MAPS has funded more than 27 key organizations throughout the life of the program and worked with more than 55 companies to develop products through the community of interest.

MAPS defeats incoming threats to combat vehicles without adding excessive armor weight. While these active protection systems—sensors, defeat mechanisms, processors and other components—are not a replacement for armor, they can significantly increase survivability of vehicles and Soldiers in multidomain operations by integrating hard- and soft-kill systems. Hard-kill systems use physical countermeasures such as blasts or projectiles to destroy or divert incoming fire, while soft-kill systems use sensors that detect signatures from weapons and send out electromagnetic signals to interfere with incoming weapons.

MAKING IT TO THE FRONT LINE

The RDECOM Ground Vehicle Systems Center conducts an autonomous leader-follower demonstration in October using an M915 truck. By using robotic platforms, Soldiers can reduce time spent on mundane, dangerous or repetitive tasks and free up time to perform other tasks. (Photo by Doug Halleaux, RDECOM Ground Vehicle Systems Center)

The benefits of MAPS include:

- Higher survivability rates.
- Increased innovation and rapid integration that will provide a quicker response to evolving threats.
- More competition and diversity within the APS community, which will keep costs low.
- Consistent, rapid implementation of safety and cybersecurity across active protection systems.

As MAPS technology evolves, additional protection technologies may be added, including active blast mitigation, adaptive armor and obscurant inhibitors. MAPS has been identified as a critical technology in the draft NGCV capabilities development document, and it supports the current NGCV requirements, so it will be integrated at the earliest possible date.

ADVANCED ROBOTICS

The Ground Vehicle Systems Center's work with the Robotic Operating System – Military (ROS-M) covers a spectrum of autonomy and robotics, including small explosive ordnance disposal-assist robots that have been fielded as part of the advanced leader-follower capabilities that Soldiers in two transportation battalions will see by summer 2019.

The ROS-M uses an open-source approach and a widely accepted software framework with common government and industry software to develop military robotics and autonomous systems. The open-source approach allows developers to create software modules for different applications and enables integrators to build modular systems using the best software modules available for military autonomous systems.

Robotics helps Soldiers in two ways: It eliminates the need for Soldiers to conduct mundane, dangerous or repetitive tasks that can be automated, and it increases the standoff distance between Soldiers and a threat, which can greatly enhance safety. Additionally, automation can increase logistics on convoy missions. For example, a pair of Soldiers can operate a convoy that normally requires two Soldiers in each vehicle, freeing the additional Soldiers to conduct other missions, such as providing security for the convoy.

AIDED TARGET RECOGNITION

Soldiers in combat or on patrol perform several tasks simultaneously: maintaining overall situational awareness, communicating with higher headquarters, planning and adjusting routes for manned and unmanned vehicles, monitoring sensor locations and gathering information from multiple sensors. Given all these tasks, they may not have enough time to focus on sensor imagery that may contain many objects that could be interpreted as targets. Spotting and deciding on the validity of potential targets is critical, so RDECOM has developed the Aided Target Recognition (AITR) system to reduce the Soldiers' workload and enable them to perform their jobs more effectively.

The RDECOM Communications-Electronics Center is providing real-time

TAKING IT OFF-ROAD
On an April 2018 visit to the RDECOM Ground Vehicle Systems Center, Secretary of the Army Dr. Mark T. Esper drives the fuel cell-equipped Chevy Colorado ZH2 demonstrator. The center leverages General Motors' fuel cell and off-road technologies in developing Army vehicles that are safer and more powerful. (U.S. Army photo by Carl Jones II)

image and signal processing AITR algorithms to support manned and unmanned vehicle targeting and decision-making. These algorithms, along with new advanced sensors, will be capable of locating concealed targets in a variety of backgrounds and under a range of conditions. As the algorithms and sensors mature, they will provide automated detection of both stationary and moving threats, augmenting traditional AITR and increasing the survivability and lethality of the NGCV platform.

Future efforts include integrating and demonstrating real-time AITR on NGCV platforms. The ability of ground vehicles to rapidly find difficult targets in complex environments will improve the ground vehicles' lethality and ability to maintain overmatch in the future.

TECHNOLOGY DEMONSTRATORS AND PROTOTYPES

RDECOM scientists and engineers are exploring the art of the possible by integrating emerging technologies onto existing platforms to demonstrate how they will work. These demonstrations inform Army leadership and the acquisition community about what currently exists, as well as what might be possible in the future.

In particular, the Ground Vehicle Systems Center has been leveraging the Mission Enabling Technologies Demonstrator, a modified Bradley Fighting Vehicle, to demonstrate various emerging science and technology capabilities for manned-unmanned teaming. Until the requirements for a remote combat vehicle are determined, we have equipped a supply of M1113 armored

personnel carriers with drive-by-wire and autonomy kits so that the Army can begin learning how to best use a remote capability. As we identify which technologies provide the biggest operational payoff, we will transition them to future NGCV increments.

Since prototypes are more targeted and specific, we view them as the best way to "fail early" and "fail cheaply." RDECOM develops a physical prototype after a digital prototype has passed a rigorous process of testing and experimentation. Putting designs and concepts through such a process greatly reduces the risk of significant redesign costs after production.

The MAPS program received its first prototype controller (hardware and software) base kits in 2016. These have been updated through ongoing development and demonstration efforts throughout the program. The base kits will be demonstrated on a platform at the end of FY19 for an overall system technology readiness level 6, but we have already transitioned products to the Product Manager for Vehicle Protection Systems within the Program Executive Office for Ground Combat Systems.

TEAM OF TEAMS

By collaborating across the command and working with academic and industry partners, we maintain a steady stream of world-class technology. We also work with hundreds of nontraditional defense companies on NGCV ideas and technologies, particularly those from the automotive industry, whose long-term goals with improved powertrains and robotics strongly align with those of the Army. This synergy already has produced valuable advances in vehicle capability. Significant improvements in engine and transmission technology have resulted from these partnerships, including vehicles that are lighter and more powerful. These relationships, along with the expertise of the RDECOM workforce, will enable the NGCV Cross-Functional Team to make informed decisions about future technology.

We regularly engage our academic collaborative partners on a wide variety of technology to support the NGCV modernization priority. Some of our academic partners include the University of Michigan, the University of Michigan Dearborn, Auburn University, Carnegie Mellon University and Michigan Technological University. We currently have more than 500 cooperative research and development agreements with domestic and international academic institutions, industry, partner militaries and government agencies. Such agreements enable both parties to trade access to labs, equipment, data and other resources for technical knowledge.

MAPS has been identified as a critical technology in the draft NGCV capabilities development document, and it supports the current NGCV requirements, so it will be integrated at the earliest possible date.

CONCLUSION

RDECOM is committed to bringing the latest, most flexible, adaptable, modular and smart capabilities possible to Soldiers to give our leaders the tools they need to accomplish their mission effectively and safely. By partnering with industry and academia, as well as the automotive and defense industries' ground vehicle developers, we accomplish our mission and provide the Army with our expertise in ground vehicle technology development and integration.

For more information, go to ***http://www.rdecom.army.mil/*** *or contact RDECOM Public Affairs at 443-395-3922. Industry partners who wish to participate in the MAPS community of interest can contact the National Advanced Mobility Consortium at* ***Questions@NAMConsortium.org*** *to learn how to participate.*

MAJ. GEN. CEDRIC T. WINS is the commanding general of RDECOM. Wins graduated from the Virginia Military Institute and was commissioned in the field artillery in July 1985. His military education includes Field Artillery Officer Basic and Advanced Courses, U.S. Army Command and General Staff College and the National War College, where he earned an M.S. in national security and strategic studies. Wins also holds an M.S. in management from the Florida Institute of Technology.

ELIMINATING PRECONCEPTIONS

BYRON A. KIGHT

COMMAND/ORGANIZATION: Installation Information Infrastructure Modernization Program, Program Executive Office for Enterprise Information Systems

TITLE: Acquisition management specialist

YEARS OF SERVICE IN WORKFORCE: 8

DAWIA CERTIFICATIONS: Level II in program management and in life cycle logistics

EDUCATION: B.S. in business management, North Carolina A&T State University

AWARDS: Director's Civilian of the Quarter; Achievement Medal for Civilian Service; Certificate of Achievement; Outstanding Service Award

Many members of the acquisition workforce have found themselves on the receiving end of a blank stare after explaining what they do for a living. Not so for Byron Kight. "People tend to be very interested in how a capability gap is filled. It's not always stated in those words, but that's the gist of their primary interest. I often encounter people who find the acquisition process to be interesting, particularly the amount of moving parts and the sheer volume of different stakeholders involved with any given effort," he said. "Those same people are often quite surprised to find out how hard most DA civilians work. We do have an unfair label, and I enjoy the challenge of ripping it off."

Kight, an acquisition management specialist for the Installation Information Infrastructure Modernization Program (I3MP) within the Program Executive Office for Enterprise Information Systems (PEO EIS), is a translator of sorts. "In essence, it's our mission to ensure that requirements, established by CIO/G-6 [Army Chief Information Officer/G-6] and TRADOC [U.S. Army Training and Doctrine Command], are logically understood by our industry partners."

He's part of a team responsible for acquisition planning, acquisition strategy development, acquisition review, and approval and configuration control of all applicable acquisition program documents, including contract data requirement lists, market research, system requirement documents, statements of work, cost estimates and documents associated with contract modifications. "I do my best to ensure that contractual language and the applicable artifacts are well understood by both our industry partners as well as I3MP staff. We also do our best to ensure that we facilitate open lines of communication with Army Contracting Command – Rock Island," he said.

"Our success is measured by corps, division and theater HQs possessing the ability to deploy and distribute warfighting functions and watch sections across mission command nodes according to a commander's intent. My goal is to assist in ensuring that the number one priority—readiness—is continuously met, as we attempt to provide stability and continuity during both war and peace."

When it comes to helping develop that documentation, he usually comes to the table empty-handed—by design. "It's been my experience that most of the confusion surrounding the acquisition process usually stems from preconceived notions. If I can begin to break down some of those notions, I can do some rebuilding," he explained. "I try to do more listening than talking and I ask very measured questions. Through those questions, I'm typically able to obtain a really good picture, figuring out what the desired end state should resemble. I can then convert the necessary

steps required to achieve that desired end state into terminology that's understood by both I3MP personnel and our industry partners, leading to increased efficiency during contract execution."

Thus the end state, he said, "is a solution that we've all developed, not something that's been put together in a vacuum. And it's also an ongoing process: It's not something that's done in a week or a year. Once we've put a plan in place, we continue to monitor the situation and the market, ensuring that we're still meeting the needs of our stakeholders."

Before joining the acquisition workforce eight years ago, Kight was a technical writer and editor with the U.S. Army Communications-Electronics Command's Integrated Logistics Support Center (CECOM-ILSC), where he supported sustainment activities. "During my time with CECOM-ILSC, I was able to collaborate with several program office representatives and was exposed to a lot of acquisition activities," he said. His work with the PEO for Intelligence, Electronic Warfare and Sensors and the PEO for Command, Control and Communications – Tactical sparked his interest in becoming part of the Army Acquisition Workforce.

LEARNING ABROAD

In 2015, Kight deployed to Afghanistan in support of the REF, where he learned valuable lessons about the acquisition process from both forward and rear assignments. (Photo courtesy of Byron A. Kight)

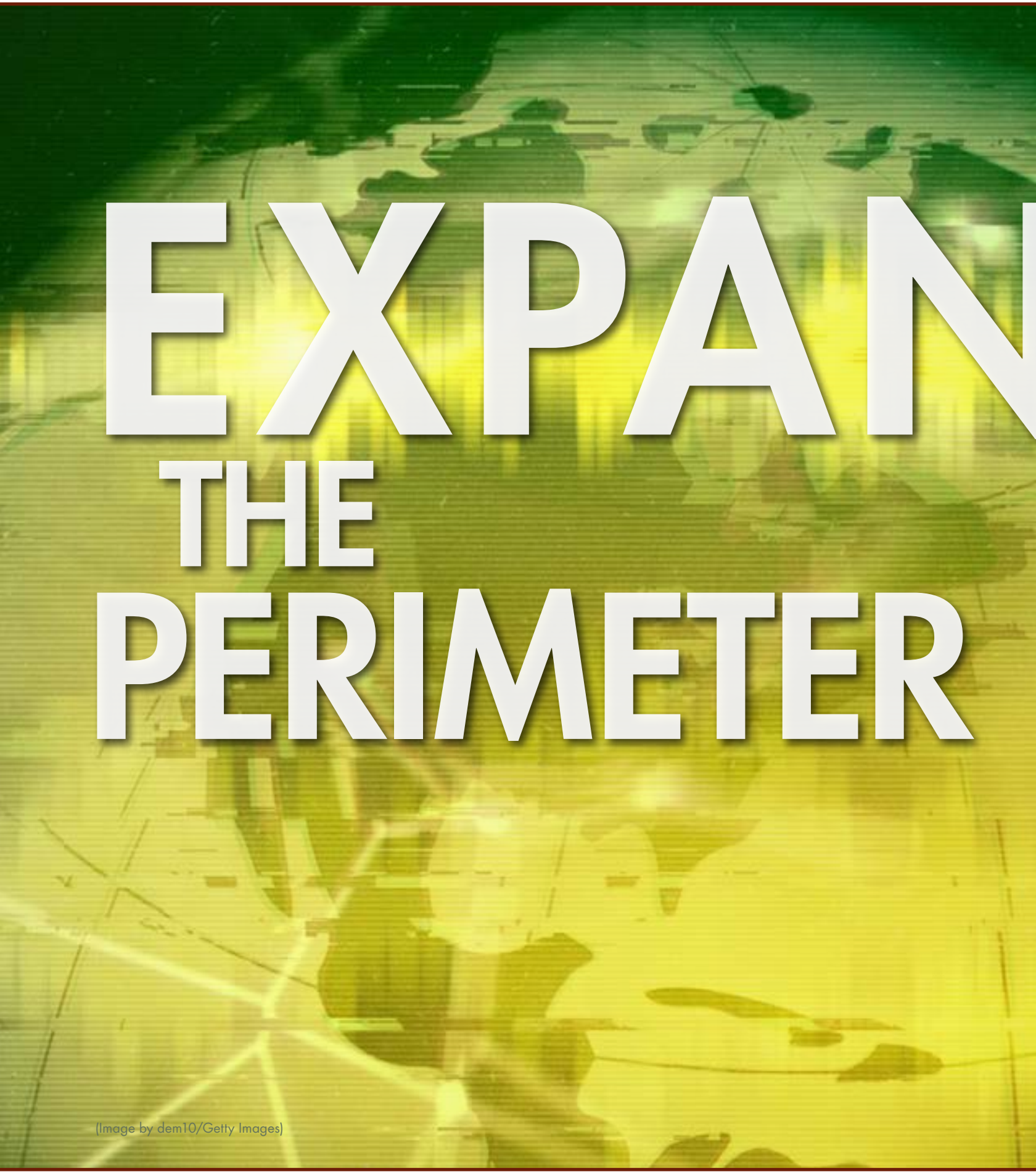
In 2015, he was selected to support the Army's Rapid Equipping Force (REF). He spent a year with that organization and deployed to Kuwait and Afghanistan. "It was without a doubt a life-changing event," he said. The assignment provided him the opportunity to "complete the puzzle," he said. "While at REF-Rear, I worked on half of a puzzle: conducting mission analysis on incoming requirements for the sole purpose of providing solutions to operational challenges. On deployment with REF-Forward, I saw the other half: what happened when those supported solutions made it into theater, how Soldiers used it and what they thought about it."

His REF assignment also gave him the opportunity to see what it was like to serve in a few key positions—some at the same time, as he was simultaneously a logistics lead, alternate contracting officer representative and project officer. "The first key to success in dual-hatting is to accept and look forward to the fact that you're going to be a very busy, in-demand person," he said. "Then, find out the current conditions with an eye toward determining if a change/no change decision should be made. Third, breathe. Seriously." Lastly, he added, get organized and get to know your teammates. "It's your teammates who you will depend on the most. Take care and be responsible for the team. Efforts absolutely fail or succeed due to the people involved."

Serving as a project officer during the REF assignment was also educational, he noted. "Up until that point, my experience dealing with the concepts of cost, schedule and performance was really an outsider's look in. My REF work demonstrated the sheer amount of variables and responsibility someone in that position has to wrestle with."

After leaving REF, he joined PEO EIS in December 2016 to serve as an acquisition management specialist. "The most important thing I've learned so far is to meet people where they are. In most cases, to do that, you must learn something about that person and know a fair amount about yourself as well. But it's worth it: It leads to better relationships, clearer communication, improved efficiency, better morale and readiness."

— SUSAN L. FOLLETT



EXPAN THE PERIMETER

(Image by dem10/Getty Images)

IDING

Cyber defense and partner nation interoperability are vital to meeting national security objectives at home and abroad.

by Andy Strand

In "Sneakers," a 1992 comedic caper about the ethical and political implications of cyberwarfare, Sir Ben Kingsley's villainous character, Cosmo, sententiously instructs Marty, the film's protagonist, played by Robert Redford, that war and power are no longer dominated primarily by weapons, energy or even money, but by the control of information.

More than 25 years later, the prescience of those lines is evident in a U.S. national security posture that highlights the criticality of information dominance and protection. In the 2018 National Defense Strategy, "Sharpening the American Military's Competitive Edge," then-Secretary of Defense James N. Mattis warned:

"America is a target, whether from terrorists seeking to attack our citizens; malicious cyber activity against personal, commercial or government infrastructure; or political and information subversion. New threats to commercial and military uses of space are emerging, while increasing digital connectivity of all aspects of life, business, government and military creates significant vulnerabilities."

DOD is, therefore, focused on increasing information technology capacity, both within the department and on behalf of U.S. allies, to meet national security objectives at home and abroad.

Using the foreign military sales process, the U.S. Army's Program Executive Office for Enterprise Information Systems (PEO EIS) international programs office, Allied Information Technology (AIT), headquartered at Fort Belvoir, Virginia, is doing its part to assist our allies. That assistance comes in the form of the command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) and defensive cyber capabilities necessary to defend against threats and contribute to allied coalitions, thereby expanding the perimeter of collective security.

AIT has taken acquisition notes from U.S. Special Operations Command (SOCOM) to do this as efficiently and effectively as possible. By focusing on speed, absorptive capacity (a country's ability to absorb and support a particular capability), decentralization of command and interagency relationships, AIT is better equipped to deliver the right information technology (IT) solutions to our allies.

INTEROPERABILITY IN THE 21ST CENTURY

The global proliferation of IT over the past quarter-century has unlocked seemingly limitless potential for human well-being. The ability to create, manipulate, distribute or store information

BUILDING NEW TECH AND PARTNERSHIPS

Black Box Network Services personnel build a new server room in March in the Ukraine command-and-control operations center. Ukraine's armed forces have not only embraced the partnership, but they also requested that AIT personnel continue to advise them on the investments needed to ensure that Ukraine can continue to sustain new capabilities. (Photos by Jeremy Way, AIT support contractor)

instantly has fundamentally changed the way we live and operate in the world. Just think of the ease with which a person can now communicate with family, friends, colleagues or customers from anywhere in the world through any number of digital media. Consider the significance of IT to fields like science and medicine, space exploration, commerce and education, to name just a few.

The internet has connected the world in ways our grandparents could never have comprehended, and while all of the interconnectedness is making life better in so many ways, our ever-increasing dependence on the IT that can improve our experience can also expose us to unique vulnerabilities and formidable threats. Indeed, our very way of living in the 21st century—the strength of our economy and our national security—now depends largely on a stable and secure cyberspace. DOD is prioritizing its focus on this issue not only for our own joint force, but also for our allies.

DOD's mission is to make combat-ready the military forces needed to deter or prosecute war to protect and defend the security interests of America and its allies around the world against a continuum of state, nonstate and transnational bad actors. A key component of this mission is theater security cooperation, which begins with the conviction that building stronger defense partnerships and interoperability with our partners lightens our own security burden and enables them to play a larger role in the shared responsibility of maintaining what the 2018 National Defense Strategy calls the "free and open international order."

Given the emphasis our joint force places on C4ISR and defensive cyber capabilities, it behooves DOD to continue investing in like capabilities for our allies. In doing so, we improve the durability of their IT infrastructures, help to improve the accuracy and reach of their warfighting systems, increase interoperability with our own systems and, perhaps most importantly, fortify their networks against antagonistic cyberthreats.

STRIKE A POSE

Personnel from AIT, General Dynamics Information Technology and Ukrainian armed forces gather for a photo in December 2017 during construction of a new Ukrainian special operations forces IT training center.

AIT has seen a sharp increase in appetite for these capabilities over the past several years, particularly in Eastern Europe, where Russia continues to provoke U.S. allies with cyberattacks and other overt acts of hostility. In Ukraine, for instance, AIT currently has underway several major IT modernization efforts for the Ukrainian armed forces, including a revamped network infrastructure, new training centers for Ukrainian special operations forces, a state-of-the-art joint operations center with effective command-and-control tools, NATO-interoperable logistics and medical defense business systems, and a first-of-its-kind cybersecurity operations center. All of these enhancements are a tremendous boon to the Ukrainian armed forces, enabling their leaders to make faster, more accurate decisions while defending against ubiquitous cyberthreats.

In fact, the Ukrainian armed forces are already seeing the operational impact of these capabilities in the ongoing conflict with Russian-backed separatists in eastern Ukraine. What's more, the Ukrainian chief of general staff (equivalent to our chairman of the Joint Chiefs of Staff), recently wrote to the commander of U.S. European Command and NATO supreme allied commander, Europe, praising AIT for its efforts in Ukraine and requesting that AIT personnel continue to advise him and his senior staff on the investments needed to ensure that Ukraine can continue to optimize, maximize and sustain these capabilities over time.

FULL C4ISR KIT

Dan Hawkins, right, AIT country program manager for Ukraine, briefs then-U.S. Deputy Ambassador to Ukraine George Kent, left, and Ukraine's deputy chief of defense, Lt. Gen. Serhii Bessarab, center left, in January 2018 on the new training facilities for Ukrainian special operations forces being outfitted by AIT with various C4ISR and defensive cyber capabilities.

They agreed that the Ukrainian armed forces' senior staff should visit U.S. Army Europe in Wiesbaden, Germany, "in order to visualize the digital common operating picture and to receive an overview of battle staff procedures in support of the commander's decision-making process." Beyond the goodness of kudos, the real significance here is that AIT is having an impact far beyond the foreign military sales transaction itself, working to ensure that these capabilities do not become wasted investments.

But any success AIT has achieved, it has not achieved alone. We rely on best practices and lessons learned from organizations throughout the interagency enterprise, including SOCOM, to help us build partner capacity at the speed of relevance.

BUILT FOR SPEED

One of the biggest complaints from allies and foreign partners about the foreign military sales process writ large is that it takes too long for requirements to be prioritized, defined properly, organized and then processed through the many layers of DOD's security cooperation enterprise. The sheer abundance of complexity in the IT space—system design, data sharing and protection agreements, etc.—can make foreign military sales in this area seem more daunting, especially considering the pace at which technology in this field changes. This is why AIT has chosen, not unlike other interagency organizations, to take a page from SOCOM's stated acquisition methodology to cut timelines and bring greater velocity to the foreign military sales process. For AIT, the tenets of SOCOM acquisition translate to:

Speed as an attitude. Teams that understand not only how to execute their mission, but why it matters to the bigger picture, are generally motivated to hustle. AIT conducts sync meetings throughout the week during which one teammate is called upon to discuss the tasks he or she has for the week and why accomplishing those matters to both AIT and the Army's overarching security priorities. This simple exercise encourages better communication, creates shared consciousness among the team and ensures that each individual—leader or follower, government or contractor—understands how his or her actions support success for DOD's broader security cooperation mission. All of that tends to generate an expeditious vibe in the office.

Absorptive capacity matters. Not every country is prepared technologically, organizationally or even culturally to implement the latest and greatest capability that the U.S. defense industry has to offer. It may sound counterintuitive, but when we try to deliver too much capability too quickly, we end up overburdening the customer, making things perhaps worse than when we started. In our business, the best way to achieve effective results quickly is to deliver capability in a crawl-walk-run approach. Starting with smaller amounts of capability and using time-phased optimization to scale those capabilities later can build confidence

The ability to create, manipulate, distribute or store information instantly has fundamentally changed the way we live and operate in the world.

in system users, earn buy-in from senior leaders and help the U.S. government know when, where or whether further investment is desirable.

Decentralize to win. Building tailored IT system solutions in a foreign country requires tremendous amounts of touch labor and calculated risk tolerance, which cannot be managed effectively from a desk in Northern Virginia. That is why AIT has chosen a decentralized organizational model, pushing most of the technical, operational and program management decision-making capability forward, where its personnel, led by an area-of-responsibility portfolio director (a government civilian), can work directly with the geographic combatant command and theater special operations command functional proponents (e.g., J-5, strategic plans and policy, and J-6, command, control, communications and computers and cyber), as well as the offices of defense cooperation and host nation ministry of defense itself. The proximity of AIT personnel to these commands provides front-row access to the requirements coming down the pike, which we then can take an active role in developing with the customer. This ensures that requirements are actionable by the time AIT officially receives guidance and funding to execute the projects.

Expand the Rolodex. Every AIT employee is encouraged to cultivate relationships with interagency members and other partners in the public and private sectors, and bring back ideas that can help us solve problems. By leveraging lessons learned from coaches and teachers, first responders, special operations forces, executives in finance and anyone else who can improve the way we operate, AIT will continue to increase its capacity to deliver efficient, effective IT capability across the globe.

CONCLUSION

The United States and its allies are clearly aware that the exchange and protection of information is paramount. Security is no longer solely about who has the biggest bombs or the most bullets; it is about access to and control of information. The 2018 National Defense Strategy acknowledges this reality, and the combatant commands are developing security cooperation strategies that will strengthen bilateral defense partnerships, enhance coalition building and interoperability, and increase the readiness of our allies and partners in uncertain, complex and potentially hostile security environments.

AIT understands its role in this mission and is working to cultivate a culture of acquisition operators who are laser-focused on doing foreign military sales better and faster.

For more information, go to ***http://www.eis.army.mil/programs/ait****.*

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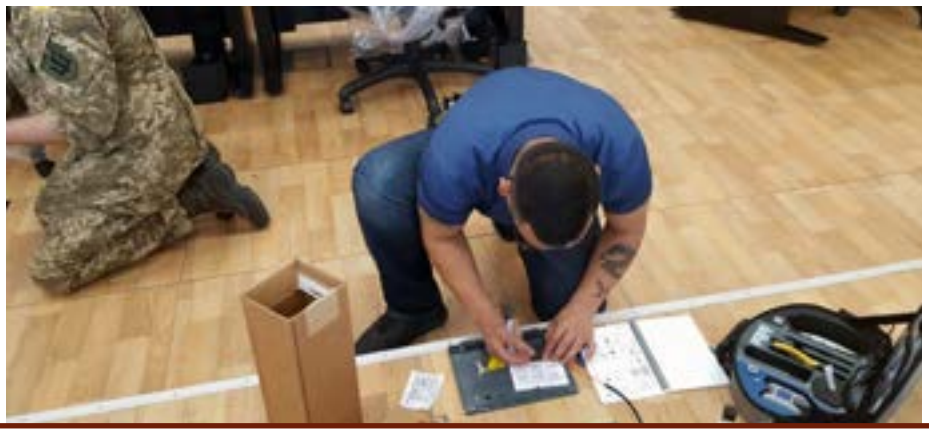


SECURITY COLLABORATION
Black Box Network Services personnel work side by side with Ukrainian armed forces personnel at the new command-and-control operations center in Ukraine.

UNIQUE *INSIGHT*

An unusually frank and open forum among government and industry competitors yielded new insights into developing a Gator Landmine Replacement command-and-control system.

by Waliul Mizan and Sean Stevens

Traditional land mines have been used for decades by the U.S. Army to "shape the terrain" in order to deny, slow or steer an enemy advance. However, once the mines were deployed, the warfighter lost the ability to control the field.

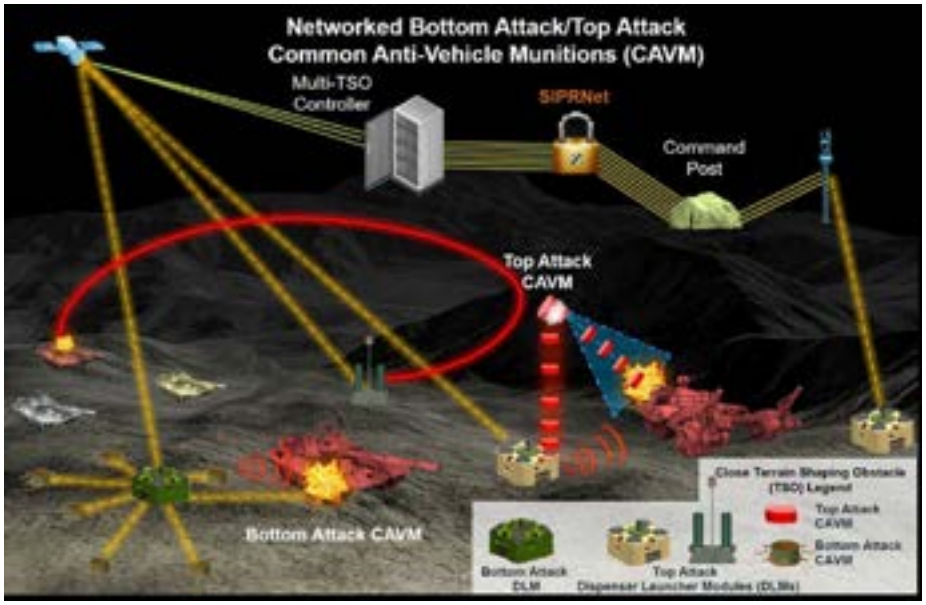
Adding a command-and-control architecture would provide the gateway for the warfighter to remotely arm, fire and assess the status of the minefield.

This capability would add a whole new dimension to terrain-shaping, with the ability to selectively turn it off. To simplify, a user could create a dynamic munition field that could feed sensor information back to Army mission command to ascertain vehicle movement in the minefield and to allow a remotely initiated lethal response or safe passage. An aging land mine inventory that needed to be replaced created an opportunity at Picatinny Arsenal to push for this capability.

The effort is significant, as current policy restricts the use of antipersonnel land mines to systems that have a human in the loop. The requirement for the replacement includes a command-and-control capability in the Gator Landmine Replacement system. (See related article, "A New Way of Thinking," Army AL&T January – March 2017, Page 40.) Each munition field consists of three critical components: a bottom attack capability, a top attack capability and a command-and-control architecture to securely network the field back to Army mission command. (See Figure 1.) Part of the difficulty in creating the command-and-control portion of the system is that each building block of a minefield, which can be made up of many building blocks, is 150 by 250 meters. Within a minefield, the munitions must communicate not only with other munitions, but also with the operator-control station. The number of operators required in the loop has yet to be determined.

The Product Manager for the Gator Landmine Replacement (PM GLMR) is on an accelerated schedule—milestone A is scheduled for the third quarter of FY19, with milestone B just 18 months later—to develop and deliver the next-generation field of

FIGURE 1



SHAPING THE FIELD

PM GLMR is developing the next-generation field of munitions for the CTSO program. Each munition field consists of three critical components: a bottom attack capability, a top attack capability and a command-and-control architecture to securely network the field back to Army mission command. (SOURCE: JPEO A&A)

munitions for the Close Terrain Shaping Obstacle (CTSO) program.

Because of the criticality and risk of integrating a command-and-control capability in terrain-shaping materiel solutions, the Project Manager for Close Combat Systems (PM CCS) engaged industry to assess industry approaches and solutions. PM GLMR is part of PM CCS, within the Joint Program Executive Office for Armaments and Ammunition (JPEO A&A, formerly PEO Ammunition). JPEO A&A is headquartered at Picatinny Arsenal, the Joint Center of Excellence for Guns and Ammunition, in northern New Jersey.

Through these industry engagements, PM GLMR has been conducting competitive prototyping activities for the next generation of terrain-shaping obstacles since 2016. That effort culminated in a technology roundup demonstration in January – March 2017. Recently the office undertook an exercise to narrow the focus of prototyping efforts to refine requirements for the command-and-control architecture and make informed decisions on where to continue investing in the technology maturation and risk reduction phase of the program.

A LANDMARK FORUM

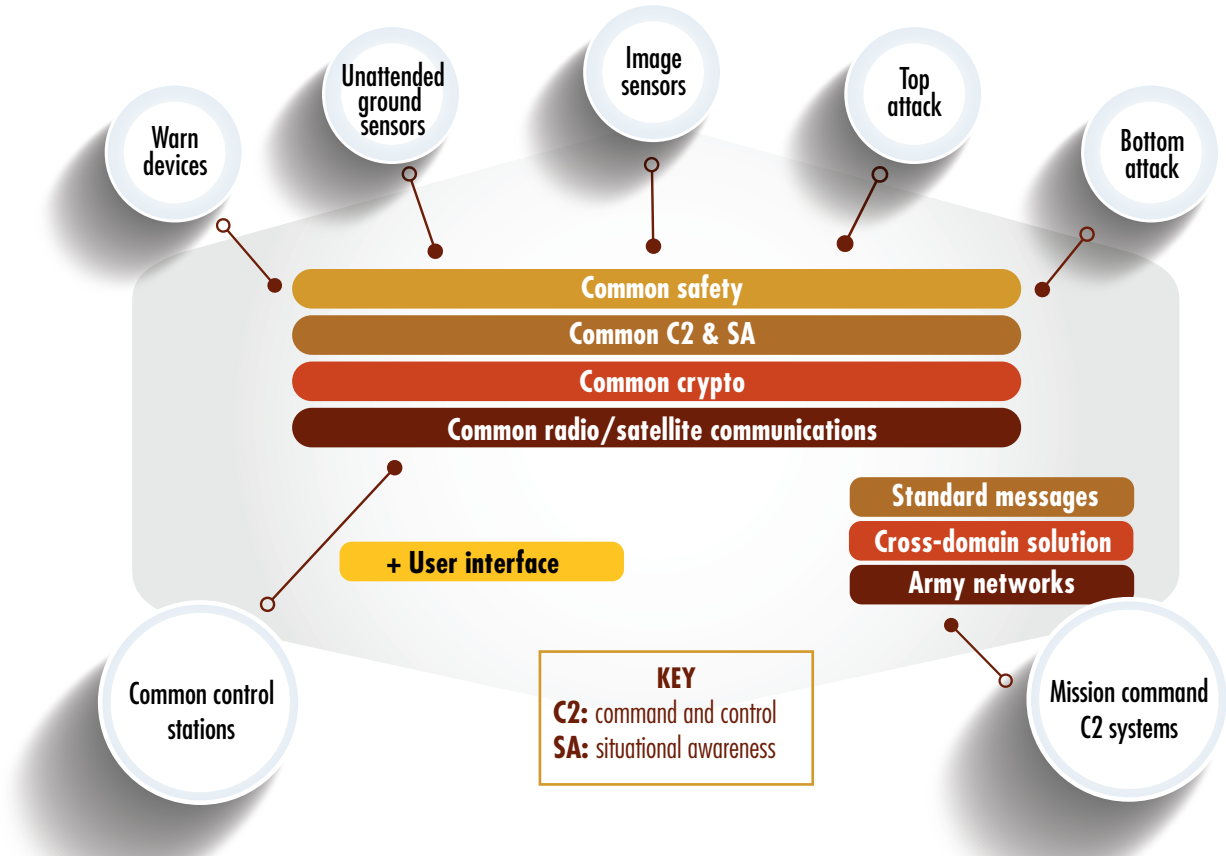
CCS held the CTSO command-and-control forum on May 15 at Picatinny, with more than 100 government and industry stakeholders attending. This unusually frank and open forum provided the platform for industry to ask questions of not only government representatives, but also of other members of industry, both potential collaborators and competitors.

The deputy project manager for CCS kicked off the session, stating that the intent was to discuss system-concept options, to allow industry and the government to exchange information on previous accomplishments related to terrain shaping and the current work each contractor was doing, and to provide an opportunity for discussion and collaboration. The intention was to have free and open discussion of program and technology risks. A lot of work had been done under government contracts since 2016, and it had to be shared with the entire audience of government and industry stakeholders so that leadership could get accurate feedback to better inform government on how to proceed with a command-and-control architecture.

In attendance at the forum was a government panel consisting of leadership as well as experts in communication electronics, encryption and sensors from JPEO A&A; the project manager for Positioning, Navigation and Timing within the Program Executive Office for Intelligence, Electronic Warfare and Sensors; the U.S. Army Armament Research, Development and Engineering Center (ARDEC); the U.S. Army Communications-Electronics Research, Development and Engineering Center; the U.S. Army Research Laboratory; the U.S. Army Maneuver Support Center of Excellence; the Air Force Life Cycle Management Center, and MITRE Corp., a federally funded research and development center.

The industry panel consisted of leadership and technical teams from Fantastic Data; Northrop Grumman Mission Systems; Northrop Grumman Innovation Systems (formerly Orbital Alliant Techsystems), which previously fielded legacy Family of Scatterable Mines; Textron Systems, which fielded the M7 Spider mine system and developed the follow-on XMX1100

FIGURE 2



TOUGH QUESTIONS
The CTSO command-and-control forum put government and industry experts together to look for answers to questions about safety, such as safe passage for friendlies; security and encryption of data; long- and short-haul communication capabilities; acquisition and supportability. (SOURCE: JPEO A&A)

Scorpion: Intelligent Munitions System; and NAL Research Corp.

In preparation for the meeting, the government support team created 12 questions to help meeting facilitators spur conversation. These critical questions encompassed the major focus areas of safety, such as safe passage for friendlies; security and encryption of data; long- and short-haul communication capabilities; acquisition, supportability and general topics. (See Figure 2.) The questions were employed several times to force industry briefers to share more insight into their solutions.

DIFFERENT PLAYERS, DIFFERENT APPROACHES

With such a large list of players, it was not an easy task for PM GLMR leadership to coordinate and gain agreement from each organization or company to support and brief their respective command-and-control expertise. Nondisclosure agreements between potential competitors had to be created and signed. Additionally, the government prepared internally a list of topics that would be off-limits to protect industry's intellectual property and maintain trust from the industry participants. These off-limits topics were distributed among the key meeting facilitators so that discussion topics were known by all meeting attendees before the start. Doing this created a sense of mutual understanding between the government and industry that intellectual property would be protected and freer-flowing conversation would result.

Participants in the daylong forum from government and industry presented more than eight hours of briefing material to the audience. This consisted of technical details of the various industry approaches that were investigated, followed by

discussion of the various trade-offs of each approach.

Participants discussed command-and-control high-level capability requirements, such as handling of the message information, encryption, data resilience and security classification. For example, the Fantastic Data team described its approach of creating an internodal network where data could flow between every munition on the field. The Northrop Grumman Innovation Systems team discussed its approach to achieving long-haul communications by integrating Iridium satellite connectivity into the munition field. Textron Systems went into detail on its short-haul and long-haul communication concepts. NAL Research described its road map to get to a system-on a-chip solution.

Government and industry panels candidly identified schedule and performance risks for each industry and government approach, which, in any other forum, would be sidelined for private meetings individually held between each industry member and government representatives. However, with the ground rules agreed upon and the right people in attendance, the opportunity could not be missed to have these discussions in order to get real-time, honest feedback.

This unusually frank and open forum provided the platform for industry to ask questions of not only government representatives, but also of other members of industry, both potential collaborators and competitors.

This was also a forum to present government solutions, offering opportunities to gain insight into alternate approaches as risk mitigations. The government team presented key networking concepts and encryption approaches to lead the discussion on trade-offs. Industry members benefited by hearing about government advances such as a new, miniaturized encryption chip developed by the Air Force that enables unattended munition systems to handle encrypted information, a capability that provides a broader look at all potential options for command-and-control approaches. Some of the government solutions were offered up to industry for further analysis and applicability to their concepts.

CONCLUSION

Overall, the forum was a unique opportunity for information exchange among industry members and the government. Its uniqueness was that it was not just a government-to-industry exchange of information, but also allowed for industry-to-industry discussion. This exchange provided CCS with an opportunity to hear industry competitors ask questions and critique each other's approaches, giving the government valuable insight for future decisions and investments.

Armed with the information presented, CCS is narrowing the focus of its efforts for terrain-shaping concepts and directing that aspects of the system be implemented in future phases of the program while ensuring that they are not duplicating work across the various contractors. In one instance, the deputy project manager for CCS provided candid feedback directly to one of the contractors on modifications to its approach after seeing what others had presented.

The forum also brought to light other technologies that were not previously known by either the program office or the system contractors, such as the Air Force's encryption chip. The insight and knowledge gained at this forum will enable the program to drive partnerships among industry partners and narrow down potential solutions for the CTSO capability. This type of venue is something the program office will certainly look to pursue again.

For more information, contact the authors at ***waliul.mizan.civ@mail.mil*** *or* ***sean.r.stevens.civ@mail.mil.***

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SEAN STEVENS is a GLMR project officer for PM CCS at Picatinny Arsenal. He holds an MBA from the Florida Institute of Technology and a B.S. in chemical engineering from the University of Delaware. He has more than 10 years of acquisition experience and is Level III certified in program management. He is a member of the Army Acquisition Corps and a recipient of the Achievement Medal for Civilian Service.

HEARING BACK

Soldiers and Army civilians provide feedback to the IPPS-A program during a user jury in late 2017. User juries use operational mission scenarios that showcase various features and functionality of the new system. (Photos and images courtesy of IPPS-A)

INNOVATION *through* AGILITY

PEO EIS uses Agile teaming to build the Army's Integrated Personnel and Pay System.

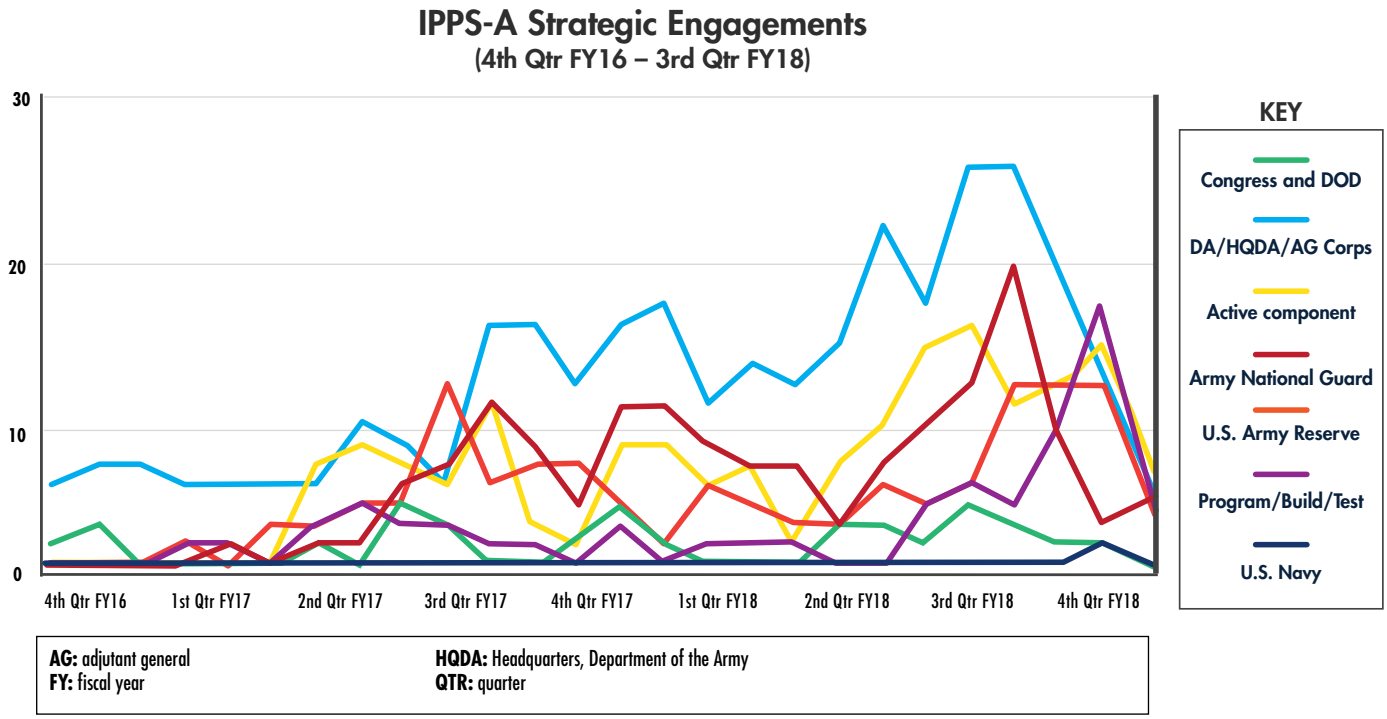
by Col. Gregory S. Johnson

Today, the Army faces a complex dilemma: how to deliver warfighting capabilities in an environment increasingly defined by rapid technological advances and the changing character of war. According to a summary of the 2018 National Defense Strategy, "Sharpening the American Military's Competitive Edge," the United States is facing a host of challenges from adversaries spanning the globe. The strategy highlights that we as a nation are "facing increased global disorder, characterized by decline in the long-standing rules-based international order." The growing complexity of the global security environment provides the imperative for us to modernize.

While modernization ensures that the American warfighter is equipped with the most capable weapon systems and equipment, it also applies to the processes and infrastructure that drive the management and pay of the Soldier: the Army's most valuable resource. Currently, the Army uses approximately 200 human resources (HR) and pay systems to process routine transactions—none of which are standardized across the active, National Guard and Reserve components. This fragmentation and lack of standardization presents challenges to Soldiers and commanders alike, and detracts from the overall readiness of the total force.

For example, a recent Army Inspector General report showed that roughly 29 percent of all formal Soldier inquiries submitted in FY15 dealt directly with personnel and pay issues. A subsequent investigation found that commanders struggled to keep up with administrative requirements, in large part because the Army's HR and pay systems were not integrated. Overall, the research reveals that "the current Army HR automated systems at brigade and below lack the capability to create, route and track awards, leaves and promotions from initiation through completion," among other problems that burden Soldiers and commanders and threaten mission readiness.

FIGURE 1



TRANSFORMING PAY

The IPPS-A team has made significant progress toward building a unified, standardized system that will totally transform the Army's HR and pay processes. In the last 25 months, the IPPS-A program executed over 660 engagements with Soldiers and Army civilians, in addition to other key stakeholders, to get their feedback and seek their buy-in. Full operating capability for the entire Army is projected for FY20.

Our current HR and pay environment limits the Army's ability to effectively facilitate modern capabilities, including talent management. The complexity of more than 200 authoritative systems across the three Army components has led to inefficiencies, deviations and errors with Soldiers' records. This limits our visibility and consequently our ability to unlock the potential of our people. Today's environment is rooted in the industrial age, and we need to take it into the 21st century.

To that end, as part of the Total Force Policy, the Army mandated the employment of an integrated personnel and pay system that standardizes business practices, provides authoritative data for military personnel and facilitates a continuum of service across all three components. The Integrated Personnel and Pay System – Army (IPPS-A) is our solution to a decades-long problem of inefficiency and data inaccuracy that has plagued the total force.

A USER-FOCUSED TEAM EFFORT

The Army first set out to develop the new system at a time when DOD was struggling to integrate HR and pay capabilities for the Army, Air Force, Navy and Marine Corps. Recognizing the urgent need to modernize, the Army launched its own initiative to build a system tailored to the specific needs of the Army community and to improve access, timeliness and accuracy of records for each Soldier. IPPS-A's objective is to fully operationalize HR and pay while simultaneously adding a talent management capability—an ambitious effort, given the bureaucratic complexity and multicomponent structure of our nation's premier combat force.

Since we began this effort, the IPPS-A team has made significant progress toward building a system that will totally transform our Army's HR and pay processes. In the last 25 months, our program executed more than 660 critical engagements with Soldiers and Army civilians. (See Figure 1). We have engaged with stakeholders

across the Army, including leaders and commanders at all levels—from the Pentagon to the battalion—HR professionals, and most important, our rank-and-file Soldiers. These engagements are critical to ensure that we capture and apply the feedback of those who will use IPPS-A as part of their daily activities. In addition, we have kept key decision-makers and stakeholders at the Office of the Secretary of Defense and HQDA and in Congress informed at every turn to solicit their support and ensure that they are aware of our progress.

To date, our progress is based on our ability to operate as cross-functional Agile teams. Teams of total force Soldiers and Army civilians work together to customize and tailor commercial off-the-shelf products to meet the unique needs of the Army. We use the Agile methodology to break tasks into short phases of work with frequent reassessment and evaluation. We also rely on the expertise of HR and finance professionals, PeopleSoft developers, Army commanders, data integration developers, testers and many others filling diverse roles. And by using commercial software, we ultimately will allow the Army to rapidly modernize and update like private sector organizations.

IPPS-A's teams function differently from the typical Army chain of command. Senior leaders work hand in hand with other team members to uncover new and innovative ways to solve the challenges we encounter as we design, build and test the system. The emphasis is on self-government, a structure that enables our IPPS-A team to use a design process centered on the user and to facilitate events that consistently integrate the user early and often. We listen to feedback from the field and build the system in phases, each delivering value and improving the next delivery.

For instance, our user juries provide Soldiers and Army civilians the opportunity to actually use the system and provide feedback on various features and functionality. IPPS-A uses operational mission scenarios to showcase how the system will improve the lives of Soldiers, commanders and HR professionals. These events also serve to train, develop and transition the total force in advance of IPPS-A's deployment. Practical, hands-on, side-by-side assistance is recognized by the Army for not only supporting proficiency and readiness at the unit level, but also strengthening the relationships between HR and finance professionals pre-IPPS-A, collaboration that is essential to successfully executing the system. (See Figure 2, Page 34.)

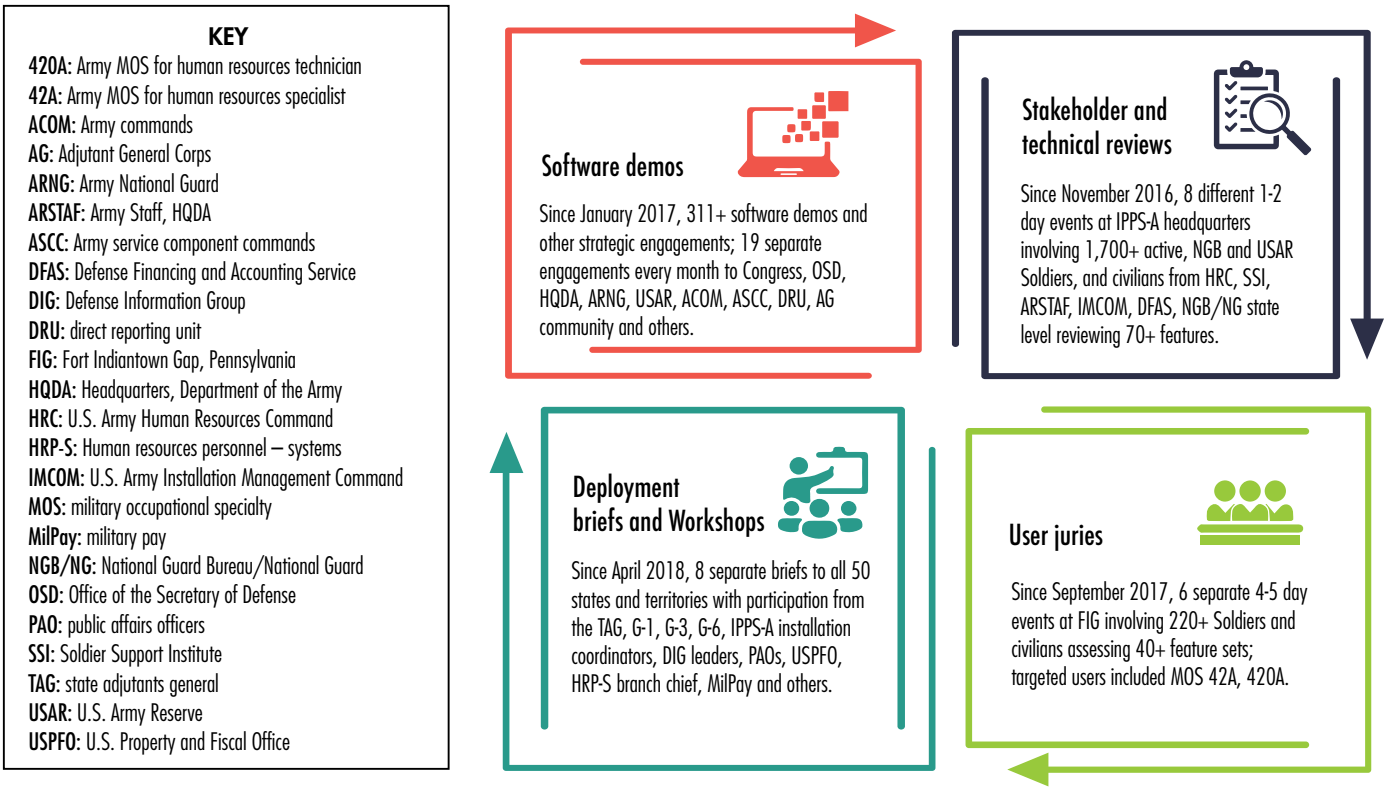
THE IMPERATIVE FOR CONTINUED AGILITY

Today's fragmented personnel and pay systems are no longer adequate to meet the demands of our Army or address the complexity of an ever-changing security environment. Modernization is imperative, and the IPPS-A program remains committed to delivering a single, integrated personnel and pay system to all components. Only through harvesting industry innovation can IPPS-A expect to solve the Army's larger, more nuanced problems of personnel and pay.

"It is essential that the technical competencies of the Army, its battle labs, and laboratory and development systems be focused in two ways," Dr. Bruce D. Jette, assistant secretary of the Army for acquisition, logistics and technology, said during a House Armed Services Committee hearing in March 2018. "First, to know what is being developed commercially which may benefit the Army and, second, what must be developed by the Army because of its unique military value."

While modernization ensures the American warfighter is equipped with the most capable weapon systems and equipment, it also applies to the processes and infrastructure that drive the management and pay of the Soldier: the Army's most valuable resource.

FIGURE 2



USER-CENTERED DESIGN

IPPS-A uses operational mission scenarios to show how the system will improve the lives of HR professionals, commanders and Soldiers. These events also serve to train and transition the total force in advance of IPPS-A's deployment.

CONCLUSION

IPPS-A must be developed. As we deploy its capabilities to all three components, beginning with the National Guard in early 2019, the program will continue leveraging agile teams to innovate and formulate solutions to the challenges of building an integrated personnel and pay system. We will also continue listening to feedback from stakeholders at all levels as we rely heavily on this input to improve the utility and usability of the system. IPPS-A needs the continued support of Soldiers and Army civilians across the total force to bring this transformation to fruition.

The IPPS-A Program is currently on track to roll out initial capabilities to the National Guard in 2018-2019. As we work toward full operating capability, we remain committed to developing a system that embodies the mantra of "One Soldier, One Record, One Army" and we are going to get this done for the Total Force.

For more information, go to the IPPS-A website at ***www.ipps-a.army.mil****.*

COL. GREGORY S. JOHNSON is the functional management division chief for IPPS-A, under the G-1 Technology and Business Architecture Integration (TBAI) directorate. He manages the partnership between TBAI and the Program Executive Office for Enterprise Information Systems (PEO EIS) to develop, deliver and set the conditions for successful sustainment of IPPS-A. He is a career Army Adjutant General Corps officer. He holds a master's degree from the U.S. Army War College, a Master of Policy Management from Georgetown University's Public Policy Institute and a Master of Education from the University of Oklahoma. He is a distinguished military graduate of the University of San Francisco, earning a B.A. in U.S. history.

Photo Credit: Specialist Adam Hoppe

THE U.S. ARMY

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Logistics Modernization Program

THE COST OF SPEED

BELER H. WATTS III

COMMAND/ORGANIZATION: Close Combat Weapon Systems Project Office, Program Executive Office for Missiles and Space

TITLE: Deputy product lead, Lethal Miniature Aerial Missile System

YEARS OF SERVICE IN WORKFORCE: 10

YEARS OF MILITARY SERVICE: 20

DAWIA CERTIFICATIONS: Level III in program management and in logistics

EDUCATION: M.A. and B.A. in business management, Columbia College

AWARDS: Commander's Award for Civilian Service (2)

Like most members of the Army Acquisition Workforce, Beler Watts has a lot on his plate. He's deputy product lead for the Lethal Miniature Aerial Missile System (LMAMS) within the Program Executive Office for Missiles and Space (PEO MS), and he and his team are working to get the new system fielded expeditiously. But speed often comes at the expense of quality and utility, and he's hoping to avoid that. "We want to get the system to the Soldier as quickly as we can, but we want to make sure we're getting them something that does what it should. What's that saying? 'Quick and cheap isn't always good, and good isn't always quick or cheap.' "

It's Watts' job to make certain that all aspects of the LMAMS program are accomplished. "I ensure that the contracting actions are complete, and I monitor the finance actions and training for the system," he said. "I try to ensure that Soldiers are getting the best product in their hands in the shortest amount of time. The greatest satisfaction I have is knowing that what I do is part of the bigger picture and that my small part ensures that quality products are fielded to the warfighter."

It's not surprising that the biggest challenge he faces is time management—"finding time to do all the different things that need to get done, and doing them well." Adding to that challenge is the size of Watts' team: At around 10 people, it's relatively small. "We all get to wear a lot of hats, but that's what makes this job so interesting. I do a multitude of things on a daily basis, including contracting, finance, logistics and engineering. And that's the best thing about my job—that on any given day, I'll be in contact with all of those different areas. Every day I'm doing something different."

After a 20-year career in the Army, Watts retired in 2005 as a sergeant first class. While on active duty, he worked with the Dragon and TOW (tube-launched, optically tracked, wire-guided) missiles for Bradley Fighting Vehicles and with missile guidance systems. After retirement, he spent three years as a contractor, doing staff work related to aviation maintenance, pre-positioned stocks and equipment transfer.

He joined PEO MS in 2008, initially assigned to logistics programs related to the Bradley: testing, equipment specifications, working with depots and producing technical manuals and other publications. In 2012, he took a developmental assignment as deputy product lead. "I had been a logistician for about four years with the Close Combat Weapon Systems [CCWS] Project Office, and was ready for a change. I then competed for the deputy product lead position, was fortunate enough to be selected, and I've been here ever since," he said.

"My advice is to pursue some of the opportunities out there for developmental assignments and experience what the acquisition world has to offer," he said. "There are

multiple programs available for acquisition personnel, and the more someone takes advantage of these programs, the more rounded that person will be. And it will set them up better for advancement in their careers."

Although he's no longer in uniform, Watts still uses the leadership experience he gained from his active-duty tenure. "The supervisory and organization skills I learned as a noncommissioned officer come into play on this job when it comes to working with people, and the experience I gained in logistics, maintenance and supply operations are invaluable in keeping things moving."

Originally designed to target snipers or those emplacing improvised explosive devices, LMAMS is a Soldier-carried and Soldier-launched loitering missile system that allows precision engagement of enemy combatants without exposing warfighters to direct fire. The system allows Soldiers on the ground to engage with targets they cannot see. It can fly to a specific position or be diverted with its wave-off capabilities to minimize collateral damage.

LMAMS started out as a rapid acquisition system and is fielded under multiple joint urgent operational needs statements. "It's not a program of record yet, but we're working toward that. We work with HQDA and obtain funding through overseas contingency operations funds to buy and develop what we need," Watts explained. "We're working with the Maneuver Center of Excellence and the Capability Development Integration Directorate, and the courses I took through Defense Acquisition University have been really helpful as we go through that process."

Whether LMAMS will become a program of record is unresolved. "We're on the verge, but it's tough to say where it will go. It's important that we demonstrate what it can do and how it can fit into the Army's needs." Despite the uncertainty, Watts is grateful for the experience he has had. "Being able to stay in this job and see a new system through the process of becoming a program of record is very interesting. Having the mentorship of some of the CCWS leadership and learning from their experiences also has helped me tremendously," he said.

He added, "The most important lesson that I've learned is to treat people with respect and kindness. I apply that in my work by trying to understand where others are coming from, in their opinions and respective positions. Always trying to see any situation from both sides has greatly enhanced my work, and I hope it has enabled me to become a better co-worker and leader."

—SUSAN L. FOLLETT

LEADING FROM THE FRONT

Watts still uses the leadership experience he gained from his 20 years in the Army. "The supervisory and organization skills I learned as a noncommissioned officer come into play on this job when it comes to working with people," he said. (U.S. Army photo by Chuck Braziel, PEO MS)

HERE'S HOW THIS WORKS

RLSC's Jon Hyatt conducts operator training for Soldiers at Fort Polk, Louisiana. In addition to serving as the Army's repair and maintenance provider for more than 4,000 robots, RLSC provides training support to the Army, the Air Force, the Coast Guard and the Marine Corps as well as the National Guard Bureau and foreign military sales partners. (Photo by William Gothreaux, RLSC)

CUTTING the COST of NUTS and BOLTS

PEO CS&CSS's Robot Logistics Support Center uses IDIQs and a unique sustainment approach to keep robot systems up and running.

by Thomas A. Lettis and Adam Bennett

Conventional Army contracting mechanisms can be manpower-intensive, cumbersome and costly. The Robot Logistics Support Center (RLSC) uses indefinite-delivery, indefinite-quantity (IDIQ) contracts to keep costs down, minimize demands on contracting personnel and quickly return repaired systems to the warfighter.

RLSC is the Army's only source of repair and maintenance for its fleet of more than 4,000 non-standard robots, consisting of five different models and 28 unique configurations. The RLSC sustainment team conducts repair and return services at 11 locations in the United States and a site in Kuwait; a new site is slated to open soon in Germany. The organization also provides robot sustainment and training support to the U.S. Air Force, the U.S. Coast Guard, the U.S. Marine Corps and the National Guard Bureau, as well as foreign military sales partners. RLSC is part of the Project Manager for Force Projection within the Program Executive Office for Combat Support and Combat Service Support.

RLSC establishes a five-year IDIQ contract with each robotic original equipment manufacturer to supply parts at the wholesale and retail levels for robot repairs as well as for recapitalization and reset activities. It currently has IDIQs with two manufacturers, both in Massachusetts: QinetiQ North America in Waltham and Endeavor Robotics in Chelmsford. The use of IDIQs reduces procurement action lead time and the effort that goes into requirements package preparation. It also yields benefits in the form of shorter staffing, faster execution, more direct lines of communication with manufacturers and no vendor fees. IDIQs also boost small business participation, resulting in a more stable and solid robotics industrial base.

Late in 2018, the RLSC Contracting and Budget Team received the Secretary of the Army Award for Excellence in Contracting for Outstanding Unit/Team in the category of Systems, R&D, Logistics Support (Sustainment) Contracting as a result of its use of IDIQs and its approach to sustainment.

BENEFITS OF IDIQ CONTRACTS

An IDIQ contract provides for an indefinite quantity of a product or service, with stated limits, during a fixed period. This type of contract requires the government to order (and the contractor to furnish) at least a stated minimum quantity of supplies or services. The contracting officer decides a reasonable maximum quantity for the total contract. IDIQs can streamline the contract process and speed delivery times.

The main content of the IDIQ contract is the master parts list, which contains each part found at all levels of the bill of materials for all supported robotic platforms—in other words, the smallest replaceable component or smallest part that makes up a larger assembly. The master parts list is especially important to RLSC to perform immediate field-level repair and return, and for depot-level reset and recapitalization sustainment activities. RLSC holds weekly meetings with each manufacturer to forecast revision of parts, discuss engineering changes and address obsolescence issues.

A WINNING TRIO

The RLSC Contracting and Budget Team—from left, procurement analysts Barry Jones and Amy Zappitell and program analyst Jennifer Maxwell—received the Secretary of the Army Award for Excellence in Contracting for Outstanding Unit/Team in the category of Systems, R&D, Logistics Support (Sustainment) Contracting in late 2018. (Photo by Adam Bennett, RLSC)

CAN YOU HEAR ME NOW?
Shawn Wyzlic, a technician at RLSC, troubleshoots the communications system on a Talon robot. By isolating problems to the smallest repairable or replaceable component, RLSC has reduced sustainment costs as well as repair time. (Photo by Jay Lambertson, RLSC)

RLSC contractors are as organic to the mixed-manpower staff as the government civilian employees, ensuring a cooperative relationship between contractors and government representatives that has lasted more than a decade with an exceptionally high degree of success.

Using IDIQ contracts, RLSC can quickly award delivery orders for any required part or list of parts within one to two weeks. Previously used contracting mechanisms—namely, assisted acquisition contracts—required a minimum of three months for the preparation of a substantial requirements package, staffing and execution.

From a cost perspective, every part on the master parts list is priced for five years, which is extremely beneficial in the areas of budgeting and planning for projects and programs that span multiple fiscal years. As an example of cost savings, RLSC transitioned the contracting mechanism on a robot recapitalization program within its portfolio to an IDIQ contract from an assisted acquisitions contract. After contract negotiations, the average cost of a production kit to upgrade a single robotic system was reduced by an estimated $20,000, or 13 percent of the total hardware cost, according to internal estimates. The reduced cost for the recapitalization program provides for acquisition and allows for delivery of additional assets, allowing RLSC to reach full operational capability sooner and for funding to be diverted to other crucial areas such as acquiring spare parts, training and fielding.

Additional gains through the use of IDIQs have been made in manpower. Other contracting mechanisms require 1.5 man-years of an RLSC procurement analyst and four man-years of personnel from the U.S. Army Contracting Command (ACC) – Warren, Michigan, to staff an extensive contracting package through to contract award. Under an IDIQ contract, the manpower is reduced to one procurement analyst, one contract specialist and a half of a procurement contracting officer's time, cutting ACC – Warren contracting manpower figures to 2.5 man-years. Much of that reduction comes because a price analyst is not required to award requirements on an RLSC IDIQ contract, since the master parts list is fully priced from the IDIQ award for five years.

SUSTAINMENT MODEL PROMOTES AGILITY

While the IDIQ contracting mechanism yields many important benefits, equally beneficial to robot readiness throughout the extensive customer base is RLSC's sustainment model. Its maintenance philosophy is to repair robots to the lowest repairable component. Since RLSC is able to purchase components at the lowest level of the bill of materials for robotic systems, technicians need not remove a depot-level repair part, or major assembly, from a fully configured robot—essentially removing an entire assembly, shipping it to another facility for repair or refurbishment, and then applying a replacement assembly in its place.

Instead, the technician can troubleshoot and then isolate the smallest component causing the failure and complete a work order action to remove and replace it. These lower-level components can include nuts, bolts, screws or other pieces of hardware, wiring harnesses or controller boards.

The depot-level repair part replacement process was put in place in 2006 when these robotic systems were first procured for the contingency operations in Iraq and Afghanistan. When RLSC assumed responsibility for the sustainment of all non-standard equipment robotics systems in 2014, the sustainment strategy shifted to the more agile model that remains in place.

For example, a technician might determine that a manipulator arm assembly has a fault: One of the arm's joints is not moving through its intended range of motion. If the former depot-level repair part model were applied, the technician would have to remove an entire arm assembly and replace it with a costly new or refurbished one. However, under RLSC's model, the technician would isolate the fault to the smallest repairable or replaceable component, such as a pinion gear within one of the arm's motors.

There are four major benefits to be realized when applying this model. The first is financial. The cost of a whole arm assembly can exceed $20,000, while the cost of an arm motor pinion is $50. Over a five-year period, RLSC completed approximately 650 work orders to repair robot arms.

If every arm had been done using the depot-level repair part process, the cost of the arm assemblies would have been roughly $13 million. But filling those work orders using the arm motor pinion gear reduces the cost to approximately $35,000. Even if each work order were isolated to an arm motor, it would be $3 million versus $13 million, a savings of $10 million over that five-year period.

The second benefit is supply availability, impacting the turnaround time for the work order action to be completed. By

TAB A GOES INTO SLOT B

RLSC technician Todd Oakey rebuilds the arm of a Talon robot. RLSC recovers components from legacy systems and uses them as stock for newer projects, improving capabilities and providing a bridge between older systems and newer ones. (Photo by Jay Lambertson, RLSC)

keeping smaller consumable parts on hand at the retail or shop level, RLSC can immediately apply parts and complete the work order within hours instead of days or weeks.

The third benefit is the time saved by eliminating the need to change the robot's configuration. Arm assemblies are high-dollar, serialized components. If the arm assembly is to be removed, additional logistics automation transactions are necessary to adjust the robot's configuration within the logistics automation database.

Finally, the fourth benefit is eliminating the need to send the work to a facility with the capabilities to replace major hardware assemblies on the robotic system. RLSC has skilled technicians at both the main depot and 13 locations inside and outside of the United States, all of which are capable of performing field-level and depot-level repairs.

THE BENEFITS OF SEED STOCK

RLSC also recovers legacy systems when new robotic systems are fielded to military units, and these older variants later serve as seed stock for future projects. This seed-stock method has been applied to two recent recapitalization and modification efforts.

The first is a recapitalization of explosive ordnance disposal robots that will serve as a bridging solution until the program of record reaches the materiel release phase and begins fielding the replacement system. The second effort is a modification of an existing platform that detects chemical, biological, radiological, nuclear and high-yield explosives. The modification will provide additional capabilities of area mapping and sensor feedback from the robot to the operator's position. For the second effort, the base chassis of the robot was upgraded to accommodate the installation of additional payloads to provide the increased capability and enhanced performance. A new procurement of this asset would typically cost approximately $315,000 per robot. However, by reusing the base chassis of a seed stock asset, the cost was reduced to $287,000.

CONTRACTOR LOGISTICS SUPPORT

Key to the RLSC sustainment model is government-led contractor logistics support. When acquisition professionals think of contractor logistics support, there is a perception that this means program-owned robots or that those on military unit property books are evacuated from the program manager shop or from the field to a separate contractor organization for maintenance and sustainment activities. As part of this evacuation process, there is a complicated logistics tail of having to perform multiple government-furnished property transfers to establish a chain of custody as robots are shipped to and received from the contractor. Instead, RLSC embeds contractors into the government maintenance induction process and employs a logistics automation database that makes additional transfer of government-furnished property unnecessary. RLSC contractors are as organic to the mixed-manpower staff as the government civilian employees, ensuring a cooperative relationship between contractors and government representatives that has lasted more than a decade with an exceptionally high degree of success.

CONCLUSION

RLSC will continue to employ its contracting and sustainment approach across its operations, including several upcoming important efforts:

- An FY19 recapitalization production kit purchase for explosive ordnance disposal robots.
- Semiannual sustainment parts purchases for several robotic platforms.
- Numerous foreign military sales cases for robots, parts and training.

The flexibility and experience that have grown within the organization, accompanied by the agility and efficiency found in the execution of IDIQ contracts and RLSC's smaintenance approach, allow RLSC to provide the highest level of sustainment support for its worldwide customer base and user communities, ensuring the safety and lethality of today's warfighters.

For more information, contact Tom Lettis, RLSC director, at ***thomas.a.lettis.civ@mail.mil****, or go to* ***http://www.peocscss.army.mil/*** *or* ***http://www.peocscss.army.mil/pmfp.html****.*

THOMAS A. LETTIS is director of RLSC, a position he has held since October 2016. Lettis entered civil service in 2005 after serving 21 years in the Army and retiring as a command sergeant major. He holds an M.A. in program management and a B.S. in business administration from Excelsior College. He is a member of the Army Acquisition Corps and is Level III certified in program management and life cycle logistics.

ADAM BENNETT is a product support integrator in RLSC. An 11-year Army veteran, he has worked in defense robotics for a decade. He holds a B.S. in criminal justice from Ferris State University.

BENJAMIN LITTLE

COMMAND/ORGANIZATION: Product Manager for Virtual Training Systems, Project Manager for Training Devices, Program Executive Office for Simulation, Training and Instrumentation

TITLE: Systems engineer

YEARS OF SERVICE IN WORKFORCE: 9.5

DAWIA CERTIFICATIONS: Level III in systems engineering; Level I in program management

EDUCATION: B.S. in computer engineering, University of Central Florida

WORKING THE PROCESS

When Ben Little is not at his office at the Program Executive Office for Simulation, Training and Instrumentation (PEO STRI), you can find him in his kitchen or working around his house. Both places provide lessons that he uses in his work as a systems engineer for the Product Manager for Virtual Training Systems (PM VTS). "In both of these areas, similar to being at work, you have to devise creative solutions to achieve your goal. When I have a home project I want to do or a dish I want to make, I research how to do it, buy supplies and tools and execute the process, with the final result of a completed project or a delicious meal. Similar processes are followed throughout the acquisition of a training device."

Formerly the Product Manager for Ground Combat Tactical Trainers, PM VTS is assigned to the Project Manager for Training Devices, responsible for providing realistic training environments and equipment. PM VTS develops, fields and provides total acquisition life cycle management for precision gunnery, driver, route clearance, air and watercraft operation, satellite control and maintenance virtual training systems supporting institutional, home station and contingency operations.

Little is responsible for working with customers, stakeholders and contractors to define, develop and deliver training systems that meet cost, schedule and performance requirements and provide effective training to ensure the combat mission readiness of every Soldier that receives training. "Proper training can save lives, and without adequate training and training devices, warfighters will be ill-prepared for the duties and tasks they will face while deployed," he said.

"Whenever I tell people about my job, the one thing that always catches their attention is the travel," noted Little. "Traveling is a frequent occurrence on the job, and I've been fortunate enough to have the opportunity to travel to places I've always wanted to go—as well as some places that I never thought I'd go—and I have enjoyed them all." Among the places he's visited are Germany, South Korea, Hawaii and Alaska, often to deliver or upgrade a training system. "It's really gratifying to see something we've worked on finally in the hands of the users, in different locations and for different types of training. It's also gratifying to have the opportunity to get their feedback—hearing their comments and questions firsthand is invaluable."

After working in industry for a few years as a contractor for PEO STRI, Little learned about an internship within the organization and decided to apply. "I saw working for PEO STRI as an opportunity to get closer to the fight and have a greater impact on the training devices we provide our Soldiers—to be involved with the development of training systems from inception to delivery to the warfighter," he said. But he noted that his first acquisition position, engineering intern, came with a steep learning curve. "For someone who was recently out of college and wasn't prior service, much of being an engineering intern was learning the processes and

the lingo, as well as the roles of people and agencies within the Army acquisition community."

Transitioning from private industry to the public sector also gave him a perspective on how both components operate in the acquisition process. "When I was working in private industry, the challenge was to work within the cost, schedule and performance constraints that were set by the client. Now I'm on the other side of that equation, as part of the team that establishes those parameters."

For Little, one of the most important points in his career was the first time he oversaw a project from inception to delivery—in this case, an upgrade for a virtual gunnery training system. The U.S. Army Training and Doctrine Command updated training standards, which necessitated changes to the system. "Being responsible for coordinating meetings with stakeholders, conducting negotiations with the contractor, holding working groups to develop the product, leading test events and delivering the product to the site was an exciting experience that gave me opportunities to learn at every point along the way," he said. "The lead engineer on the program was always there to guide me if I had any questions and supported my ability to manage the project."

SEEING IT THROUGH

One of Little's most valuable experiences as a product manager, and a first in his career, was to shepherd the Stryker MGS Advanced Gunnery Training System, a major upgrade, from inception to delivery.

TEST FIRE

Little tests the Stryker Mobile Gun System (MGS) Advanced Gunnery Training System, which provides precision virtual gunnery simulation training for MGS crews and platoons. The system replicates the gunner and commander positions within the turret of the Stryker MGS vehicle. (Photos by Andrew Richards, PM VTS)

His biggest takeaway from the project was confidence. "For me, acquisition was far removed from anything I learned in college, so there was a lot to learn. But I worked through the entire process and was able to go to the lead engineer when I had questions. And when it was all done, I realized I had learned a great deal and was confident more in my abilities as a result."

No matter the project, he added, "communication and teamwork are key. In any acquisition program, there is too much for one person to do it all and you have to be able to engage the resources around you. You won't know everything, so ask for help. You can't do everything, so learn how to prioritize tasks and delegate what you can."

For Little, the biggest payoff in being part of the Army Acquisition Workforce is "being a part of the Army family, where career development and personal development are equally important. The amount of consideration and care that is exemplified through the recognition of career milestones, personal life milestones and camaraderie throughout the organization is unmatched. I'm grateful for the support that VTS provides to its workforce."

For those looking to advance their careers, he added, "Don't be afraid to ask questions, but be prepared to learn the information given. There are many Army acquisition professionals who came before you who have a lot of knowledge to offer. The more you can learn from them, the better an acquisition professional you will become."

—SUSAN L. FOLLETT

INNOVATION *COUNTDOWN*

Expeditionary Technology Search narrows Army-funded competition from over 350 proposals to 12 contenders for a $200,000 award.

by Dr. Matt Willis and Jennifer Smith

When Dr. Bruce Jette, assistant secretary of the Army for acquisition, logistics and technology (ASA(ALT)), launched the Army Expeditionary Technology Search (xTechSearch) in June 2018, the focus was to start a conversation, lower barriers to engaging industry and build trust with small businesses and startups. Thus they could rapidly develop new, innovative technologies for the Army using the unconventional paradigm of a prize competition to connect with small nontraditional businesses in a way that cuts bureaucracy and streamlines cumbersome administrative processes, while increasing mentoring and partnership opportunities.

Dr. Thomas P. Russell, deputy assistant secretary of the Army for research and technology (DASA(R&T)), said that xTechSearch "gives us the potential for future capabilities, but the bigger impact is getting people aware of the things we're interested in."

Accordingly, the Army structured the xTechSearch program as a prize competition with a minimal requirement for entry—a 1,000-word white paper describing the technology. To maximize outreach to elements of the technology sector that traditionally would not do business with DOD, the Army advertised xTechSearch broadly, including on Challenge.gov, FedBizOpps.gov, venture capital platforms, and media venues, including national media (e.g., Engadget, Mashable), government periodicals, Twitter and Facebook. As the U.S. Army Research Laboratory (ARL) described xTechSearch

And the finalists are:

Adranos Inc.

Aeronics Inc.

Blacksand Technology LLC

Cuberg Inc.

Hivemapper

Hyperdyne Inc.

Nodar Inc.

Notch Inc.

Sempulse LLC

TangiTek LLC

WildSpark Technologies LLC

Wiser Systems Inc.

For a quick look at a sampling of the finalists, read about four of them and their technologies in "A Wealth of Ideas," Page 51.

on its website, the solicitation requested "innovative technologies and ideas" from the nontraditional defense community—from concepts to fielded products—"that can solve Army challenges" for the future battlefield by supporting its six modernization priorities.

More than 350 companies submitted papers for Phase I of the competition. The companies represented a wide spectrum of the country, including 42 states; 70 percent of those companies had no previous engagement with the Army, with 40 percent of those having no previous engagement with the government.

THE SELECTION PROCESS

After a rigorous technical review of the white papers, senior technologists from several Army laboratories along with scientists, engineers and operators from ARL, the Army Capabilities Integration Center, U.S. Army Special Operations Command and the DASA(R&T) selected 125 companies, or 35 percent of those that had submitted technology concepts. More than 100 Army scientists, engineers and warfighters participated in the technical review.

Each of the 125 companies received $1,000 and an invitation to Phase II of xTechSearch, in which they would pitch their concepts to a panel of Army experts, including laboratory scientists and engineers, operators and technology transfer leads. During this phase, each company identified the ARL Open Campus location, of several across the country, where they wanted to make their venture capital-style pitches. The locations included Playa Vista, California; Chicago; Austin, Texas; Boston; and Adelphi, Maryland.

HEIGHTENED AWARENESS

Dr. Thomas P. Russell, DASA(R&T), introduced xTechSearch presentations at the Innovator's Corner of the 2018 AUSA meeting in Washington. The xTechSearch competition, he said, "gives us the potential for future capabilities, but the bigger impact is getting people aware of the things we're interested in." (Photo by John Scott, ARL)

AND THE FINALISTS ARE ...

Russell and Dr. Bruce D. Jette, ASA(ALT), center right, pose with representatives of the 12 finalists in the xTechSearch competition at the AUSA annual meeting in Washington. Each of the 12 companies received $125,000 and an invitation to participate in the final phase of xTechSearch, a capstone demonstration this spring. (Photo by John Scott, ARL)

ARL's Open Campus concept is a science and technology ecosystem that encourages groundbreaking advances in basic and applied research areas of relevance to the Army. Through the Open Campus framework, Army scientists and engineers work collaboratively, usually in the same location, with visiting scientists from academia and industry. The panel of experts evaluated each pitch based on its potential to impact or revolutionize the Army, its scientific and engineering viability, and the product team's experience and abilities.

After review, the Army invited 25 companies to Phase III of xTechSearch. Phase III conferred a $5,000 prize and exhibit space in the Innovator's Corner at the 2018 Association of the United States Army (AUSA) Annual Meeting and Exposition in October in Washington.

During the Phase II and Phase III events, companies also had the opportunity to network with Army representatives from the laboratories' small business and technology transfer offices in a low-pressure environment that broke down perceived barriers between industry and the military. Karl Kappra, ARL's chief of strategy management, said that "xTechSearch provided an opportunity for small businesses to make government labs aware of their innovative ideas. Then, working with our military, we can collaborate with them to give them insight on how they could tailor their ideas to support Army modernization priorities."

LOW-PRESSURE NETWORK
ARL experts in partnering and technology transfer brief xTechSearch participants at a networking session during Phase II of the competition at ARL's Open Campus West – University of Southern California in Playa Vista. The low-pressure networking sessions were designed to break down perceived barriers between industry and the military. (Photo by Tracie Dean, ARL)

The networking was also valuable to the Army; Russell said that the bigger impact of the xTechSearch competition was "increasing our network of people in our ecosystem and to try and think about how we solve Army problems." Feedback from one company was that the networking talk opened up many new possibilities.

CONCLUSION

Phase III culminated in Russell announcing the 12 finalists at the AUSA event, with Jette attending to provide his congratulations. (See Page 48 for the list of finalists.) Each of the 12 received $125,000 and an invitation to participate in the final phase of xTechSearch, a capstone demonstration in spring 2019 in which each company will showcase a technology proof of concept to Army leadership. At the capstone demonstration, one company will receive the top award of $200,000.

For the long run, the major benefit that all the companies gained from the xTechSearch competition was understanding the spectrum of opportunities for engaging with the Army research community. In addition, through the questions and concerns presented by the small businesses, the companies began to understand the technical challenges the Army is trying to solve—without all the red tape.

The Army plans additional xTechSearch initiatives in 2019, showcasing it again at the Innovator's Corner of the AUSA Global Force Symposium and Exposition, scheduled for March 26–28 in Huntsville, Alabama. The conversation about innovative solutions to Army challenges will continue.

For more information, contact ***usarmy.pentagon.hqda-asa-alt.mbx.xtechsearch@mail.mil.***

DR. MATT WILLIS is director for laboratory management in the Office of the DASA(R&T). As such, he shapes policies that impact the workforce, infrastructure, technology transfer, and science, technology, engineering and mathematics educational outreach at the Army science and technology research laboratories. He holds a Ph.D. and an M.S. in chemical engineering from the University of Illinois at Urbana-Champaign and a B.S. in chemical engineering from Cornell University. He is Level II certified in science and technology management and is a member of the Army Acquisition Corps.

JENNIFER SMITH was detailed during 2018 from the U.S. Army Engineer Research and Development Center's Geospatial Research Laboratory to Office of the DASA(R&T) and served as deputy director for laboratory management. She holds an M.S. in geospatial intelligence from George Mason University and a B.S. in physical science from the University of Maryland.

A WEALTH OF IDEAS

From hundreds of possibilities, the 12 companies chosen to develop proofs of concept for the final phase of the assistant secretary of the Army for acquisition, logistics and technology (ASA(ALT)) Expeditionary Technology Search (xTechSearch) competition represent a broad swath of innovation, from nanotechnology to field medical triage devices to smart antennas to radar-absorbing materials. One of the 12 competing capabilities will prove to the ASA(ALT) and the Army to be worth a $200,000 award.

Following are snapshots of four of the finalists and their xTechSearch technologies, randomly chosen by the Office of the Deputy Assistant Secretary of the Army for Research and Technology.

HIVEMAPPER

Hivemapper's team of mathematicians, physicists, computer scientists and user experience designers set out to create a modern mapping platform fed by a network of videos. It blends 3D mapping with computer-vision algorithms that automatically see and reveal changes happening in the world. Every new car, drone and airplane has a camera, and will soon have lidar (light detection and ranging) sensors; Hivemapper brings together all of the information they gather into one tool for analytics.

Cameras and lidar sensors generate massive amounts of data—far more data than satellites ever could—requiring analysts to spend hours staring at a map to derive valuable information. Hivemapper automatically answers the critical question of what's new, what's gone and what's unchanged. Immediately discover whether a tree is leaning into a utility pole, a road is eroding beyond safety limits, a natural disaster has damaged a city, and more.

Hivemapper merges the utility of 3D maps, the visual fidelity of video, the accuracy of lidar and the power of machine learning analytics for the analyst on the ground.

MAPPING CHANGES

Hivemapper has developed a modern mapping platform that blends 3D mapping with computer-vision algorithms that automatically see and reveal changes happening in the world. (Image courtesy of Hivemapper)

SEMPULSE LLC

VITAL INFORMATION

Sempulse has developed a sensor that adheres to the back of the ear and acquires patients' vital signs—including blood pressure, heart rate and core body temperature—as well as GPS and more. (Image courtesy of Sempulse)

Sempulse has developed a noninvasive vital signs sensor that adheres to the back of the ear and acquires patients' five major vital signs—which the company says is an industry first—cuffless blood pressure, pulse oximetry, heart rate, respiratory rate and core body temperature, plus GPS and more.

The idea came from discussions with medics returning from Afghanistan about the need for new technology to triage casualties. Three years of research, development and testing led to the miniature device, which can easily be placed on most casualties to provide real-time monitoring of vital signs. Instead of several minutes to triage a patient, the device allows for triage in seconds for multiple casualties and provides more care or a link to a remote physician. The 30 hours of battery life allows monitoring to continue through and after transport.

The software has been optimized for medevac. An artificial intelligence and machine-learning platform is designed to identify issues like internal bleeding. Sempulse has a simple goal: saving lives. Its platform is also finding interest from civilian markets, such as neonatal intensive care units, heart disease treatment and postoperative monitoring.

Sempulse is a component of the MassChallenge innovation ecosystem and the Texas Health Catalyst program.

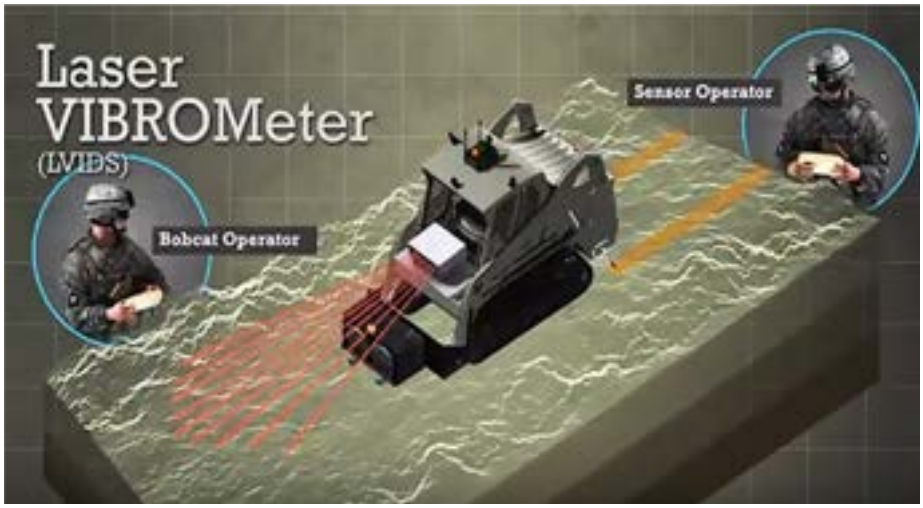
NODAR INC.

NODAR, an early-stage, high-tech startup formed by Massachusetts Institute of Technology alumni and located in the Boston area, builds optical 3D sensors for autonomous vehicles. The company, which previously developed a laser vibrometer that operated from a moving ground vehicle, says its unique technology outperforms the current lidar market in both reliability and safety, and that its robust, long-range technology operates in extreme weather conditions and temperatures.

NODAR's system projects a continuous nonscanning laser array to measure range to objects by triangulation. The proprietary laser array and optical receiver filter are optimized for performance across a range of distances and in varying types of light, from darkness to broad daylight. NODAR, whose name comes from "native optical detection and ranging," is a solid-state camera/projector-based system with no moving parts and inexpensive standard and proprietary components. The company touts its high reliability and durability as well as its ability to operate in a wide range of environmental and atmospheric conditions. Applications for these characteristics include self-driving consumer, commercial and industrial vehicles.

For the xTechSearch proof-of-concept capstone event, NODAR will demonstrate its 3D sensor in harsh weather conditions such as rain, snow and hail, to show how the sensors would significantly enhance autonomous operation of the Army's combat vehicles, supply vehicles and other robotic platforms.

NODAR



FOUL WEATHER TOOL

NODAR previously developed a laser vibrometer that operated from a moving ground vehicle. The company builds optical 3D sensors for autonomous vehicles and says its technology outperforms current lidar and operates in extreme weather conditions and temperatures. (Image courtesy of NODAR)

NOTCH INC.

NOTCH

Notch, founded in December 2017, focuses on the development of metamaterials for smart antennas. Notch has developed a retrofit enclosure that converts an omnidirectional antenna to a smart antenna that can electronically reconfigure its radiation pattern (without any moving parts) at a lower cost as compared with phased array systems. A Notch powered antenna system can then be used to boost communication range and protect against multiple simultaneous directions of jamming suppression. The company says that the system's functionality can easily be upgraded in software, and that its retrofit nature allows for easy, inexpensive deployment to existing systems.

The applications of this technology include covert communications for autonomous vehicles, reduced radio frequency signature for handheld radios, anti-jam GPS receivers, retrofits to omnidirectional jammers to prevent directional jamming of friendly communications, ground stations that can electronically track low-Earth-orbit satellites, denial-of-sleep protection in internet-of-things devices, and cellular 5G communications.

Notch is a recent graduate of the Boston Techstars Autonomous Accelerator, an entrepreneurial partnership with the Air Force that gives the military access to emerging technologies.

—ARMY AL&T STAFF

SMART ANTENNA

Notch has developed a retrofit that converts an omnidirectional antenna to a smart antenna, boosting communication range and protecting against multiple simultaneous directions of jamming suppression. (Image courtesy of Notch Inc.)

SAFE AT HOME

A Soldier with the New York Army National Guard is reunited with family in August 2017 after a nine-month deployment to Kuwait and Iraq. Studies indicate that PTSD occurs more often in deployed Soldiers than in civilians, and an Army medical research program is looking into new ways to treat the alcohol and substance abuse disorders that often accompany it. (U.S. Army National Guard Photo by Staff Sgt. Michael Davis, New York National Guard)

TEAMING UP on SUBSTANCE ABUSE

Consortia partnerships developing treatments, especially for patients with TBI or PTSD.

by Erin Bolling

It has been eight years since Congress first funded an Army-led research program to address substance abuse, yet it remains an issue that, for many individuals and family members, dwells in the shadows. For those who live with alcohol and substance abuse in their homes, the Congressionally Directed Medical Research Programs (CDMRP) manages the Alcohol and Substance Abuse Disorders Research Program (ASADRP) to explore potential therapeutic solutions.

The ASADRP looks for integrated approaches to address alcohol and substance abuse disorders, especially those related to traumatic brain injury (TBI) and post-traumatic stress disorder (PTSD). Through multidisciplinary, team-based efforts, researchers translate basic knowledge into enhanced clinical pharmacological treatments.

A recent Institute of Medicine report, "Substance Use Disorders in the U.S. Armed Forces," viewed alcohol as the key substance abuse problem in need of intervention and treatment among military personnel.

"The use of alcohol is common in all branches of the military," said Dr. Ray Santullo, ASADRP program manager. "Furthermore, the National Institute of Alcohol Abuse and Alcoholism reported that 37 percent of those experiencing alcohol abuse also may have a mental health condition."

PTSD "is a chronic, debilitating anxiety disorder that may develop after direct or indirect exposure to traumatic events," said Santullo. Recent studies have shown that alcohol dependence and PTSD

are highly comorbid—that is, medical conditions that have a high likelihood of existing simultaneously.

PTSD AMONG VETERANS

Among the general population, current rates of PTSD are estimated to be between 3.5 and 8 percent. In comparison, a large-scale investigation of 88,000 veterans serving in the Iraq war found that 12 percent had symptoms of PTSD soon after deployment and 17 percent had symptoms of PTSD at six months post-deployment, which is more than twice the civilian rate.

Along with the current effects of PTSD, approximately 25-30 percent of veterans who served in the Iraq and Afghanistan conflicts may have suffered a mild traumatic brain injury. Evidence indicates that the prevalence of alcohol and other substance abuse disorders from these recent conflicts in veterans with TBI is approximately twice that of veterans who did not suffer TBI.

The "warrior ethos" of the military, which may make some service members reluctant to admit to either mental health or substance abuse problems, can make military personnel less likely to seek help when it's needed, Santullo said. This challenge has to be taken into account in order to reach the military population that needs help.

The ASADRP is conducting its research at U.S. Department of Veterans Affairs medical centers, as well as military substance abuse treatment centers at Fort Gordon, Georgia, and Naval Medical Center San Diego. By conducting research at these military-specific locations, the program is able to access the appropriate populations and ensure relevant, impactful research.

A BIG-PICTURE APPROACH

"The current services offered to veterans do not adequately address co-occurring substance abuse disorders and PTSD, and there is an immediate need for the development of novel, evidence-based treatments," Santullo said. "Our goal here is to explore new opportunities addressing alcohol and substance abuse disorders, especially related to TBI and PTSD."

To achieve this goal, the ASADRP has invested in multidisciplinary teams of leading expert scientists and clinicians, in the form of consortia partnerships. One such partnership is the Pharmacotherapies for Alcohol and Substance Abuse (PASA) Consortium, a collaborative effort with 10 research institutions aimed at bringing new medications to market to treat alcohol and substance use disorders, with a special emphasis on TBI and PTSD in service members and veterans.

This team-based research approach aims to identify promising compounds for use as pharmacotherapies; conduct proof-of-principle research to determine which compounds are most appropriate for human trials; and conduct human proof-of-concept trials with the promising compounds, in order to ultimately provide functional medication to patients.

"The PASA consortium has released three rounds of funding opportunities and five studies are funded: two preclinical discovery studies and three proof-of-concept trials," said Dr. Rick Williams, PASA principal investigator with RTI International.

Four medications are in preclinical tests for alcohol use disorder and PTSD: doxazosin, developed to treat high blood pressure; zonisamide, an anti-seizure medication; ASP 8062, developed to treat fibromyalgia; and CERC 501, developed to treat depression and substance abuse disorders. Three other compounds are undergoing clinical review: PT 150, developed to treat alcohol abuse; naltrexone, used to treat substance abuse disorders; and buprenorphine, developed to treat opioid addiction.

"We have actively cultivated pharmaceutical company partners who have excellent compounds for alcohol and substance use disorders or PTSD available but need the complement of experts, which the PASA consortium provides, in order to complete human studies to the U.S. Food and Drug Administration's (FDA) standards," Williams said.

"Our initial partnerships started with small companies, but our successes in just the last two years have progressed to larger-scale partnerships with companies that can afford to conduct FDA Phase III studies and prepare new drug applications, if our Phase II studies show efficacy," he said.

BRINGING SOLUTIONS TO THE TABLE

Peer and programmatic review panels include scientists, clinicians, consumers from advocacy communities and members of the military. Consumers serve as full voting members and play a major role in ensuring that a program continues to focus on research with the potential to make a significant impact. (Image courtesy of the author)

REDUCING THE IMPACT

ASADRP is focused on decreasing the clinical impact of alcohol and substance abuse for service members, veterans and the American public. (Photo by U.S. Army Acquisition Support Center/KatarzynaBialasiewicz/Getty Images)

The new drug application is the vehicle toward FDA approval and the final step before pharmaceutical sales. The information gathered from these animal and human clinical trials become a part of the application.

To complement these industry collaborations, the Department of Veterans Affairs and the National Institutes of Health are helping to build a strong infrastructure, Williams said, allowing the discovery of new treatments and helping to bridge what is known in translational research as the "valley of death." These collaborations provide the funding and support needed to cross this valley, allowing medical research to become a new therapy or treatment and ultimately help the patient who needs it.

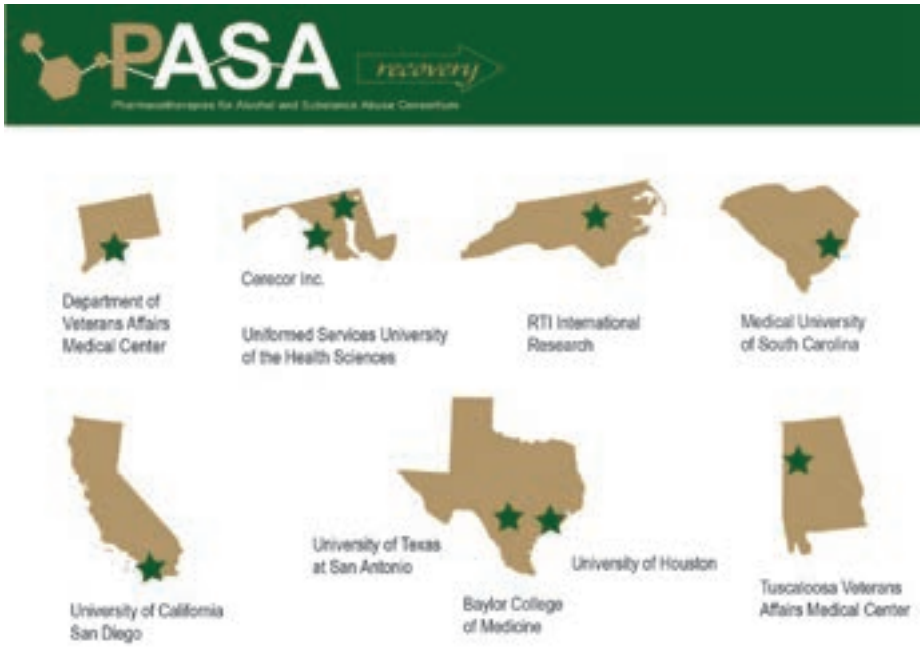
A CONSORTIUM CASE IN POINT

Another consortium partnership funded by ASADRP is the Institute for Translational Neuroscience, which collaborates with 22 research institutions with expertise in alcohol and drug addiction, PTSD and veterans health.

Dr. Jennifer Mitchell, the consortium's principal investigator and associate professor at the University of California, San Francisco, said it focuses on rapidly and inexpensively developing therapeutics by identifying and testing compounds that are already approved by the FDA for other indications and could work for alcohol and substance abuse disorders.

"We are currently testing three promising compounds," said Mitchell. "The first is oxytocin, which is a neuropeptide that is naturally produced in the brain and important for social bonding. Oxytocin can be administered as a nasal spray and has been used to treat a number of indications [mostly related to childbirth] for many years.

"More recent findings suggest that oxytocin can also block some aspects of alcohol intoxication, can decrease alcohol craving and can decrease signs of PTSD," she continued. "We are trying to gather funds to conduct a Phase III study of oxytocin in people with alcohol use disorder and PTSD, and we hope to someday see



PATIENT-CENTERED

As part of efforts to identify new treatments for PTSD and substance abuse, ASDRP has put together several multidisciplinary teams. One such organization, the PASA consortium, facilitates collaboration among universities, government research facilities, veterans affairs agencies and private industry to help focus research on compounds that could be used to treat TBI and PTSD in service members and veterans. (Graphic courtesy of the author)

this drug readily dispensed to individuals suffering from this comorbidity."

The second compound the consortium is focusing on is N-acetylcysteine, or NAC, a dietary supplement that builds antioxidants and is typically found in grocery or health food stores. NAC is also FDA-approved to prescribe for other conditions, such as cystic fibrosis or chronic obstructive pulmonary disease. Mitchell explained that strong evidence from both animal and human models shows that NAC can lessen the severity of symptoms of PTSD and alcohol use disorder.

"NAC has been used for many years, and is safe and inexpensive," said Mitchell. "Our consortium is now completing a series of studies that more thoroughly assess the conditions under which NAC improves mental health and behavior."

Tolcapone is the third compound that the consortium is investigating. Typically used to help patients with Parkinson's disease, tolcapone inhibits the degradation of the neurotransmitter dopamine, which allows dopamine to act longer in certain parts of the brain, helping to regulate movement and emotion.

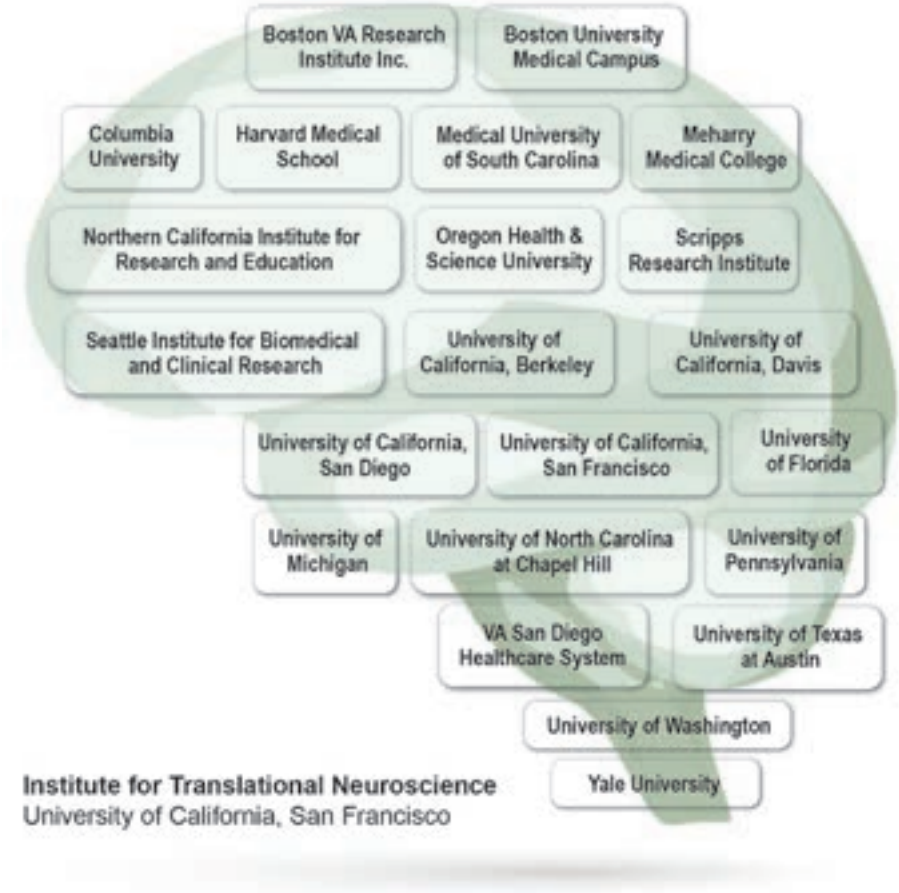
"Recent research shows that administration of tolcapone can help people that struggle with impulsivity and alcohol abuse," said Mitchell. "We hope that additional studies with tolcapone will help us determine the best dose to use to help people who are trying to control their alcohol consumption."

PROGRESS IN PARTNERSHIPS

As well as the partnerships among experts in the research field, CDMRP involves patients, survivors, family members and caretakers in the scientific review process. These individuals are selected through a three-step process that includes nomination by an advocacy organization, submitting an application and completing an interview. This integration of consumers with firsthand experience of a disease, injury or condition provides a depth of knowledge and contributes a human dimension to the research.

Retired U.S. Coast Guard Lt. Thomas Faulkenberry served as a consumer reviewer on the ASADRP programmatic panel for vision setting. Consumer reviewers such as Faulkenberry sit along with scientists on both the programmatic and peer review panels, and have full voting member status. These meetings provide an opportunity to harness the consumer's personal experience to focus the program's goals.

He welcomed the opportunity to advocate for other service members as part of his transition out of the military. "The research is fascinating to me. I like to know the pros and cons of a medication, as well as alternatives to medication in treating the common disorders in afflicted service members," he said. "I found the recent development that not enough



BUILDING BLOCKS

The Institute for Translational Neuroscience is made up of 22 research institutions with expertise in alcoholism, drug addiction, PTSD and veterans health issues. Led by Dr. Jennifer Mitchell, its focus is on rapidly and inexpensively developing therapeutics by identifying compounds that are already approved by the FDA for other conditions. (Graphic courtesy of the author)

healthy service members were available to launch a study eye-opening, but it was also an indicator that much more work needs to be done to observe progress. However, it also makes me want to fight harder to help a community that would give everything to know they are well and able to stand a taut watch," Faulkenberry said, using an expression that's common in the sea services.

CONCLUSION

Since its establishment in 2010, the ASADRP has been working to address the research gaps in treatment for substance abuse. The program has many exciting opportunities looking into effective medications for different substances of abuse with and without comorbidities such as PTSD. Additionally, the program is testing a variety of nonpharmacological approaches—including mindfulness, hypnosis and meditation—to treating pain and comorbidities in military and veteran populations.

The ASADRP's approach to multidisciplinary, team-based research combines experts in the field to develop actual treatments with the patients who need them, here and now. Williams and Mitchell are examples of how consortia work together to develop solutions.

"It can be difficult to work to improve the public perception of drug and alcohol use and PTSD and to engender greater compassion for those suffering from these conditions," said Mitchell. "If someone has a visible disability from combat, it can be relatively straightforward to feel that they deserve our help and patience. But those who carry trauma and emotional wounds that affect their mental health are more frequently discounted.

"We are so very grateful to the DOD for support of our consortium," she said. "These aren't typically the kinds of drugs that drug companies are interested in developing, so we need to be creative in funding our therapeutic pipeline and generating greater support for these debilitating and all too common conditions."

For more information on the ASADRP activities and other CDMRP research programs, go to ***http://cdmrp.army.mil/****.*

ERIN BOLLING of Ripple Effect Communications Inc. is the public affairs specialist for CDMRP, located at Fort Detrick, Maryland. She holds a bachelor of fine arts in graphic design from Shepherd University and an associate of arts in visual art from Hagerstown Community College. She has provided public affairs support within the U.S. Army Medical Research and Materiel Command for more than nine years and is a member of the Public Relations Society of America.

DOWN THE HATCH

Since October 2011, USAMMDA's PSPMO has managed the supply of two types of adenovirus vaccine for administration to service members during basic training. Production of the tablets, which have been highly effective in reducing febrile respiratory illness in the U.S. military population, is possible only through an industry partnership with a commercial manufacturing company. (Photo courtesy of USAMMDA Public Affairs)

MEDICAL *PARTNERSHIP*

USAMMDA works with military, federal civilian and contract professionals to develop and deliver quality medical products.

by Jeffrey M. Soares

Since its establishment more than 30 years ago, the U.S. Army Medical Materiel Development Activity (USAMMDA) has been partnering with industry to create effective medical product solutions to support our warfighters in the field and at home. Over the years, USAMMDA's multiple project management offices have overseen the development of numerous medical products and devices, which include the antimalarial drug tafenoquine, an adenovirus vaccine, freeze-dried plasma, the Chemical Patient Protective Wrap, the Environmental Sentinel Biomonitor and the Laboratory Assay for Traumatic Brain Injury. In so doing, the organization has used a number of approaches to secure the right type of partnership for a given product, such as various types of contracting methods, cooperative research and development agreements (CRADAs) and "open campus" models.

As a subordinate command of the U.S. Army Medical Research and Materiel Command at Fort Detrick, Maryland, the USAMMDA team is a partnership of military, federal civilian and contract professionals working together in support of the organization's mission to develop and deliver quality medical capabilities to protect, treat and sustain the health of our nation's service members. However, given the nature of medical product development in the world of Army acquisition, USAMMDA does not have the manufacturing capability to carry a product all the way through the life cycle pipeline on its own. Therefore, the command uses its expertise in project management and reaches out to commercial partners to create the best product to satisfy a given military requirement.

In addition to creating products for troops on the battlefield, USAMMDA works to find solutions to treat wounded warfighters returning from battle. While the scars of traumatic brain injury and post-traumatic stress disorder may not be readily visible, the damage of catastrophic wounds can clearly be seen, and the command has multiple teams that look to discover treatment options for these types of physical and emotional injuries.

PARTNERING FOR SUCCESS

While USAMMDA does its part in the development of critical medical products moving through the acquisition pipeline, it relies heavily on commercial partners in industry to complete this important task. Kathleen Berst, USAMMDA's deputy for acquisition, explained that the command seeks opportunities to partner with companies currently holding a technology that has a civilian market and is militarily relevant but not necessarily military-specific.

"Everything we do is driven by a requirement," she said. "However, our requirement is probably not the only driver of our industry partner's development effort. So the question we ask ourselves is, 'How do we integrate our requirement with the industry partner's strategy to deliver a commercially viable product that is sustainable and meets the military's need?' "

Berst pointed out the similarities between DOD's business model and that of typical companies throughout the industry. "We both look at the same factors: How much will this cost? What is the need for this? What is the market? How long will it take to develop? What's the programmatic risk? The bottom line is that it's an investment decision," she said.

Berst explained that, working within a relatively small budget, the Army must remain diligent in its investment decisions, so it considers partners with the greatest chances for success. DOD cannot create a militarily unique product that leaves the government as the only customer, as this would create the difficult scenario of having to solely sustain the product indefinitely.

Dr. Lawrence Lightner, project manager of USAMMDA's Pharmaceutical Systems Project Management Office (PSPMO), which oversees the development of items including tafenoquine, the adenovirus vaccine and freeze-dried plasma, underscored the critical role of contracting in the partnering process. He explained that a government contract provides a flexible mechanism for using DOD funds to assist industry partners in a variety of areas. The CRADA is a very important tool as well.

"The CRADA essentially affords the DOD a seat at the table in contributing to decisions made by the industry partner," said Lightner. "Under a CRADA, the industry partner may provide funding to DOD for specific activities, while DOD can provide other material items to the industry partner for the product development process."

The CRADA played an important part in the recent U.S. Food and Drug Administration (FDA) approval of tafenoquine, which was realized after 40 years of research and development involving numerous partners. Malaria remains the top infectious disease threat to U.S. service members deployed overseas, and DOD has been committed to discovering an effective solution for the prevention and treatment of this life-threatening illness among its troops, as well as civilian populations worldwide.

Tafenoquine was first discovered in 1978 within the Experimental Therapeutics Branch at the Walter Reed Army Institute of Research. In 1988, the drug was transitioned to USAMMDA's PSPMO for management and oversight of the product development effort, and it has remained under the PSPMO's guidance ever since. While many organizations have been involved in studying the drug, production of tafenoquine as a weekly prophylaxis was secured through the establishment of a CRADA between USAMMDA and its industry partner, 60° Pharmaceuticals LLC, which will manufacture the drug for DOD.

The result of this type of partnership is usually a win-win scenario: The industry partner ends up with a commercially profitable product that DOD can purchase, generally at a reduced cost, for use throughout its military forces. As DOD cannot solely sustain a militarily unique product for the sake of its warfighters, industry partnerships such as this are vital to maintain military readiness and to provide medical product support. Although some exceptions exist

INTERNAL PARTNERSHIPS

When it comes to partnerships, those across the command are equally as important as the commercial ones established outside of the military for the advancement of critical products.

"USAMMDA has access to and the availability of multiple contracts and sites to conduct the pivotal testing of vital Army medical products," explained Lightner. "For instance, with infectious diseases that are endemic in other countries of the world, we have command assets that include labs in Thailand and Kenya that have developed field sites to conduct clinical testing of products.

"Our DOD partners in these labs overseas are regionally focused and have access to populations that are directly affected by diseases we are trying to eliminate, so these locations remain extremely important with regard to product effectiveness testing," he said.

APPROVED!

Members of USAMMDA's tafenoquine integrated product team gathered to celebrate FDA approval of the antimalarial drug during a ceremony at Fort Detrick, Maryland, on Oct. 25. From left to right are Ty Miller, Kristina Pannone, Dr. Gregory Reichard, Robert Charles, Jennifer Rebelez, Dr. Francis Klotz, Mary "Kathy" Simpson, Dr. Lawrence Lightner, Maj. Victor Zottig, Dr. Geoff Dow, Dr. William McCarthy, Dr. Bryan Smith, Carmen Sanders, Doug Loock, John Clarke, Dr. Selva Murugesan and Maj. Katherine Carr. (Photo by Ashley Force, USAMMDA Public Affairs)

for products that are a DOD operational priority but have no civilian market, these cases are rare.

USING THE OPEN CAMPUS MODEL

While USAMMDA maintains traditional commercial partnerships to produce the majority of its medical products and devices, it is engaged in a unique open campus project as well. The open campus concept brings together government, industry and academia in an effort to maximize resources and output. Since 2016, representatives from USAMMDA have helped to guide the establishment of the Advanced Regenerative Manufacturing Institute (ARMI) in Manchester, New Hampshire.

In 2016, ARMI was awarded the BioFabUSA project, which is a DOD-sponsored initiative in the Manufacturing USA network and the first to address biomanufacturing. The BioFabUSA program looks to bridge the gap between early scientific research and later-stage product development by advancing critical technologies to enable large-scale biological manufacturing efforts—in this case, tissue regeneration.

"ARMI is a public-private partnership serving as one of Manufacturing USA's 14 manufacturing innovation institutes," explained Air Force Lt. Col. Melinda Eaton, USAMMDA's director of strategic acquisition planning and program management. "My role in this effort is to serve as the government program manager, to help ensure that we are effectively utilizing the $80 million of federal funding provided by DOD to establish this partnership."

DOD's interest in tissue regeneration grew from the challenges of restoring service members to form, function and appearance following catastrophic combat injuries. As conventional approaches may sometimes fall short of full restoration,

READY, FAST AND EASY

Andrew Atkinson, product manager for USAMMDA's PSPMO, demonstrates the speed and ease of reconstituting freeze-dried human blood plasma during an Army senior leadership visit at Fort Detrick in March 2018. Produced through a successful effort between USAMMDA and its industry partners, the freeze-dried plasma product could be approved and readily available for use by 2020. (Photo by Ashley Force, USAMMDA Public Affairs)

USAMMDA's Combat Trauma and Acute Rehabilitation Project Management Office has overseen numerous research projects focused on developing novel solutions to address this need. Currently, the most successful projects in its portfolio are efforts in the field of vascularized composite allotransplantation, which involves hand and face transplants, and the ongoing development of a skin substitute to treat burn wounds.

BioFabUSA is focused on tissue engineering, at manufacturing readiness levels between 4 (validated in a laboratory environment) and 7 (demonstrated in prototype in an operational setting), said Eaton. The group hopes to research immature technologies to see if these can be scaled up, or scaled out, to ensure a consistent quality of tissue manufacturing.

"We have more than 100 members within the various industries and academia and private partners that have joined the institute, and these will add over $200 million in private commitments," she said. "BioFabUSA is currently working with these partners to set up a tissue foundry so they can create test facilities where the partners can come in and learn how to scale up some of their own products.

"Our goal," Eaton explained, "is to ensure that these public-private partnerships are sustainable, so that after the government funding ends, the institute can continue on its own as a sustainable entity. In the end, we want to make sure we have those manufacturing partnerships in place with these industry partners."

Eaton values the open campus concept, as it allows USAMMDA to reach out to more partners than it could on its own. She believes it is helping the organization connect with researchers in academia as well as its usual partners in the commercial industry.

"We have a lot of partners in industry and academia that want to support the DOD, but they just don't know how—and we're able to provide them with our unmet needs and capabilities so they can provide support to the DOD," she said.

"At the same time, we're providing them with our expertise, and they are able to work with our science and technology partners and tap into some of our military populations for clinical trials, if they would like to study the effects on our unique population,"

While USAMMDA does its part in the development of critical medical products moving through the acquisition pipeline, it relies heavily on commercial partners in industry to complete this important task.

PRESENTING THE FUTURE

Air Force Lt. Col. Melinda Eaton, director of strategic acquisition planning and program management, prepares for a presentation on the work of USAMMDA's Combat Trauma and Acute Rehabilitation Project Management Office, which supports research efforts in such areas as vascular repair and burn treatment. Eaton also serves as government program manager for ARMI's BioFabUSA project, a DOD-funded effort to enable large-scale biological manufacturing. (Photo by Ashley Force, USAMMDA Public Affairs)

BRAIN BLOOD TEST

Veronika Shevchenko, center, research scientist with industry partner Banyan Biomarkers Inc., leads a training session to demonstrate the Laboratory Assay for Traumatic Brain Injury at Fort Detrick in March 2018. The device tests blood for biomarkers released upon injury to the brain and can help diagnose post-traumatic stress disorder. (Photo by Jeffrey M. Soares, USAMMDA Public Affairs)

she said. "For example, we know we have unique wounds from the battlefield that they may not see in the civilian sector, and this could be very helpful to their own research."

CONCLUSION

It would be hard to diminish the value of industry partnerships or the open campus concept, especially in light of the recent success of tafenoquine as the first FDA-approved malaria drug in nearly two decades. The idea of collaboration is infused throughout the important work of USAMMDA and the collective mission of all involved.

Army Col. Ryan Bailey, USAMMDA commander, has been immersed in military medical product development since assuming command of the organization in 2017. He recognizes the true value of industry partnerships for success in these unique endeavors.

"These types of partnerships are not about multiple teams racing toward a finish line, hoping to jump ahead of each other in the final stretch," he said. "The concept is more like a relay race, where talented individuals work closely together to reach the goal, doing everything possible to ensure the team does not 'drop the baton' along the way."

Although the BioFabUSA project may have a great deal to prove in the future, the prospects are exciting. In working with an extensive list of partners, it is likely that many good things will come from such synergistic relationships. For this important effort, restoring wounded service members and civilians to form, function and appearance remains paramount—and the possibilities through effective partnerships remain endless.

For more information on the work and mission of USAMMDA, go to ***http://www.usammda.army.mil/****.*

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APPLIED MEDICINE

Field medics treat a simulated burn patient with Remote Diagnostic Technologies Ltd.'s Tempus Pro monitoring system during an open house and tech demonstration at Fort Detrick in September. Events like this one help experts explore emerging medical technologies and their potential applications in military medicine. (Photo by Elizabeth Lamie, MRMC Public Affairs)

RUNNING the OPTIONS

How MRMC leverages expertise and relationship-building with industry.

by Elizabeth Lamie

The U.S. Army Medical Research and Materiel Command (MRMC) aims to lead the advancement of military medicine and responsibly create, develop, deliver and sustain medical capabilities for the warfighter. MRMC knows the importance of industry and building relationships, but understands that sometimes industry can't reach us or doesn't know how to communicate with us. It's an important issue to address: Simply put, MRMC can't get products to the end of cycle without industry.

Six laboratories make up the command's core science and technology capability; these specific areas of biomedical research are staffed by highly qualified military and civilian scientists and support personnel. There are five additional MRMC subordinate commands that focus on command requirements—such as medical materiel development, logistics and contracting—to complete the life cycle management of medical materiel.

MRMC partners with government agencies, academic institutions and commercial entities to identify solutions that address critical gaps in Military Health System medical research and development (R&D) programs.

MRMC has several tools to assist small businesses and help build relationships. The MRMC "Gateway to Partnerships" guide went live on the MRMC website in November 2017 as a reference to help businesses better understand what we do and how to partner with us.

DECISION GATE

MRMC understands that there are many challenges to overcome on both sides when working with small businesses. For example, there may be difficulty attracting and

CHANGING THE FIGHT
The National Defense Industrial Association's Army Science & Technology Symposium & Showcase explored the future of warfighting and how it is changing with technology modernizations. (Photo by Christina Watson, MRMC Public Affairs)

maintaining qualified personnel, staff can get frustrated with current government processes that could use improvement, and some government processes can take longer than expected to complete.

To ensure that the acquisition system runs efficiently, MRMC uses its decision-gate process with every medical R&D product that enters the pipeline. Decision gate provides a governance structure for the development of products throughout the acquisition process, and features event-driven milestones that allow successful products to move along the development pathway.

The decision-gate process was implemented in 2005 as a way for MRMC to manage its medical materiel development efforts. It is an overarching process that integrates DOD acquisition processes with the U.S. Food and Drug Administration requirements and industry business practices. The goal is to focus materiel development efforts on meeting DOD requirements as quickly and efficiently as possible.

FORUMS AND EVENTS

Forums and events are great opportunities for MRMC commanders and their staff to learn about other R&D efforts and their importance within the command. During forums and events, leaders and industry can have face-to-face discussions, network and gain knowledge through professional development. Such events allow government, academic and private sector experts to explore emerging medical technologies and their potential roles in supporting military medicine. For example, the Telemedicine and Advanced Technology Research Center (TATRC) 4th Annual Open House and Technology Demonstration in September 2018 educated the military medicine community and external partners about TATRC's focus on supporting military readiness through innovative technologies across the Military Health System.

VENDOR DAYS

Military Health System Vendor Days are cooperative ventures by the military services, located at Fort Detrick, Maryland. Typically held seven times a year, the event focuses on assisting the services' medical agencies with strategic market analysis of products and technologies that may be applicable to austere medical environments.

The agencies involved are:

- Defense Health Agency Medical Logistics Division.
- U.S. Army Medical Research and Materiel Command.
- U.S. Army Medical Materiel Agency.
- Naval Medical Logistics Command.
- U.S. Air Force Medical Operations Agency.
- U.S. Marine Corps Systems Command.

RESEARCH SYMPOSIUMS

Like open houses, conferences and symposiums facilitate networking, collaboration with peers and small-group discussion sessions. One such event, the U.S. Army Military Health System Research Symposium, held in Kissimmee, Florida, Aug. 20-23, is considered by many as a premier DOD medical research meeting, bringing together military and civilians to collaborate and create partnerships.

MRMC also participated in the 2018 National Defense Industrial Association's Army Science & Technology Symposium & Showcase, held Aug. 21-23 at the Walter E. Washington Convention Center in Washington. Events such as this allow representatives and leadership

to engage with industry and discuss ongoing research projects and capabilities.

MECHANISMS FOR COLLABORATION

Two congressionally mandated programs—Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR)—were created to promote technological innovation and economic growth among small businesses through federal investment. SBIR and STTR allow small, high-tech U.S. businesses and academia the opportunity to provide innovative research and development solutions in response to critical DOD needs.

Five federal agencies participate in both SBIR and STTR:

- DOD.
- NASA.
- Department of Health and Human Services.
- National Science Foundation.
- Department of Energy.

Six federal agencies participate in the SBIR program only:

- Department of Agriculture.
- Environmental Protection Agency.
- Department of Education.
- Department of Homeland Security.
- Department of Transportation.
- Department of Commerce.

CRADAS

The preferred vehicle for technology transfer is a cooperative research and development agreement (CRADA), which allows MRMC investigators to collaborate with scientists in industry and academia and work toward a common research goal. CRADAs allow federal laboratories to collaborate on R&D with nonfederal parties and are used for nondisclosure agreements, material transfer agreements and complex R&D collaborations. Visit the MRMC's Office of Research and Technology Applications (ORTA) at **http://technologytransfer.amedd.army.mil/index.cfm** to learn more about the possibility of creating a CRADA with MRMC.

MRMC also has technologies available for licensing. For licensing opportunities, please contact ORTA at **USArmy.Detrick.MEDCOM-MRMC.List.ORTA@mail.mil**.

OTHER WAYS OF DOING BUSINESS

The Medical Technology Enterprise Consortium (MTEC) consists of industry, academia and other entities organized and operated through a nonprofit corporation. MTEC currently has more than 200 members and is seeking new members from the following areas:

- Small and large businesses.
- Academic medical research organizations.
- Not-for-profit organizations.
- Nontraditional government contractors.

MRMC works with MTEC through a prototype other transaction agreement, which provides a flexible method to combine public and private resources to focus research, prototype development and commercialization on specific shared military and civilian medical technology needs.

An other transaction agreement is a funding vehicle used by federal agencies for obtaining or advancing R&D or prototypes. It's generally used with small businesses and nontraditional contractors, but traditional contractors can be funded through that way if certain criteria are met. Other transaction authority is not a contract or assistance agreement.

MRMC's decision gate provides a governance structure for the development of products throughout the acquisition process, and features event-driven milestones that allow successful products to move along the development pathway.

The other transaction agreement mechanism enables discussions with potential performers throughout the process to develop better requirements for projects to meet the needs of both military and commercial health care markets. This type of interaction is usually not allowed through typical contracting and grants processes.

MAXIMUM OPPORTUNITIES

MRMC is committed to ensuring that businesses are provided with maximum opportunities to compete for procurements. There are several systems and portals that enable academia and industry to submit ideas and research.

The command recognizes that unsolicited proposals with unique and innovative products or ideas that have been developed outside of the government can help it accomplish its mission. MRMC uses the New Products and Ideas (NPI) system as a mechanism to evaluate new products and ideas, currently configured or in development, that support the mission.

The NPI is a web-based system that provides a means for our subject matter experts to assess these products and ideas, evaluate their applicability and provide feedback to the submitter. It gives academia and industry an opportunity to showcase their products or ideas without needing to travel to Fort Detrick and without giving anyone an unfair competitive advantage. After the submitter enters data, an expert receives the information and provides feedback within 60 days.

Additionally, NPI gives the public direct access to the scientific expertise of DOD. It is open to the public so anyone can submit ideas or information. NPI has been a successful avenue for submission, giving submitters the opportunity to obtain feedback without an extensive process.

No funding is associated with NPI, but it allows for constructive feedback that can help with developing and refining the ideas that are submitted. Recent submissions to NPI resulted in further collaborative ventures for products in such areas as combat casualty care, military operational medicine, burn treatment, infectious diseases and surgery.

OFFICE OF SMALL BUSINESS PROGRAMS

The mission of MRMC's Office of Small Business Programs is to maximize opportunities for various categories of small businesses to compete for procurements as either a prime or subcontractor and to forge strategic business alliances. The office is committed to supporting small businesses in their pursuit to provide products, services and solutions that sustain our nation's warfighters. The organization's goal is to ensure that small businesses remain an integral part of MRMC's business solutions. For information about the MRMC Small Business Office, go to **http://smallbusopps.amedd.army.mil/**.

FOCUS: WARFIGHTER NEEDS

The 2018 Military Health System Research Symposium focuses on the unique medical needs of the warfighter. The symposium consisted of more than 75 breakout sessions, 90 exhibits and 1,400 poster presentations. (Photo by Leticia Hopkins, MRMC Public Affairs)

CONCLUSION

Military forces will continue to seek advanced medical products and devices to support their missions. The process needs streamlining—with requirement approval currently taking two to three years and technology moving so quickly, the technology may become obsolete before it is even implemented. The goal is to get products requested by the warfighters in their hands as quickly as possible.

Although the acquisition process may provide challenges, it also includes a necessary system of checks and balances to ensure the delivery of safe, effective, affordable and sustainable solutions to service members.

*For more information and for details on working with MRMC, go to **http://mrmc.amedd.army.mil**.*

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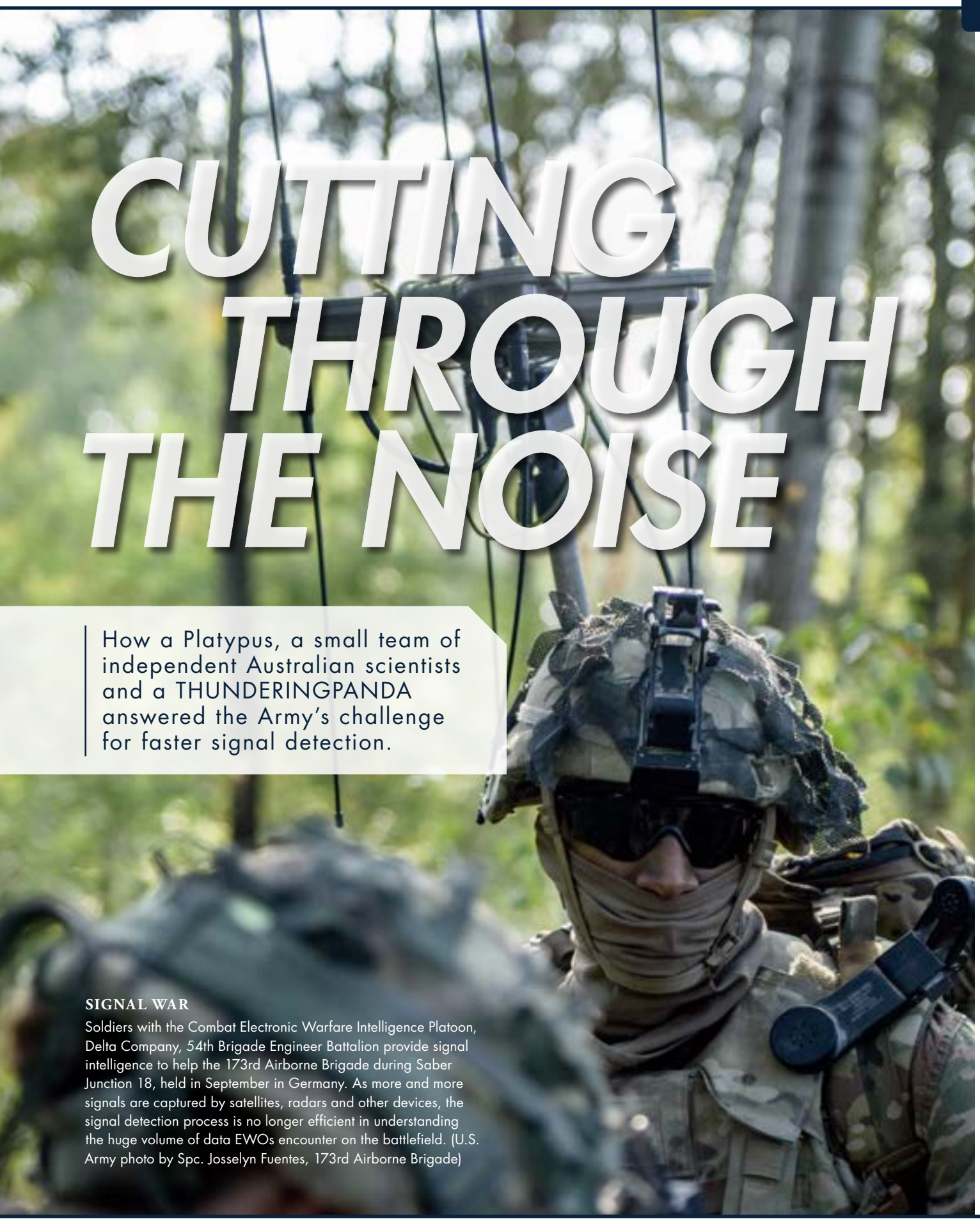
CUTTING THROUGH THE NOISE

How a Platypus, a small team of independent Australian scientists and a THUNDERINGPANDA answered the Army's challenge for faster signal detection.



SIGNAL WAR

Soldiers with the Combat Electronic Warfare Intelligence Platoon, Delta Company, 54th Brigade Engineer Battalion provide signal intelligence to help the 173rd Airborne Brigade during Saber Junction 18, held in September in Germany. As more and more signals are captured by satellites, radars and other devices, the signal detection process is no longer efficient in understanding the huge volume of data EWOs encounter on the battlefield. (U.S. Army photo by Spc. Josselyn Fuentes, 173rd Airborne Brigade)

by Nancy Jones-Bonbrest

The Army Rapid Capabilities Office (RCO) does things differently. It has to. Doing things differently is mandated in its charter and embedded in its culture.

So when it came time for the small acquisition shop to find a way to speed up signal detection, it knew it wouldn't seek answers using traditional methods.

Instead, RCO studied commercial models for getting answers quickly and created a "challenge" that gave industry, academia, scientists and other agencies the opportunity to go head-to-head in a competition, with prize money awarded to the top three performers.

The challenge focused on using artificial intelligence and machine learning to speed up the rate at which electronic warfare officers (EWOs) could sift through the congestion and noise that comes with signal detection. With an ever-increasing number of signals flooding in from satellites, radars, phones and other devices, the signal detection process is no longer efficient in understanding the vast amount of data presented to EWOs on the battlefield.

Within four months of setting up the Army Signal Classification Challenge, RCO knew mathematically who had the best-performing algorithm.

The challenge also had an unexpected result. By offering an unorthodox method for garnering participation in what would have been a traditional request for information (RFI), the RCO challenge resulted in the top three prize winners spanning the unconventional, including a federally funded research and development center, an independent group of Australian scientists and a team from a big business.

"By structuring this as a challenge instead of an RFI, we were able to model what industry does and create something much more hands-on," said Rob Monto, director of RCO's Emerging Technologies Office. "We invited anyone with a possible capability to participate and posted it on Challenge.gov and FBO.gov. This is very similar to the commercial model of posting on Kaggle.com, where data sets are sent out to communities of data scientists who want to compete against one another to determine who has the best solution."

RCO's online challenge offered synthetically generated data based on what could be seen in the electromagnetic spectrum, and challenged participants to prove they had the best artificial intelligence and machine learning algorithm for performing "blind" signal classification quickly and accurately. The challenge was strictly performance-based and open to anyone. Because it was all online

WINNING TEAM

Team Platypus from The Aerospace Corp. won first prize in the Army Signal Classification Challenge over the summer of 2018. The team includes (front row, from left) Eugene Grayver, Alexander Utter and Andres Vila; and (back row, from left) Donna Branchevsky, Esteban Valles, Darren Semmen, Sebastian Olsen and Kyle Logue. (Photo by Elisa Haber, The Aerospace Corp.)

HOLDING THE EDGE

Stryker crewmen with the 1st Squadron, 2nd Cavalry Regiment fire an M1128 Mobile Gun System during a joint live fire exercise in August at Bemowo Piskie Training Area, Poland. The Army RCO, in partnership with the Project Manager for Electronic Warfare and Cyber, opened a challenge to identify new approaches to signal detection to speed up the rate at which EWOs could eliminate the congestion that comes with signal detection. (U.S. Army photo by Sgt. John Onuoha, 24th Press Camp Headquarters)

and completed in four months, it came with very little cost or burden placed on those participating.

"The response was overwhelming," Monto said. "We had more than 150 participants from across traditional and nontraditional industry partners, universities, labs and government. As an incentive, we offered $150,000 in prize money."

RCO announced winners on Aug. 27. First place and $100,000 went to Team Platypus from The Aerospace Corp., a national nonprofit corporation that operates a federally funded research and development center. Second place, with an award of $30,000, went to TeamAU, made up of a small team of independent Australian data scientists. And third place, with a prize of $20,000, went to THUNDERINGPANDA of Motorola Solutions.

"Having a specific problem that can be worked on by industry, academia and private citizens is a great way to establish and build a community of innovators for this technology area," said Dr. Andres Vila, an engineering specialist at The Aerospace Corp. and a member of Team Platypus. "This challenge, which extended for approximately three months, was the right balance of having time to formulate a unique and robust solution but also not so long that the team lost urgency to find that award-winning approach."

The challenge proved a better way to assess industry's capabilities, instead of using a more traditional RFI and white paper approach, Vila said, calling it "spot on."

"The challenge arrived at a great time, as we were just kicking off this research and the Army had a well-formed problem set and, most importantly, data," Vila said. "This competition gave us the chance to take our latest innovations and prototypes and apply them to this new customer-curated, hard problem. These types of customer-sponsored competitions provide very focused challenges that give us the confidence that we are using the best technology available to meet their mission needs."

THE PROBLEM SET

The idea for the challenge stemmed from RCO's partnership with the Project Manager for Electronic Warfare and Cyber, within the Program Executive Office for Intelligence, Electronic Warfare and Sensors, which recently delivered new electronic warfare prototype systems in response to an operational needs statement from U.S. Army Europe. Soldiers are using the equipment to implement electronic protection for their own formations, to detect and understand enemy activity in the electromagnetic spectrum and to disrupt adversaries through electronic attack effects.

However, in enhancing the signal footprint for EWOs, the prototype systems also brought more data to an already complex electromagnetic spectrum. Through the challenge, RCO wanted to determine if artificial intelligence and machine learning (AI/ML) could assist them in digesting that data and sorting through what is and isn't important.

"We knew industry was already making leaps and bounds in applying AI/ML for image recognition and video recognition, but found that there was very little work being done in this specific area of signal detection," Monto said. "What we discovered in a very short period of time is that AI/ML could in fact be applied to a data set that could translate to being integrated into an electronic warfare system on the battlefield."

The idea is to create this application as a layering effect, whereby artificial intelligence and machine learning does one subset of signal classification for the EWOs, then layers other applications

that are more encompassing onto that to give the EWOs a wider range of what they can identify, said Monto.

While the EWOs would remain as the lead for identifying signals of interest and analyzing their impact, the use of artificial intelligence and machine learning could help them quickly and accurately detect patterns, identify signals of significance, filter out unwanted signal noise and paint a picture of the electromagnetic spectrum.

THE CHALLENGE

RCO's Army Signal Classification Challenge began April 30 and closed Aug. 13. After opening registration online, competitors were given access to the training data set, consisting of more than 4.3 million instances across 24 different modulations, which included a noise class. (The noise class represents "white" noise to replicate the real-life environment that signals would be detected in, rather than a pristine lab environment.) The effort sought solutions that could perform "blind" signal classification quickly and accurately. Blind signal classification requires little to no prior knowledge about the signal being detected in that specific instance. Instead, the solution would automatically classify the modulation, or change of a radio frequency waveform, as a first step toward signal classification.

The challenge gave participants 90 days to develop their models and to work with the training data sets. That was followed by two test data sets of varying complexity that were the basis for judging submissions. The first data set was released 67 days after the challenge launch, with a solution submission window of 15 days. A second, more complex test data set was released 84 days after the challenge launch, with a shorter submission window of only seven days.

Participants' scores were based on a combined weighted score for both test data sets. Competitors could see how well they were performing against their peers through a participant leader board that showed scores in real time.

For first-place winners Team Platypus—which participated in the Defense Advanced Research Projects Agency's Software Defined Radio Hackfest 2017 and whose name references platypuses' ability to detect electrical fields with their bills—the challenge lined up perfectly with its core research in artificial intelligence and advanced signal processing.

"We really enjoyed the challenge process, which included the hard problem curation, providing training data and a specific scoring algorithm," Vila said. "To do this with the highest level of confidence, we had to use a multipronged approach. We built statistics and metrics inspired by communication principles, and we also developed deep learning classifiers that work directly on the raw data. We ended up using several state-of-the-art AI techniques to achieve the winning submission."

Their technology includes an algorithm trained to identify what kind of signal is present in the midst of a congested radio frequency environment, much like Soldiers would find in an urban core or battlefield where both friendly and enemy radio communications are being detected.

CONCLUSION

By structuring this effort as a challenge and not going through the traditional RFI process, RCO proved it could take an industry model and move fast. For its efforts, it is substantially closer to identifying a potential solution that could be applied to battlefield electronic warfare capabilities in the very near future. The challenge also showed that RCO could harness the promise of artificial intelligence and machine learning by applying it to a specific problem. The amount of interest and quality of performance, including from nontraditional organizations, was remarkable.

Now, RCO is quickly moving forward to the next step, with two possible options. First, RCO could initiate a second, more intense challenge and open it up to only the top performers in the first challenge. Or, RCO could begin to immediately move the algorithms into the hands of Soldiers through software enhancements to their existing electronic warfare equipment. This would enable the Soldiers to give immediate feedback and enable the Army to incrementally build capability.

Over the next several months, RCO will begin to advance what was learned from the challenge, potentially prototyping the leading artificial intelligence and machine learning algorithms into Army electronic warfare systems.

For more information on the Army RCO, go to ***http://rapidcapabilitiesoffice.army.mil/****.*

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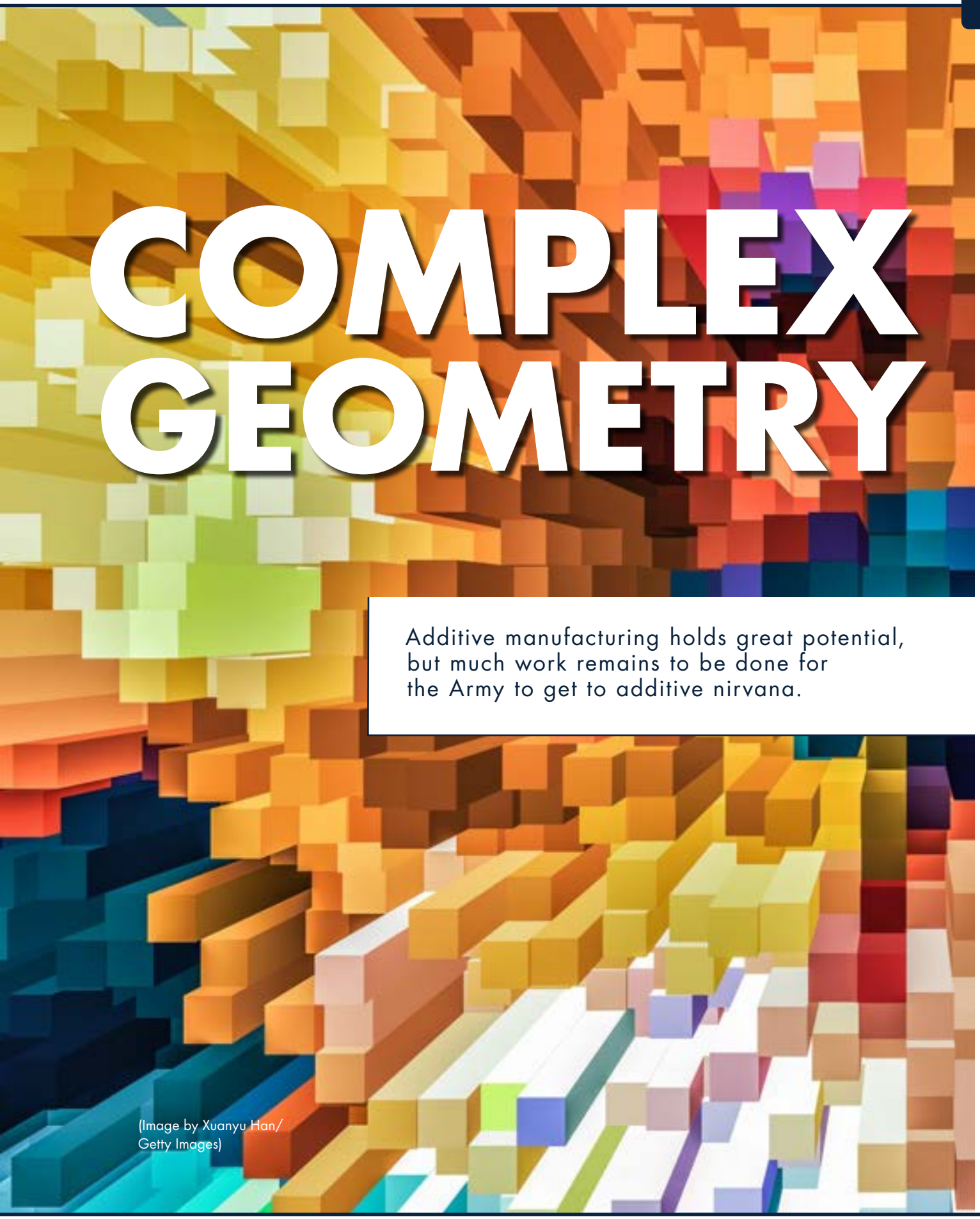
COMPLEX GEOMETRY

Additive manufacturing holds great potential, but much work remains to be done for the Army to get to additive nirvana.



(Image by Xuanyu Han/ Getty Images)

by Steve Stark

> ***"Remember, when you take a part out of a weapon system and replace it with an additive manufactured part, you're putting lives on the line if that part is not fully capable. So we have to be very sure...we understand the science."***

Additive manufacturing shines with promise. The discipline, also known as 3D printing, holds the promise of being the most powerful, efficient and versatile method of manufacturing, enabling a whole new world of products—complex shapes, compound geometries and compound materials that no designer could envision without it. It also holds the promise to speed logistics, reduce waste in materials and processes, and enable customization to a degree unimaginable with conventional manufacturing—and more.

"The Army wants to be at the forefront of this advancement in technology," said Dr. Philip Perconti, director of the U.S. Army Research Laboratory (ARL), at the opening of the new Advanced Manufacturing, Materials and Processes (AMMP) manufacturing innovation center in Harford County, Maryland, near Aberdeen Proving Ground, in October. Additive manufacturing, he continued, is at a pivotal stage in development, and the Army is basing strategic investments in agile manufacturing and material processing programs to leverage technology breakthroughs for rapid prototyping and development. He said that he foresees the mobile production of "replacement components to alleviate distance delays and provide performance enhancements and new capabilities through optimization of complex architectures and integrated functions."

That vision sums up the Army's effort to drive additive manufacturing technology forward and fulfill its potential to positively impact virtually every Army system. With aging and in many cases decaying organic manufacturing capabilities at depots around the country, the technology is a natural fit for the Army as it upgrades organic manufacturing. ARL is partnering with the National Center for Manufacturing Sciences in the AMMP effort. The center also launched its AMMP consortium.

In pursuit of its additive future, the Army has stood up the Additive and Advanced Manufacturing Center of Excellence at the Rock Island Arsenal Joint Manufacturing and Technology Center, Illinois. There's a robust community of practice on milSuite. Defense Acquisition magazine devoted its entire November-December 2016 issue to additive manufacturing. All of this means that additive is very much in the Army's sights, but it has a long way to go to meet its potential.

A YOUNG FIELD

Invented in the mid-1980s by Charles Hull, who went on to found 3D Systems Inc., additive manufacturing is still very much a young field, especially when compared with the thousands of years that humans have been manufacturing. Conceived by Hull as stereolithography, the process still bears that imprint: 3D-printing design files have the designation ".stl," for stereolithography (or standard tessellation language), but both are backronyms created to fit the initials. There are seven types of additive processes with their own pros and cons, and new methods within those process categories are being developed all the time.

For the Army, additive is attractive for how it can improve readiness. But readiness is a broad category, encompassing logistics, sustainment, repair and much more. From

buildings to motor parts to aerial systems, additive offers the possibility of creating nearly on-demand anything, on-demand anywhere.

In theory, instead of traveling to an operational environment with tons of gear, units could go with just enough equipment to get established, then set up machines that could additively produce on the spot the equipment or structures they need from local resources. That—manufacturing at the point of need—is a major feature of additive.

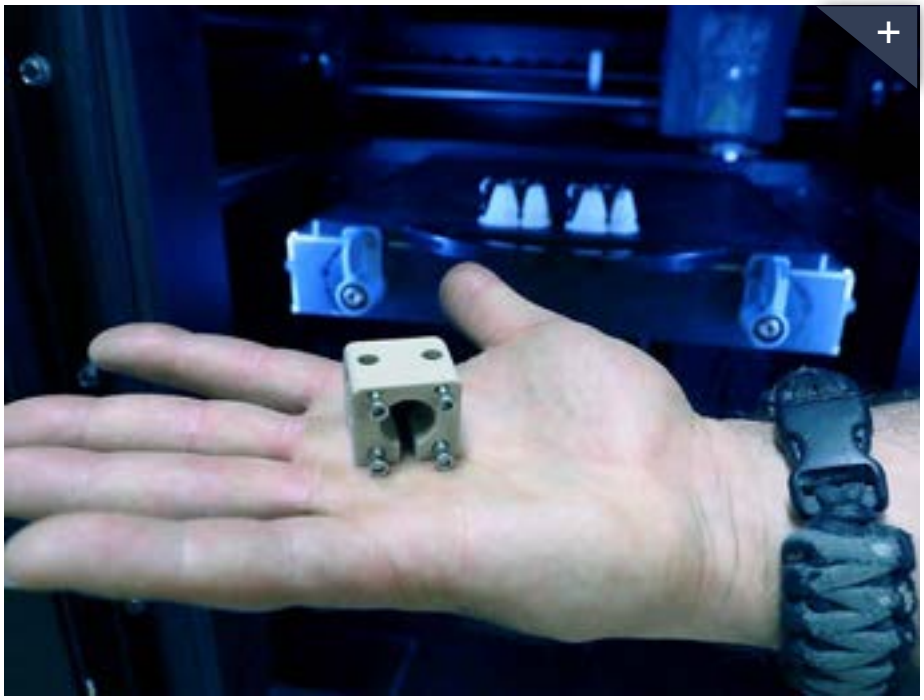
And while the Army does position additive capabilities in operational areas to produce parts and equipment at the point of need, mostly the Army is printing parts, plastic or metal, to enhance readiness and make the sustainment process more sensible and speedy, said Mike Nikodinovski, mechanical engineer and additive expert at the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC).

Many of these efforts are a matter of experimenting with the technology to see where and how it works best.

"We've been repairing parts for the M1 Abrams. … We've done projects cross-Army and with the Marine Corps where we printed things like impeller fans," Nikodinovski said in an interview with Army AL&T. "A lot of the things we've been doing are just basic one-for-one replacement. What can you do with additive for a part that's traditionally manufactured? A lot of that gets at sustainment, and that's what we're trying to stand up at Rock Island—give them the capabilities so they can print metal parts, especially if you want … long-term procurement for parts where you only need a couple, vendors are no longer in business and it doesn't make a lot of sense to spend a lot of money to set up tooling. Can additive be used to supplement the sustainment process, where I can just, say, print three parts and save all the time it would take to find vendors or set up the tooling?"

ADDITIVE OR 3D?

Most of the experts that Army AL&T spoke to used additive manufacturing, but shortened the term to AM or, most often, additive. "3D printing" was a close second, but nearly all referred to the additive manufacture of an object as printing. For most, additive manufacturing is the most inclusive category. It's also worth noting that many aspects of traditional manufacturing are now referred to as subtractive manufacturing, especially more recent, digitally driven techniques like computer numerical control (CNC). So, precision machining of material in a CNC machine, turning a piece of metal or wood on a lathe, or drilling and machining materials, is now often called subtractive.



MAKING CONNECTIONS

An REF engineer displays a completed part—a 3D-printed 90-degree strain relief offset connector—while others are being produced in the background. The connectors, designed and fabricated by REF engineers at Bagram Airfield, Afghanistan, prevent cables from breaking when attached to a piece of equipment. However, AM experts noted that having a finished part is not the same thing as being able to use the finished part: It has to meet the Army's standards, as does the machine that makes it. (U.S. Army photos by Jon Micheal Connor, Army Public Affairs)

CREATIVE SPARK
Ryan Muzii, REF support engineer, cuts metal for a project. The Army has positioned additive capabilities in operational areas to produce items at the point of need, but much of its additive work is in printing parts to enhance readiness and speed up the sustainment process.

> ***"For prototyping or for mainstream manufacturing, I can have a tool made [additively] and up and running in 24 hours."***

That kind of exploratory effort is happening in various places around the Army—the U.S. Army Research, Development and Engineering Command (RDECOM) and its subordinate organizations TARDEC, ARL, the Edgewood Chemical and Biological Center, the Communications-Electronics Research, Development and Engineering Center, the Aviation and Missile Research, Development and Engineering Center (AMRDEC) and the Natick Soldier Research, Development and Engineering Center; in addition to the U.S. Army Corps of Engineers.

The Army has already used additive to produce buildings, weapons, food and robots and to repair tank parts. Yet none of that really approaches the gleaming possibility of on-demand anything.

It's hard to overstate just how profoundly different additive is from conventional manufacturing. And that means much has to be done to better understand the discipline, to build knowledge for design and to develop the necessary training.

THE TRAINING QUESTION

While 3D printing makes additive manufacturing seem dead simple—and if you're talking about simple objects that you'd create on a MakerBot, maybe it is. But for the kind of solutions the Army seeks, it is anything but simple. Which makes the training all that much more important.

The U.S. Army Combined Arms Support Command and the Training and Doctrine Command have the Soldier side of the training effort, and the center of excellence and RDECOM have the civilian side.

Training will have to account not only for engineering in three dimensions, but also machines, materials, processes and more. "That's a huge undertaking," said Edward Flinn, director of advanced manufacturing at Rock Island Arsenal, in an interview. "We need to not only train

the people who are going to touch and run the machines, but train the troops and the engineers on the capabilities of and how to design for AM."

Additive is so fundamentally different in nearly every aspect, the training is critical. (See sidebar, "Thinking in Volumes," Page 84.)

"You've got to train the Soldier on the capabilities of the technology along with how to actually use the machine," Flinn said, "Then there's how to teach the design community themselves the benefits of additive so they can start designing for it."

According to Megan Krieger, mechanical engineer at the Engineer Research and Development Center, her organization has "a project through Makerspace for installations, so not quite as advanced as what we're talking about, but we're able to get maker spaces into the MWRs [morale, welfare and recreation facilities] at libraries, basically across all installations in order to teach the fundamental hobbyist perspective." That, Krieger said in an interview, is "so that people, when they get into their [military occupational specialty] where they use additive manufacturing, they're already a little bit familiar with the technology, because if people are passionate about making things, they'll learn it a lot better than if they're just thrown into it."

The Army still isn't 100 percent certain where additive belongs, although it has lots of ideas. Nor is it possible to fully grasp what additive will be able to do in the near-, mid- or far-term. The discipline is, as Perconti noted, at a pivotal stage in its development. There is much the Army needs: materials developed for additive, and the design tools necessary to both limit the inherent possibilities and exploit them.

MATERIALS SCIENCE

"There are different levels of challenge within [additive manufacturing]," said Dr. William Benard, senior campaign scientist in materials development with ARL in Adelphi, Maryland, in an interview.

"The Army's near-term efforts are looking at readiness, and in research, one of the simpler things is to just design new materials that are easier to print with, more reliable to print with, [the] properties are well understood—that kind of thing as a substitute, sort of a more direct approach to support of existing parts.

"One of the areas of investment that ARL is making to support this, and I know others in the RDECOM community are looking at it as well, is, really, new design tools for additive," Benard said.

That effort is "basically to handle the complexity of new materials, understanding how they're going to work, mixing materials, changing the properties as a function of location—that's for really high-performance parts. And that's sort of the long-term vision. You have the near-term, which is replacing what already exists, and then the mid-term … which is consolidation of parts, but it's essentially a functional equivalence of some assembly that we have. And then the longer-term view is designing things for additive, taking full advantage of this new geometric space. The far term is what can we get by mixing and modulating materials in sort of a voxelized fashion. Now, that's way down the road,

DISCUSSING THE PROCESS

Dr. Patrick Fowler, right, former lead engineer of the Ex Lab in Afghanistan, works with a Soldier on an idea for a materiel solution. Soldier training will be an important part of Army efforts to incorporate additive manufacturing—not only training those who will operate the machines, but showing Soldiers and engineers how to design for it.

but there are really interesting things that come as a function of that."

Voxel combines the words volume and pixel to describe the smallest unit of a 3D digital object.

THE ADDITIVE EQUATION

There are also significant questions to be answered about the economics of additive. A smart article in Defense AT&L magazine in December 2016, "Getting AM Up to Speed," lays out issues of speed versus cost in additive. The author, Stacey L. Clarke, then-deputy director of systems engineering for RDECOM at Aberdeen Proving Ground, Maryland, shows the tension between speed and cost.

When time is the driver, cost is less of a factor. When cost and manufacturing reproducibility—both major concerns in Army acquisition—are primary drivers, things slow down. When is it worth spending $5,000 on a product to get it now rather than waiting six months for a product that costs only $500? "That's a question that probably needs to have an equation," Clarke said in an interview with Army AL&T. There are other variables to add to that equation, such as how critical the need is or what else might be dependent on the product.

That equation might also need to take into account such variables as the speed with which developments are being made in the discipline. Another significant variable is where the Army puts its money. For the most part, the Army is focusing its efforts on its modernization priorities, and it will be up to industry and academia to develop the breakthrough technologies.

The Army's focus is what additive can do today. "We as scientists and engineers can talk about material properties and print bed temperatures and print heads and all this kind of stuff, but the senior leadership is looking at, 'So what? How does this technology improve readiness? How can I keep systems and Soldiers ready to go?' And that's what we're learning," said Tim Phillis, expeditionary additive manufacturing project officer for RDECOM's Armament Research, Development Engineering Center's Rapid Fabrication via Additive Manufacturing on the Battlefield (R-FAB). R-FAB is essentially an additive manufacturing facility in a 20-foot shipping container.

"There are lots of areas that the Army is looking into, and DOD and other organizations are looking into, for 3D printing," said Dr. Aura Gimm. At the time Army AL&T interviewed her, she managed the Army's university-affiliated research center program at the Institute for Soldier Nanotechnologies at the Massachusetts Institute of Technology, which recently produced 4D (the extra dimension is motion) flexible robots via additive. "It's one thing to create decorative parts, but it's something else if you're trying to create a load-bearing or actuating parts that could fail," Gimm said.

The vast majority of the objects created with additive, Gimm said, are essentially decorative. A plastic-polymer mockup of a gear-shifting mechanism for a car design or a reproduction of a missing drawer pull may be nice to have, but the Army requires much more out of the military-specification articles it procures.

Some, though, like Humvee gas caps and the junctional tourniquet created by the Army Rapid Equipping Force's (REF) Expeditionary Lab (Ex Lab), are not a great deal more substantial in terms of their physical structure, but are considerably more useful than decorations.

However, the point that Gimm made is something that Army scientists and engineers have to keep in mind: Items made for the operational Army have to withstand considerable stresses. "The standardization and making sure that we have metrology or the metrics to test and evaluate these parts," Gimm continued, "is going to be quite critical, for [items made with additive] to be actually deployable in the field. Because one thing that we don't want is to have these parts … not work as expected."

That's something that Perconti emphasized in his remarks at the opening of the AMMP Center. "Ultimately, the goal for us is to enable qualified components that are indistinguishable from those they replace. Remember, when you take a part out of a weapon system and replace it with an additive manufactured part, you're putting lives on the line if that part is not fully capable. So we have to be very sure that whatever we do, we understand the science, we understand the manufacturing, and we understand that we are delivering qualified parts for our warfighters."

There is much the Army needs: materials developed for additive, and the design tools necessary to both limit the inherent possibilities and exploit them.

WHAT'S NEXT?

Dr. Patrick Fowler, now with RDECOM, draws on his experience as lead engineer of the Ex Lab at Bagram Airfield to explore agile manufacturing and material processing programs with the goal of harnessing breakthroughs for rapid prototyping and development.

FROM DUST IT CAME

To get things to work as expected and up to Army standards is no simple task. AMRDEC has been working with General Electric Co. to produce parts for the T700 motor, which powers the Apache and Black Hawk helicopters.

"It's kind of like a demonstrator project for additively producing significant engine components," said Kathy Olson, additive manufacturing lead in the Manufacturing Science and Technology Division of the U.S. Army Manufacturing Technology program at Redstone Arsenal, Alabama, in an interview. "There's been some successes already with doing full builds of the parts," she continued. The project is mainly geared toward gaining knowledge, she said, so the part won't be part of a helicopter that Soldiers are flying. Yet.

In part, that's because the motor parts have not been tested and qualified at the Army's standards. "It's more of a knowledge transition," Olson said. It's intended to show "that we can build these significant parts."

AMRDEC produces each part on a laser-powder bed machine, then goes post-production. Jeff Gaddes, mechanical engineer and Olson's colleague at AMRDEC, described the production process for using the machine that produces the metal parts. "We spread a layer of powder over a plate. It's very even, basically like a windshield wiper. So you wipe that powder across so you've got a nice thin, consistent layer of powder, and then your laser comes in, melts where it needs to melt, so you've got regions of melted powder and regions of unmelted powder. Then you drop your build-plate down a little, and then you wipe powder over the whole deal, so you've got fresh powder covering the entire bed," he said.

"You have a high-powered laser that comes in and selectively melts [and fuses] regions of that, and you wipe more powder across and the laser will come in and selectively melt regions of that." Each layer the machine adds is a slice of the digital design. As the process continues, the "volume" that holds the powder and the part fills up."

"In the end," Gaddes continued, "you take it out of the machine, shake the loose powder off and you've got your final part. Then about 70 percent of the work is in the post-processing, removing the powder, post-[processing] heat treatment, machining it if necessary, removing it from the build plate—that type of work." The metal dust that's left can be reused.

Having a finished part is not the same thing as being able to use the finished part, Olson emphasized. The part has to be qualified, a process that assures that the part meets quality standards. Qualifying a part is no simple matter. The materials have to meet the Army's standards, and so does the machine that's making the part.

To qualify a part made with additive, "you'll go through the process of qualifying your material and writing your material [specifications] for whatever material you're going to use," she said. "Then you have to qualify your machine and make sure it's producing repeatable parts, and then qualify the process for the part that you're building, because you'll have likely different parameter sets for your different geometries for the different parts [that] you're going to build.

HAVE ADDITIVE, WILL TRAVEL
The REF Ex Lab at Bagram Airfield produced these items after Ex Lab engineers worked with Soldiers to develop solutions to problems they encountered. Additive manufacturing has the promise to allow Soldiers deployed in remote outposts around the world to print virtually anything they need—shelter, weapons, even medical devices.

"It's not like you can just press a button and go. There's a lot of engineering involved on both sides of it. Even the design of your build-layout is going to involve some iteration of getting your layout just such that the part prints correctly," Olson said.

"That's one of the challenges," said Rock Island's Flinn. "How much test and evaluation is going to be needed, and how willing are engineers going to be to approve a requested change without it? With manufacturers saying that AM powder metal is similar to casting in strength, the push for approval is only going to grow. Yet AM material specifications are still being developed, so the engineering community has little data to verify those claims, and testing each individual component will just delay acceptance of AM." That doesn't even take equipment variations into account. "Process and equipment variation in metal printing is such that certification of individual machines is pretty much a requirement," Flinn said.

Another challenge is the variety of different ways to print metal, which is where the Army wants to go. The kinds of metal printing change all the time, RDECOM's Phillis said, "because people are always coming up with new ideas. From a commercial standpoint, you've got the laser-powder bed. You've got things like Desktop Metal and Markforged, where they're extruding a metal powder as part of a filament like a polymer filament to make a part. You've got binder-jetting, which is like glue and metal that gets put into a sintering oven. That goes through a couple of processes where it finally gets sintered. HP just came out with one that's similar. And then you have deposition, where you just spray powder or wire into a laser or plasma [heat source] and that melts, like [using] a large welder. People are coming up with different stuff. Those [in addition to metal and ceramic slurry printing] are what's commercially available right now. Universities may be working on something completely different. That's what makes it a problem. There's not just one technology that can do it all. There are many different technologies."

THE ADDITIVE SWEET SPOT

The Army stood up its Additive and Advanced Manufacturing Center of Excellence at the Rock Island Arsenal Joint Manufacturing and Technology Center to establish the organizational structure, with the attendant policies, equipment and methodologies to immediately address Army readiness. It will also aid in the growth of additive manufacturing in the Army organic industrial base by developing the business case for it, according to Flinn.

"Right now, the big win for additive manufacturing is tooling," he said. "I'm talking about tool holders, fixtures, patterns, investment and injection molds, assembly aids; all that stuff that's tied to traditional manufacturing that people don't immediately think about when they think AM. Yet the time and cost savings in tooling can provide breakthroughs in meeting readiness," he said.

The beauty of this approach is that changes in the tooling process don't require an engineering change.

"You can get quick turnaround on tooling. The design process takes place, but the manufacturing can take place in days instead of weeks," as opposed to the traditional way that tooling has to get up to speed for manufacturing, Flinn said. "For prototyping or for mainstream manufacturing, I can have a tool made [additively] and up and running in 24 hours. We've experienced that here [at Rock Island] on a process where we were getting 50 percent scrap. We changed the tooling on it and basically eliminated the scrap completely."

This business of figuring out where the additive sweet spot lies is one of the things that REF's Ex Lab and RDECOM's R-FAB are helping the Army understand, either inside or outside the battlespace, Phillis said.

"What missions can we solve? We're finding all kinds of things. Humvees are being dead-lined because they don't have gas caps. Or the gas cap breaks. When they order it, they've got to sit there for 30 days or 45 days or however long it takes to get that through the supply system.

"If we can produce it in a couple of hours, now we've got a truck that's ready for use while we're waiting for the supply system to catch up. And that's the big piece that we always want to emphasize, that this is for emergency repair or temporary missions only. We are not doing field printing to replace" the manufacturer, he said. That can only be done to supplement the supply system and with the maker's knowledge. Any time a Soldier wants to engage R-FAB, the part must be ordered through the supply system before R-FAB can produce a replacement.

That shows where additive technology is useful. It shows not just how the discipline can work for the Army, but where it should work. R-FAB wants to know where additive manufacturing has intervened to help readiness.

CONCLUSION

Conventional manufacturing has been around since the dawn of time. Additive has been here for about 25 years, and that shiny surface of possibility has scarcely been scratched.

Right now, one of the major impediments to additive is physics itself. There is only so hot you can make a polymer, only so fast you can squeeze it out of a nozzle.

"There are definitely physical limits [to additive manufacturing]. I can only pump so much laser power into a metal-powder bed without burning everything up. Inputting too much heat can cause a distortion and the whole thing just melts away," said AMRDEC's Gaddes.

"In every different type of additive process, they have some sort of physical limitation that's associated with them. … Most of the materials that we're manufacturing [with] right now are not really designed for additive. They're legacy materials." For example, a nickel-based alloy, Inconel 718, "is a welding alloy, which makes it relatively easy to additively manufacture, but it really wasn't designed for additive."

The big breakthroughs in additive seem most likely to come with new materials and processes and new design tools. "When we start designing our materials for additive manufacturing, that's when you can really start to see some performance gains, I believe," Gaddes said.

Additive manufacturing will allow Soldiers deployed in remote outposts around the world to print virtually anything they need, from food to shelter to weapons, or even new skin cells to repair burned skin. Efforts are underway to create replacement body parts and custom-made medical devices.

The replicator from "Star Trek" worked by rearranging molecules to create whatever was needed. We're a long way from that, but the Army, as Perconti noted, is working to "develop the additive manufacturing tools that will leverage machine learning, information-fusion capabilities and the like to seamlessly integrate various designs, various digital manufacturing techniques and to bring things all the way from concept to final design in the components, quickly and inexpensively." That's the Army's future.

For more information on the Army's additive center of excellence, go to ***https://www.dvidshub.net/news/297208/ria-jmtc-hosts-amc-summit-discuss-additive-manufacturing-way-forward****.*

STEVE STARK is senior editor of Army AL&T magazine. He holds an M.A. in creative writing from Hollins University and a B.A. in English from George Mason University. In addition to more than two decades of editing and writing about the military and S&T, he is the best-selling ghostwriter of several consumer health-oriented books and an award-winning novelist. He is Level II certified in program management.

THINKING IN VOLUMES

Additive manufacturing demands a whole new way of thinking, and we're not even close to what's possible in this exciting technology.

One of the best ways to understand how different the approach has to be for additive manufacturing is to think of objects as things that exist in space—volumes. The designer also needs to think of the capacity of the machine as the volume that contains the printed object's volume, because, for the most part, the object can be no larger than the printer. (That's "for the most part" because in some cases, printed objects can be larger than the printer, and there are robotic printers that can print in free space, subject to the law of gravity, at least on Earth. But each is still a volume in terms of design.)

The geometries of that volume can be quite precise and quite complex. They can also be simple. Additive doesn't care. The software used for printing an object breaks it into slices; each object is made up, essentially, of stacks of slices. Each of those slices, in turn, is made up of voxels. To understand the concept of the voxel, it's a portmanteau word, a mash of volume and pixel.

Those voxels can be as small or as large as the design requires, but they have to be within the capability of the machine that will print the design.

"When you break a volume into essentially three-dimensional pixels, the idea would be that each voxel—each pixel within your volume—could have different properties because either it's a different material when we're mixing materials, or alternatively we're

modulating materials," said Dr. William Benard, senior campaign scientist in materials development with the U.S. Army Research Laboratory in Adelphi, Maryland. "For example, dynamic alloying, or even changing the properties of a particular alloy by modulating the process as we print." In other words, to add particular properties to the object, a printer could deposit different types of metals in close proximity, and they'd be alloyed as a laser melts them.

"You already have some degree [of control in manipulating materials] in conventional manufacturing, and so we'll profile the material at different places," Benard said. "When you cast something, it's not going to be identical, but you don't have very much option to control it. It's largely a function of the process and the part geometry. There are some things you can do to sort of nudge [the material] here and there. But with additive, there's really this unprecedented potential." To have real control of each voxel, he said, "is really far down the road."

This is not only about shapes but also about the composition of materials and the deliberate blending of materials to gain a particular result. The desired goal, Benard said, is "that the material might perform a substantively different function. So a good example is in electronics packaging. We may print a volume that has both conductive elements and dielectric elements."

Dielectrics, Benard said, are materials that both resist against electricity and have some capacity to store it. What interests scientists about dielectrics is what is known as the dielectric constant and the strength of the dielectric. "We care about both," he said, "but we care about the dielectric constant for the design of the normal operating performance of a device (antenna, capacitor, etc.), while the dielectric strength sets the operating bounds—essentially how much charge we can safely apply before the device fails catastrophically."

With that in mind, he said, "We might place a microchip and then print around that to get a solid volume, which would make it much more mechanically robust. We could print in the electrical contact as part of the volume, as opposed to having it be a discrete wire."

That means that additive manufacturing has the potential to "design electronics with embedded antennas, for instance. So we can use … metal traces to now make antennas.

"But we may want different dielectrics, and now we're going to use different-property materials on the dielectric side, depending on what the properties of the antenna need to be. There have also been demonstrations of embedding things like wave guides. That can be optimal wave guides, akin to a fiber, and these can all be embedded in a structural member. So you could theoretically use glass fiber both as a reinforcing agent, to make the member stronger but also for optical communications at the same time."

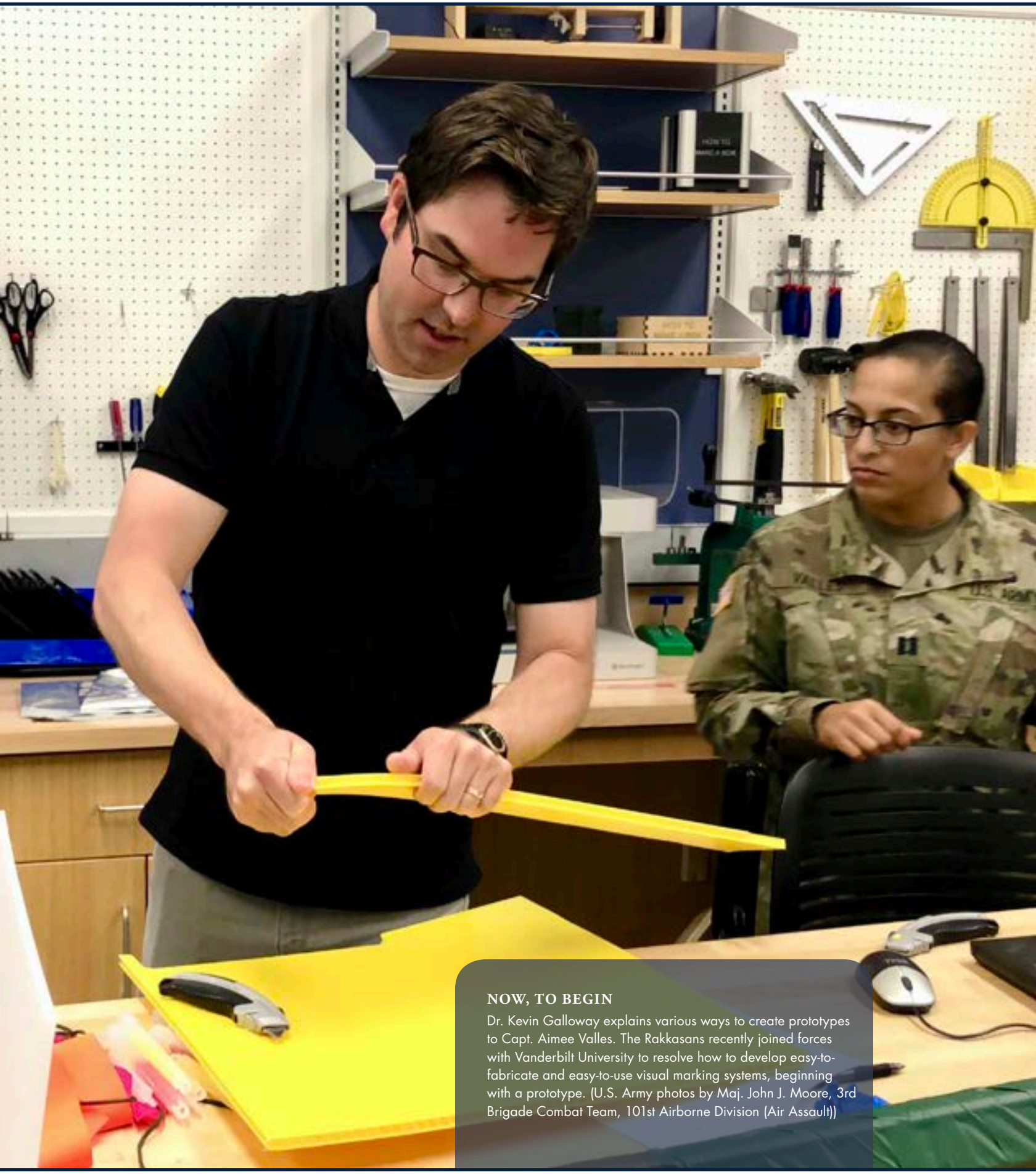
But as wonderful as that flexibility and manipulability of materials in design sounds, Benard was quick to caution that we're not there yet, because creating such structures also brings in variables that have to be foreseen.

To illustrate that in the context of the antenna, he said, "I'm using my fiber optic as a structural member, but I'm also using it for communications. But now, as I strain the lever arm that it's reinforcing, that may modulate the properties of the fiber, which will affect my communications. It gets into a very complex space. It gives lots of opportunity for high performance. There's also a lot of opportunity for unintended consequences."

For Benard, one of the most important things that the Army can do as it moves forward with additive manufacturing is to create the digital design tools that will be necessary for structures that are complex not only in their geometry, but also in materials. That's why "we're building digital design tools to help manage that complexity and help understand what the impacts are going to be," he said.

Because of this approach to an object as a volume, giving designers the inherent ability to digitally explode it into a million or more tiny voxels, "there's all kinds of functions and ways you can build these in all different sizes and scales." There's "a lot of opportunity, but also a lot of complexity that you've now got to manage on the design side. Very exciting, but very challenging at the same time."

—STEVE STARK



NOW, TO BEGIN

Dr. Kevin Galloway explains various ways to create prototypes to Capt. Aimee Valles. The Rakkasans recently joined forces with Vanderbilt University to resolve how to develop easy-to-fabricate and easy-to-use visual marking systems, beginning with a prototype. (U.S. Army photos by Maj. John J. Moore, 3rd Brigade Combat Team, 101st Airborne Division (Air Assault))

MARKING PROGRESS

The Rakkasans and a university are innovating 3D printing to direct traffic at the tactical level.

by First Sgt. Robert Clark and Capt. Aimee Valles

Innovation is about finding new and sometimes unexpected solutions to complex problems. Soldiers from the 3rd Brigade Combat Team "Rakkasans," 101st Airborne Division (Air Assault) have informally teamed up with Vanderbilt University to leverage emerging technologies in innovative ways.

The 3rd Brigade Combat Team fosters a culture of innovation from the highest-ranking officer to the lowest enlisted Soldier. Col. John P. Cogbill, commander of the Rakkasans—a Japanese word meaning "falling umbrella men," given to Soldiers from the 187th Airborne Regimental Combat Team during post-WWII occupation—encourages Soldiers and leaders in the brigade to think critically, collaborate and find creative solutions to complex problems.

Seizing an opportunity to do just that, the Soldiers of Company B "Breacher," 21st Brigade Engineer Battalion, a company in the Rakkasan Brigade, recently worked with the Wond'ry Makerspace at Vanderbilt University to employ 3D printing to fix problems that were historically addressed with little more than 550 parachute cord and 100 mph tape—also known as duct tape—common items found in every Army unit and widely on the internet.

INNOVATION IN ACTION

Among the challenges that the Rakkasan Soldiers face is how to sustain operations and maintain readiness in remote and austere environments. During quarterly brainstorming sessions and brigade innovation forums they realized that 3D printing technology could offer materiel solutions to some of these challenges.

They invited Dr. Kevin Galloway, director of making and a research assistant professor in the Vanderbilt University Mechanical Engineering Department, to an innovation event sponsored by the Rakkasans to explore these ideas. In this open setting dedicated to sharing and exploring ideas, Galloway and Rakkasan leaders discussed how to turn ideas into action.

Soldiers from Breacher Company visited Galloway's Wond'ry Makerspace, a state-of-the-art prototyping laboratory with 3D printers, fiber arts, mold-making and casting materials. Breacher Company leaders and Galloway's team had an opportunity to work together to bring concepts to life. "The rapid fabrication tools available today have significantly lowered the barriers to advance innovative ideas," Galloway said in an interview. "With a little technical training, anyone can quickly learn how to harness the power of these tools to validate early stage ideas before more resources are invested."

The Soldiers presented the difficulty of developing easy-to-fabricate and easy-to-use visual marking systems to Galloway's team. Soldiers employ a variety of marking systems as visual signals across the battlefield. These signals help direct traffic, maintain unity and spacing between Soldiers, and, perhaps most importantly, designate safe zones and lanes for weapon systems. The problem the company faced was that its current systems were bulky and not standardized within the unit. For

SYSTEM PREPARATION

Galloway prepares a base for a silicone mold for the chemlight marking system while Sgt. 1st Class Jesse Frederick and Capt. Aimee Valles look on. The silicone molds can be filled with resin to fabricate holders without the use of a 3D printer.

FIRST PRINTING

Frederick presses print on the first 3D printing project between the Rakkasans and Vanderbilt University: a chemlight marking system.

a marking system to be effective, it must be easy to carry and use, and universally recognizable to Soldiers across the entire unit. With Galloway's help, the Soldiers explored ways to develop a standardized marking system.

THE LINKS THAT BIND

Marking systems are more complex than a single VS-17 panel, a cloth marker commonly used to allow pilots to identify friendly units from the air during the day, or a single luminous chemical light during the night. During a recent .50-caliber machine gun training, Sgt. 1st Class Jesse Frederick, a platoon sergeant in the company, was inspired by the links that hold the .50-caliber ammunition in place. He had seen these links used to hold chemical lights together, but realized that they could be welded together to hold multiple chemical lights (of different colors) in a standardized system. Frederick created a prototype of the marking tool he envisioned.

Initially, he molded a rudimentary holder in the shape of two links to house two chemical lights and a grommet to hold a strip of VS-17 panel. There were some initial design flaws in the prototype; the holes were too small and did not push to the middle of the chemical light, and the material was flimsy and would likely break if carried over long distances in a pocket or a backpack. However, with Galloway's help and a little bit of computer-aided design work, a 3D printer was producing a more precise and durable marking system within 30 minutes.

Once the initial product was complete, Breacher Company progressed to the casting and molding room. There they learned how to create silicone molds that could be filled with resin to batch- fabricate holders without the use of a 3D printer. After all, there may not be a 3D printer and a dedicated laboratory in the remote and austere environments where the company may have to operate.

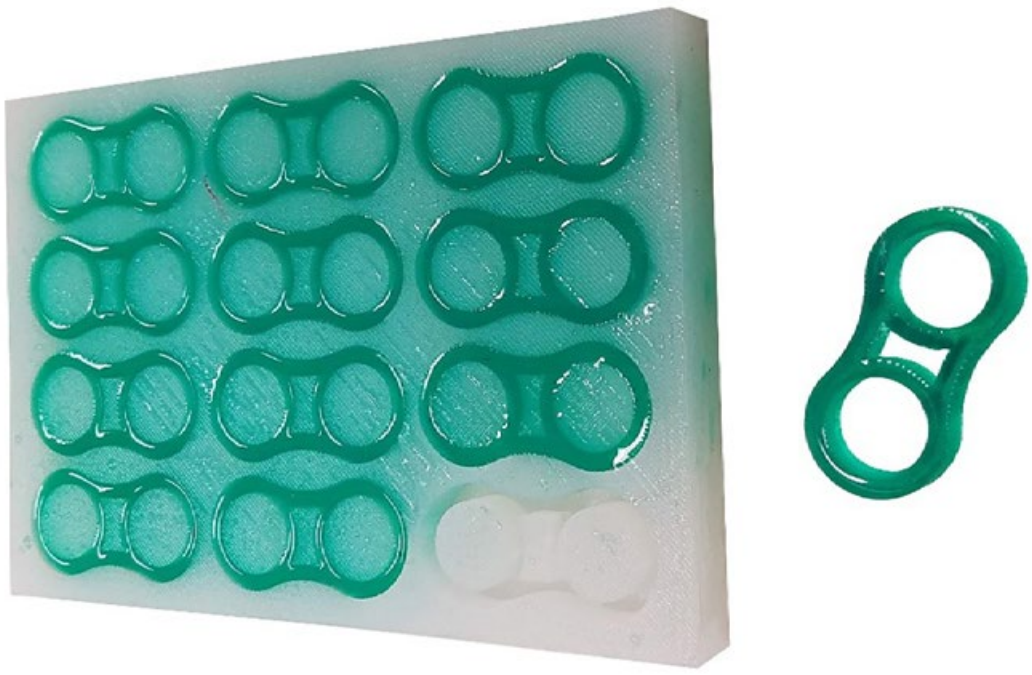
Now, several weeks after that initial visit, Breacher Company has produced hundreds of these systems and can offer the Rakkasan Brigade a standardized and effective marking system for both day and night operations.

CONCLUSION

The marking system is just one of the latest collaborations between the Rakkasans and Vanderbilt University, and more projects are ongoing. "This partnership from the beginning has been very rewarding," Galloway said. "Soldiers have lots of ideas and challenges to share. Creating this opportunity for them to see how the latest technology could be used to advance their

BATCH PRODUCTION

This silicone mold was cast from a 3D printed positive mold for batch fabrication of holders. These molds can be used in place of a 3D printer in the austere environments where the Rakkasans may have to operate.



EXPLORING THE FUTURE
Breacher Company leaders visit the Wond'ry facility at Vanderbilt and discuss prototyping and 3D printing.

> ***"With a little technical training, anyone can quickly learn how to harness the power of these tools to validate early stage ideas before more resources are invested."***

idea while creating real-world challenges for students to advance their skills, it's a win-win situation."

The collaboration between the 101st Airborne Division (Air Assault) and Vanderbilt could serve as a model for the rest of the Army. "This type of symbiotic relationship between tactical units and partner universities could, if scaled, greatly accelerate the velocity of innovation efforts, providing the Army with a more ready and lethal force," Cogbill said. "Formalizing these relationships is exactly the kind of initiative that the Army Applications Lab at the Army Futures Command is looking to facilitate."

For more information about the Wond'ry Makerspace at Vanderbilt University, go to ***https://www.vanderbilt.edu/thewondry/****.*

FIRST SGT. ROBERT CLARK is company first sergeant of Company B, 21st Brigade Engineer Battalion, 3rd Brigade Combat Team Rakkasans. He previously served as a platoon sergeant in the same company, as well as an instructor at the prestigious Sapper Leader Course. He is sapper and Ranger qualified and is a member of the U.S. Army Corps of Engineers.

CAPT. AIMEE VALLES is company commander of Company B, 21st Brigade Engineer Battalion, 3rd Brigade Combat Team Rakkasans. Previously, she was brigade engineer for the Rakkasans and an observer and coach trainer at the National Training Center in Fort Irwin, California. She holds a B.S. in leadership studies with minors in sociology and military studies from Texas A&M University. She is sapper qualified and is a member of the U.S. Army Corps of Engineers.

TECHNICALLY SPEAKING

WHY *the* HYPE?

Additive manufacturing is all the rage, but why?

by Steve Stark

Additive manufacturing, or 3D printing, gets people—and the Army is no exception—very excited because of its apparent potential to make virtually anything, even body parts or replacement organs.

But how? What makes it so special?

Imagine a baker decorating a cake, using a bag with a nozzle to squeeze out a fine line of frosting in a pattern. But the baker keeps adding lines on top of existing lines, eventually building up the layers into a form.

That, in a basic sense, is how additive manufacturing works: A machine deposits material sequentially, layer upon layer, or slice by slice, hardening the material as it goes, until the object is finished. Sometimes, like the baker's method, there's a nozzle depositing each layer until the shape is complete. That's analogous to what's known as material extrusion, probably the most well-known technology in the additive manufacturing portfolio of technologies. A nozzle deposits a heated plastic polymer (which usually comes in spools of fat, colored fishing line) that cures as it cools. MakerBots do material extrusion.

With other processes—such as with powder-bed fusion, which constructs objects using metal or plastic dust and heat, or vat photopolymerization, which uses a light-sensitive liquid plastic polymer—there's no nozzle, but the layering process is essentially the same. (Vat photopolymerization, also known as stereolithography, was the first method of 3D printing. Seeing a video of the technique can make it appear truly magical: A form is created, almost invisibly, layer by layer, in a vat of liquid and, when complete, rises out of the liquid as if from some digital womb.)

This layer-by-layer approach enables the transformation of a virtual, 3D model into a physical object. In theory, that single design can be customized endlessly, depending on the need.

DESIGNING MAGIC

But how do we get from idea to design to magic?

Designs can begin with a 3D scanner, which works much like a 2D scanner you might use for a photograph but with an added dimension. Or a designer can build a virtual model entirely in computer-aided design (CAD) software. The resulting CAD file, which has the .STL file extension (for stereolithography or other unwieldy backronyms), then can be printed with the appropriate machine.

Software divides the design into slices, and each slice represents one pass on the machine. With hundreds or thousands of passes—or more—the machine assembles the object, slice by slice. Depending on the kind of process, that can done with

wire, polymer filament, powders, liquids, gels, mixtures of glues and materials, and slurries. ASTM International (previously the American Society for Testing and Materials) notes seven primary manufacturing processes. Within those exists a growing list of more specialized methods. It is entirely possible that more have been developed since ASTM's survey of the state of the art. That's how fast the technology moves.

QUICK AND CUSTOM

Quick custom design and build is one of the great promises of additive manufacturing as a category. In theory, every pair of shoes that every Soldier wears could be custom fit and printed to match the contours of a Soldier's feet. Indeed, at least one major athletic shoe brand makes a shoe that's entirely additively manufactured, although it's not customized to each pair of feet. Yet.

That customization possibility extends to both very large objects, such as the buildings that the U.S. Army Corps of Engineers' Automated Construction of Expeditionary Structures program is making, to the extremely small, such as the 4D robots (the fourth dimension is motion) that the Institute for Soldier Nanotechnologies at the Massachusetts Institute of Technology (MIT) recently developed. Dr. Xuanhe Zhao and his team created "soft, magnetic, 3D-printed structures that can transform their shape almost instantaneously by the wave of a magnet."

That speed is the real breakthrough, Zhao said in an interview with Army AL&T, but the use of nanomaterials is nothing to sneeze at. Currently, he said, "the drawback of existing [4D] structures is that their movement [is] very slow."

"We use four additive manufacturing machines there, which we run 24 hours a day, and what we're building is going right into the hands of U.S. Soldiers."

Zhao, an associate professor at MIT and a researcher at the Institute for Soldier Nanotechnologies, said, "What we developed is basically a new material system for 3D printing." In additive manufacturing, conceptually, the process, the design and the materials are all equally important. Zhao's team's new method places nanomagnetic particles strategically within the soft plastic. The placement and orientation of the materials enable controlled, rapid movement. "We use a new stimulation method, which is magnetic." Watching video of the structures is a bit like watching muscles twitch.

Indeed, Zhao, said, that's the point. "You can reach the level of energy density and the power density of real muscles. So now, we can make it move very fast and forceful."

Zhao said the technology that he and his team invented has real promise for biomedical devices that can be customized, but neither the printer nor the ink for the method they used existed, so they had to invent them. "We invented a printing method and the ink so that … researchers can print structures that they want—different shapes of robots, different shapes of actuators—and when we apply a magnetic field, you can actuate it or you can move this object."

Watching the structures move, it's not hard to imagine why Zhao said the team envisions them in medical applications. "We are actually trying to simulate the functions of the heart, so the heart beating, and muscle contraction inside the human body. And also, we are making this kind of magnetic materials, 3D-printed into, for example, catheters. But those catheters, you know, are smart. … They can steer themselves inside the human body. For example, in the blood vessel, they can make turns. … So that indeed is one … project we are working on."

'ADDITIVE DOESN'T CARE'

Human beings have been making things for thousands of years. The word "manufacturing" actually means "handmade," coming from the Latin for hand (manu) and made (factum), despite current connotations of machine-made.

Doing something for thousands of years means that an almost intuitive understanding of the materials and processes has been passed down from generation to generation. Sloughing off the knowledge built from thousands of years of doing the same thing and perfecting it evolutionarily is not an easy task, and that can be a serious problem for designers—that and the addition of potentially millions more variables into the manufacturing process.

WIDE ARRAY

These parts were made using additive manufacturing, which creates plastic items and other durable components by adding material, layer by layer, using 3D printers. Depending on the process used, wire, polymer filament, powders, liquids, gels, mixtures of glues and materials, and slurries can produce components. (U.S. Army photo)

Most often, the complex objects that we manufacture today are made up of lots of smaller, much less complex parts made in bulk, then fastened together. Each of those pieces needs to be cast or machined or forged or milled, and then someone has to assemble them. Additive manufacturing is most intriguing because it makes things holistically, with all the parts built together as one, and can potentially transform hundreds or even thousands of parts into just a few. At the very least, this opens up the possibility of much quicker prototypes, which has the Army excited.

Mike Nikodinovski, mechanical engineer and additive manufacturing expert in the Materials Division at the U.S. Army Tank Automotive Research, Development and Engineering Center, said that an example he often uses to demonstrate the difference between legacy manufacturing and additive is a hole.

"If you drill a hole in a part," he said, "usually it's in a straight line because that's the only thing that you can do with a drill," he said, "But additive doesn't care about that. If I want that hole to be twisty and do different things, now, designers … can design for something different, because the limitations of traditional manufacturing are gone. Now they can say, 'I can do all these crazy different things.' " That's one of the benefits, but also one of the problems. Sometimes it makes sense to do something completely outside any box ever made, but other times, not so much.

It's more than a radical change when everything you know about how to design and build an object are out the window.

"When you deal with a material that's been forged or cast for centuries, there are a lot of assumptions built into the selection of the material and the manufacturing method," said Dr. William Benard, senior campaign scientist in materials development with the U.S. Army Research Laboratory (ARL) in Adelphi, Maryland. According to Benard, ARL's research and development portfolio is divided into campaigns that reflect the Army's priorities. Senior campaign scientists work across the organization to develop and coordinate research strategy and to communicate and interface with the broader research communities—DOD, national labs, industry and academia.

That deep institutional and engineering muscle memory in manufacturing simply does not exist in additive, which has only been with us since the mid-1980s. That's not much more than a couple of ticks of the historical clock compared with the thousands of years that humans have been casting, forging, cutting, milling and drilling.

"That's where we really have to do the research to understand how the materials behave differently," Benard said. "It's not that they're so fundamentally different, it's just building up the knowledge base that we have with other manufacturing methods."

Not only that, said Benard, "I think the scale of the design space that is opened up makes it very challenging to develop good intuition. This is one of the areas we are working on—design tools to manage complexity and help identify non-intuitive optimal designs. The tools have to address the complexity of selecting and placing different materials in a volume, or modulating the material properties, to satisfy constraints and performance objectives that exist in multiple intersecting fields and dimensions—for example, looking

QUICK TURNAROUND

The 3D-printed On-Demand Small Unmanned Aircraft System is a new concept whereby Soldiers add requirements to mission planning software, and the system selects the optimal configuration for an aerial vehicle. It can be printed and delivered within 24 hours. This kind of quick custom design and build is one of the great promises of additive manufacturing. (U.S. Army photo)

at thermal, mechanical and electrical performance of high-power electronics packaging."

SAME TECHNOLOGY, DIFFERENT RESULT

Part of the potentially endless advantages of additive is the capability to easily produce dead-simple to ragingly complex objects. So, while we would seem to be a long way from printing a new human heart, the Rapid Equipping Force's Expeditionary Lab (Ex Lab) in Afghanistan recently designed and printed a specialized tourniquet component to help stanch blood flow from a Soldier's groin wound in the field.

This junctional tourniquet is just one of the hundreds of projects that the Ex Lab, which is essentially an engineering and fabrication facility in a box—in this case, a 20-foot shipping container—has created as the result of Soldiers' requests. "Among other fabrication processes, we use four additive manufacturing machines, which we run 24 hours a day, and what we're building is going right into the hands of U.S. Soldiers. That's a small piece of where the Army is with additive manufacturing in the deployed environment," said Angel Cruz, the U.S. Army Research, Development and Engineering Command (RDECOM) project lead, REF Ex Lab, in an interview.

"Everything that Ex Labs build is custom. A Soldier comes in with a mission-capability shortfall that can be solved by a materiel solution, and then the engineers we have downrange brainstorm with the Solider and build the custom solution on-site. If we can't build it there, we have it built somewhere within RDECOM and ship it forward. Ex Labs provide a truly unique and powerful capability accessed directly by deployed Soldiers."

There are probably too many advantages to the Ex Lab approach to list, but at the very top is the capacity to get unique equipment that does not currently exist to Soldiers very quickly. The Soldier brings an idea or a problem directly to the engineers, and they collaborate on a design that can be hammered out right then and there. The junctional tourniquet originated with special operations medics, Cruz said. They found it very difficult to stanch blood flow with the standard tourniquet in groin wounds. These medics were using chewing tobacco containers and applying them with ace bandages.

The medics brought the tobacco container method to the Ex Lab engineers and within hours had several printed prototypes to test and select the best one. And that's just one of the many solutions that's come out of the Ex Lab.

Similarly, according to Tim Phillis, the U.S. Army Armament Research, Development and Engineering Center's Rapid Fabrication via Additive Manufacturing on the Battlefield (R-FAB) is a factory in a box. "R-FAB only has additive with 3D scanning capability, as well. It's only polymer printing because that technology and those pieces of equipment were the ones we felt were the most ready for

expeditionary use. And that's the whole thing: How do we get this technology to the tactical level?"

CONCLUSION

Additive's seemingly endless possibilities mean that the Army has a lot of work to do in figuring out what capabilities make sense to take forward, what capabilities to develop, and where they all belong. That's the focus of a lot of the Army's efforts, from building nanorobotic components to aircraft engines, to standing up the Additive and Advanced Manufacturing Center of Excellence at the Rock Island Arsenal Joint Manufacturing and Technology Center.

We are not yet—nor likely will be ever be—to the point where we will have the Replicator from "Star Trek." But additive has opened, and continues to open, a host of possibilities for the Army to explore.

For more information, go to ***http://www.lboro.ac.uk/research/amrg/about/the7categoriesofadditivemanufacturing/****, which has a detailed rundown of the different processes for items made with additive manufacturing. The website* ***https://3dprinting.com*** *has considerable coverage of the additive manufacturing industry, from home and educational use to industrial capabilities.*

STEVE STARK is senior editor of Army AL&T magazine. He holds an M.A. in creative writing from Hollins University and a B.A. in English from George Mason University. In addition to more than two decades of editing and writing about the military and S&T, he is the best-selling ghostwriter of several consumer health-oriented books and an award-winning novelist. He is Level II certified in program management.

Neither the printer nor the ink for the method they used existed, so they had to invent them.

LIGHT OF INNOVATION

An initial prototype of a chemlight marking system developed by Sgt. 1st Class Jesse Frederick for the 3rd Brigade Combat Team of the 101st Airborne. The finalized, 3D printed product eliminates the prototype's flimsiness. (U.S. Army photo by Maj. John J. Moore, 3rd Brigade Combat Team, 101st Airborne Division (Air Assault))

PRINT POSITIVE

The finalized 3D printed plastic positive mold for a dozen chemlight holders, produced at the Wond'ry Makerspace at Vanderbilt University for the 3rd Brigade Combat Team. (U.S. Army photo by Maj. John J. Moore, 3rd Brigade Combat Team, 101st Airborne Division (Air Assault))

EVERYWHERE MAN

P.W. Singer

Whether it's his fiction and nonfiction, his work as a TRADOC 'mad scientist,' the interviews he's done with defense media, the pages of Popular Science, or some other venue, P.W. Singer is the Army's must-read thinker.

by Margaret C. Roth

VICTORY ASSURED
In a social media war, commanding the most attention, most effectively, secures victory. (Image by Zabelin/metamorworks/iStock/Getty Images)

In the ongoing, all-consuming exploration of the future battlefield, the recently published book "LikeWar: The Weaponization of Social Media" adds a new dimension. Only this battlefield is already well-established: the internet.

"[T]he internet has become a battlefield," one that "changes how conflicts are fought," co-authors P.W. Singer and Emerson T. Brooking write. "[T]his battle changes what 'war' means," with victory going to those who command more attention, more effectively. The principles of warfare on the internet are already pretty clear, they write. In fact, Prussian general and iconic military thinker Carl von Clausewitz (1780-1831) "would have implicitly understood almost everything it is doing to conflict today." But, as "LikeWar" explores, social media have created new rules for war and politics that would have flummoxed Clausewitz and are doing much the same to today's leaders.

The evolution of warfare is more than comfortable territory to P.W. (Peter Warren) Singer. It is where he has built much of his life's work. Singer is a strategist at New America, a Washington-based think tank "dedicated to renewing America by continuing the quest to realize our nation's highest ideals, honestly confronting the challenges caused by rapid technological and social change, and seizing the opportunities those changes create." He is also an author and an editor at Popular Science magazine and an official "mad scientist" for the U.S. Army Training and Doctrine Command.

To call Singer prolific is a glaring understatement. So is just naming the six books he has authored, both nonfiction and fiction. The Wall Street Journal has called him "the premier futurist in the national-security environment." The Smithsonian Institution has named Singer one of the nation's 100 leading innovators. Defense News includes him among the 100 most influential people on defense issues. Foreign Policy magazine has him on its Top 100 Global Thinkers List. And Onalytica Ltd., a social media data analysis consultancy, counts him among the 10 most influential voices in the world on cybersecurity and 25th most influential in the field of robotics.

These many titles of authority are no casual hyperbole. Singer comes by them honestly, and with surprising humility. His thinking and writing venture into virtually every corner of defense: the nature of warfare in all of its realms—land, sea, air, space and cyber—military history, doctrine, emerging and future technologies, war gaming, organizational change and more.

Given mundane but necessary time constraints, Army AL&T had a painful choice to make in talking with Singer: where to focus its discussion. We chose transformation to be Topic A, namely the transformational aspects of technology and whether there's any realistic hope for DOD to transform its acquisition system into one that could be responsive to emerging technologies. The theme is all too familiar to Singer, based on his experiences with the military.

"There have been a series of decisions that really attack some of the core advantages that allowed us to be ahead—specifically, spending on research and development and attracting the world's top talent to America."

"The pressure point for the acquisition system is going to be, 'How do I have my tentacles out there so that I am aware of this technology, when and where these breakthroughs are happening, and I'm incorporating it as rapidly as possible?'" he told Army AL&T in an interview, explaining how the game-changing technologies are increasingly proliferated around the world. "The thinking can't be, 'We're going to be the only ones with this technology.' Rather, it should be, 'We're going to be the ones that make use of it the best.'"

THE NEXT

Straightforward and plainspoken, Singer asks as many questions as he answers; but then, that's the point. In interviews Singer has done with the military specialty media, one of the key questions he has embraced centers on technology, which now happens to be the focus of the Army's push to modernize so that it can establish a decisive advantage in the battlespace. Is the U.S. military in a position to seize advantages that are already there, such as the internet? It's one thing to adapt technologically in response to a known threat, but quite another to waste no time in harnessing technology to claim the battlefield in the first place.

USE IT WISELY

Singer believes the acquisition system will need to be hyper-aware of advantage-altering technologies as they arrive—the Army will have to move from thinking "we're the only ones with this technology" to "we use this technology the best." (Image by U.S. Army Acquisition Support Center/PlargueDoctor/iStock/Getty Images)

Singer is no ivory tower polemicist. He has worked in the thick of conflict in his work with DOD, both on the battlefield and in the Pentagon, participating in war games and talking with scientists, Soldiers, generals, even Iraqi insurgents.

In 2009, recognizing that the U.S. military had no guarantee of maintaining the technological edge it had enjoyed in global warfare for the past few decades, DOD contracted with Noetic Group, an international strategic consulting firm, to assess the implications of emerging technologies on future warfare. The method was Project NeXTech, led by the Rapid Reaction Technology Office within the Office of the Secretary of Defense and in which Singer played a central role.

Through research on the state of emerging technologies with leading scientists, engineers, academics, military leaders, policymakers, investors, journalists and futurists, NeXTech set out to define "what are the technologies that today's naysayers derisively describe as 'science experiments' that will actually be key to shaping the battlefield of tomorrow?" according to a September 2013 report by the Center for a New American Security. "The goal that guided them was to identify what technology right now is akin to where the computer was in 1980 or the Predator [aerial drone] was during the 2001 Quadrennial Defense Review—real but not yet noticed as transforming the world."

NOT CLAIRVOYANT

Singer talks about the future of technology, cybersecurity and threats in January 2018 during the Maneuver Warfighter Conference at Fort Benning, Georgia. "When it comes to predicting the future, we're not very good at it," he said. (Photo by Suhyoon Wood, Fort Benning Public Affairs)

"I'm very, very gung-ho of the idea of having more and more of a presence by the Pentagon not just in Silicon Valley, but these tech clusters all over the nation. It's incredibly important for them to be out there technology-scouting, finding opportunities."

NeXTech comprised a series of war games in partnership with the U.S. Army War College, the U.S. Naval Postgraduate School and the U.S. Naval Academy, among other organizations, to examine the barriers to use of the technologies as well as their appropriate uses from tactical, strategic, doctrinal, legal and ethical standpoints. The project focused on five areas of technology with the potential to produce "game-changers"—biotechnologies (e.g., human enhancements), energy (e.g., lasers and superefficient batteries), materials (e.g., 3D printing), hardware (e.g., robots) and software (e.g., electromagnetic and cyber weapons).

While the outcome of NeXTech was primarily to shape senior defense leadership's decision-making on resource-constrained planning and investment in science and technology, it was a starting point in the slow reorientation of defense priorities toward emerging technologies in a globally competitive environment.

TECHNOLOGY OUTPACING GOVERNMENT

In an interview in November 2013 with the late journalist Matthew Power, published on TED Talks' website, Singer observed that in the four years since NeXTech concluded, the pace of technological change and the pace of government were getting further and further apart. The difference has only grown, he told Army AL&T.

"It's getting worse, because in some areas we're no longer playing catch-up. We're literally moving in the opposite direction" in terms of defense policy and its people, he said. Singer cited as an example the Trump administration's decision last spring to eliminate the White House position of cybersecurity coordinator, a position created under President Barack Obama. National Security Adviser John R. Bolton stated that the post was no longer necessary because lower-level officials had already made cybersecurity issues a "core function" of the president's national security team.

"It took us a long time to wake up to the threats and challenges [in cybersecurity], and we started to build organizations," Singer said. Eliminating the cybersecurity coordinator "left pretty much everyone in the field mouths-open, stunned by that idea that we would no longer try to have strategy and top-level coordination on a topic as important as cybersecurity."

The White House cybersecurity coordinator was in charge of shaping national cybersecurity policy and the political responses to national cybersecurity incidents. Instead, Bolton assigned the task to two National Security Council senior directors, at a time when defense and intelligence officials were (and are) anticipating more cyberattacks, not fewer, given cyber threats from major powers such as Russia's NotPetya ransomware and North Korea's WannaCry ransomware.

In addition, Singer said, "There's the larger challenge of a geopolitical economic and technologic race with China, where China is behind but moving at a much faster pace ahead. And there have been a series of decisions that really attack some of the core advantages that allowed us to be ahead—specifically, spending on research and development and attracting the world's top talent to America.

"You look at the history of leading American technology companies, and the overwhelming majority of them were started by either an immigrant or son of an immigrant." Yet current national immigration policy has moved to create the opposite, with dangerous potential consequences, he said, evoking the United States' deportation in 1955 of Qian Xuesan, the first director of Cal Tech's famed Jet Propulsion Lab who would go on to found the Chinese intercontinental ballistic missile and space rocketry program.

Those days of McCarthyism and the Red Scare were over a half-century ago, but the current national policy's singling out of certain Muslim countries for restrictions on immigration to the U.S. are painfully familiar, Singer said. "You can pretty much [draw] a direct line between actions driven out of bias that harmed national security. ... We know what works, we know what doesn't, from history, and we're ignoring these lessons today.

"It's a deep worry. I do a fair amount of travel, and it's something that our allies are deeply, deeply worried about, as well."

TECH COMPETITION

On the plus side, Singer sees DOD's outreach to Silicon Valley as a "saleable" step in the right direction as the Army modernizes. "I don't think it's the end-all, be-all solution, and the challenge is multifaceted," he said.

"One is, at the end of the day, the Pentagon's spend in Silicon Valley is not going to be enough to alter the behavior of the large tech companies. It is enough to open up opportunities for some of the smaller companies and startups and the like, but it's not going to change what, as we've already seen, the Googles or the Apples are going to do."

The second major challenge is that, whereas the Soviet Union competed technologically with the United States, now China is also competing economically for American investment, which colors U.S. companies' willingness to do business with DOD. "The China market is crucial to so many companies' future prospects. And so it leads them to look at that relationship with the Pentagon—that full-fledged jump into, you know, a more

FIGHTING FOR THE FUTURE

"LikeWar: The Weaponization of Social Media," which Singer co-authored with Emerson T. Brooking, is an in-depth exploration of the battlefield of the internet. (Image courtesy of Houghton Mifflin Harcourt)

Exercises often are designed to validate existing concepts or planned programs of record to demonstrate "that this was a good investment, as opposed to really, really kicking at the tires."

traditional defense industry role—with a different kind of eye.

"That's just a reality, and we're not going to be able to change it with the opening of a small office" of DOD's Defense Innovation Unit nested amid major tech companies. "But I'm very, very gung-ho of the idea of having more and more of a presence by the Pentagon not just in Silicon Valley, but these tech clusters all over the nation. It's incredibly important for them to be out there technology-scouting, finding opportunities."

The reason lies in the very nature of the game-changing technology that exists today. Unlike the atomic energy or aircraft carrier or ballistic missile of earlier generations, the organizations that research, develop, buy and use the technology will be both government and the private sector, and it will comprise both civilian and military applications.

"So you think of something like artificial intelligence [AI] or robotics or big data: These are areas where the breakthroughs won't be coming out of exclusively governmental labs funded primarily by the Defense Department. They're going to be coming from lots of different directions. The users of them are not going to be exclusively governmental or even military in the first generation, the way we saw with some of these past key technologies, even arguably the start of the computer."

Additionally, given the nature of the technology, it's becoming easier and easier to use—AI, for example—because of machine intelligence. A drone that is flown by a brain-machine interface lowers the barrier to use by "all sorts of different actors; the 'pilot' didn't have to learn how to become a pilot to fly this complex piece of machinery," Singer noted.

TALKING TECH

Singer discusses new technology with an officer and DOD civilian at an Air Force facility. Advances such as artificial intelligence and brain-machine interfacing will change the way the Army conducts war. (Photo courtesy of P.W. Singer)

PREPARING FOR CYBERWAR

Capt. Joe Spracklen, left, and Capt. Brad Pemberton conduct cyberspace training in August during Operation Tiger Stance, a situational cyberspace training exercise designed to prepare cyber protection teams for real-world operations. (Photo by Bill Roche, U.S. Army Cyber Command)

CHALLENGING THE STATUS QUO

Truly challenging war gaming is essential to this dominance, Singer said. That means looking at new technologies across multiple different scenarios, as the NeXTech project did in 2009. "Too often in these war games—not just war games, but when we're thinking about a certain weapon system or technology—we put it into the context that we're most familiar with or we most want for the future."

In NeXTech, by comparison, "we were thinking about scenarios that ranged from high-intensity conflict to counterinsurgency to an embassy evacuation to a response to an earthquake—all different kinds of settings that U.S. forces have been in—and saying, OK, in these different contexts, how might the technology be used? And then, secondly, not just how might the U.S. use it, but how might it be used against us? How might a drug cartel use it? How might a terrorist group use it? How might a high-end military use it? How might a midtier military use it?"

The U.S. military conducts very useful war games and training exercises, he said, but with common challenges across the board. "Even when it's a challenging scenario, a high-end conflict with another state, it's still framed in a very familiar way, instead of trying to come at it from multiple angles."

A second challenge is the people chosen to be the "bad guys." The general approach is, "I take some part of my organization and say, 'You go think like the bad guys'—as opposed to actual people who think like bad guys. So there tends to be a limited framing."

Additionally, the exercises often are designed to validate existing concepts or planned programs of record to demonstrate "that this was a good investment, as opposed to really, really kicking at the tires. There's also a little bit of what I call the back-to-basics problem." That problem, as Singer sees it, is that the exercise is not so much a war game as a large-scale training event with the guiding principle being, "We haven't been doing X for 15 years. We need to get back to basics"—as opposed to asking, "OK, how maybe have the basics changed?"

Finally, he said, multinational exercises "too frequently are about making allies feel good about themselves."

As an example of "a really good effort," Singer pointed to Fort Polk, Louisiana, home to the Joint Readiness Training Center. On a historical note, Fort Polk was established in 1941 for the Louisiana maneuvers, in which, against the backdrop of World War II, the Army set out to "figure out what not just tanks, but

P.W. SINGER AT A GLANCE

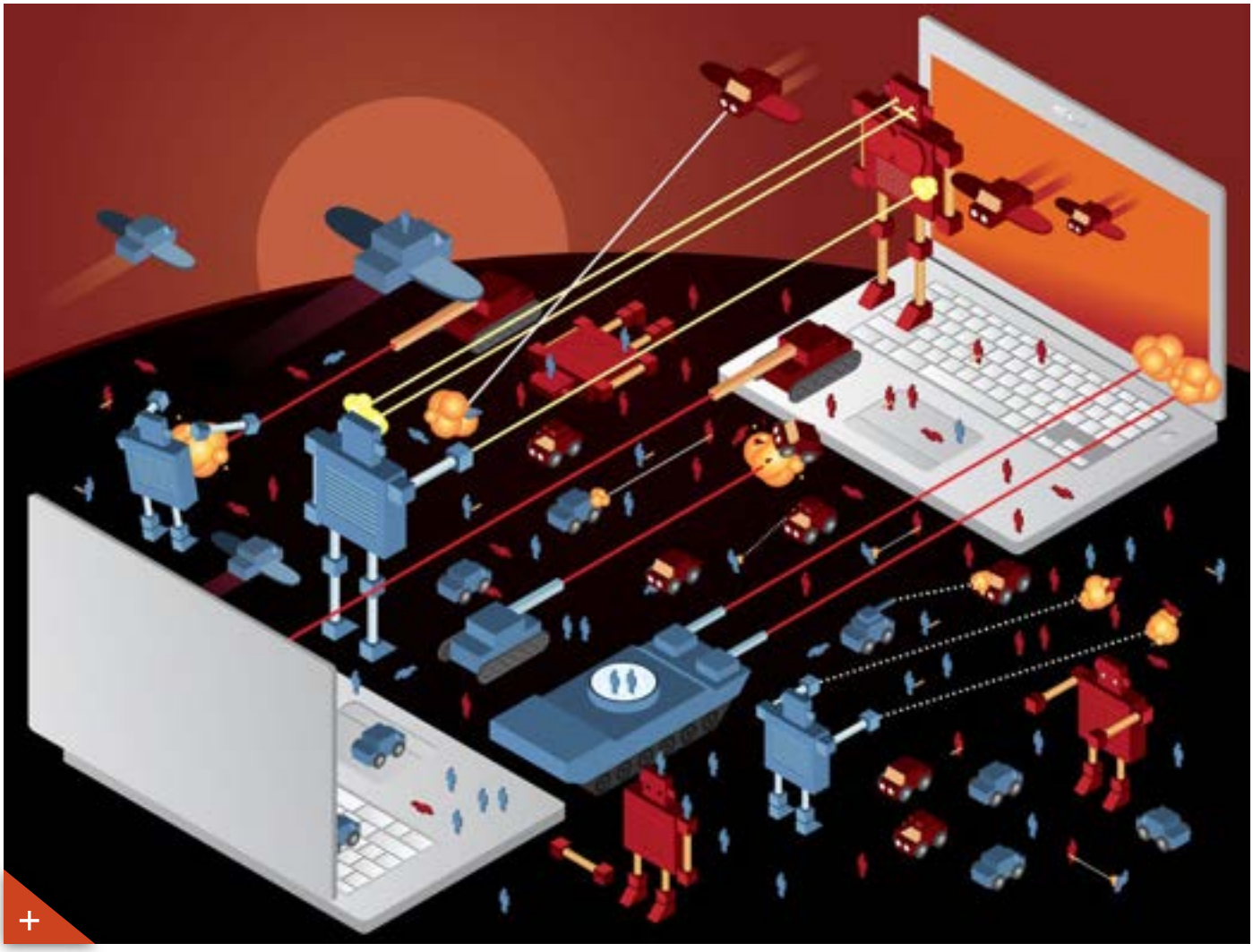
Dr. P.W. Singer is considered one of the world's leading experts on changes in 21st-century warfare, with more books on the military professional reading lists than any other author, living or dead, according to his official biography. He has consulted for the U.S. military, the Defense Intelligence Agency and the FBI, and he served as an adviser to entertainment programs, including for Warner Brothers, DreamWorks, Universal, HBO, Discovery, History Channel and the iconic video game series "Call of Duty."

He served as coordinator of the Obama campaign's defense policy task force in 2008 and was named to the U.S. military's Transformation Advisory Group. He currently is an associate with the U.S. Air Force's China Aerospace Studies Institute. In addition to his work on conflict issues, Singer served as a member of the U.S. Department of State's Advisory Committee on International Communications and Information Policy.

Singer received his Ph.D. in government from Harvard University and a B.A. from the Woodrow Wilson School of Public and International Affairs at Princeton University.

EMBRACING CHANGE

P.W. Singer, a prolific fiction and nonfiction author and "mad scientist" for the U.S. Army Training and Doctrine Command, is dedicated to making the most of the opportunities brought about by rapid technological and social change. (Photo by Sam Cole)



WAR ZONE

Cyberspace is the battlefield of the future, and the Army needs to understand cyber to be fully prepared. The recent White House decision to eliminate the cybersecurity coordinator adds uncertainty to how that understanding will develop, Singer said. (Image by ryccio/DigitalVision Vectors/Getty Images)

mechanization and wireless communication at large, had done to war and how we needed to change to adjust for it."

Singer noted that since then, Fort Polk, with its collection of villages and counterinsurgency sites, "has become the training and thinking ground for everything from, how do we stop Soviet tanks to after 9/11"—to, most recently, a cyberspace "battleground." Singer has advised one of the companies involved in that program.

Called the Social Media Environment and Internet Replication, its purpose is "basically building a fake internet over the fake wars that take place at Fort Polk." The "insurgents" chat online, recruiting, reporting, pushing their story just as the Islamic State group does. "I find it utterly fascinating from a historic standpoint, because a little over a generation ago, the military had literally created the internet with ARPANET and then walked away from it [and] handed it off to the civilian side."

SCI-FI LEADS THE WAY

As a rare combination of novelist, nonfiction writer and scholar, Singer sees elements of science fiction today predicting what technologies the military will spin in from the civilian world tomorrow.

"Artificial intelligence, of course, and autonomous robotics are some of the most frequent technologies that pop up in sci-fi, and they are definitively part of military futures," he said. "Brain-machine interface technology, you know, is already being played with in labs and in video gaming. I see that moving over to the military in the future."

Three-D printing is "really the 'Star Trek' replicator in a certain way, already popping up on military bases in a mostly ad hoc manner."

Singer also predicts that the U.S. military is also going to see more biological technology. "There are amazing breakthroughs happening in the biosciences and genomics affecting, of course, not just diseases, but shaping what humans can do that they couldn't do previously. And if it's being used in health, if it's being used in sports, we shouldn't be surprised to see it make its way over to the world of war, too."

FUTURE MATERIALS

Army scientists explore materials at the nano level with the goal of finding stronger or more heat-resistant compounds that could be used to design more durable, secure computers. (U.S. Army photo by David McNally, U.S. Army Research Laboratory)

Is the U.S. military in a position to seize advantages that are already there, such as the internet?

This crossover from fiction to fact is nothing new, he said. "Science fiction has always played with technologies that then become real and then are applied to war, whether it was the flying machine or the undersea boat or H.G. Wells' concept of an 'atomic bomb.' It's going to be the same thing in the 21st century. Of that, I'm confident."

MARGARET C. ROTH is an editor of Army AL&T magazine. She has more than a decade of experience in writing about the Army and more than three decades' experience in journalism and public relations. Roth is a MG Keith L. Ware Public Affairs Award winner and a co-author of the book "Operation Just Cause: The Storming of Panama." She holds a B.A. in Russian language and linguistics from the University of Virginia.

(Image by U.S. Army Acquisition Support Center/Peshkova/Getty images)

INDUSTRY INSIGHT

Industry Insight is an occasional Army AL&T column in which we provide members of the defense industry an opportunity to share perspectives that are useful in helping the Army Acquisition Workforce do its job better. What issues does industry face? What could the Army do better? For this issue, with its industry theme, we reached out to industry and asked what it wanted our audience to understand or know. The following columns are the result.

A BOLD FUTURE FOR THE ARMY

accenture

Jim Kinkade

Jay Chung

Reimagining the Army's logistics enterprise resource planning systems.

by Jim Kinkade and Jay Chung

If the Army could start over today, it would not choose to design the enterprise resource planning (ERP) system landscape as it exists now. It would not seek systems designed to serve one specific function and siloed based on functionality; hardware, software, governance and budgets would not be decentralized; business intelligence would not be scattered across dozens of data warehouses; contractors would not hold intellectual property hostage; and governance and change management processes would not lead to wait times measured in years.

Of course, there is no starting over. Our Army—the world's most powerful land force—is engaged in more than 120 countries. More than 1 million Soldiers must be equipped and more than 800,000 pieces of equipment must be procured or maintained—and all synchronized in a way that generates sustainable readiness. This cannot be achieved without essential functions currently executed or managed within three ERPs: the Logistics Modernization Program (LMP), the Global Combat Support System – Army (GCSS-A) and the General Fund Enterprise Business System (GFEBS). An organization uses an ERP system to execute and integrate the core functions (e.g., finance, logistics, procurement and human resources) of its mission.

However, continuing with the status quo is not a realistic option, either. As the Army's top leaders have identified, several factors make it paramount that savings be harvested from every corner of the Army. Two factors in particular—the relentless requirement for Army engagement on every continent and

HOLD FOR LAUNCH

Spc. Pedro Rosario-Roche, from 1st Battalion, 62nd Air Defense Artillery Regiment, performs a maintenance check on an MIM-104 Patriot at an undisclosed location in Southwest Asia as part of a missile defense exercise in June. Army logistics systems support critical preventive maintenance tasks but have become stovepiped and costly. (U.S Air Force photo by Staff Sgt. Dana J. Cable, 332nd Air Expeditionary Wing)

the requirement to modernize or replace several of the Army's "Big Six" weapon system fleets concurrently—are compelling everyone from the secretary of the Army on down to identify opportunities for savings.

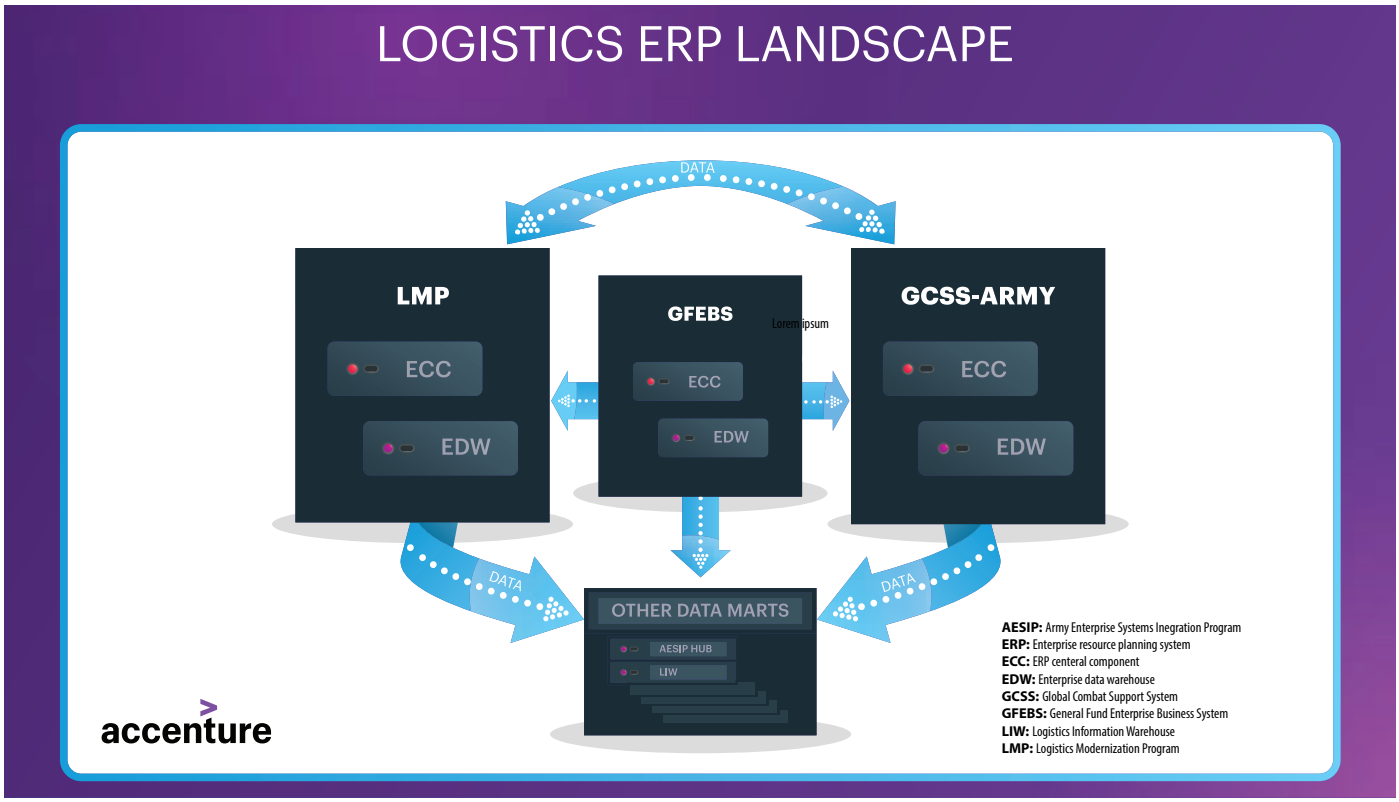
While Army leaders seek savings from every budget line, it makes sense to look closely at its billion-dollar ERP landscape. It is not too late to put the Army on a path to a rationalized, more effective, less expensive way to run its business. It is not too late to bring powerful new technologies to bear to free precious resources, allowing the Army to focus on its core competency of preparing for combat.

But this renaissance in Army logistics will require help from the Army's acquisition professionals to procure the expertise to manage, sustain and modernize its ERPs in a different way. The Army needs to shift from buying capacity to buying outcomes; from gatekeeping to enabling users; and from decentralized, competing priorities to a unified mission focus through the support of its acquisition leaders.

SURVEYING TODAY'S LANDSCAPE

The Army has made great progress over the past 10 years in the transition from dozens of standardized management information systems and home-grown systems to its current landscape of seven

FIGURE 1



TOO MUCH MOVEMENT

Segregation and duplication of core ERP functionality has led to unnecessary movement and replication of data across the Army's logistics enterprise. Integration is further complicated, the authors noted, when processes require personnel data. (Image courtesy of the authors)

ERPs. And access is in the right hands: One or more ERPs are represented in every supply room, motor pool and orderly room—not to mention every headquarters from company to corps.

Logistics ERPs have undoubtedly improved Army effectiveness. LMP permits visibility and management of national-level stock and organic industrial base production down to the shop floor. GCSS-A integrates all unit-level supply and maintenance transactions into a single system. GFEBS replaced more than 80 legacy systems and standardizes financial, asset and accounting data across all three Army components—active, Reserve and National Guard. (See Figure 1.) Most desired core ERP functionalities have been fielded and are in sustainment mode, except Army aviation, which is scheduled for GCSS-A Increment II.

But even in sustainment, costs have ballooned. Different program offices operate each ERP. Years of customizing core functionalities and of decentralized hardware and software strategies have made ERP integration efforts costly and have spawned integration applications such as the Army Enterprise Systems Integration Program Hub and Logistics Information Warehouse.

Most troubling is user communities' real or perceived lack of return on investment. Some users complain of lengthy requirements-gathering sessions with multiple rounds of prioritization and approval, followed by extended wait times (six to 12 months) for low-complexity change requests. Often they discover that requirements have been misinterpreted when enhancements are finally delivered.

LOGISTICS ENTERPRISE REIMAGINED

Careful observation of the most successful private sector ERP implementations reveals essential characteristics that the Army

should consider mandatory for its future logistics enterprise system. That system must be:

- Governed and funded by a single entity.
- User-centric, with an architecture that maximizes self-service.
- Able to rapidly respond to change and introduce new functionality.
- Scalable—up or down—for both infrastructure and services.
- Acquired as an outcome-based managed service.

Transforming the Army's disparate ERPs into an enterprise with these characteristics will be hard, but it can be achieved with three major efforts: Consolidate ERP sustainment; consolidate business intelligence and analytics; and finally, collapse different ERPs into a unified ERP.

SYSTEMS AND SUPPORT UNDER ONE ROOF

The U.S. Army Communications-Electronics Command's (CECOM) Software Engineering Center is spearheading the initial steps toward the first effort. CECOM recently announced plans to explore consolidating sustainment across its ERP portfolio. We applaud leaders for taking these steps but suggest they prepare for an even bolder one. Additional centralization between core ERP sustainment (owned by CECOM) and modernization efforts (owned by the assistant secretary of the Army for acquisition, logistics and technology) would make it easier for Army leaders to prioritize between investments in current versus future capabilities—and help fully optimize life cycle management of the Army's logistics systems.

Acquisition professionals can readily see benefits of this consolidation, including improved visibility into requirements and better buying power that can drive cost savings. Also, the ability to prioritize spending across a larger pool of requirements, using combined resources, will ensure that the most impactful requirements are addressed—not just the top priority for a slice of the enterprise.

Further, ERP support service contracts should shift away from buying capacity to buying outcomes. When requirements are not well-defined, using multi-award indefinite delivery, indefinite quantity contracts or blanket purchase agreement-like strategies can help mitigate risk to the Army. By leveraging these acquisition vehicles, the Army can award more highly targeted and smaller task orders to a handful of prequalified vendors. Task orders could take

PUTTING THE RIGHT TOOLS IN PLACE

Soldiers assigned to the 3rd Armored Brigade Combat Team, 1st Cavalry Division ready an M1A2 Abrams main battle tank for maintenance at Exercise Bright Star 2017 in Egypt. Mechanics worldwide rely on logistics systems such as LMP for transparency of available inventory. Changes to LMP and similar ERPs would improve their effectiveness and lower the costs of operating them. (U.S. Army photo by Staff Sgt. Leah R. Kilpatrick, 14th Public Affairs Detachment)

the shape of firm fixed-price contracts for specified outcomes, shifting the risk to vendors and allowing the vendor and the Army to share the benefits of rapid and efficient delivery.

BUSINESS INTELLIGENCE IN THE LOGISTICS ENTERPRISE

The wide-scale deployment of ERPs enabled organizations to harvest mass amounts of data to enhance their decision-making processes, a process commonly referred to as business intelligence. In the early years of ERPs, business intelligence development relied on a few technical experts working with key "super users" to gather requirements and then build and deploy reports. The process was slow and often not scalable (i.e., replicable on a larger scale). The inability to deliver these capabilities efficiently on a large scale led to an emphasis on extreme consensus, through prioritization across multiple organizations.

The result was reports that often did not meet users' specific requirements. Users were also left believing their data was locked away, beyond their reach. Thus began the era of local data marts. Today, the Army is flooded with an uncountable number of local data marts, from enterprise-wide systems like the Logistics Information Warehouse and the Army Workload and Performance System to smaller, localized battalion or brigade databases. The proliferation has led to tremendous cost in terms of resources consumed and multiple versions of "truth." (See Figure 2.)

In contrast, in the private sector, today's self-service analytics technologies have all but eliminated the need for "super users," report developers and redundant data marts. Instead, ordinary users are empowered to create their *own* reports and conduct their *own* analytics through intuitive self-service applications like Tableau and Qlik.

To unlock the same outcomes in the Army, ERP sustainment organizations and program offices must get out of the report-generating business. They need to shift the responsibility for analytics and report-creation away from centralized information technology (IT) organizations to actual users. They should invest in self-service analytics tools and grant regular users access to data. Then, to make these changes permanent, they should eliminate budgets for report development and decommission local data marts.

LOGISTICS IN THE CLOUD

Having completed the transformative steps of consolidating sustainment and democratizing business intelligence and making it available for everyone to access, regardless of background or position, the Army can proceed toward the most significant step of modernizing its ERP landscape: collapsing siloed functions and user bases into a single, unified ERP. Skeptics of such a consolidation will cite organization-specific complexities and unique Army requirements. However, transitions like this happen every day in industry. Companies as diverse as food and beverage and clothing sales have successfully consolidated ERPs after mergers and acquisitions.

The bottom line is that the Army's focus should be on increasing readiness and lethality, not hosting software. For the Army to free up the millions of dollars needed for modernization and sustaining its high operations tempo, it is imperative to find leap-ahead efficiencies; marginal changes will not move the needle. Fortunately, recent advances in secure, cloud-based computing and storage are allowing industry and U.S. intelligence agencies to unlock tremendous savings in operating costs, while also having access to cutting-edge applications in the cloud.

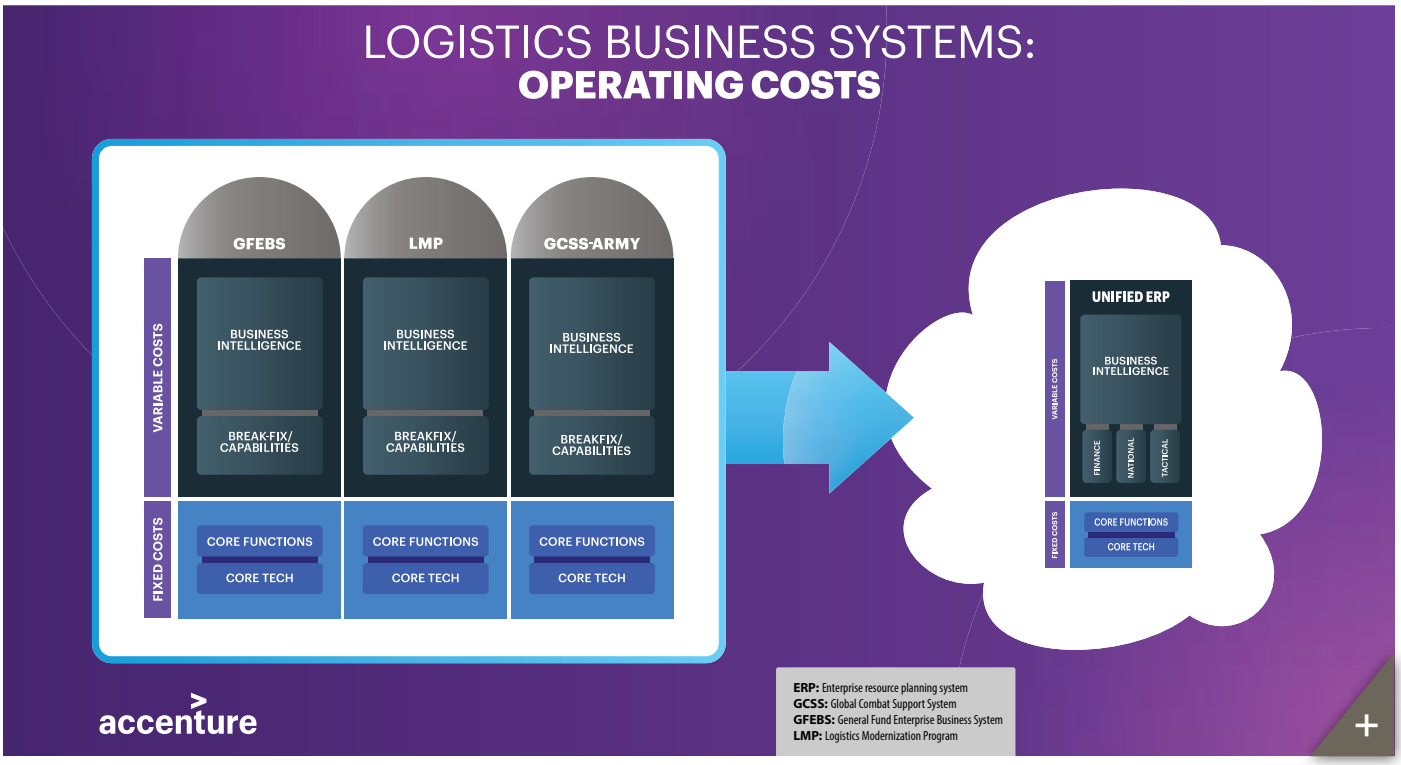
Of course, for the Army, more than savings is at stake: Near-peer adversaries are seeking every opportunity to achieve parity with the U.S. in any domain. "One of the surest ways for our Army to ensure 'IT overmatch' is to get into the cloud," as retired Lt. Gen. Susan Lawrence, former Army chief information officer/G-6 who now leads the Army and Air Force portfolio within Accenture Federal Services' national security practice, said recently.

The Army should seize the opportunity for overmatch and plan for its unified logistics ERP to operate from the cloud. Beyond the strategic advantages that will accrue, moving away from fixed government data centers to cloud-based managed services will also allow for more precise and efficient ways to pay for what is needed. As the Army's cloud-based environment automatically scales up or down based on consumption, a "pay by the drink" model will derive costs directly from usage, as opposed to basing them on fixed labor pools and fixed hardware costs. This approach will eliminate the requirement for the Army to plan, program and budget for IT infrastructure procurement, maintenance and refresh.

CONCLUSION

The business economics today are simply different from just a few years ago. Even complex ERP services can now be delivered in a relatively low-risk and cost-effective way, primarily because of the modern capabilities of cloud technology. Unlike the Army's experience with outsourcing LMP in the 1990s, today the Army can transition ERPs into outcome-based managed services and then change contractors at any time, without fear of losing control of its data or intellectual property.

FIGURE 2



FROM MANY, ONE

Stovepiped ERPs, such as those depicted on the left, have led to inflated and suboptimal sustainment expenditures, such as for "break-fix" IT services, whereby support is made available only when the customer needs repairs and upgrades, as opposed to proactive "managed" IT services. However, the authors noted, technology advances have enabled modern ERP implementations to combine enterprise-wide functions and business intelligence in the cloud, and cloud-based applications will empower systems to respond more rapidly to changes in requirements. (Image courtesy of the authors)

With a few bold decisions, the Army can take advantage of proven technologies, transform its logistics enterprise, improve effectiveness, generate significant savings and liberate resources that can be used to ensure that our Army remains the most feared and respected force on the planet.

For more information, contact the authors at ***james.d.kinkade@accenturefederal.com*** *and* ***jay.m.chung@accenturefederal.com****.*

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JAY CHUNG is senior manager for Supply Chain Analytics at Accenture Federal Services. He has more than 15 years of experience working with clients in the defense, industrial manufacturing, consumer goods, retail, and food and beverage sectors to leverage enterprise applications, commercial best practices and analytics to transform their supply chain operations. He holds a B.S. in supply chain management and marketing from the University of Maryland.

COLLABORATION WORKS

Bell's experience with the Joint Multi-Role Technology Demonstrator shows the effectiveness of government-industry collaboration to deliver advanced technologies to the warfighter—and points out ways that such partnerships could be even stronger.

by Mitch Snyder

Mitch Snyder

"The Army of 2028 will be ready to deploy, fight, and win decisively against any adversary, anytime and anywhere, in a joint, multidomain, high-intensity conflict, while simultaneously deterring others and maintaining its ability to conduct irregular warfare."

—U.S. Army Vision

An ever-changing landscape and rapidly evolving technologies make it vitally important for industry and government to work together to deliver game-changing capabilities to our military quickly and efficiently.

Conceptually it's simple: Government and industry need to have a shared vision, collaborate and better use acquisition tools.

Although this appears to be challenging, Bell has a strong public-private partnership that proves it is possible.

Imagine progressing from a clean-sheet design for an affordable and reliable aircraft with twice the speed of legacy aircraft and three times the range to flying this high-performance aircraft in six years. Our experience working on the Joint Multi-Role Technology Demonstrator (JMR-TD) is an example of how an effective partnership between industry and the government can bring technologies into reach faster. Bell, its partners on Team Valor and the U.S. Army Aviation and Missile Research, Development and Engineering Center have worked side by side to design and develop the V-280 Valor. Dec. 18, 2018, marked one year of sustained flight and testing for the V-280, proving it can deliver overmatch potential at a sustainable cost.

SUCCESSFUL TRANSITION

The Bell V-280 successfully transitioned in October to the Bell Flight Research Center in Arlington, Texas, where the JMR-TD team will continue to host government officials for demonstrations and expand the flight envelope in testing. (Photos courtesy of Bell)

As the conflicts our military encounters are increasingly complex and dynamic, we need to capitalize on the lessons learned from rapid-advancement programs like the JMR-TD to modernize our forces. The modernization process should leverage commercial innovations, warfighter feedback, prototyping and cutting-edge science.

FROM PROGRAM TO ACTUAL CAPABILITIES

There is clear willingness on all sides to move out aggressively to make sure our military retains the means to deter or defeat any adversary. Army leadership is fostering a renewed culture of innovation and smart risk-taking with the establishment of the U.S. Army Futures Command and cross-functional teams aligned with the Army's modernization priorities. The strategy has one

The Army should take credit for technology maturation achieved under this effort by determining a similarly innovative acquisition path to deliver a revolutionary capability for warfighters at a sustainable cost and years ahead of current schedule projections.

FLYING HIGH

In August, the Bell V-280 Valor participated in flight tests in Amarillo, Texas, demonstrating agility and maneuverability as part of the JMR-TD program. The author points to Bell's experience working on JMR-TD to show how partnerships between the industry and government can bring advanced technologies within reach quickly.

focus: to make troops and units more lethal to deploy, fight and win our nation's wars.

Our industry is constantly looking at new ways to turn technology and engineering prowess into solutions for our national security challenges. We have the innovative thinkers, technical know-how and a highly trained workforce ready to compete for funding, once we know the requirements.

The participants in the JMR-TD program work in an environment of cooperation, shared vision and shared risk. There is also a commitment by industry to use its own funds to ensure success.

We were able to learn from more than 400,000 operational flight hours on our fleet of V-22 Ospreys, allowing us to rapidly develop and mature technology for the V-280. The results are an aircraft with suitability characteristics (reliability, maintainability, logistics supportability) that are as outstanding as its effectiveness and survivability characteristics (range, speed, payload, invulnerability, crashworthiness). The V-280 Valor is affordable to acquire and maintain while still delivering exceptional capabilities, such as twice the speed and range of a legacy rotorcraft. It also uses open systems architecture—a statutory requirement for new DOD programs.

The challenge on both sides is how to make the acquisition process more of an enabler. It should be more open and collaborative.

Instead, it is still a sequence of verification steps that isn't agile enough to keep up with the speed at which industry can move, nor with how fast our military needs the equipment. Agile acquisition entails clear and concise high-level requirements, (partially) funded prototyping and a transition plan to turn experimentation into programs.

Bell's V-280 in the JMR-TD effort accomplished the first steps by taking an identified gap in warfighter capability, investing industry and government funds at a 5-1 ratio to rapidly develop and mature technology, and creating a flying aircraft that delivers twice the range and speed of legacy rotorcraft. The Army should take credit for technology maturation achieved under this effort by determining a similarly innovative acquisition path to deliver a revolutionary capability for warfighters at a sustainable cost and years ahead of current schedule projections.

CONCLUSION

The current Army leadership is battle-tested. It knows how to guarantee our nation's security. Our military is looking for innovative ideas and capabilities that match its unique circumstances, and it is our responsibility as an industry to equip the warfighter today with the tools of tomorrow.

The Army has a thoughtful path to modernize. We welcome the opportunity to work with the Futures Command to streamline processes, unleashing the power and creativity of the Army and industry together.

To turn this potential into programs of record, the government must act quickly with industry to recognize the significant advances in technology, clearly define the final operational requirements, define an acquisition path that avoids unnecessary duplication and apply funding.

Smart investments are those that deliver game-changing capability with room for future improvements, without breaking the budget.

We fully support the Army as it refines and executes the plan to meet security challenges with smart, bold acquisition and modernization reforms. Our partnership of industry and government is working well. If properly executed, this partnership will deliver capability to warfighters at a sustainable cost, years ahead of current schedule projections.

For more information, go to ***https://www.bellflight.com/military/bell-v-280*** *or contact Michael Reilly, senior public affairs specialist, at* ***mreilly@bellflight.com****.*

MITCH SNYDER is president and chief executive officer of Bell. Before being named CEO in October 2015, he was executive vice president of military business, responsible for providing strategic direction, overall management and performance for all of Bell's government programs. He spearheaded several of the company's most significant initiatives, including the V-22 program, and led the manufacturing centers. Before joining Bell, he held several senior leadership positions at Lockheed Martin Corp. in engineering, business development, manufacturing and program management. He worked with customers throughout Europe, Asia and the Middle East. He holds a B.S. in electrical engineering from Kansas State University, where he is an alumni fellow and Hall of Fame inductee selected for his distinguished service throughout his career in industry.

As the conflicts our military encounters are increasingly complex and dynamic, we need to capitalize on the lessons learned from rapid-advancement programs like the JMR-TD to modernize our forces.

PRIME PARTNERSHIP

The Army teams NVESD with General Micro Systems to put multifunction video display at all crew stations inside the MRAP mine-clearing vehicle.

by Chris A. Ciufo

Chris A. Ciufo

Keeping U.S. warfighters prepared on the battlefield, at sea or in the sky is highly complex, requiring DOD to work with outside contractors to procure hundreds if not thousands of systems to effectively meet its needs. These top-tier prime contractors then team with myriad subcontractors to help complete the work. For more than 35 years, General Micro Systems (GMS) was one of those subcontractors, helping to build rugged, high-density, high-performance, conduction-cooled computing systems for military applications.

That changed in 2017, with the U.S. Army awarding GMS its first prime contract (then worth $88 million over three years) to supply powerful, rugged server and display systems for the multifunction video display (MVD) software the Army had created. The goal was to offer complete visibility within Medium Mine Protected Vehicles (MMPV) Type II by integrating full-motion video from all sources at all vehicle crew stations into a single, unified user interface on each display.

This story actually started years before GMS won the contract. The company received a referral to a lab—the Night Vision and Electronic Sensors Directorate (NVESD) within the U.S. Army Communications-Electronics Research, Development and Engineering Center—that thought GMS might provide prototype hardware for software the Army had developed as a way of providing a consistent user interface to the displays in the MMPV Type II. With decades of experience working with the Army as a subcontractor and trusted adviser, GMS helped NVESD create a demonstration system that proved the lab's concept. (The initial design story was told in "Many Eyes, Same Picture," in the July – September 2015 issue of Army AL&T magazine, page 114.)

Now, more than three years later, we can look more closely at the relationship between the Army and GMS that made this project a success. The experience has been eye-opening and demonstrates how effective technology partnerships benefit all stakeholders—including the warfighters whose lives are on the line.

MOVE ASIDE
Eliminating disparate systems on the MMVP Type II variant of the MRAP, shown here during route clearance training in June 2018 at Fort Drum, New York, means that each operator can have access to all of the sensors on the vehicle from the display at his or her station. (U.S. Army National Guard photo by Sgt. Avery Cunningham, 172nd Public Affairs Detachment)

THE INITIAL DESIGN

The Mine Resistant Ambush Protected (MRAP) family of vehicles, which includes the MMVP Type II, provides Soldiers with highly survivable, multimission platforms capable of mitigating improvised explosive devices, rocket-propelled grenades, explosively formed penetrators, underbody mines and small arms fire threats, which produce the greatest number of casualties in overseas contingency operations. However, earlier versions of the vehicles had disparate systems for each vehicle operator or combat engineer, such as the driver, the second-seat operator for night vision, the gunner who controls the remote turret gun, and other operators managing various functions of the MMVP Type II, sensors, interrogation arm and a semiautonomous robot.

Each crew member has a separate mission, which meant no crew member had access to what the others were seeing and operating. If one were incapacitated for any reason, the others could not take over that person's role without leaving their console. As well, each user interface was specific to that station—meaning that another crew member might not immediately be able to operate another's console interface when needed.

By moving from disparate systems on the platform for each operator in the MMVP Type II vehicle, each could work at his or her crew station with access to all of the sensors on the vehicle, including video sensors and even the tactical Single Channel Ground and Airborne Radio System. With the MVD software presenting a consistent, modular user interface to all crew stations, any operator can perform the functions of or get access to the functions of any other crew station. (See Figure 1, Page 121.) This helps balance workload and increases situational awareness, as additional eyes can see each video feed and sensor input on any display.

CONNECTING THE SYSTEMS

These kinds of modern military systems present significant challenges. To make the MVD system possible requires networked, high-performance, interconnected smart display systems, sensors, video processors and a server mounted inside the MMVP Type II vehicles on which to run the Army-created software. This software is hardware-independent and uses a modular, plug-in-based VICTORY-conformant Army architecture—meaning new enabler systems can be added without modifying the existing code. One goal was eliminating the stovepiped nature of individual systems that do not interoperate or intercommunicate.

The first challenge was technical. Traditionally, disparate systems come from different contractors and, almost by definition, are not interoperable. For many reasons, including bidding, contract and development times, military systems are typically deployed using computer technology that is one or two (or more) generations behind what is offered in current consumer devices. This MVD application, however, required the processing of extremely high volumes of video encoded as data messages with very minimal delay (low-latency processing), which demanded the best-available and latest-generation technology from the civilian world. For example, servers running Intel's latest processors were needed; however, they are not battle-hardened.

From the operator's standpoint, delays of as little as a single video frame from when something happens outside the vehicle to when it's displayed on the

user interface can cause motion sickness, because the images lag behind what the operator's body is feeling in the vehicle. That meant the technology required to take input from the sensors, process it and then display it on the networked crew workstations in near-real time demanded today's highest-performance digital signal processing capabilities.

ENTER GMS

Another challenge for this MVD program was an extremely tight budget. If it couldn't be completed within the budget, it wouldn't happen—leaving warfighters without advanced mine-clearing capabilities. As described in the previously referenced article, NVESD decided that using multiple vendors for different system components made hitting the budget target impossible. In addition, it seemed likely that using the traditional subcontractor-prime contractor mechanism would add unnecessary cost. The only way this project could be completed within budget was to have one vendor supply all the necessary hardware components and also informally advise on the system integration architecture.

SCREEN TIME

The new MVD, installed in an MMPV Type II, was tested by Soldiers with the 36th Engineer Brigade at Fort Leonard Wood, Missouri. By partnering with GMS to implement modular servers and displays, NVESD was able to field a system that integrates full-motion video from all sources at all vehicle crew stations into a single, unified user interface on each display. (U.S. Army photo by Maj. Jason E. Carney, U.S. Army Operational Test Command Public Affairs)

NVESD had several hardware choices to complete the original prototype—from a rackmount server to a rugged workstation. With funding for a commercial off-the-shelf upfront design and improved in-vehicle architecture, GMS provided a proof-of-concept version of its rugged, conduction-cooled server while helping the Army decide that converting the sensor data to video-over-Internet Protocol packets on a network was a scalable approach to the system problem.

As the Army demonstrated the system for early feedback, requirements evolved, and GMS was able to add more capability and expand functionality, ultimately helping complete the initial proof-of-concept program on budget.

EARLY DEVELOPMENT PHASE

As the program evolved from concept phase and through multiple early demonstrations, the company and NVESD began working more on the remaining design challenges. This included transitioning each of the system components from laboratory-grade prototypes to full military-standard, conduction-cooled, production components capable of operating at minimal cost in the extreme environments of the MMVP Type II. Performance requirements also evolved, and as GMS migrated its standard product servers from one generation to the next in response to market conditions, the MVD system was able to take advantage of those gains while still using GMS commercially available, rugged off-the-shelf hardware.

As GMS evolved its hardware, the Army continued writing its own software while preparing for the eventual integration into the vehicle, a process typically left to a prime contractor. At some point in the program's evolution, the Army had decided that not only would the addition of a traditional prime contractor add unnecessary expense to the program (and likely push it out of budget), but that it would be the Army that integrated and installed the MVD system into MMVP Type II vehicles.

From that point, the Army, following protocol, put the design out for bid in its usual process. While competitors to GMS were considered—weighing factors such as lead time, price, performance and decades of building similar rugged, high-density, high-performance conduction-cooled systems—in every case, NVESD determined that the GMS system was the best choice and awarded GMS the prime contract in an open competition. Instead of working through a prime—which would have added cost—making GMS the prime contractor allowed the Army to purchase complete and assembled kits with cables and final documentation. The Army would do the integration and installation into the vehicle.

Interestingly, even as the Army started the final, open bidding process, the requirements evolved again, requiring bidders and GMS to add performance into the system to meet the new requirements. For example, because the GMS architecture is modular, meaning it is built using standardized "compute engines" that can be independently implemented in different systems, GMS was able to add media converter channels and upgrade from a previous-generation Intel server processor to the Intel Xeon E5 server processor. As described earlier, military systems are typically generations behind commercial technology, but this modular approach allows GMS' mobile battlefield server in MMVP Type II to use the same processor

that is available from Apple in its latest iMac Pro series of desktop computers and can be updated when more advanced processors come out.

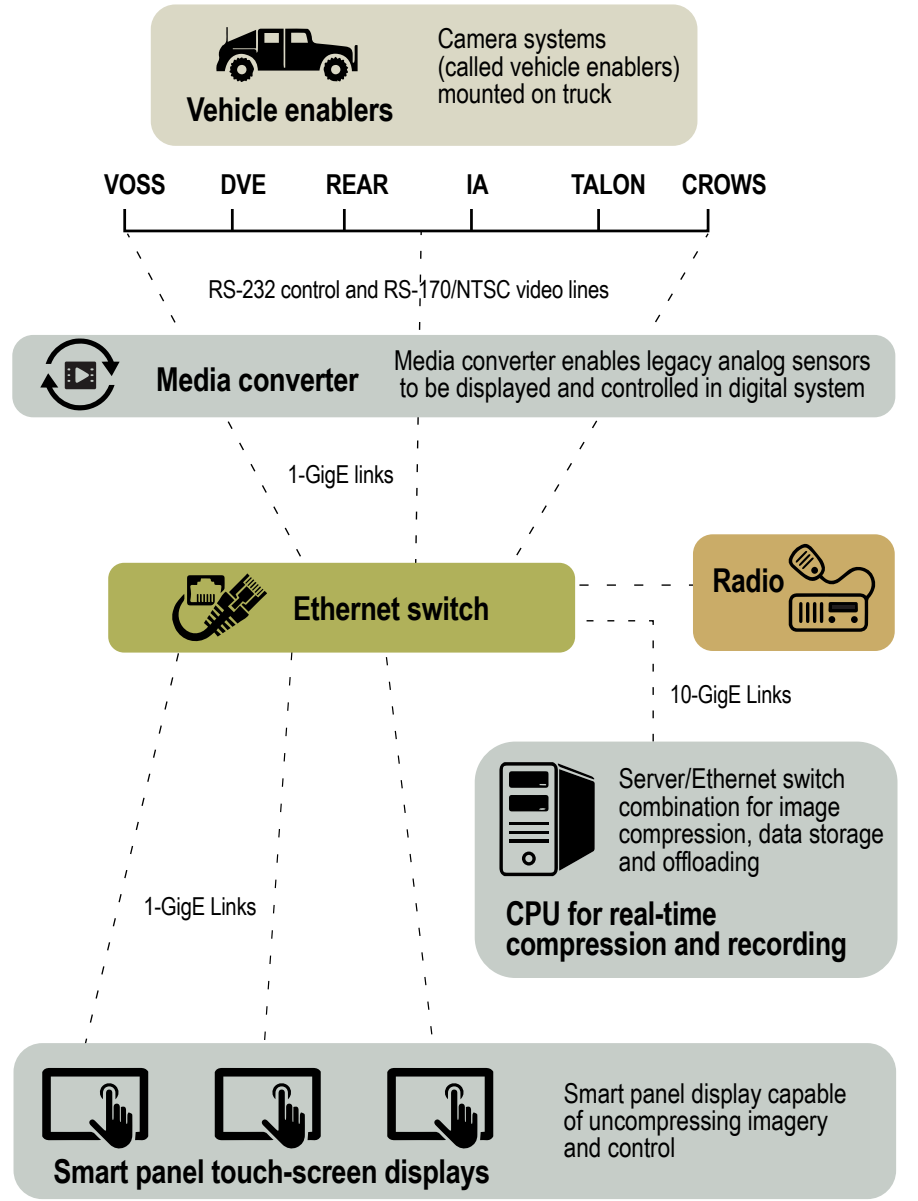
CONCLUSION

The uncommon partnership—with GMS helping to design and build the systems and the Army actually creating the software and then installing it in the MMVP Type II itself—should pay great dividends over time for both the Army and GMS. The approach is already saving significant engineering and integration dollars and allowing Soldiers and service personnel to become familiar with installation, networks, servers, video and software—developing additional skills that will be valuable for them after they leave the service.

Overall, NVESD was able to bring much-needed (and current) capability to the battlefield, with mine-clearing technology that is expected to be more effective as the MMVP Type II vehicle is upgraded and deployed. And while the technology existed in the civilian market, partnering with GMS to implement its modular servers and displays enabled NVESD to bring the MVD system onto the battlefield faster, which will allow the warfighter to get the job done even better. MVD is a real-time system with the future clearly in sight, thanks to a real partnership.

CHRIS A. CIUFO is chief technology officer and vice president of product marketing at GMS. He is a veteran of the semiconductor, commercial off-the-shelf and defense industries, where he has held engineering, marketing and executive-level positions. He has published more than 100 technology-related articles. He holds a B.S. in electrical engineering and materials science from the University of California, Davis, and participates in defense industry organizations and consortia.

FIGURE 1



THIS IS HOW WE DO IT

The MVD system uses networked, high-performance display systems as well as sensors, video processors and a server inside the vehicle that runs the Army-created software. Because of GMS' modular approach, the processor in the mobile battlefield server—the same processor available in Apple's latest iMac Pro—can be updated when more advanced processors come out. (Image courtesy of the author and the U.S. Army Acquisition Support Center)

Four Future Trends In Tactical NETWORK Modernization

Advances in commercial wireless enable Army mobile tactical internet.

by Charlie Kawasaki

Charlie Kawasaki

PacStar®

Our adversaries possess increasingly sophisticated communications and information technology (IT), allowing them to leverage advanced wireless technology and smartphones while actively moving in ground vehicles. They are also able to execute cyber and electronic warfare attacks in tactical settings that can cause substantial, intermittent and lasting damage to U.S. defense forces' ability to communicate.

U.S. forces continue to advance their tactical networks to counter these emerging threats, enable new forms of maneuver and maintain integration with military IT services available stateside—all while taking advantage of rapid innovation from the commercial IT industry. Specific to network modernization, communicating securely with command-and-control and other units within the increasingly communications-reliant battlefront landscape is critical to ensure the success of the mission and the safety of warfighters. However, as the battlefield evolves and missions require units to be mobile and support myriad tactical capabilities (Wi-Fi, LTE [Long Term Evolution, a standard for high-speed wireless communication for mobile devices and data terminals], etc.), critical communications infrastructures are becoming more difficult to establish and maintain.

Additionally, innovations in the cloud, "internet of things," sensors, robotic and autonomous systems, analytics, artificial intelligence and deep learning are driving tactical network developers to consider deploying warfighting systems that are highly reliant on high-performance computing and storage. Yet, in the face of potentially degraded communications, those resources may only be available if deployed all the way out to the individual warfighter or small teams conducting operations in austere and hostile environments, such as forward operating bases or combat vehicles—locations known as the tactical network's edge.

Four capabilities that enable DOD and warfighters to modernize their tactical networks and maintain overmatch through communication and IT are command post mobility,

FUTURE VISION

In this staged photo, PacStar imagines what a command post using the company's secure communications modules would look like for Soldiers in a deployed environment. (Photos courtesy of Pacific Star Communications Inc.)

secure wireless communications, cybersecurity and edge computing. Advances in mobility and secure wireless enable DOD and warfighters to quickly relocate command posts in theater and give commanders more flexibility and options to maneuver.

Edge computing enables warfighters to gain access to data and software previously available only at large data centers—including access to cloud services even when wide area network (WAN) access is down. Tactical cybersecurity solutions are increasingly important for warfighters, especially in light of increasing cyberattacks on our tactical networks.

COMMAND POST MOBILITY

U.S. Army and Marine Corps tactical networking and command post programs widely acknowledge the critical need to improve mobility. The current state of the art for tent-based command posts requires hours of setup, including thousands of feet of copper wiring, which delays network availability and results in a dangerous lack of situational awareness for commanders.

Currently, troops who jump from one location to another typically do so in phases, with tent infrastructure, generators, network servers and satellite links going up first, followed by the running of cables to provide the local area network command post support. This process translates into long delays in availability of critical information services, which, in turn, can lead to increased vulnerability of people and their systems.

Defensive postures of the past applied to a much more stationary battlefield environment. It was simply assumed that communications would be limited as warfighters moved from position to position. But technology advances by adversaries demand that our warfighters have the same secure communications experience while on-the-move as they do at-the-halt. At the same time, communications solutions must be delivered in a smaller form factor—whether to fit on the back of a Soldier or in a High Mobility Multipurpose Wheeled Vehicle.

And the fight does not stop just because you are moving. This is why defense forces need networking on-the-move capabilities. On-the-move means communications components that are smaller, ruggedized to adapt to mobility over any terrain, and reliable in the face of unanticipated conditions such as poor power sources and extreme temperatures.

SECURED TRANSMISSION

PacStar's Secure Wireless Command Post (Wi-Fi) is a modular communications package that provides a classified wireless network for all the warfighter's mobile devices within 100 feet in deployed environments.

EXPANDING THE RANGE

The Secure Wireless Command Post (TLS) expands the range on the Wi-Fi enabled command post, from thousands of feet to several miles from the cellular base station, and allows secure transmission of classified information using LTE-enabled devices.

In other words, situational awareness cannot wait until troops establish an at-the-halt position. Entering a dynamic tactical environment "blind" puts warfighters at a significant disadvantage, which can lead to loss of life and mission failure. There is a need to ensure that transportation vehicles and aircraft operators can communicate directly with a warfighter's headset—and vice versa—while en route to the destination.

True mobility demands innovation and modernization designed to reduce size, weight and power requirements. Not only do dismounted Soldiers need mobility, but so does the network infrastructure to support them.

All else being equal, communications equipment can never be too small, too light or too power-efficient. In contrast to legacy data-center-style, rack-mounted equipment, new generations of equipment designed for tactical and expeditionary use are becoming available with enterprise-grade networking and security technologies.

SECURE WIRELESS

The DOD shift from wired to wireless battlefield and in-theater communications has been slowed by warfighters' not being able to securely transmit classified information over wireless networks. Without the confidence to share classified data securely, warfighters lose situational awareness relative to adversaries who can move faster and accept more security risk. This is particularly problematic when it comes to how defense units have historically operated in tactical environments.

While it was possible in the past for warfighters to use Wi-Fi, LTE and other radio types to transmit classified data, it was prohibitively expensive and required both ends of the connection to be staffed with Soldiers cleared to take possession of classified cryptographic hardware. As a result, wireless Internet Protocol networking was primarily limited to site-to-site, WAN communications, and warfighters did not have the ability to use mobile devices for classified warfighting operations.

To enable mobility for warfighting, the National Security Agency established a program called Commercial Solutions for Classified. This program enables DOD organizations to transmit classified information using commercial-grade encryption solutions, eliminating the need for expensive, difficult-to-use classified equipment.

A new class of deployable small wireless access systems is bringing the benefits of classified wireless access to warfighters in the field, allowing warfighters to use commercial smartphones, tablets and laptops to access classified information over Wi-Fi and LTE.

CYBERSECURITY

Cyber has emerged as a new warfighting domain, and DOD is considering cyber at the same level as traditional land, sea and air warfighting domains.

Many experts believe that cyberattacks will soon have the capacity to destroy physical infrastructures and kill humans if unauthorized individuals gain access. Because of these frightening possibilities, the Marine Corps is testing deployments of cyberwarriors at the tactical edge as part of a longer-term project to incorporate cyber best practices into tactical units, thus addressing a set of threats and challenges in tactical cyber, including:

Limited visibility into cyberthreats— Cybersecurity technologies of yesterday are too large and expensive to deploy, leaving tactical networks ill-equipped with the mobility and scalability needed in a cyber warfighting environment. Without the right technologies in place, Soldiers' views into the threat landscape can be restricted and even at times inaccurate, as real-time situational awareness of cyberthreats is impaired.

Shortage of cybersecurity skills in tactical settings—A response to cybersecurity threats on the battlefield must come in real time, as the difference between waiting hours and days versus seconds and minutes to respond could have dire consequences. Yet, the shortage of cyber specialists readily deployed and available in tactical environments makes real-time response difficult if not impossible. And even for tactical operators in the field, maintaining multiple systems can be overwhelming.

More vulnerability at the tactical networks—The electronic footprints of current tactical networks are often easy to discover, and the closeness of adversaries in battlefield environments makes it easier for communications to be intercepted, which is all the more heightened given how tactical networks are traditionally dispersed. Internal and external cyberthreats at the edge of the network challenge DOD when it comes to rapid detection and response.

EDGE COMPUTING

Innovations in the internet of things, sensors, analytics and artificial intelligence promise entirely new warfighting capabilities, serving as force multipliers and enabling new levels of situational awareness. New robotic and autonomous systems promise to reduce the number of warfighters in harm's way, while speeding our ability to project force on the battlefront.

Advances in cloud, high-performance computing and storage are key enablers for these systems—driving tactical networks to deploy warfighting systems that rely heavily on high-performance computing and storage. But in the event of degraded long-distance communications caused by cyber and electronic warfare attacks, those computer and storage resources may only be available if deployed to the tactical network's edge. Tactical networks need data center-like computer, networking and storage capabilities at the edge to support applications, including:

- Situational awareness, mission command and command-and-control applications.
- Signal and image data gathering and analytics workloads.
- Emerging internet of things and sensor fusion-based applications.
- Cybersecurity and virtual desktop infrastructure solutions.

Additionally, as DOD enterprise IT moves to the cloud, tactical networks must unify access to data and applications from the enterprise level to the tactical edge. This means deploying cloudlike services at the tactical edge of the network, so that data is available at the edge even when WAN connectivity is unavailable.

At the same time, the internet of battlefield things is raising the table stakes significantly when it comes to the volume and complexity of devices and sensors in tactical environments that can be compromised. From wearables on the troops themselves to connected tanks, helicopters and drones, interconnectivity through the internet of things is only an advantage as long as it is secure, trusted and available.

A new class of modular, tactical data centers is becoming available for tactical and expeditionary programs, capable of hosting cloud and storage, artificial intelligence and analytics applications. Using ultra-small form-factor modules for computer, storage and networking functions that reduce size, weight and power requirements, these systems can be deployed dismounted, at forward operating bases, in command posts, and on ground vehicles and aircraft—supporting a diverse array of use cases in disconnected, intermittent and limited environments.

U.S. forces are taking advantage of commercial IT advances to maintain overmatch, reduce costs and ultimately modernize their tactical networks in order to stay one step ahead of increasingly well-equipped adversaries.

For more information about new IT technologies transforming the battlefield, go to ***www.pacstar.com****.*

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*CHARLIE KAWASAKI, Certified Information Systems Security Professional, joined PacStar in early 2005. He is the chief technical officer, leading numerous innovation programs and developing tactical solutions for secure wireless, cybersecurity and data center applications. He is part of the PacStar team that recently won the networking equipment awards for both the U.S. Army Transportable Tactical Command Communications and U.S. Marine Corps Networking-On-The-Move vehicle-mount and deployable tactical communications programs. He has more than 35 years' experience in cybersecurity, software and network engineering, and systems integration. He serves on the board of the Technology Association of Oregon, is vice chair of the Oregon Cybersecurity Advisory Council (****www.cyberoregon.com****), and is co-founder of Northwest Cyber Camp (****www.nwcyber.camp****).*

FROM THE DIRECTOR OF
ACQUISITION CAREER MANAGEMENT
CRAIG A. SPISAK

UNDERSTANDING INDUSTRY

As complex as its operations and motivations are, knowing how the commercial sector works is fundamental to being a skilled acquisition professional.

The acquisition profession is a complex business. It's made up of highly competent professionals in 13 career fields ranging from contracting to engineering to test and evaluation to cost estimating. But it's always important to understand that we don't get from the point of "I think I need a piece of equipment or system that does A, B, C or D," to Soldiers having that in the field without a whole lot of people playing in the process.

Although we have a tremendous amount of competence and capacity inside the Army's acquisition system, the majority of kit and product is actually built by industry, our critical partner. One of the main ways we can ensure that we get from "I need something" to "I have something" is to understand all of the pieces of the mechanism that make that capability a reality. Industry is one of the main players.

Army acquisition professionals need to develop the skills and competency to understand how industry works—what its motivations are, what an appropriate profit margin is, how much overhead should cost, what challenges they are facing related to end-item or second-tier and third-tier suppliers, and how they source materials. The better we are in understanding that, the better we can not only provide quality products to Soldiers in the field but do so efficiently, effectively and affordably.

The key here in many cases is affordability. Industry is a commercial practice. Businesses are in it for profit. They deserve to be able to make a reasonable profit, but it's also incumbent upon us as acquisition professionals to find ways to partner with them to incorporate newer technologies, obtain greater capabilities and get better deals. We need to make sure that we understand we're not paying more than we should for those benefits.

AN INSIDE LOOK AT INDUSTRY

TWI and Education with Industry (EWI) fellows attend an Amazon Web Services business conference in Tysons Corner, Virginia, on Sept. 27. From left are Maj. Chris Ehlers, Army operations research analyst and TWI fellow; Staff Sgt. Robert Staal, Air Force EWI fellow; Dalila Wortman, Amazon Web Services; and Maj. Desiree Dirige, Army acquisition TWI fellow. (Photo courtesy of Maj. Desiree Dirige)

IT'S ALL ABOUT THE HOW

Understanding industry is an absolutely critical element of being a solid acquisition professional, and there are many aspects to it:

- How do companies develop their business strategies and operating plans?
- How do they determine costs and prices for their products?
- How do they find suppliers and subcontractors?
- How are their senior executives provided incentives, motivations and rewards?
- How do companies plan and prioritize investments and pursue government contracts?
- How are key financial ratios used to measure a company's financial health?
- How do they employ different negotiating strategies?

To rapidly get a better, more affordable product to Soldiers who desperately need it today, we require a better understanding of what industry does and doesn't provide, and what oversight is necessary.

A key component of understanding industry is making sure that we truly do partner with them. It's clear that the decades-old philosophies that kept industry at arm's length did not result in better outcomes for the Army. And yes, there are certain things that we must be careful to do to avoid the perception of impropriety, or impropriety itself. But we have to be good partners with industry. We have to invite members of industry to understand our business so that they can adequately address provisions that we put in our requirements documents. We want industry to understand what we in the Army do, and understanding them will help us do that as well.

That's why we have a number of partnerships with industry in a variety of areas. This includes big contractors, our federally funded research and development centers, our work with universities, laboratories and industry associations and a number of efforts with small businesses.

COMMUNICATION AND CREATIVITY

As we work with industry, especially with nontraditional contractors, we need to be as creative as possible. Not everything has to be a long, drawn-out buy of a major acquisition system through traditional processes. We need to use underutilized acquisition approaches such as the rapid prototyping and rapid fielding made possible under Section 804 of the National Defense Authorization Act for Fiscal Year 2016 and other transaction authority, which provides more efficient acquisition of prototype systems involving nontraditional defense contractors.

We also need to be sensitive to intellectual property rights. We have to understand how industry views intellectual property in order to be able to buy what's appropriate. We need to communicate about equipment and engineering capabilities that come from a company's independent research and development that we hadn't even envisioned. The vast majority of creative engineering development takes place in private industry, and quite a bit of that takes place in innovative small businesses.

FIGURE 1

We need to do a better job of conveying our system and process to them, breaking down the barriers for small businesses to work with DOD. How can we creatively find the technological solution to the problem-after-the-next if we haven't made a solid effort to have that clear line of communication and break down the barriers to competition from all facets of industry, big defense contractors as well as small business?

All of that is an important part of the clear dialogue and communication that has to take place. In order to do that for a number of our professionals, we have programs like Training with Industry (TWI), which helps build that competency inside our force. After working with industry, Army acquisition professionals can return to the organizations they work for and explain to those around them who may not have had the opportunity to go spend a year with industry what they learned, sharing that experience with them.

This year DOD has a pilot program, the Industry Exchange Program, which will not only place high-performing, midcareer civilians in industry, but also will bring industry participants to work inside of our organizations. The program will allow DOD civilians and private sector participants to gain a better understanding of each other's business operations and challenges, while sharing innovative and cost-saving practices. Naturally, we will be careful to make sure that any areas that might cause a conflict of interest are addressed ahead of time so that we don't give any unfair advantages or provide any type of inappropriate access. Deloitte, Unisys, Northrop Grumman, Boeing, Lockheed Martin, General Motors, Jacobs, Guidehouse (formerly PricewaterhouseCoopers Public Sector), Booz Allen Hamilton and Raytheon have agreed to host DOD exchange participants in this pilot. (See Figure 1.)

I think the more open we are with businesses about our processes and challenges, the more open they will be. I've typically found industry to be very willing to explain what they do and why they do it. There are many opportunities for the Army and industry to find better ways of doing business together to provide the best products to Soldiers in the field. I suggest every reader do what they can to foster this important government-industry partnership.

BROADENING ACQUISITION PERSPECTIVES

DOD is rolling out the pilot of its Industry Exchange Program, which will enable civilian employees and private sector participants to better understand each other's business operations and challenges. (Graphic courtesy of the Office of the Director, Acquisition Career Management)

CAREER NAVIGATOR

Mapping ACQUISITION

DAU's handy-dandy subway map helps make it easier to understand contracting and find the right tool.

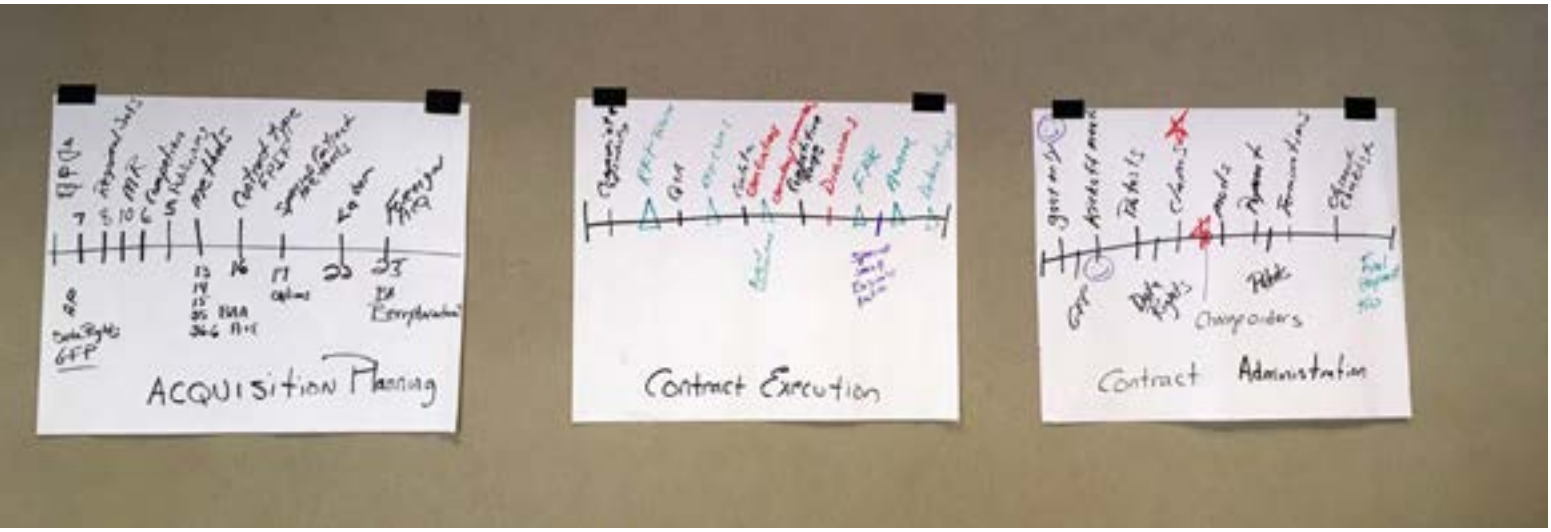
The orange line is for contract administration, the red is for acquisition planning and the blue is for contract execution. The green line indicates places for industry engagement.

It's easy to get lost in the byzantine process known as DOD acquisition. It often seems that there are countless ways to acquire goods and services, countless contract types and an inconceivable number of rules and regulations to keep in mind. Defense Acquisition University's (DAU) Michelle M. Currier has created DAU's Contracting Subway Map to help make sense of it all.

"Everybody in acquisition needs to know where they are," said Currier, a professor of contract management at DAU, because one person's decisions will affect the whole of the process. "We need to get people thinking about not just themselves [and where they are in the process], but the big picture," she said. The map helps students, acquisition professionals, leadership—anyone—get a picture of how the whole acquisition process fits together and be better educated on why the process is the way it is.

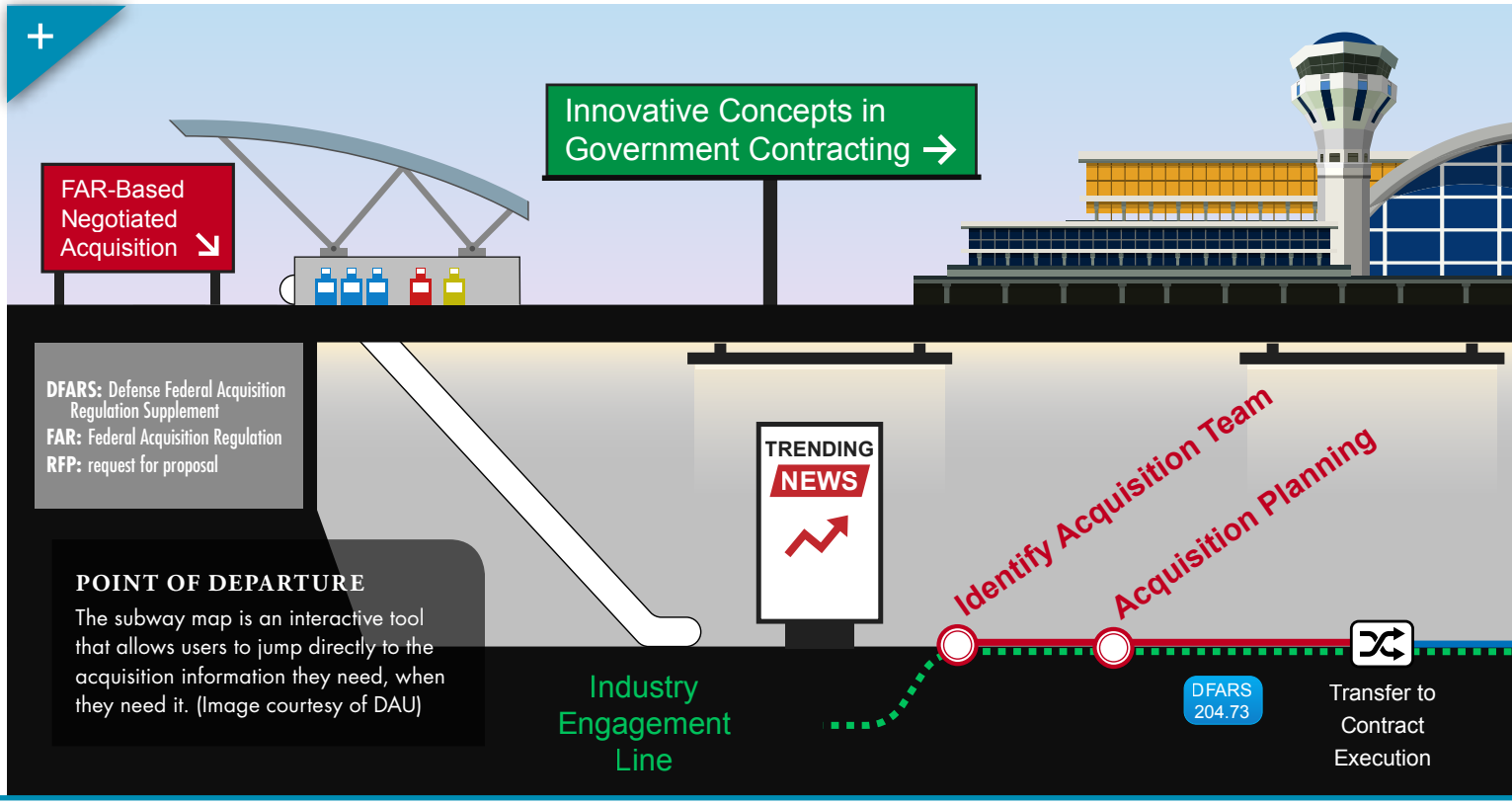
In fact, that's why Currier initially developed the map: to help her DAU students understand the why behind the many steps of the acquisition process, she said. The map started in 2016 as a magic-marker drawing on unwieldy butcher block paper—one that Currier drew in her living room and carried around for almost two years, redrawing it whenever it became too tattered, before it was finally digitized in 2018 as users see it now.

Divided into two parallel modes of transportation, the map visualizes the steps for the Federal Acquisition Regulation (FAR)-based process (trains) and the



GETTING THERE FROM HERE

Michelle Currier hand-drew this map—the first iteration of the contracting subway map—on her living room floor in 2016 to help her students visualize the bigger picture of acquisition. "If they could see the end result upfront, it would encourage them to critically think through each process to craft a good contract for the warfighter and the taxpayer," she said. (Photo courtesy of Michelle M. Currier)



POINT OF DEPARTURE

The subway map is an interactive tool that allows users to jump directly to the acquisition information they need, when they need it. (Image courtesy of DAU)

non-FAR-based process (planes), Currier said. Each stop along each line represents a step in the process and is labeled with information icons and numbered icons. The numbered icons link to FAR citations for quick reference. The map is further color-coded to represent the different acquisition efforts: The orange line is for contract administration, the red is for acquisition planning and the blue is for contract execution. The green line indicates places for industry engagement, which is extremely important to acquisition, Currier said. "We want to include industry at every single phase of the process."

The map brings users focused information on a topic when they need it through an information link—a blue icon labeled with an "I". These links take users to lists of regulations, best practices, templates, mythbusting, examples and a wealth of other information related to the acquisition process, Currier explained. The references icons are linked directly with websites that contain the topic information, and are therefore updated when a parent organization updates the website. Currier can also update the map in real time with suggestions from users—which she encourages them to send in—or with new and trending information related to acquisition.

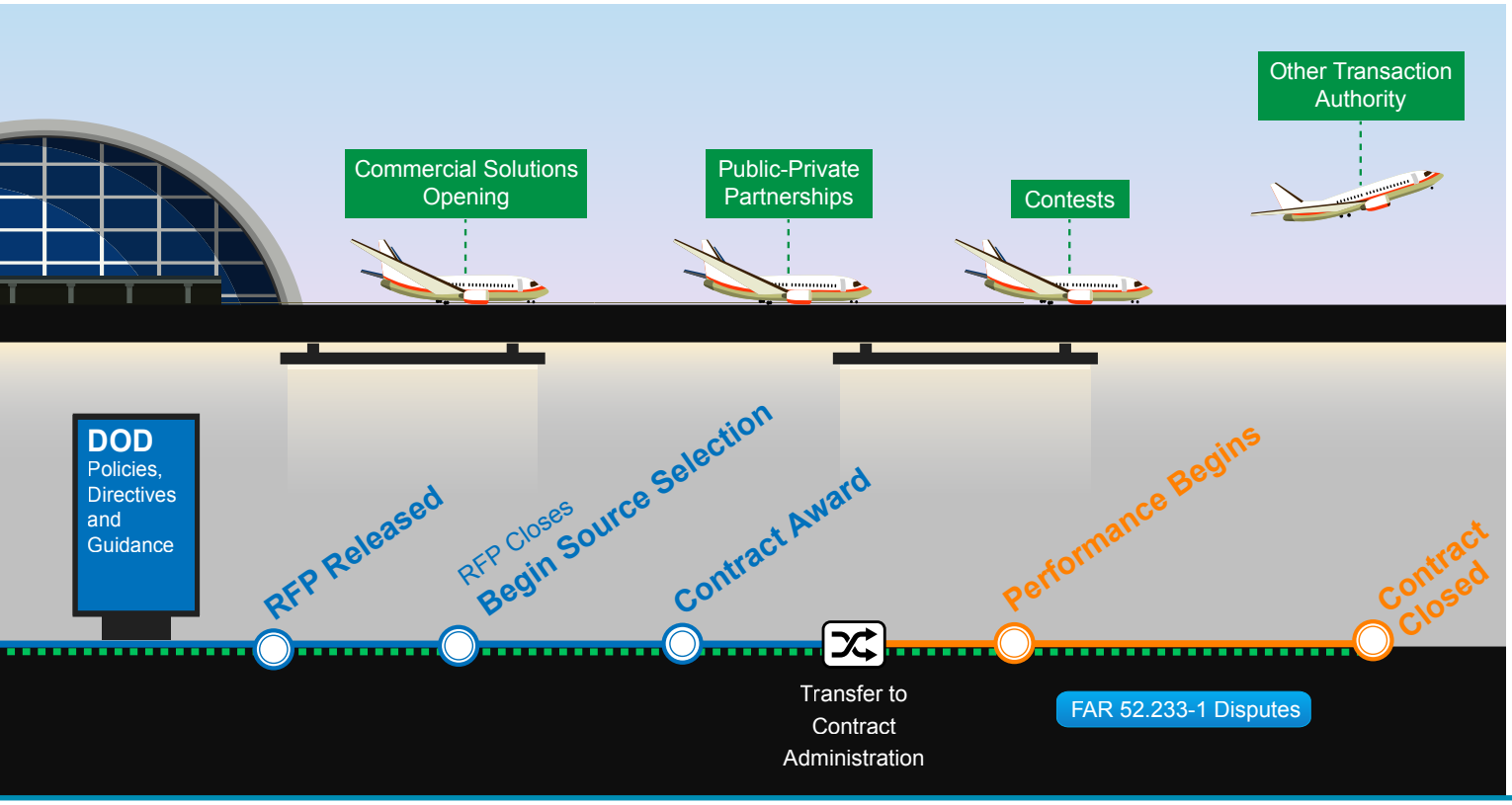
The primary method of acquisition is the FAR-based process, Currier said. But with technologies changing so fast, the Army doesn't have time for that anymore. It's now looking to a non-FAR-based process, like other transaction authority. Currier believes it is her job to get everyone to think critically about the different tools the Army has in acquisition.

"You have to look at the tool for what you're trying to buy," she said, and "select the appropriate tool that takes into consideration the risk, the time we have to solve the problem, to make sure we have the best risk management profile to get the products and services to the warfighter." The map will help users learn to select the appropriate acquisition tool.

While the map is not a larger part of the decluttering of the acquisition process, it is a picture of how the process works today and will change to reflect how the process changes over time, Currier said. "It's not meant to be the end-all to everything; it is meant to be a jumping-off place" where users can get the information they need at a moment's notice.

For more information, go to ***https://www.dau.mil/tools/t/Subway-Map****. If you have suggestions on how to improve the map, submit them to* ***SubwayMap@DAU.mil****.*

—JACQUELINE M. HAMES



JONATHAN B. HILL

COMMAND/ORGANIZATION: Integrated Air and Missile Defense (IAMD) Project Office, Program Executive Office (PEO) for Missiles and Space

TITLE: Chief, Performance Management Division

YEARS OF SERVICE IN WORKFORCE: 17

DAWIA CERTIFICATIONS: Level III in production, quality and manufacturing and in engineering; Level I in program management

EDUCATION: Ph.D. in industrial and systems engineering (expected in fall 2019) and M.S. in engineering management, University of Alabama in Huntsville; B.S. in mechanical engineering, University of Alabama

AWARDS: Distinguished Departmental Fellow, University of Alabama Department of Mechanical Engineering; numerous awards for contributions to the IAMD Battle Command System, the PEO for Aviation's Unmanned Aircraft Systems Program Management Office (UAS PMO), the Technical Management Division of the UAS PMO, the U.S. Army Aviation and Missile Research, Development and Engineering Center's Engineering Directorate and the Shadow Tactical Unmanned Aircraft System

ENGINEERING A SUCCESSFUL PATH

Jonathan Hill has received numerous awards over the course of his acquisition career, including recognition for his support of reliability growth for the Integrated Air and Missile Defense (IAMD) Battle Command System; critical contributions to the Unmanned Aircraft Systems Program Management Office (UAS PMO) within the Program Executive Office (PEO) for Aviation; and contributions to improving alignment between UAS PMO and the U.S. Army Aviation and Missile Research, Development and Engineering Center (AMRDEC).

But it's his first award that holds the most meaning for him: recognition for contributions he made in 2007 to improve the safety of the Shadow Tactical Unmanned Aircraft System. Hill and his team partnered with Defense Contract Management Agency personnel at Fort Huachuca, Arizona, to reduce aircraft incident rates for the Shadow by 50 percent for two consecutive years.

"That award was meaningful for two reasons: It was the first time in my career that I was recognized for my work, and I learned that good work gets rewarded," he said. "Second, but most importantly, it demonstrated that my work had a direct impact on Soldiers in the field. People often think that since the Shadow is unmanned, when it crashes, it's not a big deal—no one gets hurt, and it's only equipment that's lost. But it is a big deal: Soldiers in urban operations rely on the surveillance information that the Shadow provides, and without it, they can find themselves walking into harm's way."

Hill is chief of the Performance Management Division within the IAMD Project Office within the PEO for Missiles and Space, responsible for the safety, reliability, configuration and data management, production, quality and manufacturing of the IAMD system of systems. "Being a part of the Army Acquisition Workforce provides opportunities to solve unique technical challenges every day," he said. "Most people assume that engineers work nearly in isolation with little interaction, when in fact almost everything we do is done through teamwork. Working in a team environment allows us to develop better solutions to problems and requires the ability to work well with others."

He oversees a team of approximately 18 government and contractor personnel. "For me, the hardest part of my job is the difficult conversations that supervisors often have to have with the people they lead," he said. "No one wants to hear that there's something they're not good at or there's a skill they need to get better at; even constructive feedback can be hard to hear. But those conversations are necessary. They're an important part of growth and improvement, both personally and for our team as a whole."

Hill became part of the Army Acquisition Workforce as a co-op student after his freshman year of college; he alternated semesters between working and attending classes throughout his undergraduate years. "The diversity of work assignments appealed to me as an engineer in training. I saw that I could work on a wide variety of products and technologies throughout my career with ample opportunity to transition to different projects."

One of the most important points in his career came about 10 years ago, when he was competitively selected for a developmental assignment as executive officer to a Senior Executive Service (SES) member. Originally assigned to work for Patricia Martin in AMRDEC's Engineering Directorate, Hill ended up working for Randy Harkins, who had become the acting director after Martin was named acting director for AMRDEC's Systems Engineering and Support Division. "That assignment helped me get a much better perspective of how the Army works at a much younger point in my career than is typical," said Hill. "It also broadened my view of possible career paths and helped me to form relationships with senior leaders that have mentored me throughout my career."

"Most people assume that engineers work nearly in isolation with little interaction, when in fact almost everything we do is done through teamwork."

A BLENDED APPROACH

Working in a team environment fosters better solutions to problems than tackling them alone, said Hill, center. His team at the IAMD Project Office includes, from left, Carla Auchterlonie, Donnie Shumate, Taylor Martin, Gary Ferris, Scott Gill, Gary Hayes, Glenn Greenlee and David Hou. (Photo by Chuck Braziel, PEO for Missiles and Space)

Hill now tries to pay that forward by mentoring others. "The most important advice that I have been given and that I try to pass on to junior personnel is to have a plan for how you want to achieve your career goals. You will not achieve your career goals by accident or without deliberate action. Also, be proactive in managing your career. Do not assume your supervisor will do it for you."

In that vein, he volunteered to help with an effort undertaken by the Army Career Program 16 Proponency Office to update the career map for occupational series 0801, general engineering. Hill was one of 13 people selected as a subject matter expert for that effort, based on his experience and his supervisory and technical expertise. "It's a really comprehensive map of the functional competencies, training and certifications from GS-1 all the way up to the SES level. It's helpful even for someone at my level, and it's even more beneficial for someone just starting out, to know what degrees and training and experience will be needed to advance."

Now in the 17th year of his career, he's seen several big changes come his way. "The change from the abundant funding that we saw during the global war on terror to the budget challenges and sequestration was big. Budgets got a lot smaller, and we were asked to do as much or more with a lot less money. The biggest change I've seen recently is the push to get capabilities fielded faster." If he were in charge, he said he would "look to streamline where I could—cut review times, speed up the contracting process. I'd also look to make changes in the budget process, specifically when it comes to the continuing resolutions. We could get a lot more done if we didn't have to spend three or four months wondering about funding."

—SUSAN L. FOLLETT

Learning Through DISASTER

Military catastrophes teach IDEAL students about strategic planning and leadership.

by Debra Valine

Desert One, the 1980 attempt to rescue 52 American hostages in Iran, failed. America's Delta Force, formed just three years earlier, lost eight men, seven helicopters and a C-130.

Task Force Smith, the first U.S. Army ground maneuver unit to enter combat in Korea, in July 1950, was supposed to be a show of strength to delay North Korean troops advancing near Osan. Some 150 American infantrymen were killed, wounded or missing. The North Koreans were delayed only seven hours.

In Tunisia's Kasserine Pass, the U.S. Army experienced defeat in its first engagement with German troops during World War II. German Field Marshal Erwin Rommel and his Afrika Korps broke through an Allied defensive position Feb. 20, 1943, killing more than 1,000 American troops and taking hundreds of prisoners.

Robert Moore, deputy to the commanding general of the U.S. Army Security Assistance Command (USASAC), used these examples to illustrate the need for strategic planning and leadership, Aug. 31, during the Army Acquisition Workforce's Inspiring and Developing Excellence in Acquisition Leaders (IDEAL) course at the University of Alabama in Huntsville. The six-month course, designed for Army civilians at GS-11 through GS-13, prepares participants to lead people and teams effectively.

Moore spoke to 31 workforce members during the course, explaining that the lessons learned from those three events show that strategic planning and better preparation would have helped to successfully accomplish the missions.

"All the things you have been studying are caught up in these three events," Moore said. As strategic planners looking at the current fight (now – 2025), the next fight (2026 – 2035) and the future fight (2036 – 2050), use lessons learned from these events to help make sure those kinds of things do not happen again, he advised.

He used USASAC as an example of the importance of building a team, walking the class through the USASAC hierarchy and the worldwide partners it takes for the foreign military sales mission to succeed. USASAC, a subordinate command of the U.S. Army Materiel Command, develops and manages all foreign military sales and security assistance programs for the Army, to build partner capacity, support combatant command engagement strategies and strengthen U.S. partnerships.

"As a leader, you are a team of teams," Moore said. "You do not do this by yourself. As you work and plan, it is about bringing your team together. You have to look at where you are today and where you want to be tomorrow. As you plan, it has to be a collaborative effort. There has to be a culture of trust, teamwork and partnerships."

Moore reminded the group of the importance of the Army values and the Army Civilian Corps Creed. "These are not new to you. I know you have seen them before. These are values to instill in employees, personal traits to which all employees should aspire and a code of conduct to follow; it's about doing the right thing."

DIFFICULT LESSONS
Robert Moore discusses planning and leadership at the IDEAL class Aug. 31. Moore used examples of U.S. military defeats to illustrate the need for strategic planning and leadership. (Photo by Debra Valine, USASAC)

There are various attributes of leaders, he said:

- **Seers**—Individuals who are "living in the future," who possess a compelling vision of "what could be."
- **Architects**—Those who are adept at building systems that elicit contribution and facilitate collaboration.
- **Connectors**—Those with a gift for spotting the "combinational chemistry" between ideas and individuals.
- **Mentors**—Those who give power away rather than hoard it.
- **Guardians**—Vigilant defenders of core values and enemies of expediency.
- **Bushwhackers**—Those who clear the trail for new ideas and initiatives by chopping away at the undergrowth of bureaucracy.

Moore gave some tips for senior leaders, starting with instituting a reading program to enhance leadership skills and maintain currency in functional areas. He recommended a few of his personal favorites: "The Hard Hat," by Jon Gordon; "Start with Why," by Simon Sinek; and "Make Your Bed," by Adm. William H. McRaven.

Other tips include: "Focus on the objective, not the obstacles," he said. "Incentivize organizational objectives. Understand what is going on with areas of operation, but engage at your level and above. Build relationships and networks. Don't accept the status quo. How can that process, operation, etc., be improved? Be ruthless in managing your time. Don't confuse activity with results, be at crucial meetings and briefings, and don't get captured by the trivial. And think, 'What's good for the Army,' versus 'What's good for me.' "

One of the challenges Moore said he had to overcome as a leader was confidence in himself. "You have to believe you can do it."

For more information, go to ***https://asc.army.mil/web/career-development/programs/inspiring-and-developing-excellence-in-acquisition-leaders-ideal/.***

DEBRA VALINE is a public affairs specialist with PROJECTXYZ Inc., working in the Command Information Office of USASAC at Redstone Arsenal, Alabama. Previously, she was the chief of public affairs for the U.S. Army Engineering and Support Center in Huntsville. She holds a B.S. in psychology from the University of Maryland, University College.

MAGIC CARPET RIDE

PAUL L. PRICE

COMMAND/ORGANIZATION: Night Vision and Electronic Sensors Directorate, U.S. Army Communications-Electronics Research, Development and Engineering Center (CERDEC)

TITLE: Chief, Aviation Branch

YEARS OF SERVICE IN WORKFORCE: 16

YEARS OF MILITARY SERVICE: 28

EDUCATION: Continuing studies, Liberty University

AWARDS: Legion of Merit; Distinguished Flying Cross; Purple Heart; Air Medal (2); U.S. Army Master Aviator Wings; High Altitude Low Opening Parachute Badge; Parachute Badge; Armed Forces Civilian Service Medal; CERDEC Mid-Level Manager of the Year and Degraded Visual Environment Team Awards; Army Aviation Association of America Hall of Fame inductee

After retiring from the Army in 2002 following a long and distinguished career as an Army aviator, Paul Price was looking for a way to continue to support Soldiers. He found it in the Night Vision and Electronic Sensors Directorate (NVESD), where he now serves as chief of the Aviation Branch.

NVESD, part of the U.S. Army Communications-Electronics Research, Development and Engineering Center, researches and develops sensor and sensor suite technologies for air and ground intelligence, surveillance, reconnaissance (ISR) and target acquisition under adverse battlefield conditions. Price supervises a team that includes two noncommissioned officers, eight civilians and 15 contractors. "NVESD has the reputation of being the best sensor lab there is. It's my honor to be able to manage this workforce and flight-test present and future sensor arrays in support of Army aviation," he said.

"We flight-test so much more than people think, often in one day—flight goggles and multiple sensors on a Black Hawk, the ISR sensor suite on an MC-12 [reconnaissance aircraft] and the one-pound sensor on a small unmanned aircraft system." He also deploys with Soldiers to install and operate mission systems and transition the systems to Army users.

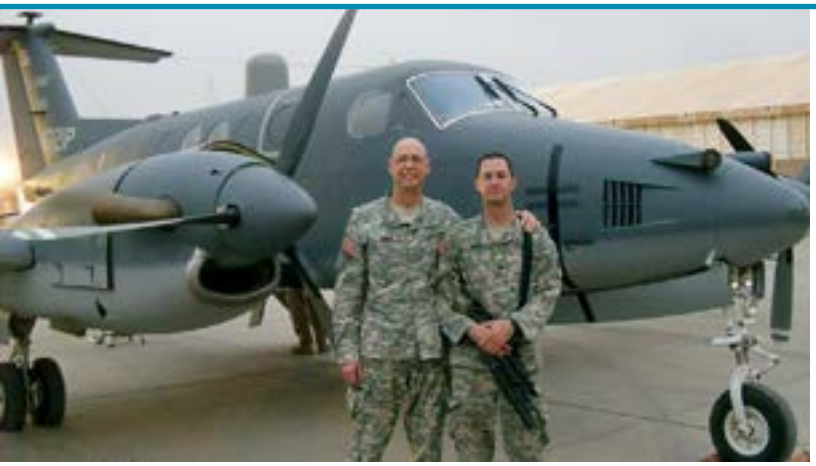
Price was originally hired at NVESD to work on transitioning systems from the laboratory to the field. "My boss decided that what he really needed is a pilot to work with the scientists and engineers when we start developing things, so they can ask me how things work—or how they don't work. So I was reassigned to the Engineering Branch and now I'm part of the entire life cycle, supporting the acquisition workforce and still within my own comfort zone."

Now with NVESD for 16 years, Price and his team have achieved a great deal. Among his proudest accomplishments is Night Eagle, a system to locate improvised explosive devices (IEDs) that was deployed in Iraq in 2007. "I deployed with it and spent over a year getting that platform ready, working with Soldiers either in identifying IEDs or doing overwatch for dismounted troops. I am very proud of the work we did because we put that system together in about a year and got it deployed."

He's also proud of current work to develop systems that allow pilots to operate in a degraded visual environment (DVE). "Our engineers have come up with a great sensor

UNDERSTANDING IEDS

Price in the "IED boneyard," where vehicles damaged by IEDs were repaired or stripped for spare parts, during his deployment to Iraq in 2007 with the Night Eagle system. Price visited the site to learn more about the damage that IEDs could do. (Photos courtesy of Paul Price)



A FAMILY AFFAIR
Price and his son, now-Capt. Kyle Price, during a deployment in Iraq.

SHARING THE MISSION
Price and his son take part in a DVE test in 2017 at Fort Drum, New York, where the younger Price was stationed.

to combat DVE," said Price. "It can't do everything, but it can do a lot. What I really like are the distributed aperture and the heads-up display." A distributed aperture uses cameras installed around an aircraft, each looking in a separate direction. Images from the cameras are combined to create a continuously viewable video sphere. When the images are paired with the heads-up display in an aviator's helmet, the aviator can look around and virtually "see" the environment around them relayed from the network of cameras, no matter the conditions. "It's just like riding on a magic carpet," said Price.

"NVESD put together three airborne platforms when [operations in Iraq and Afghanistan] started," he said. "Two of them are programs of record—that is how important our work is. So I am very proud of that. And that's not just me; it's the engineers and the scientists who make this happen. I help them implement those programs and make things work a little smoother with my background and knowledge of the Army. But it is the whole organization that helps make this thing happen."

Price joined the Army in 1974 and retired 28 years later at the rank of chief warrant officer 5. As a pilot, he logged more than 11,100 hours, including 800 combat hours, in 30 different airframes. He was involved in the rescue of hostages held in Iran; as a special operations aviator, he played a key role in developing air tactics and night-vision goggle skills. Price was part of a team that rescued Americans held in Grenada in October 1983. He also deployed to Bosnia to capture war criminals in 1997. After 9/11, he executed advanced force operations around the world in support of special operations forces.

His achievements earned him a place in the Army Aviation Association of America's Hall of Fame in April 2018. "It is humbling, it really is. There are so many other folks who are equally deserving of the award. … There are people out there who have done multiple rotations and so many other things, and for me to be singled out among my peers and among other folks is truly an honor."

Do good pilots make good acquisition professionals? "Not necessarily," he said. "In either area, the keys to success are a drive to complete the mission and complete it successfully, as well as a work ethic and a motivation that ensures that you're doing the right thing for the right purpose." To be successful in acquisition, he noted, "you need to keep your sights set on leadership's priorities and requirements, current and future, and you need to be sure that you're moving where the team is going—that you're not out in left field developing something that the Soldier doesn't need, or that you're not so far behind that by the time you've fielded your product, it's irrelevant."

Price noted that many of the aviators with whom he served "had what I would call a 'Type A' personality. The sharp end of the spear is where everybody wanted to be—up front and leading." While it might seem to be difficult to lead a group where everyone wants to be in charge, Price has found it to be an asset. "In that situation, everyone—whether it's pilots or the acquisition community—is driven to support the mission, and they each contribute something different. From a leadership perspective, it's just a matter of harnessing each of those contributions and bringing all the different skills together to successfully complete the project."

—SUSAN L. FOLLETT and DOUGLAS SCOTT

ON THE MOVE

LEADERSHIP CHANGE AT ARMY RAPID CAPABILITIES OFFICE

On Nov. 11, **Tanya M. Skeen**, director of the Army Rapid Capabilities Office (RCO), departed the organization to transition into her new role as executive director of the Joint Program Office for the F-35 Program.

Skeen came to the Army RCO after serving as deputy director of test and evaluation for the U.S. Air Force and as the program executive officer and chief engineer of the Air Force RCO. A member of the Senior Executive Service, Skeen immediately set out to build the Army RCO's capacity to execute larger and more complex programs. She aligned the RCO to the Army's six modernization priorities and grew the organization in scope, setting a trajectory for the RCO to increase its role in Army modernization.

Col. John M. Eggert will serve as acting RCO executive director until the Army names a successor. Eggert came to the RCO after serving as senior acquisition adviser to the U.S Army Training and Doctrine Command, where he supported the Army enterprise requirements generation and approval process. He also served as senior military assistant to the defense acquisition executive.

JOINT PROGRAM EXECUTIVE OFFICE FOR ARMAMENTS AND AMMUNITION

NAME CHANGE FOR PEO AMMUNITION

The Program Executive Office for Ammunition became the Joint Program Executive Office for Armaments and Ammunition (JPEO A&A) on Nov. 1, changing its name to one that more effectively encompasses the organization's portfolio.

The joint organization, which was stood up in 2002, leads research, development, production, procurement and equipping for armament and protective systems, providing joint warfighters with overmatch capabilities to defeat current and future threats worldwide. Since 2002, it has delivered more than 16.5 billion rounds of ammunition to U.S. and allied forces.

"When you hear the word 'ammunition,' you have a thought in mind of what that ammo piece is," said **Brig. Gen. Alfred F. Abramson III**, joint program executive officer. "But armaments is the weapon system and all of those subelements and subcomponents that make up the weapon system. Fuzes, proximity fuzing, timers, GPS, explosives—all of those things make up what the armament is about."

The new name also better describes the breadth of the organization's portfolio, which encompasses requirements from all the military services. JPEO A&A is the single manager for conventional ammunition and is responsible for life cycle acquisition management of all of DOD's conventional ammunition.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Abramson added that including "armaments" in the organization's name also highlighted its close relationship with the U.S. Army Armament Research, Development and Engineering Center (ARDEC). "We have a very strong relationship with ARDEC throughout the acquisition life cycle of product and programs, and the new name better aligns with what we are doing and how strong our relationship is with that organization," he said.

He added that keeping "ammunition" in the title was important to the organization's sense of identity. "I was very hesitant to remove … 'ammunition' or 'ammo' because I think that since its inception in the early 2000s, there has been a lot of great work that has come out of this organization. And if we removed the word ammunition, there might have been a sense of loss about its identity."

1: MEDIUM CALIBER GETS NEW PRODUCT MANAGER

Lt. Col. Andre J. Johnson, right, accepted the charter of the Product Manager for Medium Caliber Ammunition from **Col. Hector A. Gonzales**, project manager for Maneuver Ammunition Systems, on Aug. 8 at Picatinny Arsenal, New Jersey. Johnson, who replaces **Christopher Seacord**, oversees life cycle management of direct-fire medium ammunition and cannon-caliber ammunition for several platforms, including those used in Army aviation and ground combat systems, and by the Navy, Marine Corps and Air Force. (Photo by Jesse Glass, JPEO A&A)

2: CHANGE OF LEADERSHIP AT JOINT SERVICES

Col. Justin Highley, left, took command of the Project Director for Joint Services at a change of management ceremony Aug. 6 at Picatinny Arsenal that was led by **Brig. Gen. Alfred F. Abramson III**, center, joint program executive officer. Highley replaces **Col. Joseph Chan**, right, who retired from the Army after a 28-year career that included stints with the Army Rapid Equipping Force, the U.S. Army Training and Doctrine Command and the U.S. Army Test and Evaluation Command. Highley comes to JPEO A&A from the PEO for Aviation, where he served as assistant product manager for Aviation Networks and Mission Planning. (Photo by Jesse Glass, JPEO A&A)

JOINT PROGRAM EXECUTIVE OFFICE FOR CHEMICAL, BIOLOGICAL, RADIOLOGICAL AND NUCLEAR DEFENSE

3: PROMOTION FOR JOINT PROJECT MANAGER

Col. Matthew Clark, left, was promoted from lieutenant colonel at a Nov. 20 ceremony at Detrick Auditorium at Fort Detrick, Maryland. Delivering the reaffirmation oath to Clark was **Col. David Hammer**, joint project manager for Medical Countermeasure Systems (JPM-MCS) within the Joint Program Executive Office for Chemical, Biological, Radiological and Nuclear Defense (JPEO-CBRND). Clark is the joint product manager for Chemical Defense Pharmaceuticals within JPM MCS. (Photo by Scott Brown, JPM-MCS)

4: NEW JPM FOR CBRND

Christopher Seacord, second from right, accepted the colors of the Joint Project Manager for Contamination Avoidance (JPM-CA) from **Daniel McCormick**, deputy program executive officer for Operations and Modernization, during a Sept. 28 change of charter ceremony at the U.S. Army Medical Research Institute of Chemical Defense at Aberdeen Proving Ground, Maryland. Seacord took over from **Col. Jeffrey Woods**, left, who served as the joint project manager for more than

three years. **Sgt. 1st Class(P) Tantra Peyton**, right, also participated in the ceremony. JPM-CA is one of five directorates within JPEO-CBRND.

Seacord has more than 30 years of service to DOD as an Army officer and a DA civilian. Before joining JPEO-CBRND, he served as product manager for Medium Caliber Ammunition within the Program Executive Office for Ammunition (now the Joint Program Executive Office for Armaments and Ammunition) at Picatinny Arsenal, New Jersey. (Photo by Kelly Singleton, JPEO-CBRND)

1: DEPUTY PM PROMOTED TO CW4

JPEO-CBRND marked the promotion of U.S. Marine Corps **Chief Warrant Officer 4 Christopher Kamm**, right, who serves as deputy program manager for Chemical, Biological, Radiological and Nuclear Defense Systems, from the rank of chief warrant officer 3 at an Oct. 1 ceremony hosted by the Joint Project Manager for Protection (JPM-P) in Stafford, Virginia. **Col. Steven Redifer**, left, then-commanding officer for the Marine Corps' Chemical Biological Incident Response Force, served as promoting officer for the ceremony, which was led by **Scott Paris**, joint project manager for Protection. (Photos by Dottie McDowney, Strategic Communications, JPM-P)

PROGRAM EXECUTIVE OFFICE FOR AVIATION

2: RETIREMENT, NEW LEADERSHIP AT UAS PMO

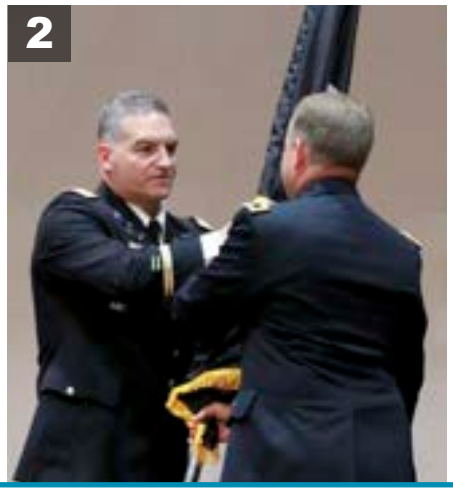
Col. Courtney Cote, top right, accepted his certificate of retirement from **Brig. Gen. Thomas H. Todd III**, program executive officer (PEO) for Aviation, during a Sept. 14 ceremony at Redstone Arsenal, Alabama. Cote, who retired after more than 28 years in the Army, relinquished management of the Unmanned Aircraft Systems Project Office to **Col. Scott Anderson**, bottom left. (Photos by Bill Stem, PEO Aviation)

3: FIXED WING MARKS CHANGE OF CHARTER

Col. James DeBoer accepted the charter for the Fixed Wing Project Office from **Brig. Gen. Thomas H. Todd III**, PEO for Aviation, during a change of charter ceremony July 11 at Redstone Arsenal. (Photo by Tracey Ayres, PEO Aviation)

4: LEADERSHIP CHANGE AT AVIATION SYSTEMS

Col. Johnathan Frasier accepted the charter of the Aviation Systems Project Office from **Brig. Gen. Thomas H. Todd III** during an assumption of charter ceremony Aug. 29 at Redstone Arsenal. At an all-hands meeting Sept. 4, Frasier presented **Jimmy Downs**, bottom right, who served as acting project manager, with the Commander's Award for Civilian Service in recognition of his leadership. Downs has resumed his role as deputy project manager. (Photos by Tom Voight, PEO Aviation)

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5: PMO GETS NEW LEADER, NEW NAME

Col. John Vannoy, top left, accepted the flag from **Brig. Gen. Thomas H. Todd III** to assume responsibility of the Non-Standard Rotary Wing Aircraft Project Management Office (PMO) July 12 at Redstone Arsenal. Vannoy's first act as the incoming project manager was to case the PMO's colors and uncase the flag of the redesignated organization: the Multi-National Aircraft Special Project Office. **Master Sgt. Timothy Lemker**, bottom left, senior enlisted adviser for the new organization, unfurled the guidon during the redesignation ceremony.

When established in 2010, the PMO focused mainly on procurement and support activities for the Mi-17 aircraft in support of operations in Afghanistan. Now, the organization provides aircraft procurement and support activities for customers around the world and services rotary and fixed-wing aircraft. (Photos by Michelle Miller, PEO Aviation)

6: RETIREMENT CAPS 27-YEAR CAREER

Lt. Col. Curt Kuetemeyer accepted a certificate of retirement from **Patrick H. Mason**, deputy PEO for Aviation, during a ceremony at Redstone Arsenal on Sept. 14. Kuetemeyer, who served as a product manager for PEO Aviation's Improved Turbine Engine Project Office, retired after a 27-year military career. (Photo by Michelle Miller, PEO Aviation)

7: MEDIUM ALTITUDE CHANGE OF CHARTER

Lt. Col. David Benjamin, right, accepted the charter for the Medium Altitude Endurance Product Office from **Col. Courtney Cote**, then-project manager for PEO Aviation's Unmanned Aircraft Systems Project Office, during a change of charter ceremony Aug. 24 at Redstone Arsenal. **Lt. Col.(P) Jay Sawyer**, outgoing product manager, received the Meritorious Service Medal during the ceremony for his support of the organization. He is now with the Missile Defense Agency. (Photo by Tom Voight, PEO Aviation)

8: BLACK HAWK SUPPORT RECOGNIZED

Lt. Col. Dan Donahue, right, received the Meritorious Service Medal from **Lt. Gen. Paul A. Ostrowski**, principal military deputy to the assistant secretary of the Army for acquisition, logistics and technology, during a town hall meeting Oct. 16 at Redstone Arsenal. Donahue received the award for his support of the delivery of 16 UH-60 Black Hawk helicopters to the Afghan air force as part of the Aviation Transition and Modernization Program. (Photo by Jason Albert, PEO Aviation)

9: NEW LEADER FOR APACHE PRODUCTION

Lt. Col. Jeffrey Poquette, left, accepted the colors of the Apache Production and Fielding Product Office from **Col. Tal Sheppard**, project manager for PEO Aviation's Apache Attack Helicopter Project Office, during a June 29 change of charter ceremony at Redstone Arsenal. Poquette takes over from **Lt. Col. Anthony Cassino**, right, who had led the product office since June 2015 and retired after more than 28 years of service. **Michael Horrocks**, center left, deputy product manager for Production and Fielding, assisted with the change of charter. (Photo by Shannon Kirkpatrick, PEO Aviation)

PROGRAM EXECUTIVE OFFICE FOR ASSEMBLED CHEMICAL WEAPONS ALTERNATIVES

NEW PEO FOR ACWA

Michael S. Abaie joined the Program Executive Office for Assembled Chemical Weapons Alternatives (PEO ACWA) as program executive officer Sept. 10. Abaie, who replaces **Suzanne S. Milchling**, is responsible for overseeing all aspects of the ACWA program, including operations at the Pueblo Chemical Agent – Destruction Pilot Plant in Colorado, the Blue Grass Chemical Agent – Destruction Pilot Plant in Kentucky and PEO ACWA's field office in Anniston, Alabama.

Abaie, a member of the Senior Executive Service, previously headed the Engineering Directorate within the U.S. Army Research, Development and Engineering Command's Edgewood Chemical and Biological Center. He also has held leadership roles within DOD's Chemical and Biological Defense Program, led by the U.S. Navy, and the Joint Program Executive Office for Chemical and Biological Defense. Abaie holds an M.E. in engineering management from Widener University and a B.S. in mechanical engineering from Fairleigh Dickinson University.

PEO ACWA is aligned under the assistant secretary of defense for nuclear, chemical and biological defense programs, a component of the Office of the Undersecretary of Defense for Acquisition and Sustainment, and under the assistant secretary of the Army for acquisition, logistics and technology.

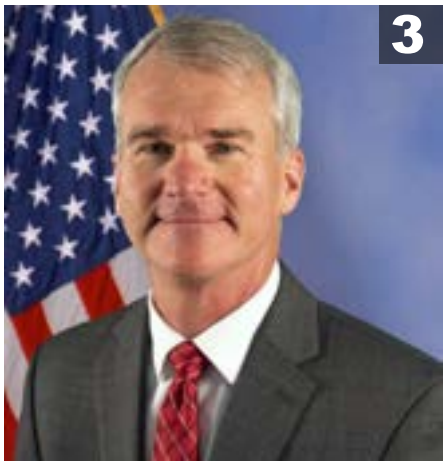
PROGRAM EXECUTIVE OFFICE FOR ENTERPRISE INFORMATION SYSTEMS

1: CHANGE OF CHARTER AT LMR

Kimberly Davidson, left, relinquished the charter of the Product Lead for Land Mobile Radio (LMR) to **Col. Enrique L. Costas**, project manager for Defense Communications and Army Transmission Systems, Aug. 30 at Fort Belvoir, Virginia. **Patrick B. Barnette**, right, deputy product lead for LMR, temporarily assumes responsibilities as acting product lead. Davidson, who received the Commander's Award for Civilian Service at the ceremony, is now with the Project Manager for Soldier Sensors and Lasers within the Program Executive Office (PEO) for Soldier. (Photo by Racquel Lockett-Finch, PEO for Enterprise Information Systems (EIS))

2: PM ACWS WELCOMES NEW PRODUCT MANAGER

Lt. Col. Christopher Center, left, assumed responsibility as the Product Manager for Army Contract Writing Systems during a change of charter ceremony July 23 in Alexandria, Virginia. **Col. William Russell**, center, then-project manager for General Fund Enterprise Business Systems (GFEBS), hosted the ceremony and presented the Legion of Merit to outgoing product manager **Lt. Col. Robert Wolfe,** right. (Photo by Racquel Lockett-Finch, PEO EIS)



3: NEW ACTING PEO FOR NETWORKS AND COMMS

Dan Joyce has been named acting assistant program executive officer for Networks and Communications, where he will lead the effort of securing Army networks. Joyce, who was appointed to the position in August, previously was with the Office of the Deputy for Acquisition and Systems Management within the Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology. (Photo by Racquel Lockett-Finch, PEO EIS)

4: NEW PRODUCT MANAGER FOR AMS2

Col. Donald Burton, left, project manager for GFEBS, welcomed **Lt. Col. Christine Youngquist** as the new product manager for Acquisition Management Support Solutions during a change of charter ceremony Aug. 27 in Arlington, Virginia. Youngquist is also acting product manager for GFEBS Sensitive Activities. She previously served as deputy product manager for the National Reconnaissance Office and as deputy director of the Mission Command and Network Test Directorate within the U.S. Army Electronic Proving Ground at Fort Huachuca, Arizona. (Photo by Racquel Lockett-Finch, PEO EIS)

OFFICE OF THE CHIEF OF STAFF, ARMY ANNOUNCEMENTS

Army Chief of Staff Gen. Mark A. Milley announced the following officer assignment:

Maj. Gen. Robert L. Marion, deputy for acquisition and systems management, Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology, Washington, to deputy commander, Combined Security Transition Command – Afghanistan, U.S. Forces Afghanistan, Operation Freedom's Sentinel, Afghanistan.

USD(A&S) ACQUISITION AWARDS

The **Hon. Ellen M. Lord,** undersecretary of defense for acquisition and sustainment, announced the winners of the 2018 Defense Acquisition Workforce Achievement Awards in November, with the Army bringing home individual awards in four categories: logistics, engineering, financial management and facilities engineering. A ceremony at the Pentagon will honor recipients of more than 20 team and individual awards in all. Here is a complete list of the winners:

INDIVIDUAL ACHIEVEMENT AWARDS

Acquisition in an Expeditionary Environment: **Maj. Jenny W. Ji**, Air Force Space Command

Auditing: **Paul H. Lefevor**, Defense Contract Audit Agency

Contracting and Procurement: **Doneise R. Lamb**, National Security Agency

Cost Estimating: **John P. Stedge**, Air Force Materiel Command

Earned Value Management: **Lt. Col. Bennet A. Burton**, Air Force Rapid Capabilities Office

Engineering: **James A. Kettner**, Program Executive Office (PEO) for Intelligence, Electronic Warfare and Sensors

Facilities Engineering: **Robert L. Fox**, U.S. Army Corps of Engineers

Financial Management: **Cassandra Simmons-Brown**, Joint PEO for Chemical, Biological, Radiological and Nuclear Defense

Information Technology: **Maj. Giacomo Sauceda**, Air Force Space Command

Life Cycle Logistics: **Billy R. McCain**, Global Combat Support System – Army

Production, Quality and Manufacturing: **Christina M. Fontanos**, Naval Air Systems Command

Program Management: **Lt. Col. Ellen M. Ellis**, National Reconnaissance Office

Requirements Management: **Cmdr. Jake Haff**, U.S. Special Operations Command

Science and Technology Manager: **Michael S. Hogan**, Air Force Space Command

Services Acquisition: **1st Lt. Christian C. Todd**, Air Force Space Command

Small Business: **Anthony J. Aldrich**, U.S. Special Operations Command

Test and Evaluation: **Daniel Ensminger**, Naval Air Systems Command

Flexibility in Contracting: Air Force Materiel Command Federal Acquisition Regulation 16.5 High Performance Team, Wright-Patterson Air Force Base, Ohio

WORKFORCE DEVELOPMENT INNOVATION AWARDS

Large Organization: Space and Naval Warfare Systems Center Atlantic – North Charleston, South Carolina

Small Organization: United States Navy Test Pilot School – Patuxent River, Maryland

ARMY TEAM WINS PACKARD AWARD

The **Hon. Ellen Lord**, USD(A&S) announced the winners of the 2018 David Packard Excellence in Acquisition Award in December, recognizing four organizations for exemplary performance and innovation in acquiring and delivering products and capabilities for the warfighter. Among the winners is a team representing the **Army Rapid Capabilities Office** and the **Project Manager for Electronic Warfare and Cyber** within **the Program Executive Office for Intelligence, Electronic Warfare and Sensors**.

The other winners were the U.S. Air Force Enhanced Polar System Team, U.S. Special Operations Command's Stand-Off Precision Guided Munitions Team and the Missile Defense Agency's Spacebased Kill Assessment Program Management Office.

The teams will be honored at a Pentagon ceremony in January or February.

ALL SYSTEMS GO

U.S. Army Research, Development and Engineering Command (RDECOM) Command Sgt. Maj. Jon R. Stanley pilots a Black Hawk Aircrew Trainer during an October visit to the Systems Simulation and Software Integration Directorate of the U.S. Army Aviation and Missile, Research, Development and Engineering Center (AMRDEC). The Army has been working toward fully immersive training since the 1980s, and hopes to have it operational by 2025, if not before. (Photo by Joseph Mendiola, AMRDEC)

THEN & NOW
1993 & 2019

TRAINING for the FUTURE

Force 2025 and beyond will need a new training system to thrive in ambiguity and chaos—the synthetic training environment. The Army's picking up speed to get there.

A four-man team of Soldiers sits in a nondescript building on Fort Belvoir, Virginia, each at his own desk, surrounded by three monitors that provide them individual, 3D views of an abandoned city. On screen, they gather at the corner of a crumbling building to meet another team—represented by avatars—who are actually on the ground in a live-training area, a mock-up of the abandoned city. They're all training together, in real time, to prepare for battles in dense urban terrain.

That's the central goal of the Synthetic Training Environment (STE)—immersive, integrated virtual training—presented Oct. 10 during a Warriors Corner session at the 2018 Association of the United States Army (AUSA) Annual Meeting and Exposition in Washington. The Army has been working toward this kind of fully immersive training experience for decades, and leadership hopes to have it operational as early as 2025.

In May 1993, Army RD&A Bulletin, the predecessor publication to this magazine, dedicated several articles to the concept and execution of distributed interactive simulation (DIS), "a time and space coherent representation of a virtual battlefield environment" that allowed warfighters across the globe to interact with one other as well as computer-generated forces, according to John S. Yuhas, author of the article "Distributed Interactive Simulation."

BETTER, FASTER, STRONGER

While the name of the program seems to emphasize individual simulation units, its overarching purpose was to bring together thousands of individuals and teams virtually in real time. Central to DIS was the idea of interoperable standards and protocol, allowing each community—"trainer, tester, developer and acquisitioner"—to use the others' concepts and products, Maj. David W. Vaden wrote in "Vision for the Next Decade."

The article explained that "distributed" referred to geographically separated simulations networked together to create a synthetic environment; "interactive" to different simulations linked electronically to act together and upon each other; and "simulation" to three categories—live, virtual and constructive. Live simulations involved real people and equipment; virtual referred to manned simulators; and constructive referred to war games and models, with or without human interaction. Sound familiar?

DIS has much in common with STE. Both provide training and mission rehearsal capability to the operational and institutional sides of the Army (i.e., Soldiers and civilians). They even share the same training philosophy: to reduce support requirements, increase realism and help deliver capabilities to the warfighter faster.

Users of STE will train with live participants and computer simulations, with some units training remotely. However, STE takes virtual reality training to a new level altogether by incorporating advances in artificial intelligence, big data analysis and three-dimensional terrain representation.

Current training simulations are based on technologies from the 1980s and '90s that can't replicate the complex operational environment Soldiers will fight in. They operate on closed, restrictive networks, are facilities-based and have high overhead costs for personnel, Maj. Gen. Maria R. Gervais, commanding general for the U.S. Army Combined Arms Training Center and director of the STE Cross-Functional Team, said in an August 2018 article, "The Synthetic Training Environment Revolutionizes Sustainment Training." Those older technologies also can't support electronic warfare, cyberspace and megacities, the article explained. For example, Soldiers in the 1990s could conduct training using computers and physical simulators—like the ones showcased in Charles Burdick, Jorge Cadiz and Gordon Sayre's 1993 "Industry Applications of Distributed Interactive Simulation" article in the Army RD&A Bulletin—but the training was limited to a single facility and only a few networked groups; the technology wasn't yet able to support worldwide training with multiple groups of users in real time, like the Army proposes to do with the STE.

Gervais presented a promotional video during "Warriors Corner #13: Synthetic Training Environment Cross-Functional Team Update," which said the STE will provide intuitive and immersive capabilities to keep pace with the changing operational environment. The STE is a Soldier lethality modernization priority of the U.S. Army Futures Command.

"With the STE, commanders will conduct tough, realistic training at home stations, the combat training centers and at deployed locations. The STE will increase readiness through repetition, multi-echelon, multidomain, combined arms maneuver and mission command training. And most importantly, the STE will train Soldiers for where they will fight," said Gen. Robert B. Abrams, then-commanding general of U.S. Army Forces Command, in the same video. Abrams is now commander of United Nations Command, Combined Forces Command, U.S. Forces Korea. Today, simulations in the integrated training environment do not provide the realism, interoperability, affordability and availability necessary for the breadth of training that the Army envisions for the future. The STE will be able to do all that—it will be flexible, affordable and available at the point of need.

"This video helps us get to shared understanding, and also awareness of what we're trying to achieve with the synthetic training environment," Gervais said during the AUSA presentation. "But it also allows us to understand the challenges that we're going to face as we try to deliver this."

CHALLENGES AHEAD

"We don't have the right training capability to set the exercises up," said Mike Enloe, chief engineer for the STE Cross-Functional Team, during the presentation. "What I mean by that is that it takes more time to set up the systems that are disparate to talk to each other, to get the terrains together, than it does to actually have the exercise go."

The Army's One World Terrain, a 3D database launched in 2013 that collects, processes, stores and executes global terrain simulations, has been the "Achilles' heel" of STE from the start, Enloe said. The Army lacks well-formed 3D terrain data and therefore the ability to run different echelons of training to respond to the threat. The database is still being developed as part of the STE, and what the Army needs most "right now from industry is content … we need a lot of 3D content and rapid ways to get

TRAINING DEBRIEF

During his visit in October to AMRDEC's Systems Simulation and Software Integration Directorate, RDECOM Command Sgt. Maj. Jon R. Stanley received briefings on several training systems, including the Army Game Studio STE Lab. The Army hopes that STE will provide the realism, interoperability, affordability and availability that's missing from existing integrated training environments. (Photo by Joseph Mendiola, AMRDEC)

them built," Enloe said. That means the capability to process terrain on 3D engines so that it can move across platforms, he said, and steering clear of proprietary technologies. The STE is based on modules that can be changed to keep up with emerging technologies.

The Army also needs the ability to write the code to develop the artificial intelligence that will meet STE's needs—that can, to some extent, learn and challenge the weaknesses of participants, he said.

Retired Gen. Peter W. Chiarelli, 32nd vice chief of staff of the Army, emphasized during the presentation that the Army needs to move away from the materiel development of the STE and focus on training as a service. "I believe that a training environment should have two critical aspects to it," he said: It should be a maneuver trainer, and it should be a gunnery trainer.

CHANGING THE CULTURE

Brig. Gen. Michael E. Sloane, program executive officer for Simulation, Training and Instrumentation (PEO STRI), said the leadership philosophy of STE's development is about fostering culture change and getting Soldiers capabilities faster. "We have to be proactive; the [cross-functional teams] have to work together with the PEOs, and we're doing that," he said. "Collectively, we're going to deliver real value to the Soldier, I think, in doing this under the cross-functional teams and the leadership of the Army Futures Command."

Many organizations are involved with STE's development. The U.S. Army Combined Arms Center – Training and the U.S. Army Training and Doctrine Command capability managers are working requirements and represent users. PEO STRI is the materiel developer. The U.S. Army Maneuver Center of Excellence is responsible for the infantry, armor and combined arms requirement. And finally, the assistant secretary of the Army for acquisition, logistics and technology (ASA(ALT)) serves as the approval authority for long-range investing and requirements.

With the Futures Command and ASA(ALT) collaborating throughout the development of STE, Sloane believes the Army will be able to reduce and streamline acquisition documentation, leverage rapid prototyping, deliver capabilities and get it all right the first time.

Gervais reminded the AUSA audience in October that she had spoken about STE at the annual meeting two years ago, explaining that the Army intends to use the commercial gaming industry to accelerate the development of STE. "I did not believe that it couldn't be delivered until 2030. I absolutely refused to believe that," she said. In 2017, the chief of staff designated STE as one of the eight cross-functional teams for Army modernization, aligning it with Soldier lethality.

Since then, STE has made quite a bit of progress, Gervais said. The initial capability document for the Army collective training environment—which lays the foundation for STE—was approved in 2018. The Army increased its industry engagement

COMING INTO FOCUS

The STE will merge live, virtual and constructive simulations into a single, cohesive training capability that provides a common operating picture from the battalion to the joint task force level. (U.S. Army illustration)

HIGH-TECH TRAINING

Soldiers prepare to operate training technologies during the STE User Assessment in Orlando, Florida, in March 2018. The assessment was part of an approach implemented by Maj. Gen. Maria R. Gervais to put industry prototypes in Soldiers' hands at the beginning of the capability development process. (U.S. Army photo by Bob Potter)

to accelerate the development of STE, according to Chief of Staff of the Army Gen. Mark A. Milley's direction, which led to the awarding of seven other transaction authority agreements for One World Terrain, followed by a user assessment in March 2018. In June, Secretary of the Army Dr. Mark T. Esper and Milley codified STE in their vision statement. "We're postured to execute quickly," Gervais said.

In the meantime, she said, there has been a focused effort to increase lethality with a squad marksmanship trainer in the field to allow close combat Soldiers to train immediately. The Army also developed a squad immersive virtual trainer. "We believe we can deliver that [squad immersive trainer] much quicker than the 2025 timeframe," she said.

CONCLUSION

STE is focused on establishing common data, standards and terrain to maximize interoperability, ease of integration and cost savings, Gervais said. With the right team effort and coordination, she believes STE can be delivered quickly. Perhaps in a few short years, STE can achieve the lofty goal that DIS had for itself, according to Yuhas: Revolutionize the training and acquisition process for new weapon systems.

For more information on virtual training in the 1990s, go to ***https://asc.army.mil/docs/pubs/alt/archives/1993/May-Jun_1993.PDF****. For more on immersive training today, go to* ***https://www.dvidshub.net/video/631823/ausa-2018-warriors-corner-13-synthetic-training-environment-cross-functional-team-update****.*

—JACQUELINE M. HAMES and MARGARET C. ROTH

Office of the Assistant Secretary of the Army (Acquisition, Logistics and Technology)

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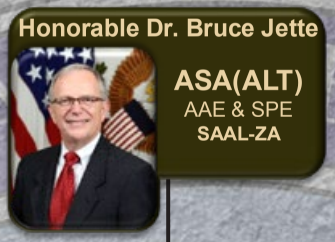

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