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ARMY AL&T

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APRIL–JUNE 2014

MODERNIZING THE FORCE

A PLAN TO MAKE – AND BREAK

RDECOM works to maintain a leading edge

THE IPHONE TEST

Setting standards for 'common' in Common Operating Environment

RESEARCH RESOURCE

Rapid pathogen detection leverages small business funds

From the Editor-in-Chief

TALK BACK

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CORRECTIONS

An article in the January–March 2014 issue of Army AL&T, "Historical Perspective," incorrectly identified the Arsenal Act (Title 10 U.S. Code, Section 4532) and the source of "United States Army Organic Industrial Base Strategic Plan 2012–2022." The plan was produced by HQDA.

The "Critical Thinking" column in the January-March issue of Army AL&T incorrectly identified one of the 10 contributors: Michelle Lohmeier, vice president, Land Warfare Systems, Raytheon Missile Systems, Tucson, AZ.

If the prognosticators when I was a child had been right, by now there should be flying cars, mile-high skyscrapers, utopian cities on the moon and ray guns! Hmm. None of that seems to have happened; well, not yet, anyway. As an old Danish proverb says, "Prediction is difficult, especially when dealing with the future," and such is the case with predicting the future for Army Acquisition.

If you want to understand just how hard it is to prophesy, consider the future contemplated by the 2014 Quadrennial Defense Review (QDR): "Future conflicts could range from hybrid contingencies against proxy groups using asymmetric approaches, to a high-end conflict against a state power armed with WMD [weapons of mass destruction] or technologically advanced anti-access and area-denial capabilities." So, how do you plan for that wide range of possible futures? In a word, incrementally.

According to Mr. Dale A. Ormond, director of the U.S. Army Research, Development and Engineering Command (RDECOM), "… research and development [R&D], especially in the early stages, often has no defined goal. If research is limited to only areas of interest, we virtually guarantee that we will miss important innovations." So, based on the QDR's vision of future combat needs, Army Acquisition may need to produce an unmanned hovercraft with mounted laser cannons (a la the U.S. Army Space and Missile Defense Command's recent call to industry for a truck-mounted 50-kilowatt laser), or a Tactical Assault Light Operator Suit, the so-called "Iron Man suit," for every Soldier (now in the beginning stages of development at U.S. Special Operations Command).

But you don't necessarily set out to build a laser cannon or an Iron Man suit. You follow the trend of technology, explore the realm of the possible and continually reinvent the future through agile acquisition procedures. To foster this rapid turnover of technology, the Hon. Heidi Shyu, assistant secretary of the Army for acquisition, logistics and technology (ASA(ALT)), is focused on a strategic modernization planning process combining a detailed analysis of current and planned investments in science and technology (S&T) and materiel development, linked to emerging threats and capability gaps across a 30-year period.

The key to maintaining flexibility and making the plan work is collaboration to solve difficult problems—collaboration with anyone and everyone you can think of: industry, academia, federally funded R&D centers and other government organizations. Initiatives such as RDECOM's Virtual Lab, which erases boundaries by allowing researchers and engineers to come together anywhere, anytime, and the U.S. Army Research Laboratory's open-campus concept that encourages partners in academia, industry and government to set up research facilities alongside the military's are breaking down barriers and spurring innovation to ensure that we maintain the decisive edge on the battlefield of the future.

But there's still more to this new focus on long-range planning. In this issue, see how the Joint Acquisition Sustainment Review (JASR, or "jazzer") brings U.S. Army Materiel Command and ASA(ALT) together to create a better future, in " 'Jazzing' It Down." Learn about what individual PEOs are doing to make 30-year planning work. Read about how the Army is cultivating revolutionary and disruptive capabilities through early-stage S&T investments in "Evolving Innovation."

So, did we accurately predict the future? Check back in 30 years and see if we got it right! Until then, if you have story ideas, comments or critiques to help make the magazine better, please contact me at **armyalt@gmail.com**.

Nelson McCouch III
Editor-in-Chief

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ARMY AL&T

APRIL–JUNE 2014

FEATURES

FROM THE AAE

ACQUISITION

LOGISTICS

ON THE COVER

Call the Army's 30-year plan "whether prediction." To posture and equip the force for whatever threats the nation and its interests might face in the future, the Army has to plan for every conceivable scenario it can, whether it involves robots, quantum communications, Iron Man-like suits or synthetic viruses, or perhaps something completely out of the blue.

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ARMY AL&T

APRIL–JUNE 2014

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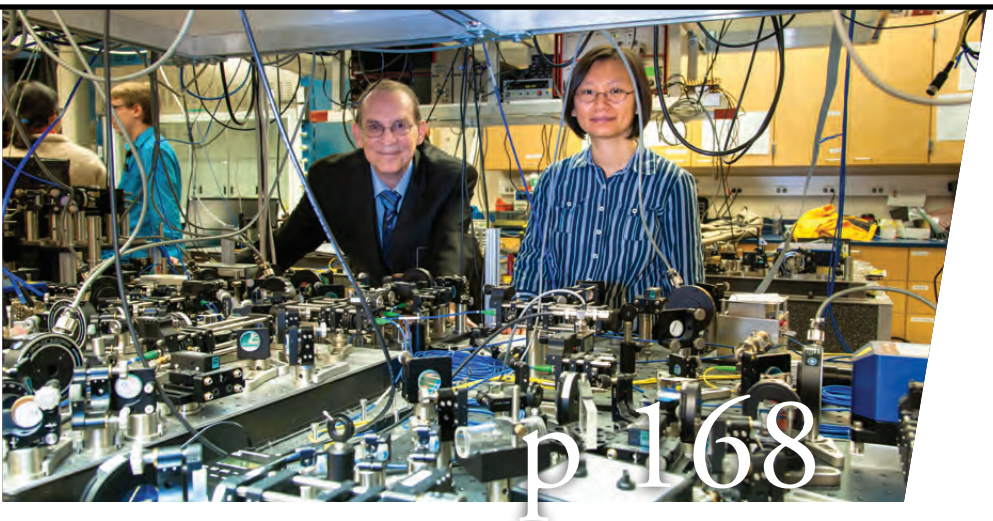

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COMMENTARY

WORKFORCE

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General, United States Army
Chief of Staff

Official:

GERALD B. O'KEEFE
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1408506

PROTECTION ON PATROL
Team leader SGT Alexander Weston, a member of 2nd Battalion, 30th Infantry Regiment, and his Soldiers secure the rear element of a dismounted patrol Nov. 18, 2013, en route to an Afghan Border Police checkpoint in Nangarhar Province, Afghanistan. The 2nd Battalion is part of 4th Brigade Combat Team, 10th Mountain Division, Task Force Patriot. The Army is making S&T investments now to produce capabilities later that will benefit dismounted Soldiers, including lighter-weight, stronger armor that will provide increased force protection, and integrated, modular, mission-tailorable Soldier protection systems. (U.S. Army photo by SGT Eric Provost, Task Force Patriot Public Affairs)

FROM THE ARMY ACQUISITION EXECUTIVE
THE HONORABLE HEIDI SHYU

FIVE TENETS *for the* **FUTURE**

Army lays out investment strategy at this time of transition

As we move into spring, budget season begins in Washington. My colleagues and I are working diligently with our friends in Congress to support the priorities laid out in the president's budget submission. The FY15 defense budget is the first to fully reflect our nation's transition to peace after 13 years at war in Afghanistan, the longest conflict in U.S. history. As we work to secure the budget for the next fiscal year, I think it is a good time to consider our equipment modernization strategy.

There is an old saying: "The best time to plant a tree was 20 years ago, and the second best time is today." As we draw down forces from Afghanistan, today is the best time to plant seeds for the Army of the future.

This is not a new concept. The most successful example of planting seeds for the future may be the end of the Vietnam conflict. That period saw the initial investments in the M1 Abrams tank, the M2 Bradley Fighting Vehicle, the UH-60 Black Hawk utility helicopter, the AH-64 Apache attack helicopter and the Patriot surface-to-air missile system. These were the key weapon systems that ensured the Army's victory in Operation Desert Storm. Those capabilities that enabled the "100-hour victory" began as investments during a period of declining resources, much like the one we are facing today. But we're also facing additional fiscal pressures in the wake of the drawdown.

EFFICIENCIES IN MOTION
Soldiers from the 5th General Support Aviation Battalion, 158th Aviation Regiment, 12th Combat Aviation Brigade conduct sling-load operations with CH-47 Chinook helicopters as part of a mission rehearsal exercise at the Joint Multinational Readiness Center (JMRC), Hohenfels, Germany. The Army's efforts to absorb reductions in its equipment accounts have included cost-saving multiyear procurements of the CH-47F Chinook. (Photo by SSG Caleb Barrieau, JMRC)

OUT OF AFGHANISTAN
Soldiers with 1st Battalion, 5th Cavalry Regiment, 2nd Brigade Combat Team, 1st Cavalry Division pull dismounted security on a hill overlooking Herat City, Afghanistan, Sept. 26, 2013. As with periods after previous wars, the drawdown from Afghanistan poses a good opportunity to plant seeds for the Army of the future. (U.S. Army photo by SPC Ryan D. Green, 982nd Combat Camera Company (Airborne))

I applaud the budget compromise reached at the end of last year, mitigating the impact of sequestration for FY14 and FY15. That funding will help us "buy back" readiness in the near term, but the prospect of long-term sequestration is still with us. The Budget Control Act reductions remain the law of the land and will return in FY16 without further congressional action.

Faced with that reality, we undertook an effort last year to create long-term investment road maps across our various capability portfolios—developing our existing programs of record, better defining research and development investments, planning for sustainment costs of transitional capabilities and tying all of this to our emerging threat picture and resource projections. The last part has proven challenging, but we're making progress on these complex efforts. Greater budget stability will help us achieve a strategic balance.

The Army's efforts to absorb reductions in our equipment accounts have included several cost-saving measures, such as:

- Reducing procurement quantities to map to the reduced force structure size.

ADVANCING THE NETWORK
Soldiers from the 2nd Brigade Combat Team, 101st Airborne Division (Air Assault) use a WIN-T Inc 2-equipped vehicle during training in November 2013 at the Joint Readiness Training Center (JRTC), Fort Polk, LA. Even with fiscal constraints, the Army continues to network Soldiers with WIN-T Inc 2, Nett Warrior, Rifleman Radio, Manpack and the Mid-Tier Networking Vehicular Radio to provide on-the-move command and control and situational awareness. (Photo by JRTC Operations Group Public Affairs)

- Preserving cost savings in multiyear procurements. For example, the second five-year award in the CH-47F Chinook program in 2013 yielded savings of $810 million.
- Diligently pursuing better buying power initiatives in contracting, increasing competition and vigorously targeting "should cost" efficiencies in the execution of our acquisition programs.

THE PLANNING PYRAMID

Our investment strategy encompasses five areas, which translate to a five-layer pyramid: divestment, reset and sustainment, modernization of existing platforms, development of new capabilities, and science and technology (S&T) investment. (See Figure 1 on Page 8.)

At the broad base of the pyramid, we must accelerate divestment of aging systems that we no longer need to reduce operations and sustainment (O&S) costs. For example, we divested 30,000 old trucks last year, avoiding nearly $100 million in sustainment costs. Reset and sustainment of equipment used in the past decade of conflict are essential to the Army's ability to maintain near-term readiness.

FIGURE 1

PYRAMID OF PRIORITIES
ASA(ALT)'s 30-year investment planning strategy can be thought of as a five-layer pyramid. (SOURCE: ASA(ALT))

The Army will continue to pursue incremental modernization of existing platforms that have reached maximum capacity in terms of size, weight and power, as we work to improve network connectivity. For example, we are replacing the Paladin, which has a high O&S cost, with the Paladin Integrated Management (PIM) system. PIM will improve the suspension, chassis structure and electric gun drive. The increased commonality of parts with the Bradley will streamline maintenance.

On Abrams, we are implementing an engineering change proposal to upgrade the electrical power and network, improve armor and introduce larger-caliber ammunition. In the future, we plan to increase energy efficiency on the Abrams with a transmission upgrade.

Despite the constrained fiscal environment, we must still develop new capabilities in certain key areas to address critical priorities. However, we cannot afford all the new programs that we would like. We had to make some tough decisions about what will be good enough in the near term. We are moving forward with our Integrated Air and Missile Defense Battle Command System (IBCS), enabling us to integrate stovepiped legacy air and missile defense systems to achieve distributed net-enabled operations, and the Joint Air-to-Ground Missile, which will enable us to counter moving targets. We continue to network our Soldiers with Nett Warrior, Rifleman Radio, Manpack, Mid-Tier Networking Vehicular Radio and Warfighter Information Network – Tactical (WIN-T Inc 2) to provide on-the-move command and control and situational awareness.

Lastly, we are planting seeds with S&T investment. It is crucial that we continue the research and development that will produce the next-generation, breakthrough technologies defining the Army of the future. The seeds we plant now will eventually give rise to future capabilities, including:

- Enhanced lethality with disruptive energetic weapons.
- Increased maneuverability via our Future Vertical Lift program to double the range and increase fuel efficiency for our aviation platforms.
- Increased force protection, as shown by our pursuit of lighter-weight, stronger armor.
- Increased Soldier performance with integrated, modular, mission-tailorable dismounted Soldier protection systems.

CONCLUSION

As we continue to draw down forces, we will leverage this period to make the best investments in developing the Army of the future.

On another note, I'd like to take a moment to reflect on the service of LTG

William N. Phillips, my ASA(ALT) principal military deputy (MILDEP) with whom I have served since 2010, on the occasion of his retirement from a distinguished Army career. The ASA(ALT) team celebrated his 38 years in the Army on April 4 at Fort Myer, VA.

The most senior aviator in the Army at the time of his retirement, Bill knows firsthand the service and sacrifice of our Soldiers and civilians. Coming directly to the Pentagon from Baghdad, his experience includes serving as the commanding general of the Joint Contracting Command – Iraq/Afghanistan, Program Executive Officer (PEO) for Ammunition and Deputy PEO for Aviation.

Bill worked tirelessly to ensure that our acquisition and contracting professionals deliver for the Soldier in the field. As my right hand, Bill worked to reinforce integrity in the contracting process and committed himself with unfailing vigor to strengthening the Acquisition Workforce. Bill was a consummate advocate for the Acquisition Corps, and his tenure as the acquisition MILDEP is marked by a dramatic increase in the professionalism and accountability with which our members serve.

On a more personal level, I am grateful for the time that I have worked with LTG Phillips and consider him a great personal friend. While working to streamline the acquisition process for efficiency and effectiveness, I have appreciated his understanding of complex military issues and have found his counsel incredibly sound. When acting to implement Better Buying Power 2.0 under a period of fiscal restraint, Bill showed great facility and displayed strong clarity, providing incalculable benefit to the Army.

PICTURE OF PROFESSIONALISM
Undersecretary of the Army Joseph W. Westphal, left, and LTG William N. Phillips, then-principal MILDEP to the ASA(ALT), tour Boeing's newly refurbished CH-47F helicopter manufacturing facility in Ridley Park, PA, Aug. 14, 2013. Shyu praised Phillips for his unfailing dedication to strengthening Army acquisition and the acquisition workforce. (Photo by Fred Troilo, Boeing Defense, Space & Security)

He has brought significant expertise to bear across the Army acquisition portfolios. For example, Bill led the identification of ways to streamline tests and refine testing requirements for PIM, eliminating redundancy. His leadership saved $15.7 million and 12 months of range time. His efforts also proved essential in developing trade-offs necessary for new capabilities like the Joint Light Tactical Vehicle, as well as modernization of the Apache and Abrams.

At the same time, Bill prioritized efforts to inspire young people to pursue careers in science and technology. A strong advocate of STEM (science, technology, engineering and mathematics), Bill maximized many opportunities to spend time with young Americans, from baseball games to NASCAR races. His many engagements often included a challenge to our members and partners in industry, academia and government to rally behind this critical program and ensure the future of our great nation.

On behalf of the entire ASA(ALT) team, I want to wish Bill and his wife, Marilyn, all the best as they enter this new chapter in their lives. Bill, you have been a tremendous gift to our organization, our Army and our nation.

Getting *a* Fix *on the* Future

Even as it closes the books on the longest war in U.S. history, the Army must plan, in difficult circumstances, for what is to come

by Ms. Margaret C. Roth

As the Army draws down to what could be its smallest size in nearly three-quarters of a century, the focus is squarely on the future. So, what does the Army need to do today to get where it wants to be 30 years from now?

In a word: Plan. But it's more complicated than it sounds. A year and a half ago, the Army initiated a new strategic modernization planning process that combines a detailed analysis of investments in science and technology (S&T) and material development, linked to emerging threats and capability gaps across a 30-year time frame. The Hon. Heidi Shyu, assistant secretary of the Army for acquisition, logistics and technology (ASA(ALT)), has described the output of this process as "a detailed road map of our future capabilities across the acquisition life cycle, linking our S&T investments with our programs of record [PORs], which, in turn, are linked to our long-term sustainment strategy."

"It is the right time to entertain a comprehensive and strategic approach to Army equipment modernization, in which we adapt a systemic approach to setting and determining long-term equipping priorities," Shyu said in October 2012 at the Association of the United States Army (AUSA) Annual Meeting and Exposition.

A year and a half later, with the war in Afghanistan drawing to a close and the defense budget continuing to decline, the Army materiel development community faces multiple challenges. Systems fielded to support immediate warfighter needs are returning to Army inventories and competing with established PORs as potential permanent solutions to the Army's capability needs.

At the same time, the strategic and operational focus is shifting to the Pacific Rim, with a more advanced threat and near-peer adversary. This significant shift in threats, operations and budgets calls on the Army to make critical decisions that will have far-reaching implications for the development, acquisition, user and sustainment communities. Every investment decision is important, including the sustainment of returning inventory and development of future capabilities.

ON THE MOVE, VIRTUALLY

Cavalry scouts from the Tennessee National Guard's 278th Armored Cavalry Regiment conduct a large-scale virtual reconnaissance mission Jan. 25 at Volunteer Training Site – Catoosa, GA, which uses the Combined Arms Virtual Training concept leveraging multiple virtual simulators to replicate heavy equipment and remote training sites that are often expensive to maintain or difficult to reach. With budgets tightening, it becomes increasingly important to keep training costs low while maintaining readiness. (U.S. Army photo by SSG Melissa Wood, 118th Mobile Public Affairs Detachment)

And, of course, money is tight. But budgetary circumstances don't alter some fundamental realities of how the Army plans its spending of the money Congress provides.

The program objective memorandum (POM) process is the U.S. military's traditional means to define program objectives over a five-year budget cycle.

However, the POM looks at specific PORs; it does not provide a holistic, long-term approach that addresses the affordability concerns that are central to better buying power across a system's acquisition life cycle. Instead, five-year program planning has led to unforeseen, unaffordable collisions of major modernization needs in the years beyond the POM.

Laying out the next 30 years of modernization needs makes those collisions apparent and avoidable. "You can see we've got all these decisions happening in the same short time frame," said Mary Miller, deputy assistant secretary of the Army for research and technology, in a March 11 interview with Army AL&T magazine. "We need to stretch [program decisions] out. … That means some of

CYBERSPACE IS KEY

Security experts consider threats in cyberspace to be among the most dangerous of all challenges facing U.S. military forces. Effective planning for Force 2025 includes developing defenses against cyberattacks as well as operationalizing the cyber realm, say senior Army leaders. (SOURCE: Thinkstock)

them we're going to have to do earlier, and we're going to have to resource that appropriately. Some of them we're going to have to stretch out later, which means we might have to do some upgrades for these platforms until we can get to where we can bring in a new platform."

It also might mean more experimentation and early prototyping while programs are still in the science and technology portfolio, Miller said. Examples of this methodology can be found in the development of enablers—such as for assured position navigation and timing as an alternative to GPS, and subsystem demonstrations for the next-generation Future Fighting Vehicle—in anticipation of getting funding later for a future POR product development.

Bottom line: "You start to live within the resources available to the Army," said Miller, who has worked in the Pentagon on and off since she became S&T liaison to the deputy chief of staff of the Army for operations – force development in 1999. "In my opinion, this is the first time we've really done deliberate planning that extended beyond the POM cycle," she said. "And so we're talking a lot more. We're planning together a lot more."

STRATEGICALLY SOUND CHOICES

This new, long-term approach to modernization planning—evaluating operational needs 30 years into the future—integrates threat analyses from the intelligence community, gap analyses and modernization strategies developed by the centers of excellence, and the materiel development efforts of the program executive offices (PEOs) working collaboratively across the Army portfolios.

That long-range planning approach now informs the POM, which becomes the instrument to implement the long-range strategy. Difficult choices still abound, but 30-year modernization planning better equips the Army to frame its decisions: Which choices will allow the Army to retain the most capability in the long term?

Much of the discussion at the AUSA Institute of Land Warfare (ILW) Winter Symposium and Exposition Feb. 19-21 in Huntsville, AL, concerned how senior leaders across the Army—including the AL&T Workforce in ASA(ALT), the long-range thinkers of U.S. Army Training and Doctrine Command (TRADOC) and the Army Capabilities Integration Center (ARCIC), and the researchers, developers, maintainers and sustainers of U.S. Army Materiel Command (AMC)—are making those choices for Force 2025 and beyond. With the theme "America's Army: Sustaining, Training and Equipping for the Future," the symposium drew about 5,800 exhibitors and participants and featured panel discussions on modernization, the operational environment in 2025, requirements for 2030 and operationalizing the Army's cyber domain, among other topics.

Meanwhile, as the following articles in this issue illustrate, the PEOs have been immersing themselves in the myriad details of 30-year modernization planning and have learned some lessons in the process.

SEEDS OF THE FUTURE

"We're navigating a very challenging period for our Army" with the drawdown of forces during a period of "dramatic

fiscal constraint and budget pressure," Shyu said at the AUSA Winter Symposium. "We're leveraging this period to make the best investments possible, planting the seeds that will secure the Army of the future. … Our goal is to provide our Soldiers the best capability possible. They deserve nothing less."

That means clearly and cogently balancing existing capabilities, identifying operational gaps, and pursuing affordable solutions that recognize the evolving threat, the operational environment and ease of maintenance and sustainment. Perhaps more than ever, it also means understanding what S&T can bring to Army capabilities—a "focus on the development of next-generation breakthrough technologies that define the Army of the future," as Shyu described it in Huntsville.

It also means that ASA(ALT) is planning in closer collaboration with TRADOC, AMC and the entire S&T enterprise.

Speaking at the symposium, GEN Dennis L. Via, AMC commanding general (CG), said that diminishing fiscal resources and growing threats drive three priorities for AMC: "We must continue to modernize our equipment; we must continue to sustain the force of today; and we must continue to develop capabilities and technologies that will give our Soldiers the decisive advantage to meet—and defeat—any potential future enemies."

Via highlighted several of the leap-ahead technologies that AMC's Research, Development and Engineering Command (RDECOM) is working on to unburden, protect, empower and sustain the joint warfighter.

"Working in partnership with industry and academia, along with a sustained level of resourcing, I'm confident we can maintain the technological edge that will produce the next generation in vertical lift, ground vehicle, night vision advancement and overmatch capabilities in our next weapon systems, all while protecting and preserving what our Army has worked so hard to achieve over the past decade," Via said.

STAGING GROUND

LTC Marc Staats, right, Army Field Support Battalion – Kuwait (AFSBn-Kuwait) commander, briefs Shyu; Via, left; and other guests during a March 16 tour of the battalion's retrograde operations. The two Army leaders and their organizations are making a concerted effort to coordinate modernization and sustainment efforts. (Photo by 1LT Ryan Seidner, AFSBn-Kuwait)

A Soldier demonstrated the Helmet Electronics and Display System – Upgradeable Protection (HEADS-UP), which provides mounted and dismounted troops with a more fully integrated headgear system featuring new technologies that include improved ballistic materials; non-ballistic impact liner materials and designs;

"WHERE DO WE INVEST TO ENSURE THAT TODAY'S FIFTH-GRADER, WHO IN THE DECADE OF 2030-2040 WILL BE A BATTALION COMMANDER, WILL HAVE THE TOOLS THEY NEED TO ADAPT ONCE THE NATION COMMITS THE ARMY?"

EXPLORING THE GAPS

Army Rangers train on Camp Roberts, CA, Jan. 31 to maintain their technical proficiency. Addressing gaps in capabilities for Soldiers over the next 30 years is a collaborative effort involving ASA(ALT), AMC and TRADOC. (U.S. Army photo by SPC Steven Hitchcock)

better eye, face and ear protection; and improved communications.

The Army exhibit at the AUSA event reinforced the closer collaboration among the major players in long-range modernization planning, particularly ASA(ALT) and AMC. (See related article, " 'Jazzing' It Down," on Page 38.) Visitors to the exhibit of 10 different portfolios could see "the full life cycle from identifying requirements and design, all the way through the process," said Rick Sims, co-director for the Army exhibit.

Dan Maslach, an engineer with the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC), showcased 200-watt fuel cells that are hybridized with the Talon, a kinetic-bomb-detecting robot that can operate in adverse conditions, navigate almost any terrain and even climb stairs. Typically the Talon has enough battery power for 2-4 hours of operation, but the fuel cell increases that to 8-24 hours.

"It drastically increases the duration the Soldiers can use the robot without changing batteries or replacing fuel," said Maslach. For Talon operators in the field, that means not having to carry extra batteries or chargers.

Via mentioned the Fuel Cell Talon among other cutting-edge systems in his opening remarks. "These materiel solutions that I've just highlighted are but a glance into what our AMC engineers and scientists are researching and developing, and a glimpse of what's possible in the future as we move toward Force 2025 and beyond," he said.

A FORCE TO MEET THE THREAT

GEN Robert W. Cone, then the CG of TRADOC who is retiring, described Force 2025 as leaner than today's, but

"TO MEET THESE FUTURE CHALLENGES, WE WILL HAVE TO ADJUST OUR RESEARCH, DEVELOPMENT AND INVESTMENTS INTO LIGHTER, LEANER, MORE MOBILE FORCES THAT ARE EASIER TO OPERATE IN URBAN ENVIRONMENTS WITH THE APPROPRIATE PROTECTION."

still mean if not meaner. Addressing the AUSA symposium, Cone said, "Expeditionary maneuvering is what drives many fundamental changes in the formations that we're talking about building for Force 2025."

Force 2025 S&T solutions include lighter, more capable protection; cyberspace operations; mission command on-the-move; optimized squads; increased presence; live, virtual and constructive gaming and immersive tools; and long-range precision fires.

"If you think through science and technology, what are you really going to be able to come up with that we're going to be able to field by 2025? The reality of it is that you better think deeper than that, because most of what you come up with will be a waypoint or an interim solution that will need to meet the needs of the Army for Force 2025," Cone said.

LTG Keith C. Walker, deputy CG, futures and ARCIC director, put it another way.

TALONS OUT

TARDEC engineer Dan Maslach demonstrates a Talon robot outfitted with 200-watt fuel cells at the AUSA ILW Winter Symposium and Exposition in February. The kinetic-bomb-detecting robot can operate in adverse conditions and rough terrain, and its improved fuel cells will lighten the load that the warfighter carries in the field. (U.S. Army photo by Cherish Washington, AMC)

POISED FOR TRANSITION

Via and Shyu examine a vehicle at a warehouse at Camp Arifjan, Kuwait, March 15 during a visit to several locations in Kuwait and Qatar where the U.S. military is processing equipment from Afghanistan. Systems fielded to support immediate warfighter needs are returning to Army inventories and competing with established PORs as potential permanent solutions to the Army's capability needs. (U.S. Army photo by 1LT Ryan Seidner, AFSBn-Kuwait)

"Where do we invest to ensure that today's fifth-grader who, in the decade of 2030-2040 will be a battalion commander, will have the tools they need to adapt once the nation commits the Army?

"We study the future not because we wish to get it exactly right, but in order to make sure that we do not get it 100 percent wrong, and so we can adapt once the future happens," said Walker, offering some insight on the likely players and challenges facing the military and the nation as a whole in the years to come.

"Force 2025 and beyond is about more than the year 2025," Walker said. "It's about what must we do to improve the Army 2020 force; it's about maintaining operational overmatch with leaner formations that have greater than or equal capability than we have today by 2025; and it's about fundamentally changing the force in 2030-40.

"While the operating environment of 2025 makes for good table discussions, its importance is in what it means to the Army today. Clearly it means while we may not be able to afford new programs today, we can adjust our investments in science and technology in order to ensure our Soldiers and their formations have the capability of what they need in the future." (See related Q&A with ARCIC leadership in "Critical Thinking" on Page 138)

Walker noted the effects of globalization, the Internet and communications among other major influences on potential future conflicts. "This exponential increase in the momentum of human interaction means that we as an Army, or we as a joint force, will have to have the ability to employ operationally significant force, which is enough force to address that conflict, with greater and greater speed if we want our strategic leaders to have options. To meet these future challenges, we will have to adjust our research, development and investments into lighter, leaner, more mobile forces that are easier to operate in urban environments with the appropriate protection."

LTG Mark Bowman, director for command, control, communications and computer/cyber, and chief information officer/J-6 on the Joint Staff, noted that "the cyber enemy is an enemy that's potentially more dangerous than any individual or machine than we have ever known in the history of the world. We've got to be able to defend against the threat." That means operationalizing the cyber realm now, Bowman said.

"We see the battlefield in cyberspace through data," said LTC Paul Stanton, technical liaison to U.S. Army Cyber Command. "In cyberspace, the avenues of approach are hundreds, if not thousands, within an operating environment. Additionally, the vehicles, if you will, that traverse that network are in the millions.

"There's just a vast amount of data that we have to have the right capabilities and tools to translate into information in support of the decision process for mission commanders," Stanton said. "How do I determine what actually is an indicator of threat activity on the network?"

CONCLUSION

The S&T community, including the Army's 16 research and development centers and 12,500 scientists and engineers in collaboration with industry and academia, is playing a key role in

HEADS-UP

New integrated helmet technology like the HEADS-UP system shown here would eliminate the need for crew members to switch to their Army Combat Helmets when dismounting from their vehicles. The AUSA ILW Winter Symposium and Exposition highlighted HEADS-UP among the emerging technologies that will support the future force. (Photo by David Kamm, U.S. Army Natick Soldier Research, Development and Engineering Center)

determining "the art of the possible" over the near, mid- and long term, Miller said. With the support of senior leadership, she said, the Army now has "a larger perspective that S&T does have a role in this continuing process of making the Army more capable."

In TRADOC war games such as Unified Quest, for example, "What we're trying to do is to give you that technical underpinning and foundation so that when you play a war game, … it's really informed by where we see technology going, what's in the art of the possible, where we see other countries' strategic plans taking it. We're trying to look for those longer-term nascent technologies that really can make a difference in tech research," Miller said.

The next step, she said, is to explore those technologies in conjunction with partners in the other services, one of which might have a greater stake in the technology and therefore be prepared to invest more money in developing it; industry, which may be able to devote independent research and development dollars to it; academia; and even other countries.

"All of us are running as we go," Miller said. "We know it's the future, and all you can do is take a best chance at trying to get it right." (See related article, "Evolving Innovation," on Page 86.)

For selected presentations from the AUSA ILW Winter Symposium and Exposition, go to ***http://ausameetings.org/winter/****.*

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Deep Dive

Soldier Modernization Process is potential model for organization, collaboration in 30-year strategic planning

by Ms. Kathleen W. Gerstein

In November 2012, Program Executive Office (PEO) Soldier, the materiel developer for virtually all individual equipment Soldiers use in combat, presented its 30-Year Modernization Strategy to Army Acquisition Executive (AAE) the Hon. Heidi Shyu. The strategy was the product of a concerted effort among members of the Soldier enterprise (SE)—the capability, technology and materiel developers responsible for the Soldier portfolio—and the start of a systematic approach to setting long-term equipping priorities for the Soldier. This approach, which goes into considerably greater detail than the AAE's strategic planning called for, reflects capabilities conceptualized and aligned across decades.

At the heart of the SE's 30-year strategy is the Soldier Modernization Process (SMP). Within this process, which the SE initiated in early 2013, are integrated schedules linking the most urgent Soldier capability gaps to emerging requirements, in-development materiel solutions, science and technology (S&T) efforts and projected sustainment needs, with the overall goal to support development of materiel solutions for the Soldier.

The SE identified nine high-priority gaps in Soldier capabilities across four focus areas: mission command and situational awareness, lethality, mobility and protection. The SMP examined each of those out to 2048, laying out the anticipated start and end dates

NIGHT SIGHT

Army Rangers fire at an "enemy" bunker as part of Task Force Training on Camp Roberts, CA, Feb. 1. In its second deep dive, the SE focused on night vision and maneuver enablers, mission command and situational awareness. (U.S. Army photo by SPC Steven Hitchcock)

of specific programs of record (PORs), S&T efforts and requirement documents in specific fiscal years. Each integrated schedule graphically illustrates each organization's contribution to a particular effort, specifically a requirement document, milestone event or achievement of a specific technology readiness level. (See Figure 1 on Pages 20 and 21.) If the requirement document isn't going to be ready, the associated POR can't start, and the planned S&T effort might be obsolete before it can feed into the POR.

This detailed, multidimensional planning required an uncommon degree of coordination—numerous meetings and teleconferences bringing the action officers together to ensure that all partners were on the same page and to reduce duplication of efforts.

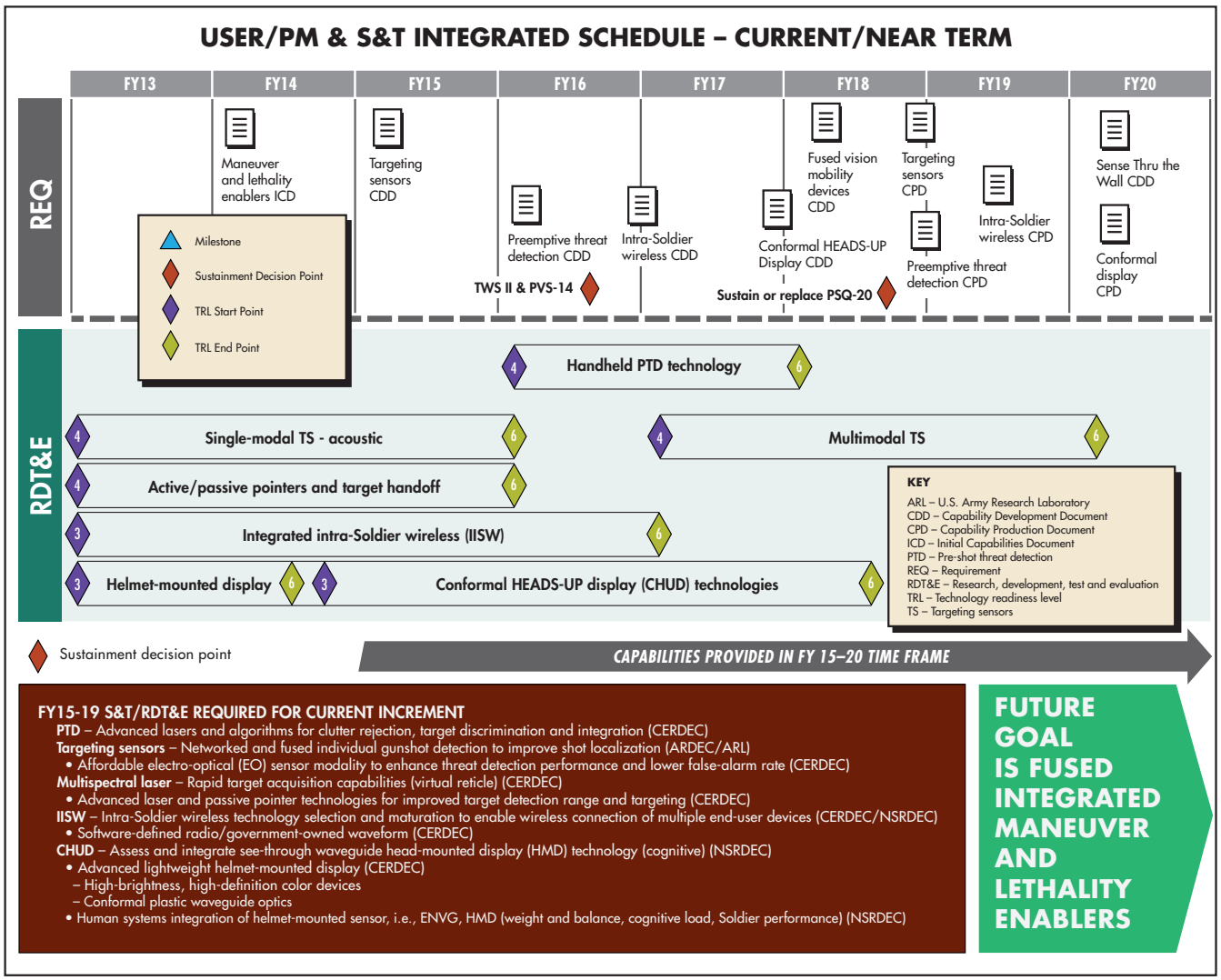
GAP ANALYSIS

The modernization planning process begins with concepts, provided by the U.S. Army Training and Doctrine Command's (TRADOC's) Army Capabilities Integration Center (ARCIC) and U.S. Army Maneuver Center of Excellence (MCoE), which drive threat-informed capabilities-based assessments (CBAs) resulting in a prioritized list of gaps. Capability and materiel developers then collaborate to produce requirement documents that address the DOTMLPF domains—doctrine, organization, training, materiel, leadership and education, personnel and facilities—to mitigate those gaps based on currently available technology.

At this point, the process calls for the U.S. Army Research, Development and Engineering Command (RDECOM) S&T community to provide technologies to address any remaining gaps. If that is not feasible, then the SE may delay the requirement, or look to industry or academia for further development of the necessary technology. The SE tracks these technologies over a specific time frame, using the integrated schedule. S&T partners—such as the Natick Soldier Research, Development and Engineering Center (NSRDEC); the Communications-Electronics Research, Development and Engineering Center (CERDEC); and the Armament Research, Development and Engineering Center (ARDEC)—not only work to narrow capability gaps but also provide insights into future technologies to inform the requirement process.

In addition, as the product manager and TRADOC proponents manage capabilities that have been fielded, sustainment decisions may be necessary that could drive new requirement documents. Sustainment decisions are also necessary when a lack of funding or insufficient maturity of materiel solutions delays requirement documents. Instead of modernizing a capability, the decision

FIGURE 1



TAKING THE LONG VIEW

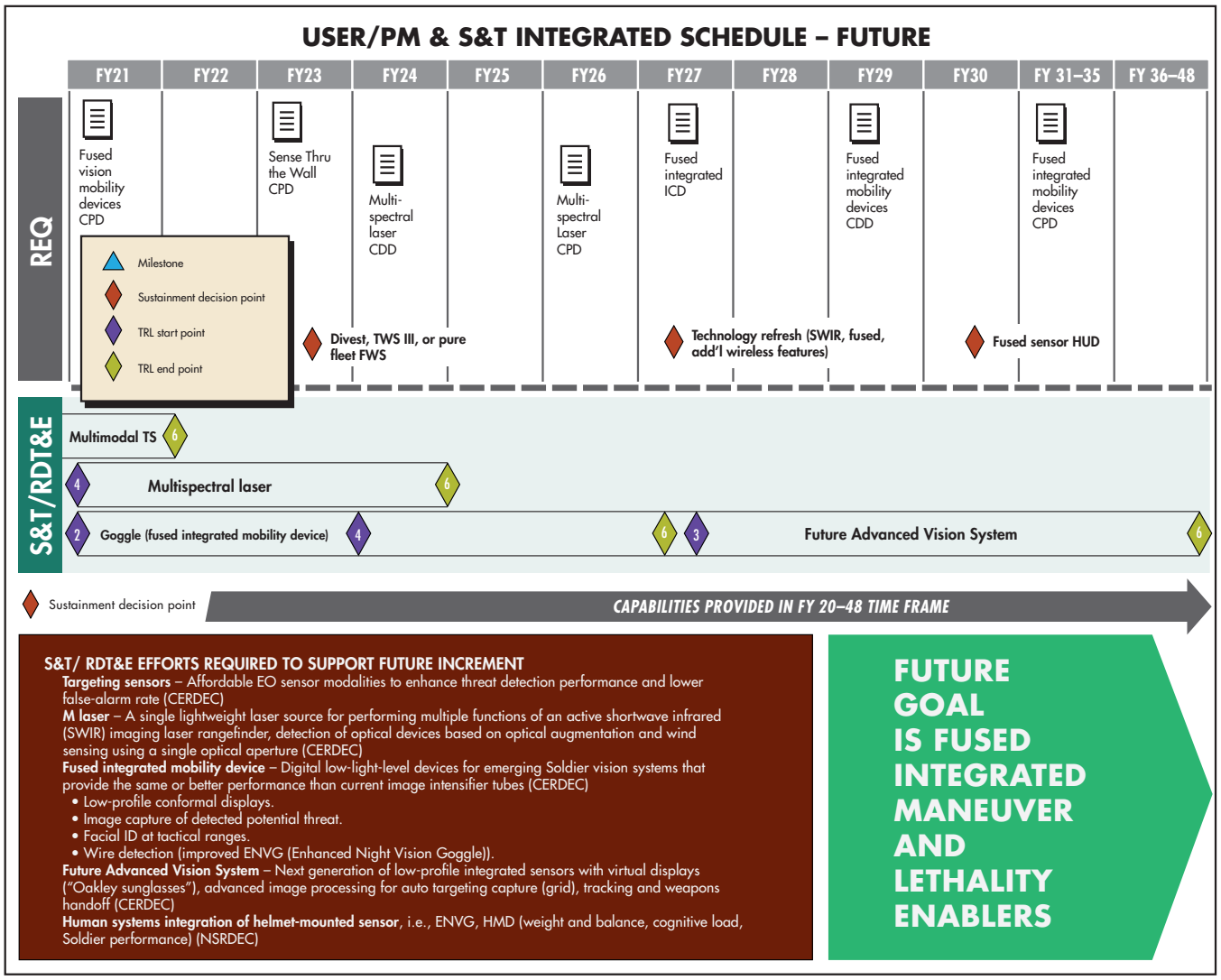
This SMP integrated schedule for maneuver and lethality enablers illustrates just how deep the SE dives in its long-term planning. With each subsequent deep dive, the SE is refining how it lays out the integrated schedule for ease of understanding. (SOURCE: PEO Soldier)

to sustain an item is necessary to keep that current capability within the Army.

The SMP takes the fundamentals of planning as a materiel enterprise to a new level. Whereas the focus over the past 13 years of war has been primarily on getting the needed equipment to the Soldier as quickly as possible to meet urgent needs, the SMP calls on all the members of the SE to pinpoint exactly where each of their pieces of the process will come into play. Thus they can see the impacts on people and programs if some aspect falls behind schedule or needs to be accelerated.

'DEEP DIVE' ASSESSMENTS

The SMP enables tracking of critical efforts out to 2048 through "deep dives" into the top nine Soldier capability gaps. Preparation for these deep dives, the first of which was in March 2013 at Fort Belvoir, VA, requires all the stakeholders to understand the others' roles and



missions. Detailed planning for the next 30-plus years is difficult enough for the materiel developer, not to mention factoring in when requirements must be generated to support future PORs, and when and where the S&T efforts might transition along the life cycle. Tackling these challenges called for new skills—working outside of one's own stovepipe with the rest of the SE, and thinking beyond the program objective memorandum (POM) to arrive at a holistic, enterprisewide view of a Soldiers' capabilities and planning to achieve those capabilities. Until recently, strategic planning typically has occurred only through a POM cycle.

In the first SMP deep dive, subject-matter experts from the capability, technology and materiel development communities presented the findings of several months of analysis. This culminated in the development of integrated schedules for small unit power, limited visibility and lethality enablers, and Soldier protection, specifically the Soldier Protection System. SE leaders traced current and projected requirement documents, technology transitions and PORs out to 2048 for these three capability areas. The integrated schedules included decision points at which equipment modernization might be necessary through new starts. They also highlighted current capabilities that might be "good enough" and require sustainment, and identified potential technology insertion points for the expected next generation of that capability.

CAPABILITY CLOSE-UP

The AN/PAS-13 TWS provides Soldiers with individual and crew-served weapons the capability to see deep into the battlefield, penetrating obscurants day or night. In its assessment of lethality capabilities, the SE saw clearly that the Army needs to continue FWS development given questions about the future availability of focal plane arrays within the TWS. (Photo courtesy of PEO Soldier)

Additionally, the collaborative sessions afforded the SE a detailed assessment of each gap through the lens of the three different developers. For example:

- During the discussion on small unit power, participants identified a decision point for additional funding to enable modernization of this critical capability, which helps reduce the logistical footprint and results in a leaner force. The SMP also underscored that the power requirements for the Soldier are enormous and ever-increasing—requiring more than just better-designed batteries, which the Soldier still must transport. This fact also arose during the deep dive on mobility. (See below.)
- Our assessment of lethality enablers underscored that, given the age and life expectancy of existing Thermal Weapon Sights (TWS), specifically the future availability of focal plane arrays within the sights, it is imperative to continue development of the Family of Weapon Sights (FWS) (individual, crew-served and sniper variants). These critical sustainment issues, plus the need to maintain overmatch and improve lethality, highlighted the need to focus on FWS and supported work to ensure funding for this key capability.
- Our protection assessment determined that while the Soldier Protection System may be the next generation of Soldier protection, the long-term sustainment of existing protection capabilities needs to continue.

A second deep dive took place in June 2013 at Fort Benning, GA. Stakeholders included not only the capability, technology and materiel developers from ARCIC and MCoE, NSRDEC and CERDEC, and PEO Soldier, respectively, but also HQDA staff members from G-3, G-4 and G-8. The HQDA representatives provided the "Big Army" view of the integrated schedules and assessments as they related to requirements, sustainment and funding. During this deep dive, the SE concentrated its efforts on night vision (NV) and maneuver enablers, mission command and situational awareness, specifically Nett Warrior and load carriage. For example:

- The integrated schedule for NV and maneuver enablers underscored that parts for current NV systems will become outdated or obsolete as the technology advances, and manufacturers won't produce them anymore. In addition, the deep dive identified several sustainment decision points in the near future.
- Although pushing the network to the tactical edge remains the number one capability gap at the squad level, fiscal realities and programmed solutions, such as Nett Warrior, will require a review of existing mission command capabilities at each echelon within the Army formations to determine what is feasible.

THE SMP IS OUR SYSTEMATIC APPROACH TO SETTING LONG-TERM EQUIPPING AND SUSTAINMENT PRIORITIES, RESULTING IN A WELL-THOUGHT-OUT, ANNUALLY UPDATED 30-YEAR MODERNIZATION STRATEGY.

- The load carriage deep dive, which focused on efforts to solve the issue of overburdened Soldiers, determined that equipment off-loading and power generation could be potential solutions. The Squad Multi-purpose Equipment Transport (SMET), a robotic mule, could take equipment off the Soldier and provide power generation but would require additional resources. MCoE has identified the SMET as an effort that should compete for funding in the FY 17-21 POM, and the requisite requirements documents are being finalized.

The third deep dive was in August 2013, again at Fort Belvoir, and the focus was lethality, specifically improving it and maintaining overmatch. Participation again went beyond the immediate stakeholders to include PEO Ammunition, allowing for the deep dive to look at ammunition and weapon as a system. This included efforts in counter-defilade target engagement (CDTE), volume effects and precision effects:

- The CDTE discussion determined that the Army should pursue development of 40 mm and shoulder-launched munition solutions as complementary capabilities to the current CDTE solution, the XM25.
- The volume effects deep dive highlighted the possibility of potential industrial base issues associated with machine gun production lines going cold, such as for the M249 Squad Automatic Weapon and M240 7.62 mm medium machine gun. Furthermore, much discussion centered on the need for a small arms ammunition configuration study, in line with the HQDA G-3 directive of Dec. 5, 2013. The purpose of the study is "to provide an updated ammunition solution assessment to mitigate the capability

THE POWER OF COLLABORATION

The Hon. Katherine Hammack, assistant secretary of the Army for installations, energy and environment, talks with CERDEC engineer Jonathan Novoa in the Pentagon's center courtyard Nov. 14, 2013, at an Army exhibit of how its research and engineering centers are enabling advances in operational energy for Soldiers. The SE's deep dive into small unit power capabilities required close collaboration among its members in the capability, technology and materiel development communities to arrive at a comprehensive view of capabilities, gaps and how to mitigate or eliminate them. (U.S. Army photo by Conrad Johnson, RDECOM)

READY, AIM, PLAN

Soldiers from 4th Brigade Combat Team, 101st Airborne Division (Air Assault) (4-101 ABN) conduct a machine gun range on Forward Operating Base Thunder, Afghanistan, Sept. 27, 2013. The SE's volume effects deep dive highlighted the possibility of potential industrial base issues associated with machine gun production lines going cold, such as for the M249 Squad Automatic Weapon and M240 7.62 mm medium machine gun. (Photo by MAJ Kamil Sztalkoper, 4-101 ABN)

SNIPER STRATEGY

SGT Charles Hyatt, assigned to 6th Squadron, 4th Cavalry Regiment (6-4 CAV), 3rd Brigade Combat Team, 1st Infantry Division, provides security with the M14 Enhanced Battle Rifle sniper weapon Nov. 10, 2013, in Pul-i-Khomri, Afghanistan. The SE's third deep dive included a discussion of precision effects, resulting in further alignment of the sniper weapons strategy among the stakeholders. (Photo by 1LT Cory Titus, 6-4 CAV)

gaps prescribed in the Small Arms CBA, and inform small arms weapons priorities and modernization strategy."

- The discussion of precision effects succeeded in further alignment of the sniper weapons strategy among the stakeholders.

CONCLUSION

The capability, technology and materiel developers who make up the SE are committed to investing in capabilities that will give Soldiers a decisive edge to achieve battlefield dominance. The SMP is our systematic approach to setting long-term equipping and sustainment priorities, resulting in a well-thought-out, annually updated 30-year modernization strategy.

The key to the SMP is the integrated schedule. By requiring each participant to indicate when their part of a capability effort's life cycle is to occur, each organization accepts responsibility for the success of the total effort. The time and work devoted to developing the nine deep dive assessments continue to be extremely productive for the SE.

The deep dive integrated schedules and assessments provide the basis for the annual Soldier and Squad Systems Review, with senior leader participation from TRADOC, the U.S. Army Materiel Command and the U.S. Army Forces Command. The SMP deep dives also inform the G-8's Soldier Portfolio Long Range Investment Requirements Analysis. Additionally, the Army chief of staff's ongoing Force 2025 initiative seeks to develop similar road-mapping efforts across the Army. By aligning the Soldier portfolio, the SMP provides a unified modernization strategy for the SE and presentation to leadership. Furthermore, the current environment of fiscal constraint only highlights the need for the SE to exercise autonomy in long-range planning.

The integrated schedules developed during the deep dives are living documents. The next updates will align with the release of MCoE's updated Soldier CBA later this year. CBAs identify capability requirements and gaps, and typically justify entry into the Joint Capabilities Integration and Development System process for identifying, assessing, validating and prioritizing joint military capability requirements. Aligning future SMP updates with the Soldier CBA will continue to solidify the modernization strategy for Soldier efforts.

The FY13 deep dives were a horizontal look at the top nine Soldier capability gaps. Besides updating these nine gaps, the SMP will examine other areas within the Soldier portfolio. The SE's current

SHIFT IN SUPPORT

Soldiers from 2nd Battalion, 87th Infantry Regiment of 3rd Brigade Combat Team, 10th Mountain Division (3-10 MTN), on a force protection patrol, stop at a hilltop overlooking the village of Mohammad Agah, Afghanistan, Jan. 23. The SMP takes planning as a materiel enterprise to a new level to ensure investment in capabilities that will give Soldiers a decisive edge to achieve battlefield dominance, in contrast with the wartime focus on getting needed equipment to the Soldier as quickly as possible to meet urgent needs. (Photo by CPT John Goodwill, 3-10 MTN Public Affairs)

deep dive focuses on small arms fire control, with future deep dives to look at indirect precision effects targeting, aircrew-specific equipment, and micro drones and sensors, to name a few capability areas.

The next step for the SMP, after all of the deep dives are complete, will be to take a vertical look at capabilities across the Soldier portfolio, to gain a true understanding of the interrelationships.

This vertical look will lay out all of the deep dives to see potential points of intersection, which will allow the SE to influence future programming and budget decisions within the Soldier portfolio. Additionally, we will review past work to ensure that we are in line with the Army Vision Force 2025 and Beyond efforts.

The decisions that have emerged so far from the deep dives could not have happened if all SE stakeholders were not working together. In most cases, the value of the SMP was more in the actual sitting down, planning and learning to work smarter within the SE than the integrated schedules that the participants produced. When capability gaps, requirement documents, technologies and PORs are all part of a coherent story and all stakeholders in the enterprise are in agreement, we will be that much more efficient and effective in improving Soldier dominance in Army operations, today and in the future.

For more information, contact the author at 703-704-4216.

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Road Maps *to the* FUTURE

PEO Missiles and Space takes visual approach to strategic modernization planning

by Ms. Marcia Holmes

The drawdown from Afghanistan. Declining budgets. Temporary versus permanent solutions. Evolving threats. A shifting operational focus. Responding to all of these factors in a 30-year plan for modernizing capabilities is no small feat for the Army's materiel providers.

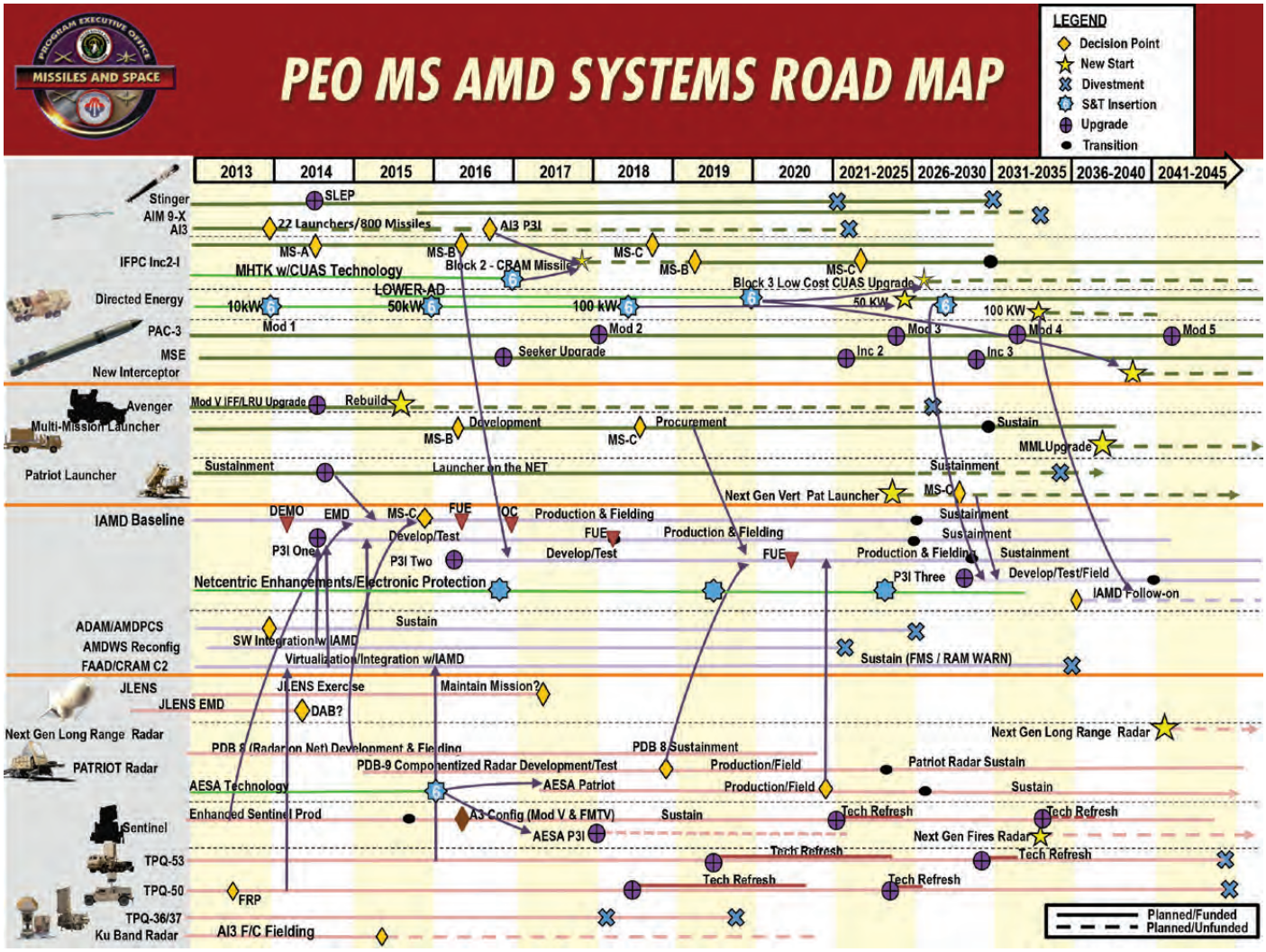
To meet this objective, Program Executive Office Missiles and Space (PEO MS) has employed a long-term approach establishing a vision to modernize its portfolios of systems: a set of 30-year technology road maps that provide a visual depiction of program upgrades along with relevant science and technology (S&T) projects that will be matured and then transition to the program of record (POR) in a future upgrade.

PEO MS' development of technology road maps began in earnest in 2012. The road maps draw from a number of different sources. The basis for them is the POR development schedule, including planned upgrades and the transition of S&T efforts. The POR schedule depicts activities funded in the program objective memorandum (POM) or planned POM requests. PEO MS planners then add the modernization plans developed by the U.S. Army Training and Doctrine Command (TRADOC) centers of excellence (COEs), as well as long-term strategy for the portfolio and projections from the long-range investment requirements analysis (LIRA) process.

This effort reconciles the plans and sets the stage for resolution at stakeholder forums, such as home-on-home engagements with the COE, program reviews with Army leadership and POM reviews with HQDA G-8.

Additionally, PEO MS has provided its 30-year road maps to interested industry partners to give them a look at current and future needs. One of the goals of this 30-year strategic planning process is to incorporate the technology development efforts of industry into the PEO's strategic planning, to ensure that industry's research and development initiatives are in alignment with Army needs for successful transition. Incorporating industry initiatives into the road maps creates an opportunity to leverage them in future Army investments, improving successful transition rates and returns on industry investment while shortening timelines and reducing development risks for the Army.

FIGURE 1



KEY

ADAM – Air defense airspace management
AESA – Active electronically scanned array
AMD – Air and missile defense
AMDPCS – AMD Planning and Control System
AMDWS – AMD Workstation
CRAM – Counter-RAM
FUE – First unit equipped
IAMD – Integrated air and missile defense
IFF/LRU – Identification, friend or foe/line replaceable unit
IFPC – Indirect Fires Protection Capability
IOC – Initial operational capability
JLENS – Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System
KW – Kilowatt
MHTK – Miniature Hit-to-Kill
MML – Multi-Mission Launcher
MS – Milestone
MSE – Missile Segment Enhancement
PAC – Patriot Advanced Capability
PDB – Post-deployment build
RAM – Rocket, artillery, mortars
SLEP – Service life extension program

ONE PICTURE, MANY PIECES

The 30-year technology road map that PEO MS developed for the AMD portfolio illustrates the relevant development activities necessary to fulfill long-term plans. (SOURCE: PEO MS Office of the Chief Engineer)

A HIGHER LEVEL OF PLANNING

Program managers (PMs) are in the habit of planning and defending program development efforts in response to acquisition regulations and guidelines. This practice, an inherent part of the acquisition process, typically is captured in the program acquisition strategy for PORs. With the recent directive from the assistant secretary of the Army for acquisition, logistics and technology (ASA(ALT)) to incorporate long-term strategic planning into program management, PEO MS has extended the established process to include planning for portfolios—a set of similar programs aligned with a TRADOC COE or warfighting function—and strategic visions to accomplish new missions.

This attention to long-range planning from top Army leadership has enabled the development of technology road maps

from a number of portfolio and capability perspectives, ranging from simple historical program evolution to road maps that incorporate S&T, modernization initiatives, and other program and budget information.

To meet the challenge to support a number of plans from a number of perspectives, it is in the PEO's best interest to develop a road map that is synchronized across stakeholders and captures as many of the requirements as possible.

Data usually are readily available to build coordinated plans, and initial road maps can take just a few days to build. However, this assembly of data is just the first step. The PEO must resolve recommendations from the various stakeholders to ensure their buy-in. By and large, the initial work within PEO MS has shown that current S&T investments are in concert with future system needs and will support the overall modernization strategy.

Updating the road maps is a continuous work in progress in the Army's ever-changing environment. A number of factors influence changes, including fiscal realities, changing requirements and evolving threats. Through the structured process of building a 30-year road map, the PEO defines long-term program goals that recognize the ever-present element of change.

Each project office has a staff that assembles the road map from its perspective, including planned S&T transitions. PEO MS employs one full-time person on staff who coordinates with project offices, the COE and S&T communities to incorporate portfolio requirements and LIRA projections.

TOOLS OF THE TRADE

Today, PEO MS captures its road maps in various sets of PowerPoint slides built to address portfolio- or program-specific plans. Each represents a snapshot in time. To maximize flexibility in view of the need to account for our ever-changing environment, the PEO MS Office of the Chief Engineer has established an ongoing effort to capture all program activities within Microsoft Project Professional, a Web-based scheduling tool. This allows for real-time evaluation of specific efforts by stakeholders in the project office and staff. By linking S&T development schedules in this Web-based environment, the PEO can better explore the impacts of technology readiness and funding shortfalls on technology transitions. More work is to be done to incorporate long-range COE plans into this environment.

The PEO is also evaluating the ability to link this Web-based scheduling tool with other model-based system engineering tools, such as MagicDraw. If the linkage succeeds, PEO MS program plans will be unified automatically with architectures and requirements. This capability will allow the PEO to evaluate the effects of real-time changes to requirements on plans, architectures and system capabilities, with the potential for "what if" analyses and quick-turn assessments of funding impacts on long-term solutions. The result will be a comprehensive snapshot of impacts that can support senior leaders in a timely manner.

MAPPING AIR AND MISSILE DEFENSE

Figure 1 on Page 27 depicts the planning strategy for the air and missile defense (AMD) portfolio. In the recent conflict, the Army identified a need to protect Soldiers in forward operating bases against incoming rockets, artillery and mortars (RAM). The response to this urgent need

AMD COMMAND AND CONTROL
The Integrated AMD (IAMD) Battle Command System, shown here with the Integrated Collaborative Environment, provides a common mission command capability enabling control and management of Army IAMD sensors and weapons. (Photo courtesy of IAMD Project Office, PEO MS)

was the fielding of RAM Warn followed by a Land-Based Phalanx improvement to counter the RAM threat. The Indirect Fires Protection Capability (IFPC) POR has been established to provide the enduring solution.

As Operation Enduring Freedom draws down and the operational focus shifts, this capability will grow to encompass the user's requirement to defend not only against RAM, but also against unmanned aerial systems (UAS). IFPC Increment 2 – Intercept (IFPC Inc2-I) is the POR established within PEO MS to address these additional requirements. The road map reflects the program milestones.

A number of planned S&T initiatives support the IFPC program. Miniature Hit-to-Kill, with counter-UAS capability developed by the U.S. Army Aviation and Missile Research, Development and Engineering Center (AMRDEC), is expected to mature to a Technology Readiness Level (TRL) 6 and transition to the POR during the engineering and manufacturing development phase. Directed energy has the potential to provide leap-ahead technology improvements for IFPC. However, several complex technologies must mature before this capability can transition; the road map tracks incremental capability and ties it to program milestones.

The AMD road map also shows the complementary weapon system development and how that fits into making IFPC a successful component of Army integrated AMD. The road map makes it easy to see all of the intricate connections that are necessary among program development efforts to provide a capability to the PEO portfolio and the warfighter. One missed milestone can have a significant ripple effect.

INTEGRATED FIRE CONTROL

CPT Jonathan Hathaway, assistant product manager for integrated fire control in PEO MS' IAMD Project Office, stands beside an Integrated Fire Control Network (IFCN) relay on display outside the Pentagon in March. The IFCN integrates Army IAMD sensors, weapons and a common mission command capability. (Photo by David Vergun, Army News Service)

PRACTICAL CHALLENGES

While the technology road maps have proven useful in defining how the PEO and stakeholders will address capability requirements across program increments, including S&T investments, many challenges have arisen in compiling the road maps. These challenges include ownership, competing priorities, fiscal realities and technology maturation.

Program schedules are the PM's primary tools to define priorities for funding and execution. PMs and, in turn, PEOs use them extensively to support senior-level program reviews and requests for data. One unauthorized change in a program's plan could have significant impacts on a POR if widely disseminated. For this reason, PMs prefer to maintain configuration control of all related schedule artifacts.

Competing priorities exist across the Army—in the user, acquisition and research communities. If each organization maintains an independent road map, there is a risk that its priorities will take precedence over all others. This does not allow for the coordination of activities and prioritization of limited fiscal resources. Only through collaboration and synchronization of efforts in a single portfolio road map can the Army realize efficiencies.

Finally, estimating technology maturation is a daunting challenge in road map development. Many technologies under consideration for transition to a POR are next-generation, advanced concepts with the potential to change the battlefield. These concepts rely on the technological maturation of a number of components. Acquisition regulations require certification of a TRL of 6 or greater at Milestone B before a concept transitions to a POR, but this is often very difficult to estimate. Variances arise in program acquisition strategies and road map planning when technology develops more rapidly than expected or there are delays in maturation.

MULTIPLE BENEFITS

These challenges notwithstanding, PEO MS' strategic road-mapping process provides many benefits. A specific example is the synchronization of activities relative to long-term portfolio planning. PEO MS manages eight project offices with a variety of products, including missiles, radars, and command and control elements, that span four independent portfolios. A COE manages each portfolio, identifying requirements, priorities and modernization efforts within it. The PEO and the appropriate project office are responsible for materiel solutions to meet COE requirements for modernization and new development.

When a particular materiel solution does not exist, but component technology could be available to support modernization, the S&T engineering development centers explore potential technologies that support the requirements. Given the current fiscal uncertainties, plans for modernization and materiel development must coordinate closely to ensure synchronization of priorities. The road map process allows the community of stakeholders a synergistic format to overlay PM development plans with COE requirements and S&T availability.

PEO MS is in close alignment with its S&T development partners. Proximity to AMRDEC and the U.S. Army Space and Missile Defense Command/Army Forces Strategic Command facilitates collaboration to plan S&T efforts and execute successful transitions. The PEO MS road maps reflect relevant schedules for technology development, linking the S&T effort directly to an identified POR for transition and pinpointing dependencies between the materiel development and S&T efforts.

S&T stakeholders have semiannual reviews with the PEO, along with quarterly reviews with PM offices and weekly meetings with engineering staffs. These collaborations help manage expectations for both the acquisition and S&T communities regarding technology maturation and transition timelines. The road maps have served as the forcing function for alignment of technology transition and program increments, allowing for early updates to program acquisition strategies.

A third benefit of the road map is its visual impact, integrating all the stakeholders' interests. In a single graphic, the PEO can describe the user requirements for the portfolio, what program development activities are underway to meet those requirements and what technology will soon be available.

CONCLUSION

The road map provides a visual means to quantify and represent the variety of impacts quickly. Through due diligence and its structured road map process, PEO MS can support Army initiatives to coordinate and synchronize all development efforts.

For more information, contact the author at 256-842-0289 or ***marcia.b.holmes.civ@mail.mil****.*

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ARL

Modernization planning for the commander's freedom of action must blend current, future capabilities

by Mr. Stephen J. Bielamowicz

The ability to adapt quickly to and address the immediate threats our forces faced in Operations Enduring and Iraqi Freedom (OEF and OIF) is a testament to the materiel development community and the strategic strength it represents. Conversely, though, the continuous adaptation redirected significant time and resources away from maintaining full-spectrum capabilities that address more traditional threats, and from modernization efforts to ensure our forces' ability to win the future fight. For example, improvised explosive devices (IEDs) posed a significant and evolving threat to our deployed forces in Iraq and Afghanistan. Adapting to this initially novel threat cost time and money that the Army might otherwise have spent on modernization.

Project Manager Close Combat Systems (PM CCS), within Program Executive Office (PEO) Ammunition, is charged with providing innovative area access capabilities to the warfighter to overcome the asymmetric IED threats that otherwise would limit the ability of U.S. troops to maneuver freely. PM CCS develops and manages systems and munitions that shape the battlefield by denying the enemy access to key terrain and restricting the enemy's ability to maneuver freely.

PM CCS originally developed and fielded systems such as the Self-Protection Adaptive Roller Kit (SPARK), the Rhino passive infrared defeat system, the Husky Mounted Detection System (HMDS) and various handheld devices, under joint urgent operational need statements (JUONS). These systems increased the commander's freedom of action by improving the mobility of deployed forces and preserved combat strength by saving lives and reducing equipment loss.

However, as the war in Afghanistan winds down and the Army rebalances its strength toward the Asia-Pacific theater, the PM CCS team and operational users are reassessing the necessary anti-access and area-denial (A2/AD) capabilities for the present and the future. Envisioning the threats of the next 20 to 30 years and aligning efforts with U.S. national security strategy, the Army has refocused on modernizing A2/AD capabilities that effectively support freedom of movement for friendly forces while impeding it for the enemy. The challenge facing PM CCS and PEO Ammunition now, similar to that facing other PEOs' program managers, is how best to manage and align diminished resources to ensure the continued sustainment and modernization of our A2/AD technologies to address anticipated capability gaps.

FAMILY OF SCATTERABLE MINES

FASCAM represents the U.S. inventory of nonpersistent land mines. It includes the Modular Pack Mine System (MOPMS), Pursuit Deterrent Munition (PDM), the ground- or rotary aircraft-emplaced Volcano, Remote Anti-Armor Mine (RAAM), Area Denial Artillery Munition (ADAM) and Gator, with different ranges and means of delivery. Future AD systems need to retain the effectiveness of the FASCAM systems while providing more operational flexibility and the ability to discriminate between targets more effectively. (Photo courtesy of U.S. Army)

Although the U.S. footprint in the Afghan theater is decreasing, our forces will continue to face a hybrid threat of IEDs and other irregular warfare tactics. According to the Center for Naval Analyses' May 2013 report "The Post-Afghanistan IED Threat Assessment: Executive Summary" (online at **www.cna.org/sites/default/files/research/DSI-2013-U-004754-Final-.pdf**), IEDs remain a global threat. The unified combatant commands are concerned that the enemy will use tactics from OEF and OIF to target U.S. interests in their areas of responsibility.

Future IED and other threats will assuredly share one key characteristic with today's threat: The enemy will improve them in an attempt to counter defeat. With knowledge gleaned from experience, future capabilities must be as flexible as the threat and enemy they will be employed against. In the case of IEDs, the enemy will use any tools and materials at their disposal to improve fabricated devices. If what they can produce does not fit their employment techniques, they will change tactics. If U.S. forces can render hostile techniques and tactics

ineffective, the enemy will seek alternate materials and sources of supply to create employable systems.

Therefore, the Army must design future systems with two overarching goals in mind. Systems must provide a broad baseline capability, in this case detection, while maintaining maximum flexibility for future modifications to counter emerging threats.

MODERNIZATION INITIATIVES

The Army is harvesting and modernizing previously fielded equipment to meet near-term requirements for countering the IED threat on the battlefield while planning for long-term modernization. Specifically, the Army is preparing HMDS for fielding to route clearance companies and brigade engineer battalions in the Army force structure. In conjunction with the engineer proponent at the U.S. Army Maneuver Support Center of Excellence (MSCoE), PM CCS has implemented deliberate steps to retain the current capability while keeping an eye on future improvements, to get the most value for the taxpayer's investment.

The Army is fielding HMDS in increments to allow future insertion of technologies still in development. This approach permits the near-term integration of the initial capability into the operating force while allowing capability modernization in the future. The initial increment will consist primarily of JUONS-fielded systems with a ground-penetrating radar capability that are currently in theater. The second increment will introduce the deep-buried detection capability, which will increase the system's effectiveness in finding deeply buried metallic explosive hazards. The final increment will add a semiautonomous capability allowing remote operation of HMDS, thus

SPIDER SETS THE STAGE

The Spider Networked Munition System, which has proven to be a highly effective force protection capability in OEF, provides munition field effectiveness equivalent to the capabilities provided by antipersonnel land mines, but without the life-threatening risks that persist after hostilities end. Future AD systems will need to provide a remote command-and-control capability similar to Spider's, but at much longer ranges. They will also need to have scalable effects for escalation of force, from nonlethal to antipersonnel and anti-vehicle. (Photo courtesy of U.S. Army)

SEND IN THE HUSKY

The Army is preparing the HMDS, shown here in use Sept. 24, 2013, by Marines with the 3rd Combat Engineer Battalion, for fielding to route clearance companies and brigade engineer battalions in its force structure. Fielding will be in increments, to allow future insertion of technologies still in development. (Photo by Cpl Austin Long, 2nd Marine Division)

FRONTAL DEFENSE

A 201st Afghan National Army Corps soldier negotiates a rough terrain course Sept. 28, 2013, at Forward Operating Base Gamberi using an Up Armored Medium Tactical Vehicle and mine roller on the final day of a five-week training course. Systems such as the mine roller have increased the commander's freedom of action in OEF by improving the mobility of deployed forces. (U.S. Army photo by SGT Eric Provost, Task Force Patriot Public Affairs)

increasing the standoff distance and reducing risk to the engineer Soldier.

Similarly, the current development of the Autonomous Mine Detection System (AMDS) builds on previously fielded detection capabilities while increasing effectiveness and standoff. To better employ this capability within dismounted formations, the U.S. Army Engineer School conceived the AMDS payloads. AMDS seeks to place detection capabilities on a robotic platform to increase standoff distance between the operator and any detected threats. AMDS will include a detection and neutralization payload to counter explosive threats. These modernization effects will improve detection and neutralization capabilities for engineer clearance missions, and will increase A2 capability and Soldier survivability.

AREA DENIAL

The enemy we have faced over the past decade did not have large quantities of heavily armored fighting vehicles or supply transports, so there was no need for our forces to limit or deny the mobility of such assets. As a result, the Army paid less attention to maintaining and training the effective AD capability that unified land operations require. In addition, unlike the A2 portfolio, AD

systems have not benefited from ongoing investments in technology and sustainment. Land mines developed during the Vietnam era are still the only systems available to provide our forces the required AD capability.

Land mines typically have two subcategories: nonpersistent mines, with the ability to self-destruct or self-deactivate, and persistent mines. Persistent land mines, while effective and relatively inexpensive, have no self-destruct ability and have the negative collateral effect of denying both friendly and enemy forces access to the mined area. In addition, persistent land mines remain lethal until action is taken to clear the minefield. If persistent mines are not cleared, they can remain a threat to the indigenous civilian populations for decades. As a result, U.S. land mine policy banned the use of all persistent land mines after 2010, leaving nonpersistent land mines as the only option currently available for operational use.

The U.S. inventory of nonpersistent land mines is the Family of Scatterable Mines (FASCAM). FASCAM systems include the hand-emplaced Modular Pack Mine System, ground- or rotary aircraft-emplaced Volcano, artillery-delivered Area Denial Artillery Munition and Remote Anti-Armor Mine, and the high-speed, aircraft-delivered Gator. FASCAM systems are more effective than older persistent mines because of their more advanced target detection capability. However, they are also more expensive because of their more advanced technology.

All FASCAM systems have a highly reliable self-destruct capability with a self-deactivation backup that greatly reduces any residual threat to civilian populations. However, like persistent mines, the FASCAM systems limit the mobility of friendly forces while emplaced. There is no remote-control capability, and they are indiscriminately activated by the proximity of the target.

ENGINEERING A SOLUTION

Engineers with the 91st "Saber" Brigade Engineer Battalion, 1st "Ironhorse" Brigade Combat Team, 1st Cavalry Division (1-1 CAV) fire a simulated mine-clearing line charge at an obstacle Nov. 12, 2013, during a combined arms live-fire exercise with tankers assigned to 2nd "Stallion" Battalion, 8th Cavalry Regiment of the Ironhorse Brigade, as part of the training exercise Ironhorse Rampage at Fort Hood, TX. Engineer Soldiers are among the primary beneficiaries of new developments in A2 capabilities. (U.S. Army photo by SSG John Couffer, 1-1 CAV).

A BALANCED APPROACH

As the Army modernizes capabilities to address these gaps, future AD systems need to retain the effectiveness of the FASCAM systems while providing more operational flexibility and the ability to discriminate between targets more effectively.

One current AD system, already in use in Afghanistan, that exemplifies this balance of effectiveness and flexibility is the Spider Networked Munition System. Spider is not a land mine; it is not activated by the presence, proximity or contact of a target. When the system detects a potential target, it alerts a human operator, who then identifies the target and determines whether to fire the lethal or nonlethal effects.

This system has proven highly effective in a force protection role in support of OEF. Future AD systems will need to provide a similar remote command-and-control capability, but at much longer ranges. They will also need to have scalable effects for escalation of force, from nonlethal to anti-personnel and anti-vehicle.

MSCoE, which plays a large role in modernizing AD systems and influencing their capabilities, is currently developing requirements that outline the overarching AD capabilities for potential future conflicts and scenarios. These requirements address the shift away from attacking enemy mobility

MINE WORKERS

A combat engineer squad assigned to Brigade Special Troops Battalion, 2nd Brigade Combat Team, 82nd Airborne Division (2-82 ABN) emplaces an M131 Modular Pack Mine System Sept. 19, 2013, as part of a sapper competition on Fort Bragg, NC. (U.S. Army photo by SSG Jason Hull, 2-82 ABN Public Affairs)

and instead focus on developing new means of denying enemy movement and freedom of action.

The probable next-step AD capability will be scalable, precise in application and discrete in effects. The future capability must be able to integrate with existing battle command systems and enhance the effects of force application and stability operations that seek to separate the friendly and non-committed from hostile elements.

Lessons learned during the Spider program will guide the modernization of FASCAM and the development of replacement systems. One of the most significant challenges during Spider development was the safety-critical nature of the system, the result of having software control the munition fuze. In order to receive safety certification and eventual full materiel release, the development team worked closely and frequently with the Army Fuze Safety Review Board to review the architecture, design and test results, and to ensure that a safety process was established and followed throughout the program. This close coordination with the safety community will be a process model during the modernization of future software-controlled munition systems.

Another lesson learned during the development of Spider was that battalion commanders quickly realized during collective training exercises that emplacing a Spider field required the opposing force to rethink their approach completely. Realistic training aids, devices, simulators and simulations for FASCAM replacement systems will facilitate collective training at home stations and combat training centers. This will demonstrate to commanders the value of emplacing these systems during operational engagements and will promote the train-as-you-fight construct.

In addition, PM CCS must endeavor to reduce development and production cost by applying acquisition strategies such as competitive procurement and leveraging existing commercial technologies.

CONCLUSION

The need for continued modernization and sustainment of A2/AD capabilities will endure for limited conflicts, hybrid threats and decisive operations conducted as part of unified land operations.

Future systems need to be agile enough to counter ever-changing threats but still affordable enough to produce and sustain with limited resources. Investing in the modernization of new A2/AD technologies is critical to shaping the battlefield while ensuring the mobility of friendly forces and concurrently minimizing risks to civilian populations. Based on a strong relationship with the combat development community and a track record of developing and delivering safe, reliable and effective A2/AD systems, PM CCS is well-positioned to provide our forces with the modern materiel solutions necessary to support our nation's security strategy, ensuring mobility- and terrain-shaping capabilities on the battlefield well into this century.

For more information about PM CCS, go to ***http://www.pica.army.mil/pmccs/Default.html.***

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‘Jazzing’ It Down

JASRs provide forum to facilitate optimization of materiel acquisition and sustainment

by COL Paul Brown

QUESTIONS AND ANSWERS
Via and Shyu address questions from the workforces of CECOM, U.S. Army Research, Development and Engineering Command, and PEOs Nov. 5, 2013, at Aberdeen Proving Ground after the first JASR. The reviews provide a forum for LCMCs and PEOs to voice local issues and opportunities. (Photo courtesy of AMC Public Affairs)

In the face of reduced resources, evolving threats and advancing technologies, the U.S. Army Materiel Command (AMC) has teamed with the assistant secretary of the Army for acquisition, logistics and technology (ASA(ALT)) to explore opportunities to integrate and synchronize efforts across the Army materiel enterprise.

To meet that intent, the Hon. Heidi Shyu, ASA(ALT), and GEN Dennis L. Via, AMC commanding general, established recurring Joint Acquisition Sustainment Reviews, or JASRs, commonly known as "jazzers," for FY14. Co-chaired by the two leaders, JASRs are forums in which key stakeholders from ASA(ALT) and its program executive offices (PEOs), AMC and its life-cycle management commands (LCMCs), and other key organizations assemble to discuss pressing topics essential to ensuring a viable materiel enterprise. Examples of such topics include the organic industrial base, the transition from production to sustainment and contracting perspectives.

The purpose of JASRs is to optimize the materiel acquisition and sustainment functions, stressing partnership and collaboration to strengthen the enterprise and ensure Army materiel readiness.

THE PARTNERSHIP BEGINS

The Communications-Electronics Command (CECOM) hosted the first forum on Nov. 5, 2013, at Aberdeen Proving Ground, MD, to focus on acquisition and sustainment support solutions for systems, capabilities, capacities and processes in the area of command, control, communications, computers, intelligence, surveillance and reconnaissance. Discussions included developing a strategy to recruit, retain and right-size the science and technology workforce; tailoring the logistics assistance representative and field service representative programs to align with an increased requirement for Army organizations to maintain their own equipment; reviewing, planning and developing intern programs; and platform modernization efforts.

Shyu opened the inaugural JASR by emphasizing the importance of the relationship between AMC and ASA(ALT).

"There's no better partner than GEN Via and AMC. We are absolutely dependent on each other for success," she said. "We have to mutually increase collaboration

SHARED MISSION

Shyu and Via co-chair the first JASR with their respective deputies Gabe Camarillo and LTG Patricia E. McQuistion Nov. 5, 2013, at Aberdeen Proving Ground. The JASR was designed to create a stronger partnership and increased synchronization between AMC and ASA(AL&T). (Photo courtesy of AMC Public Affairs)

and streamline operations, and determine how we're going to walk down this path together."

Via echoed Shyu's comments, stressing the need to align functions, roles, authorities and responsibilities, and work toward interdependent organizations.

"Today is the beginning of the most important meeting between our communities. In this room are the people who sustain and equip our Army," Via said. "We have to build trust and transparency, and it starts with us here."

The CECOM JASR included discussions on initiating comprehensive program reviews and clarifying the life-cycle support process across the materiel enterprise. Shyu stressed the need to conduct routine program reviews with AMC representatives to ensure transparency and consistency, a methodology she said is widely used within industry. The reviews would give AMC a better timeline for when systems and programs would transition to sustainment. The end state is that both ASA(ALT) and AMC have improved collaboration on programs through the life cycle.

STRENGTHENING THE FORUMS

AMC and ASA(ALT) will host additional JASRs twice per year at each LCMC location—CECOM, TACOM, Joint Munitions Command, and Aviation and Missile Command—each focused on the LCMC's respective portfolio. Based on lessons learned from the inaugural JASR, future events will begin with strategic discussion on topics that concern the entire materiel enterprise, followed by discussion on topics specific to the local portfolio. Each LCMC and PEO will have a forum to voice local issues and opportunities, with topics and presentations jointly developed and briefed.

Future JASRs will continue to build on a theme of partnership and collaboration. Materiel enterprise senior leaders will continuously align discussions to topics appropriate for the global acquisition and sustainment environment and local portfolio issues. Future JASR topics may include materiel system transition from production to sustainment; synchronizing AMC workforce skill sets to

OPTIMIZING THE PROCESS

SPC Terance Royster conducts one of five ammunition abatement checks on a Stryker combat vehicle in March 2013 at Kandahar Airfield, Afghanistan, as part of a streamlined retrograde process. The purpose of JASRs is to optimize materiel acquisition and sustainment through partnership and collaboration. (Photo by Sharonda Pearson, 401st Army Field Support Brigade Public Affairs)

PEO requirements; contracting perspectives; roles and functions of the product support manager; and partnering with private industry.

CONCLUSION

In order to be successful across the enterprise, ASA(ALT) and AMC leaders agree that both organizations must create efficiencies through increased collaboration, trust and transparency. "We have a unique opportunity to shape our Army for our future," said Via. "We won't always agree, but we will rise above and determine what's in the best interest of our Army, our Soldiers and our materiel enterprise."

Both organizations understand the challenges they face and the need to overcome complex issues and evolve to a more effective, efficient enterprise aligned to a smaller, regionally aligned Army based in the continental United States.

"We must work together to face challenges collectively. The Army will lose if we suboptimize," said Shyu. "We need to strategically position ourselves to come out as a stronger Army."

For more information, contact the Headquarters, AMC Future Operations Division at 256-450-6963.

COL PAUL BROWN is AMC's G-3/4 chief for future plans and operations. He has served in assignments from tactical maneuver units to the Joint Staff during his 33 years of Army service. An Army logistician by trade, he earned an M.S. in logistics management from the Florida Institute of Technology and a B.B.A. in transportation and logistics from the University of North Florida.

SUPPORTING 'MA DEUCE'

Soldiers from the 4th Brigade Combat Team, 1st Armored Division train on the new M205 Lightweight Tripod with a mounted M2A1 .50-Caliber Machine Gun at Fort Bliss, TX, in November 2013. With a lightweight pintle that allows greater weapon elevation and depression, the M205 is replacing the M3 tripod for the M2/M2A1 and MK19 machine guns. Any transition of new technology to a POR holds lessons learned for PMs. (Photo courtesy of Program Executive Office Soldier)

GROUND TRUTH

Lessons learned in S&T transition and sustainment

by Ms. Jill Iracki

Investing in innovative and operationally relevant science and technology (S&T) and long-term sustainment planning are key components of Army modernization. The Army's Acquisition Lessons Learned Portal (ALLP) offers a wealth of valuable lessons that span the acquisition life cycle, from transitioning S&T products to programs of record (PORs) to planning for sustainment and program termination. Following is a sample of these lessons from opposite ends of the acquisition spectrum, with the corresponding lesson learned (LL) reference numbers.

WIDE-RANGING PERSPECTIVE

GEN Dennis L. Via, commanding general, U.S. Army Materiel Command (AMC), visits Natick Soldier Systems Center, MA, Jan. 30 to learn more about new developments in body armor, Soldier systems engineering architecture, force sustainment systems, vision protection, nutrition and numerous other areas of research and development benefiting the Soldier. As the commander of AMC, Via is directly involved in the research, development and engineering of new S&T concepts as well as life-cycle sustainment. (Photo by David Kamm, Natick Soldier Research, Development and Engineering Center)

S&T TRANSITION

In order to leverage current and upcoming S&T products effectively and maximize the return on S&T investments, the Army needs to devote significant effort to ensuring the successful transition of S&T products to PORs. Proper development of the technology transfer agreement (TTA) and accurate technology readiness level (TRL) assessments will greatly support successful product transitions.

S&T organizations have most frequently identified user requirements as a factor having significant impacts on product transition, with more negative impacts when projects exceed three years.

Negative impacts stem from requirements that are ill-defined and unrealistic, or constantly changing, which may result in the cancellation or delayed transition of products—perhaps rendering the technology no longer valid for the program.

Warfighter capability requirements should drive S&T advanced technology demonstration (ATD) project development to ensure optimal product transition to PORs. The Army S&T Master Plan provides processes and procedures to make proper linkages to warfighter needs and requirements. The S&T project leader should consider the U.S. Army Training and Doctrine Command (TRADOC) capability manager as a signatory to the TTA, validating the required user need, and should stipulate TRADOC responsibilities in the TTA, including periodic reviews of ATD projects to ensure continued relevance to the warfighter. The project leader should conduct a complete project review during the third year of the project, if it is ongoing, and update the TTA to validate the required user need. (ALLP LL #300)

The POR acquisition strategy has also been a major factor in S&T product transition. The integration strategy section of the TTA or technology insertion plan serves as input to this strategy. Well-developed integration strategies, as described in the 2006 TTA template, may benefit the POR acquisition strategy and improve product transitions. It is especially important to identify the level of program manager (PM) commitment and POR funding designated for product transition and integration. The POR acquisition strategy, especially the contracting approach detailed therein, should include technology insertion as part of the overall program from its inception. (ALLP LL #301)

Insufficient understanding of, and planning for, product maturity (i.e., inaccurate TRL assessments and inadequate development schedules) can result in not reaching the required TRL, which hinders product transition.

TRL assessments should follow the April 2011 "Technology Readiness Assessment [TRA] Guidance" from the assistant secretary of defense for research and

MAJOR MILESTONE

The newly updated Kiowa Warrior aircraft, the OH-58F, makes a ceremonial first flight April 30, 2013, at Redstone Arsenal, AL. With new cockpit and sensor modifications, the OH-58F represents the first major upgrade or modernization to the Kiowa Warrior in 20 years. Sound long-range modernization planning allows for the smooth transition of funding lines as well as informs a host of other considerations. (Photo by Denise DeMonia)

engineering (online at **http://www.acq.osd.mil/chieftechnologist/publications/docs/TRA2011.pdf**), particularly with respect to subject-matter expert (SME) qualifications for expertise and independence. Currently, the S&T project SMEs determine the TRLs, while the TRA guidance recommends having independent SMEs measure the TRLs. Also, when possible, project leaders should use historical technology development data from analogous technologies when developing S&T project schedules. (ALLP LL #302)

SUSTAINMENT

In addition to developing new capabilities, modernizing the Army depends on the acquisition community's ability to sustain a capability or provide an upgrade to meet emerging threats and identified capability gaps. PMs should ensure that production does not end before securing funding for needed upgrades, and that a program is not terminated before removing the system from the active inventory.

The managers of one terminated Army program reported that the cancellation of a planned replacement system forced program officials to keep the terminated system viable and in the field longer than originally planned. The termination resulted in the loss of production funding lines, and there was no funding to support a service life extension program (SLEP); a lengthy approval process was necessary to officially restart the terminated program in order to execute the SLEP.

Therefore, it is crucial that the PM or milestone decision authority not recommend officially terminating a program until the HQDA staff makes the decision to remove the system from the active inventory. This would allow program managers to initiate SLEP efforts and modifications or upgrades as required to address capability gaps, given changing threats, until the Army has fielded replacement systems. (ALLP LL #347)

The managers of this program also reported that significant advances in the threat have occurred since its termination, reinforcing the need to modernize the system to maintain its required mission capability. However, the termination resulted in the loss of modernization funding lines. Therefore, after production is complete, PMs should request research, development, test and evaluation or procurement out-year budget lines to maintain the system to current requirements and provide for upgrades to fill emerging capability gaps. (ALLP LL #349)

For more information on these and additional acquisition lessons learned, go to ***https://allp.amsaa.army.mil*** *to request an account.*

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United States Army Materiel Command

AMC Develops and Delivers Global Readiness Solutions to Sustain Unified Land Operations, Anytime, Anywhere

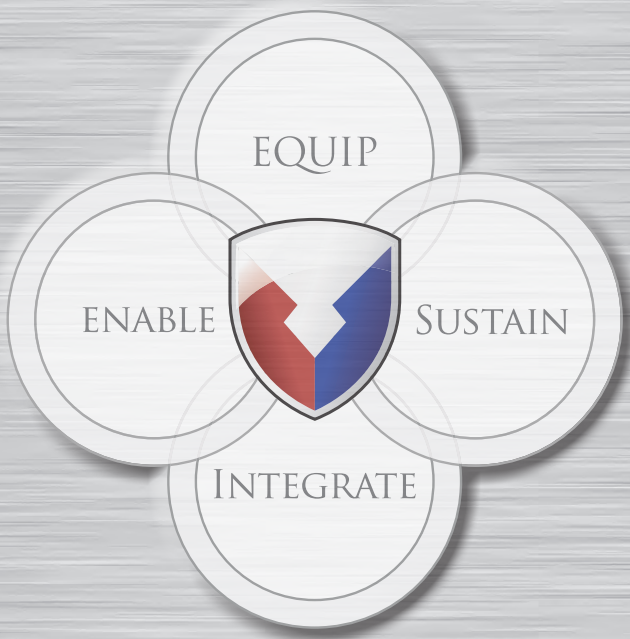
CMA
Chemical Materials Activity

AMCOM
Aviation and Missile Life Cycle Management Command

ACC
Army Contracting Command

CECOM
Communications - Electronics Life Cycle Management Command

JMC/JM&L
Joint Munitions Command/Joint Munitions & Lethality Life Cycle Management Command



USASAC
U.S. Army Security Assistance Command

TACOM
Tank-automotive and Armaments Life Cycle Management Command

ASC
Army Sustainment Command

SDDC
Surface Deployment and Distribution Command

AMSAA
Army Materiel Systems Analysis Activity

RDECOM
Research, Development, and Engineering Command

LOGSA
Logistics Support Activity

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Facilitize **THIS**

LRAS3 program blazes new path in sustaining 'core' support capabilities

by Mr. Scott Winter

A key requirement for any weapon system program is supportability. Now that many programs have reached the sustainment phase of their expected life spans, project managers (PMs) and product managers (PdMs) would do well to consider following the model developed for sustaining the Long Range Advanced Scout Surveillance System (LRAS3).

That's because, unlike when LRAS3 was procured, the government now requires that weapon systems have government long-term support facilities. These do not grow on trees; they are, in fact, the result of work that sometimes takes years to complete.

LRAS3 has an expected life span of 20 years, stretching costs far beyond initial procurement. Because of current sustainment mandates, PMs and PdMs must consider repairability and affordability early in a product's development phase.

This requirement is not entirely new, but it was not always a factor. In the 1990s, at the height of efforts to overhaul Army acquisition, the norm was for programs to rely directly on the contractor to sustain a system throughout its life cycle. Now that many of the programs begun during that period have reached sustainment, the particular project or product office must decide how best to manage the associated depots and long-term sustainment. The statutory requirement for weapon systems to have organic government long-term support facilities reflects a strategic need to ensure that the government can repair its own equipment and not have to rely on a commercial entity, which may have competing business interests, to maintain critical warfighting capabilities. As part of a system's

SUPPORTING SCOUTS

PFC Tyler Bonefield, left, and SGT Nicholas King, cavalry scouts in 6th Squadron, 4th Cavalry Regiment (6-4 CAV), Combined Task Force Duke, do security duty near Combat Outpost Khilaguy, Afghanistan, during a reconnaissance patrol Aug. 29, 2013. LRAS3 supports Army scouts by enabling them to detect, recognize, identify and geo-locate distant targets in real time. (U.S. Army photo by 1LT Charles Morgan, 6-4 CAV, 3rd Brigade Combat Team, 1st Infantry Division)

supportability assessment, a core depot assessment (CDA) determines those components of a system that are repairable within the government.

A component in this category is considered "redundant-core," that is, there exists some repair capability internal to the government, and therefore the component may be repaired either within the government or by a contractor based on a best-value assessment. Those that do not fall into the redundant-core category are "new-core," and the program must "facilitize" a government entity to create the organic capability to repair that item, in line with the statutory requirement.

CORE CONCERNS

Facilitization is not an easy task; it takes resources and dedicated people to succeed. The real challenge is that while the CDA requires facilitization, the assessment does not indicate how to carry it out. It is easy to keep going back to the prime contractor for support, although this may not be the right thing to do. Setting up a depot requires a champion who is dedicated to meeting the statutory intent as well as action officers willing to follow through. It is entirely up to the PM or PdM to determine the strategy and processes and to implement the facilitization.

In an effort initiated four years ago, PdM Ground Sensors (GS), a subordinate element of PM Terrestrial Sensors of Program Executive Office Intelligence, Electronic Warfare and Sensors (PEO IEW&S), is facilitizing Tobyhanna Army Depot (TYAD), PA, as the organic repair facility for two of its primary products, LRAS3 and the Second Generation Forward Looking Infrared (2GF) Horizontal Technology Integration B-Kit. Additionally, PdM GS is transitioning software sustainment to the Aberdeen Proving

TYAD INSPECTION

George Tokash at TYAD inspects an LRAS3 system. PdM GS is facilitizing TYAD as the organic repair facility for two of its primary products: LRAS3 and the 2GF Horizontal Technology Integration B-Kit. (Photo by Chris Sauers)

LONG-RANGE TARGET

TYAD's Scott Marzec performs a far-target location test on LRAS3. Facilitization can require test ranges, and one that TYAD currently has under construction took more than two years from concept to specification to design and contract award. (Photo by Vincent Shuta)

Ground, MD, Software Engineering Center (SEC).

FIRST, MAKE A PLAN

To start the facilitization process, PdM GS formed a technical working group with the major stakeholders—PdM GS (then called PdM Forward Looking Infrared); the Communications-Electronics Command (CECOM) Logistics Readiness Center (LRC) and TYAD—then designated a leader and allocated resources to complete the process. The PdM developed a plan to execute the facilitization, a plan that changed at various times during the effort in response to evolving circumstances.

The first step was to establish test standards for use in determining whether a repair was successfully completed. Test equipment typically poses a bottleneck during production and repairs. The PdM reviewed available documentation to determine the testing requirements necessary to ensure that a part would return to the supply system in fully serviceable "A" condition. The PdM then gave these requirements to TYAD, and the depot developed test procedures and equipment needs based on those requirements.

Acquiring the test equipment, such as temperature chambers, vibration stations, and optical and laser test stations involves writing specifications, as well as working with contracting offices on the procurement, depot facilities for space claim and installation, and the depot's public works department for long-term infrastructure support.

All of these tasks take time; planning a capital equipment purchase requires thinking in terms of months or years, not weeks. For example, a test range currently under construction took more than two years to go from concept to specification

ONE PIECE OF THE PROCESS

Mark Glose tests an LRAS3 display at TYAD. Acquiring the test equipment for sustainment is a particularly time-consuming part of the facilitization process; planning a capital equipment purchase is a matter of months or years. (Photo by Chris Sauers)

to design and contract award. This timeline was long because the range required nonstandard equipment and a development effort. Other equipment, such as optical tables and temperature chambers, took six months to acquire and install at the depot.

The next step entails identifying the probable repairs, as well as the parts and suppliers needed to complete them. PdM GS, along with TYAD and the CECOM LRC, conducted an analysis to identify items that could be repaired at the lowest possible level, such as lower-level assemblies and components of those assemblies. A National Stock Number was assigned to each of the replacement components to enable easier procurement from suppliers. PdM GS and TYAD, with help from CECOM LRC, identified sources of supply at the lowest level to ensure the best value to the government, as there is usually little or no added value in going through the original equipment manufacturer (OEM) for an off-the-shelf component from a subtier vendor.

When beneficial, based on engineering value judgments, the team also contracted with vendors to train depot personnel on specific tools and techniques for handling critical components. For example, the team contracted an optics manufacturing company to teach a class on cleaning and handling the sensitive optical components found within the LRAS3.

As PdM GS conducted repairs and developed technical instructions for specific repairs and tests, it also decided to aggregate all tests, known repairs and parts listings into a depot maintenance work requirement (DMWR). The DMWR is designed to serve as the primary source of repair processes and knowledge. Using the DMWR enables a depot technician to perform repairs on systems and their components without the need for institutional knowledge.

DATA AND SOURCE CODE

Depending on the type of data a program possesses, the development of test programs and test facilities can be challenging. For example, both the LRAS3 and the 2GF programs started during the acquisition reform period, when the Army bought systems based on a specification and required the vendor to deliver little technical data over the life of the program. With the establishment of an organic depot, however, there is a need for such data. Some suppliers will not engage in conversations with the depot or sell replacement parts to the depot unless the government has secured its technical data for a nonstandard, vendor-supplied item. For example, one optics manufacturer would not supply components to TYAD unless the government secured the "build to" drawings relating to their parts.

To acquire the data needed for facilitization, programs are invoking several Defense Federal Acquisition Regulation Supplement (DFARS) clauses contained within the contracts used to procure the systems. Specifically, DFARS 252.227-7027, "Deferred Ordering of Technical Data or Computer Software," states that "the Government may … order any technical data or computer software generated in the performance of this contract or any subcontract hereunder." It is of particular relevance to depot facilitization efforts that the clause uses the term "generated," not "delivered."

FACILITIZATION IS NOT AN EASY TASK; IT TAKES RESOURCES AND DEDICATED PEOPLE TO SUCCEED.

Thus, deferred ordering is not limited to contract deliverables. Rather, the clause covers anything created using government funds pursuant to the contract. The clause also applies for three years after contract closure or the delivery of all contract items. So, by exercising this DFARS clause, a program may compel a contractor to deliver the data, software source code and other technical items that depot facilitization requires. In return, the contractor is entitled to payment for the cost of gathering and reproducing the data, provided that the data is delivered "as is" (i.e., without any modification by the contractor).

Typically this "gathering and reproducing" charge is an order of magnitude less than the cost of building a full technical data package for the government. These data should be delivered with government unlimited rights or government purpose rights. While the government does not own the data, both levels of rights convey a license from the contractor to the government that is adequate for any and all required maintenance tasks, including facilitization.

PdM GS has spent considerable time and energy on technical data, obtaining source code and document markings. In light of this, programs should obtain the required data as a contract deliverable in an initial contract or request it at key points throughout the program, such as in engineering change proposals, software

releases and modifications because of obsolescence. Additionally, while the Army can expect the contractor to maintain configuration control during production, the PM or PdM office remains responsible for ensuring the long-term supportability of the system. Securing and controlling data is a cornerstone of that supportability task and a consideration throughout the program's life cycle.

LESSONS LEARNED, MONEY SAVED

Currently, the LRAS3 program has facilitized the depot for about 75 percent of the repairable parts. During the facilitization effort, the government has saved approximately $4 million, estimated by comparing the repair costs at the government depot with previous contractor repair costs for the same part. This represents a return on investment of more than 60 percent; the cost of parts repair is lower, and the recovery rate higher, than if the OEM had repaired them. PdM GS provided the necessary equipment and documentation for resets and overhauls, making the organic depot the single point of repair for all LRAS3 systems.

Delays in this complex project have been mostly programmatic, not technical. In particular, ordering equipment and replacement parts, and contracting with the OEM for support tasks, have presented challenges that have driven the schedule. For the LRAS3 program, only four of the 24 depot-level repairable items remain to be facilitized. The bulk of the work will be complete by the end of FY14, with a few tasks carrying over into the new year.

Software facilitization is moving forward with the expectation that the SEC will be up and running in time for post-production software support sustainment funding in FY15. This will complete the LRAS3 transition to sustainment and allow for 100 percent organic repair and support to the product as long as it is in the field.

The 2GF is in the initial stages of facilitization, scheduled for completion in FY15 and leveraging all the lessons learned on LRAS3.

CONCLUSION

PdM GS has demonstrated that an organic depot can produce a high-quality product at a much lower cost to the government than a contractor-owned facility. We realize that the warfighter is a very important stakeholder, but not the only stakeholder in a project or product manager's decisions on how best to sustain programs. The U.S. citizen and taxpayer deserve an able military at a manageable cost. A properly facilitized depot addresses both of these needs.

SCOUTING THE ENEMY

SPC Justin Barnett uses an LRAS3 Feb. 4 during a platoon-level live-fire exercise in Grafenwoehr, Germany. (U.S. Army photo by Visual Information Specialist Markus Rauchenberger, Training Support Activity Europe)

For more information, contact the author at 703-704-3006 or ***scott.h.winter2.ctr@mail.mil****.*

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PROGRAM EXECUTIVE OFFICE COMMAND, CONTROL AND COMMUNICATIONS-TACTICAL

"The ability to access these capabilities has greatly increased situational awareness and coordination."

"The various platforms of CS 13 give us a digital reach like we've never had before."

CONNECTING OUR SOLDIERS

WITH NETWORK 2.0, STARNET AND THE NETWORK AFTER NEXT

Today's Soldiers expect the Army's tactical network to provide the same seamless, intuitive experience as the communications devices they use in their everyday lives.

Leveraging feedback from the units that took Capability Set 13 to Afghanistan, PEO C3T developed a road map to drive network modernization through 2020 and beyond. The core goal is to simplify and enhance network and mission command capabilities to make it easier for Soldiers to get the information they need—anytime, anywhere and on any device.

U.S. ARMY

PEO C3T

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Simplify, Simplify

Future network must make it easier for Soldiers to train, plan, operate from garrison to foxhole

by BG Daniel P. Hughes and Ms. Jennifer Zbozny

When you think "modernization," the next word that comes to mind probably isn't "simplify."

Progress often implies more systems, with greater complexity—saturating Soldiers with technology and then surging the underlying infrastructure necessary to support everything from power to training. But does it have to?

As we plan the Army's future tactical communications network—a top modernization priority as the Army transitions to a smaller but still highly capable force—we have a different vision. Picture a landscape in which Soldiers can start up a wireless command post at the push of a button, a quick voice command can summon and interpret a wealth of operational data, and a digital map looks the same from smartphone to tablet to vehicle-mounted touch screen.

In this vision, capabilities for maneuver, fires, logistics and other functions will be delivered and accessed not on separate computer terminals, but through a common, cyberhardened framework. Powering communication systems will require less fuel and fewer batteries. Soldiers will have the same information at their fingertips from garrison to foxhole, with network-enabled training providing continuity from schoolhouses to combat training centers. Holistically, the modernized tactical network will mimic the simplicity and capacity of commercial networks, while enabling the Army to securely dominate the battlefield across the full spectrum of military operations. Above all, capabilities will be intuitive for Soldiers to operate with minimal training and field support, so that they can focus on the mission, not the network.

To achieve this vision of simplicity, the Army has begun to implement the network modernization road map, which synchronizes operational priorities for versatility, mobility and security with technology imperatives and program-of-record objectives. The road map unfolds in three interconnected phases: Network 2.0 (in FY14-15), Simplified Tactical Army Reliable Network (STARNet, FY16-20) and the Network After Next (NaN, 2020 and beyond). (See Figure 1 on Page 57.) Led by the Program Executive Office Command, Control and Communications – Tactical (PEO C3T) and aligned with Armywide efforts such as the Network Integration Evaluation (NIE), Network Capability Review (NCR) and Common Operating Environment, the road map also serves as a guide for industry to focus development efforts and to bring forward innovations quickly to fill capability gaps.

WELL-CONNECTED

SPC Joshua Provo, 4th BCT, 10th Mountain Division, sends up coordinates to his higher command during a recent dismounted patrol in Afghanistan using CS 13. The Army crossed a major threshold with CS 13 by delivering software-defined radios that connect with smartphonelike handheld devices to transmit position location information, text messages, photos and other data. (Photo by SGT Eric Provost, Task Force Patriot Public Affairs)

Simplifying the network will make it more efficient and lead to cost savings by combining hardware and other infrastructure, increasing competition, reducing software development efforts, and decreasing the number of field service representatives (FSRs) required to train Soldiers, troubleshoot systems and sustain the tactical network.

WHY SIMPLER IS BETTER

Over the past two years, the Army fielded four of the final brigade combat teams (BCTs) bound for Afghanistan with the Capability Set (CS) 13 network, which represents a huge leap forward from previous tactical communications equipment. CS 13 provides mobile satellite and terrestrial communications that allow the commander to stay situationally aware at all times, even when far away from his command post, and empowers the dismounted Soldier and squad with a new level of situational awareness through smartphones and networking radios. Deployed U.S. forces are now relying on CS 13 technology to stay connected and cover more ground, even as fixed network infrastructure is dismantled as part of coalition retrograde operations.

But while we dramatically increased network capability with CS 13, we also introduced greater complexity. During their training with CS 13, users—from the experienced signal personnel in the brigade S6 shops to company commanders suddenly inundated with communications gear—repeatedly told us that while they very much valued what the new network could do, it took an awful lot of time to learn. In part, this was because CS 13 represented the first time the Army delivered the network as a complete set of tactical communication systems for the BCT, and our training had not caught up to the integrated nature of the equipment. PEO C3T has

since implemented a new system-of-systems training curriculum for Soldiers in BCTs receiving the follow-on CS 14, who have more time to train because they don't face imminent deployment.

More importantly, however, users struggled with aspects of CS 13 because the network was not intuitive to use. Systems required too many commands entered through too many menus. Configuration changes could not be made automatically, requiring significant field support.

We saw the greatest success with systems like Nett Warrior, based on an Android smartphone, and Joint Capabilities Release (JCR), with its chat room functionality. Those systems provide the same seamless, naturally collaborative experience as the devices Soldiers use in their everyday lives. As users picked them up with minimal training—and constantly brainstormed new tactical uses as they took them to the field—the direction we needed to take became very clear. Soldier feedback from the semiannual NIEs and insights from the NCR, led by the U.S. Army Training and Doctrine Command (TRADOC), have reinforced the same theme: The network must be easier to use, train, maintain and sustain, so that it functions as a holistic weapon system that is tailorable and scalable to meet the needs of our innovative force.

MAJOR ADVANCE

Soldiers with the 2nd BCT, 101st Airborne Division (Air Assault) train at the Joint Readiness Training Center (JRTC), Fort Polk, LA, in November 2013 using vehicles, left and right, equipped with Warfighter Information Network - Tactical (WIN-T) Increment 2. Some WIN-T Network Operations tools enable communication officers to identify how well systems such as these are actually working on the battlefield, so as units move out in any direction, they can more easily manage the network and keep links connected. (Photo courtesy of JRTC Operations Group Public Affairs)

MISSION COMMAND ANYTIME, ANYWHERE

The network modernization road map is divided into several focus areas: mission command; advantaged services transport (the "upper" tactical network and satellite communications used at higher echelons); basic services transport (the radios and smartphones used at lower echelons); cyber and network operations (NetOps); and physical (power and platform requirements, and tactical operations center (TOC) footprint).

With respect to mission command, our short-term goal is to complete the Army's transition from stand-alone mission command systems to an integrated, Web-based environment that delivers powerful warfighting systems as user-friendly "widgets," or apps, merged with the common operating picture of the battlefield. STARNet and NaN then will build on that foundation to deliver a single computing environment (CE) across the tactical formation, from handheld devices to platforms to the command post.

Using standardized maps, messaging and icons, the single tactical CE will provide a unified, familiar experience—similar to what a user would have with multiple personal devices that all run an Apple or Windows operating system. Working with the Communications-Electronics Research, Development and Engineering Center, PEO C3T is implementing the standards and protocols to make this possible and enable multiple industry partners to participate.

Thanks to Apple's Siri, most Americans are familiar with voice-based digital assistants that "live" in their smartphones and tablets to answer questions, take notes and memorize tasks. For the Army, infusing our tactical systems with voice and gesture recognition capabilities is another critical aspect of modernizing mission command. Imagine a commander who can request information and direct simple tasks by talking to his apps, rather than having staff scroll through multiple systems with separate menus, icons and buttons. The unit would save significant time during operations and in training.

This technology exists today—along with other simplified human-machine interfaces such as touch screens and gesture recognition capabilities—and we are

WITH RESPECT TO MISSION COMMAND, OUR SHORT-TERM GOAL IS TO COMPLETE THE ARMY'S TRANSITION FROM STAND-ALONE MISSION COMMAND SYSTEMS TO AN INTEGRATED, WEB-BASED ENVIRONMENT THAT DELIVERS POWERFUL WARFIGHTING SYSTEMS AS USER-FRIENDLY "WIDGETS," OR APPS, MERGED WITH THE COMMON OPERATING PICTURE OF THE BATTLEFIELD.

actively pursuing such capabilities for the Army. Joint Battle Command – Platform, the successor to JCR that begins fielding later this year, takes several steps in the right direction with touch-to-zoom maps, a Google Earth-like interface, and drag-and-drop icons.

In the longer term, that is, the time frame for NaN, the human-machine interface will mature further to augment Siri-like technologies with JARVIS, a capability that acts like a "digital tactical butler" inside mission command systems. JARVIS will remember a system operator's patterns and provide needed information, analyses and recommendations without the need for constant commands.

ON-DEMAND NETWORKING

Unlike the mission command systems that various personnel use throughout a brigade, the transport side of the network can be largely invisible to all but a few signal Soldiers. But the progress of Warfighter Information Network – Tactical (WIN-T), radio waveforms and other transport avenues is just as critical to successful modernization, to provide the Soldier the freedom to attach to whatever network is available to achieve his mission.

The road map for advantaged services transport focuses on increasing capacity through solutions that provide alternatives to satellite communications, thus reducing network latency and cost. From "tropos," tropospheric scatter technologies that transmit and receive microwave signals through the lowest portion of the Earth's atmosphere, to "pseudolites," or pseudo-satellites, advantaged nodes that simulate satellite services, the Army is exploring all options for beyond-line-of-sight communications and connectivity in degraded environments. Another operational imperative is to actually remove traffic from the network through intelligent caching mechanisms that record the information Soldiers use the most, store it locally and automatically provide access to it without using additional bandwidth.

At lower echelons, the Army crossed a major threshold with CS 13 by delivering software-defined radios that connect with smartphonelike handheld devices to transmit position location information, text messages, photos and other data. The focus for the future is to "untether" the phone from the radio, using LTE (Long Term Evolution, commonly known as 4G) wireless technology, so that troops can communicate more seamlessly across echelons. Radios will continue to improve as we maintain a competitive marketplace for commercial hardware and consistently incorporate enhancements to government-owned waveforms—with the NaN goal of achieving a simple-to-operate family of radios that can adapt dynamically to any bandwidth and spectrum environment.

FAMILIAR EXPERIENCE
A Soldier from the 2nd BCT, 101st Airborne Division uses a Nett Warrior device to communicate at the JRTC in November 2013. STARNet and the NaN will use standardized maps, messaging and icons to provide a unified, familiar experience, from smartphones to vehicles to command posts. (Photo courtesy of JRTC Operations Group Public Affairs)

UNCLUTTERING THE TOC

SGT Justin McGarvey, center left, and SPC James Goodwin, center right, 2nd Armored BCT (ABCT), 4th Infantry Division (ID), participate in setting up a mobile TOC on Camp Buehring, Kuwait, in November 2013. The Network 2.0 and STARNet TOCs will be smaller, more mobile and more agile while still supporting mission command. With NaN, the Army will seek to pioneer a secure, wireless TOC. (Photo by SGT Matt Waymire, 2nd ABCT Public Affairs, 4th ID)

FLEXIBLE, SECURE AND AGILE

Another area in which the future network must be much more dynamic is in NetOps and unit task reorganization (UTR). Simplifying UTR, which refers to the network adjustments required to support a change in task organization, was one of the most urgent recommendations from CS 13 users who had to reconfigure their systems manually when they reorganized into security force assistance brigade (SFAB) formations.

As the Army pivots to the Pacific and transitions to more expeditionary operations with regionally aligned forces around the globe, Network 2.0 and STARNet will accelerate efforts to give commanders and their staffs the ability to execute UTR through a user-friendly graphical interface and automated execution process. The STARNet phase will also continue recent progress in simplifying the NetOps tools used by signal Soldiers to manage and monitor the network. The goal is to converge upper and lower tactical Internet tools into a single NetOps tool set that provides total network visibility, overlaid with the common operating picture, for faster response on a complex battlefield.

None of these network advancements will matter if we can't protect information from our enemies, making cybersecurity another essential component of the road map. NaN will bring improved tactical capability to defend against malicious cyberattacks and execute integrated offensive and defensive cyber operations, so that Soldiers can identify when they are being attacked, neutralize the attacker and retaliate. Systems will employ a simplified authentication mechanism, eliminating the need for multiple passwords to sign on to the network and increasing cybersecurity using biometric identification methods.

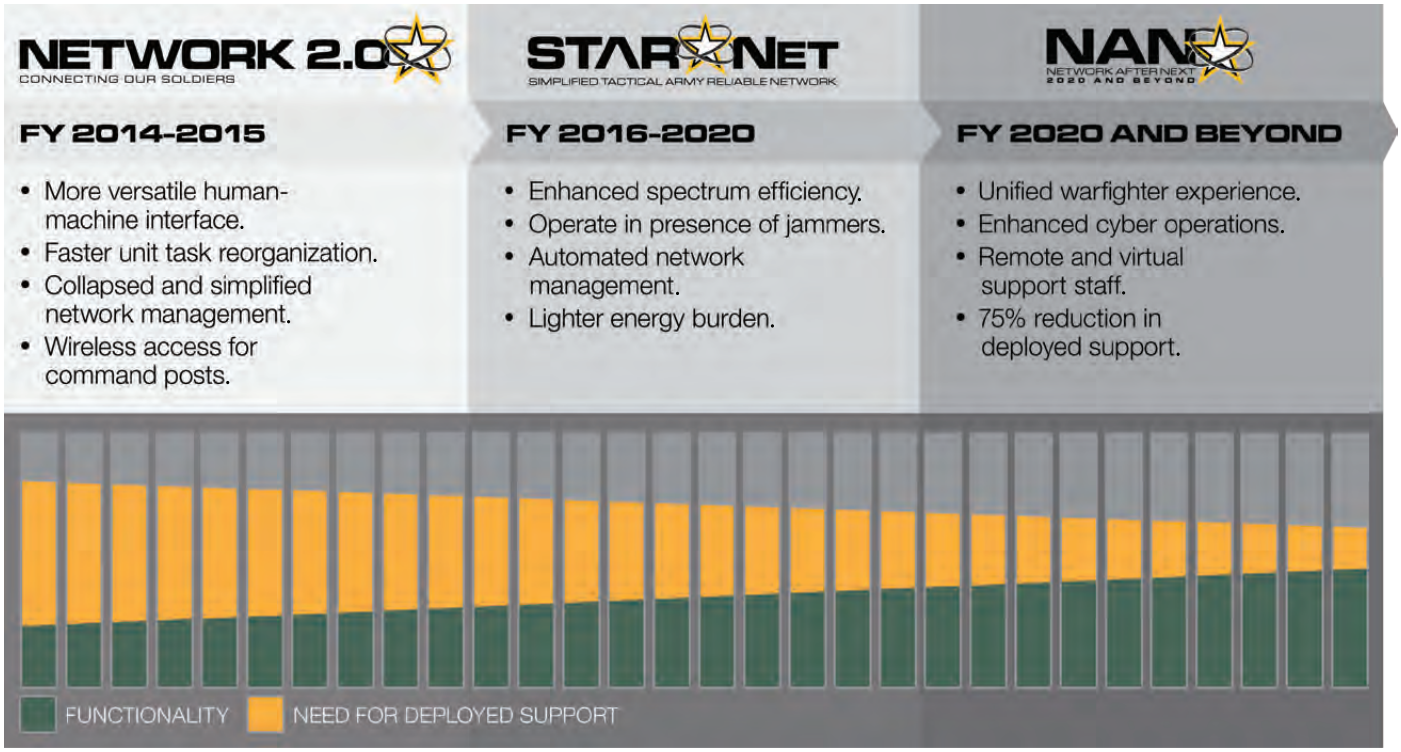
Finally, it is essential to simplify the physical aspects of the network. We need to "unclutter" TOCs by consolidating hardware such as computers, servers and wires, reducing power requirements and converting many hardware systems into software applications. The Network 2.0 and STARNet TOCs will be smaller, more mobile and more agile while still supporting mission command. With NaN, the Army will seek to pioneer a secure, wireless TOC, enabling units to set up and tear down their equipment much faster without relying on FSR support.

CONCLUSION

After working with numerous stakeholders to define these goals, the Army is now executing the "disciplined optimization" processes to make the network modernization road map a reality. With G-3/5/7, TRADOC, the chief information officer/G-6, U.S. Army Network Enterprise Technology Command and others, PEO C3T is implementing NCR recommendations and providing an updated integrated network baseline for evaluation at upcoming NIEs. Periodic assessments of the network baseline, along with changes to the NIE cycle that give industry more time to propose solutions, will allow us to better define capability gaps and set the conditions for our future modernization efforts.

PEO C3T has synchronized the lines of effort for each of our programs of record with the overall modernization strategy for Network 2.0, STARNet and NaN. In partnership with the Army science and technology community, we have outlined our technology focus areas to all interested industry partners and

FIGURE 1



MODERNIZATION ROAD MAP

The Army's network modernization road map synchronizes operational priorities for versatility, mobility and security with technology imperatives and program-of-record objectives. It comprises three interconnected phases: Network 2.0, STARNet and NaN. (SOURCE: PEO C3T)

will leverage the integrated laboratory resources at Aberdeen Proving Ground, MD, the NIEs and other venues to evaluate current and emerging capabilities that could satisfy the Army's needs.

We are not starting from scratch: The beauty of the future network, in functionality and in affordability, is that it adopts the best ideas of the commercial communications world and optimizes them for the military environment.

As we pursue our vision, we will continue fielding CS 14 and follow-on capability sets to select BCTs, continuing the incremental, integrated modernization that has brought so much positive change to Army network capabilities and processes. It is now time to build on this change to give today's and tomorrow's Soldiers a simplified, pervasive network that behaves as they expect and performs as they deserve.

For more information, visit ***http://peoc3t.army.mil/c3t/.***

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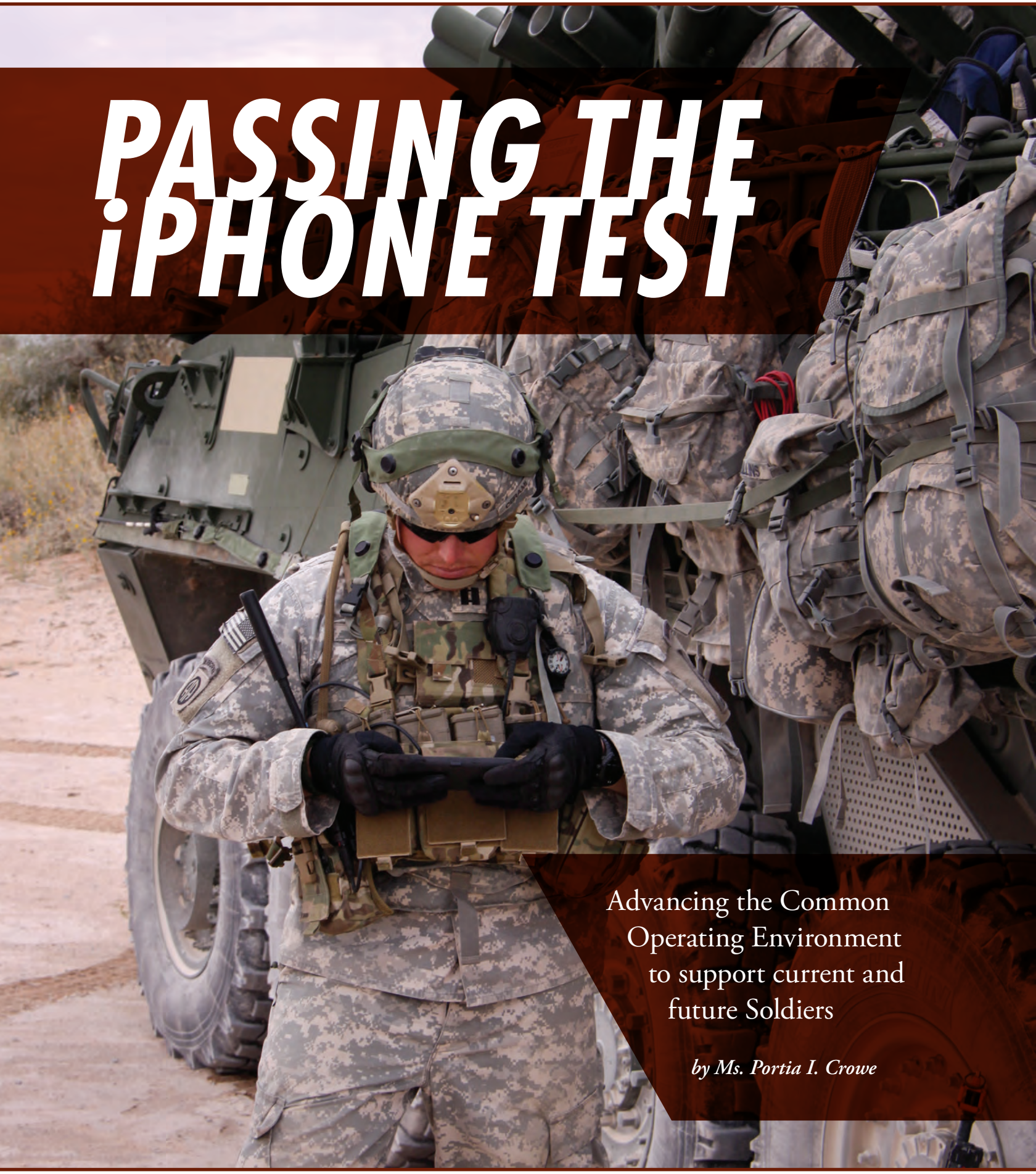
PASSING THE iPHONE TEST



Advancing the Common Operating Environment to support current and future Soldiers

by Ms. Portia I. Crowe

COMPUTING CONVERGENCE
MFoCS, developed to converge separate computing functions into a single architecture, will run JBC-P and other C4ISR applications. (Photo courtesy of DRS Technologies Inc.)

Apple's iPhone took a standard architecture and improved it, then provided a software development kit (SDK) that enabled third-party developers to quickly and inexpensively create applications, or "apps," that deliver weather, social media, games and more. It worked intuitively, at the touch of a finger and with little or no instruction. By delivering the power of the Internet when and where we wanted it, apps revolutionized information delivery and had us all saying, "There's an app for that."

That kind of "smart" is the Army's objective as it moves forward with its Common Operating Environment (COE). Without sacrificing warfighter capability or information security, but recognizing the need to converge multiple systems onto a common architecture, the Army is using a standards-based approach to try to pass "the iPhone test"—provide the intuitive interface and rapid delivery with the common look and feel of the smartphone.

COE is an approved set of computing technologies and standards that enable the rapid development and execution of secure and interoperable applications across a variety of computing environments. Established in 2010 by the Army's chief information officer/G-6 and the assistant secretary of the Army for acquisition, logistics and technology, the COE guidelines support the Army's 30-year strategic modernization approach. The COE consists of six computing environments: the data cloud, command post, mounted or platform, mobile, sensor, and real-time safety-critical or fires and missiles.

The COE infrastructure services, defined set of standards, and processes act as a platform and playbook for industry partners, government program managers and third-party developers. The COE sets the foundation to enable rapid development of a stable, secure infrastructure, allowing the Army to field capabilities quickly while creating a long-term evolutionary plan that is sustainable and affordable. Currently, integrated development environments (IDEs) and SDKs are left to the discretion of the developer. The CEs introduce a standard set of DOD-approved IDEs and SDKs for third-party developers, allowing for innovation and rapid transition of capability.

THE TECH-SAVVY SOLDIER

This model of doing business goes a long way toward meeting the expectations

TOWARD GREATER INTEROPERABILITY
A Soldier from 2nd Brigade Combat Team (BCT), 1st Armored Division (2-1 AD) uses a Nett Warrior device in November 2013 during Network Integration Evaluation (NIE) 14.1 at Fort Bliss, TX. The Army expects greater alignment of JBC-P with the well-known Android-based infrastructure to boost interoperability between the MCE and the mobile, handheld computing environment found in Nett Warrior. (Photo by Nancy Jones-Bonbrest, PEO C3T)

of today's Soldier, who has grown up with technology and expects intuitive, interoperable devices and applications with little or no learning curve. The vision of simplicity for the Soldier is at the core of efforts by the Program Executive Office Command, Control and Communications – Tactical (PEO C3T) to create a closer alignment across the tactical communications portions of the COE, which include the Command Post Computing Environment (CP CE), Mounted Computing Environment (MCE), and mobile or handheld environment, while also ensuring interoperability with the other computing environments.

As part of its network modernization road map, PEO C3T is making a concerted effort to remove stand-alone systems that require separate log-in procedures, training materials and field support, and transition to a unified tactical computing environment in which capabilities are seamlessly accessible, both vertically and horizontally, across Army echelons as well as interoperating with our joint and coalition partners.

Implementation of a tactical computing environment not only addresses the need for greater interoperability within the force, but also allows for a more agile, flexible and innovative Army.

This tighter alignment of capabilities through the COE will reduce hardware costs, simplify training and leverage industry innovation to provide new technologies quickly. It will continue to strengthen our partnerships with the Communications-Electronics Research, Development and Engineering Center (CERDEC), other PEOs and industry as we use standards that leverage industry best practices and adopt a common focus for the end state of tactical communications capabilities.

TEST BED

A Soldier from 1st Squadron, 1st Cavalry Regiment, 2-1 AD scans for possible security threats Oct. 24, 2013, during NIE 14.1 at Fort Bliss. The Army uses the NIEs, semiannual field exercises in which Soldiers assess network capabilities, to obtain Soldier feedback on the execution of mission command through Web-based applications. (Photo by SGT Aaron Palmer, 24th Press Camp Headquarters)

COMMAND AND COMPUTE

The CP CE is intended for use inside tactical operations centers by commanders and staff to synchronize operations and view a more holistic picture of the battlefield. PEO C3T's goal is a transition to a unified tactical computing environment where capabilities are seamlessly accessible, both vertically and horizontally, across the Army. (Photo by Chad Padgett, PEO C3T)

ALIGNING ENVIRONMENTS

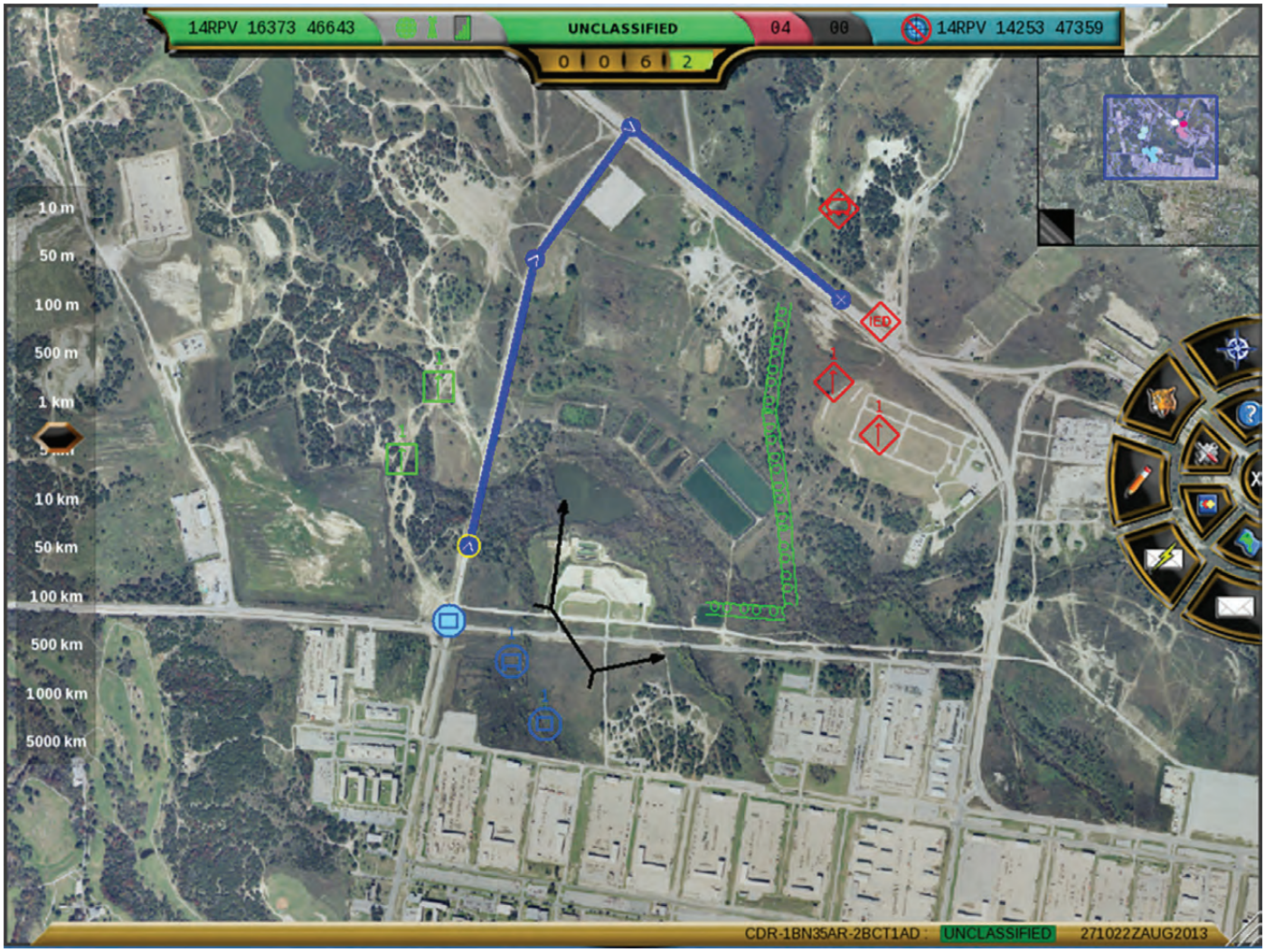
CPT Jonathan Page of the 4th BCT, 10th Mountain Division uses the Nett Warrior device at Nangalam Base, Afghanistan. The alignment of the CP CE, MCE and mobile, handheld environment will help meet the expectations of today's tech-savvy Soldier. (U.S. Army photo by SFC E.L. Craig, Task Force Patriot Public Affairs)

WEB-BASED MISSION COMMAND

CP CE is intended for use inside tactical operations centers by commanders and staff to synchronize operations and view a more holistic picture of the battlefield.

By using a government-authorized laptop connected to the appropriate classified network, commanders and staff can log into the Web-based framework and access software applications specific to their mission, including fires, logistics, intelligence, airspace management and maneuver.

To date, CP CE has taken shape by converging existing stand-alone hardware systems into a common software framework. For example, the Joint Warning and Reporting Network, which provides the operational capability to report, analyze and disseminate chemical, biological, radiological and nuclear agent detection and warning, has transitioned from a single, separate system to the Web browser-based environment.



ROUTE TO THE FUTURE

JBC-P, which upgrades the widely fielded FBCB2/BFT situational awareness system, is the foundation for MCE. With intuitive tools that include a Google Earth-like interface, touch-to-zoom maps for a quick view of a precise location, drag-and-drop icons that allow users to mark locations of friendly or enemy assets, and chat rooms that offer instant messaging, JBC-P will begin fielding later this year. (U.S. Army graphic)

Similarly, the previously stand-alone Maneuver Control System, which provides a common tactical picture, is also now integrated as a Web browser-based application. The Army unveiled the first version of CP CE during the 2013 Network Integration Evaluations (NIEs), a series of semiannual field exercises in which Soldiers assess network capabilities. CP CE received positive user feedback on the execution of mission command through Web-based applications.

Additional mission command capabilities, which include the Battle Command Sustainment and Support System, the Army's maneuver sustainment system, and Global Command and Control System – Army (GCCS-A), the Army's strategic, tactical and theater command and control system, will migrate to the Web environment as part of the CP CE evolutionary strategy.

In the near future, CP CE will provide a common data strategy that will separate the data from the applications while reducing multiple databases. CP CE has established and governed key COE enablers such as a common

standard sharable geospatial foundation, a common application framework and virtualization, supported by technical guidance, developers' handbooks and a software development kit.

MISSION COMMAND GOES MOBILE

The Joint Battle Command – Platform (JBC-P) provides a glimpse into the future of mission command. JBC-P is the Army's primary situational awareness tool and the foundation for the MCE. MCE, in turn, is the COE's standard for tactical vehicles, which continue to evolve into mobile mission command centers and serve as a vital link between dismounted Soldiers and their higher headquarters.

With intuitive tools that include a Google Earth-like interface with touch-to-zoom maps for quicker views of precise locations, drag-and-drop icons for placing enemy locations or improvised explosive devices on a map, and chat rooms that allow instant messaging, JBC-P reflects heavy Soldier involvement in its development. Fielding of JBC-P will begin later this year. Through JBC-P, which upgrades the widely fielded Force XXI Battle Command Brigade and Below/Blue Force Tracking (FBCB2/BFT) system, Soldiers in tactical vehicles will be able to access new applications as well as tools they have come to rely on.

As the JBC-P program explores the potential technical benefits of greater alignment with the well-known Android-based infrastructure, new levels of interoperability in the MCE could open up for industry, which can quickly build to the COE. This alignment with the Android operating system would also set up greater interoperability between the MCE and the mobile, handheld computing environment found in Nett Warrior handheld devices. As JBC-P accepts the migration of more capabilities through the COE, the Army will leverage existing FBCB2 hardware while continuing to evolve new solutions.

The Army took a significant step last year with the signing of a contract between PEO C3T and DRS Technologies Inc. for initial delivery of a single hardware solution in vehicles known as the Mounted Family of Computer Systems (MFoCS). With a modular "build your own system" computer, users will be able to access and operate several different software applications over a single piece of computer hardware that is scalable and tailorable to the mission and vehicle. Developed to converge separate computing functions into a single architecture, MFoCS will run JBC-P and other command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) applications.

CONCLUSION

The tactical mission command of the future—in which the Army will standardize what Soldiers see across handheld devices, vehicle mounted systems and command post screens—will provide operational agility across warfighting functions. Just as the iPhone keeps the complexity "inside the box," delivering a user-friendly interface with apps that are easy to obtain, change, upgrade, develop and test, so, too, can Army mission command.

By continuing to break down separate systems into capabilities that can run on a common infrastructure, building in intuitive features, and aligning CP CE and MCE for unified data on a common operating picture, we can offer Soldiers a computing environment that mirrors what they use in their daily lives.

Along with the operational benefits, the Army expects to realize cost savings by combining hardware and other infrastructure, reducing software development efforts, and right-sizing the number of field support personnel required to train Soldiers, troubleshoot systems and sustain the tactical network. Moving from hardware-centric to software-centric development, with standardized applications that industry is familiar with and can build to, is projected to yield further reductions.

Already under CP CE, PEO Aviation's Tactical Airspace Information System has converted from a stand-alone client to the more efficient Web-based approach, resulting in a cost avoidance of $32 million through FY25. Also, under MCE, the signing of the MFoCS contract represents a reduction of as much as 36 percent in the cost of the basic vehicle-mounted computer while increasing its performance by as much as 350 percent.

With the guidance of the network modernization road map, combined with targeted efforts for accelerating a tactical computing environment that allows for shared applications, unified data and services using common hardware over a reliable, secure transmission network, the Army will achieve its operational and programmatic goals—and pass the iPhone test.

For more information, go to ***http://peoc3t.army.mil/c3t/.***

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ANSWERING PACOM'S CALL

USAMRMC harnesses partnerships, lessons learned to prepare for Asia-Pacific missions

by COL Patricia A. Reilly, LTC Wendy L. Sammons-Jackson, LTC James W. Beach and Mr. Charles Paschal

The U.S. military's global rebalancing of forces to the Asia-Pacific region poses new challenges as the Army prepares to deliver medical care to an area spanning nearly 105 million square miles—equivalent to about half of the earth's surface—and plagued with infectious diseases.

The U.S. Army Medical Research and Material Command (USAMRMC), through its research, development and acquisition (RDA) program, is leveraging medical research, partnerships, technology modernization efforts, materiel life-cycle management and knowledge solutions to meet the unique health needs of the U.S. Pacific Command (PACOM) in combating infectious disease, managing casualty care, enhancing medical evacuation capabilities and improving psychological health treatment.

In addition to meeting the region's unique medical challenges, USAMRMC seeks to protect, treat, and optimize the health and performance of warfighters operating both at home and across the globe. Together, these advancements will contribute to maintaining the capabilities that the U.S. military needs to fight and win on the battlefield.

INFECTIOUS DISEASE

Historically, infectious diseases are responsible for more U.S. casualties than enemy fire. The PACOM area of responsibility (AOR) is an endemic hot spot for mosquito- and sand fly-transmitted diseases—for example, malaria, dengue fever and lethal viruses, such as hantavirus, as well as diarrhea caused by pathogenic bacteria—and experts predict that infectious diseases will be the primary cause of hospitalization of U.S. military personnel in the AOR. Despite ongoing prevention, vaccine and therapeutic drug development programs, no licensed vaccines are available for these diseases, and methods of prophylaxis or treatment are limited or, in some cases, nonexistent.

To meet these challenges, USAMRMC, together with U.S. Navy Medicine, has aggressively leveraged external partnerships

to amplify the impact of a comparatively small core military investment. DOD partnerships with organizations such as the National Institutes of Health, the pharmaceutical industry and philanthropic organizations such as the Bill and Melinda Gates Foundation are proving critical to making headway. The licensure of two new malarial treatment drugs is expected by 2018, and two malaria vaccine candidates are in advanced development. The manufacturer of a rapid diagnostic test, fielded in 2007, for malaria caused by the Plasmodium falciparum parasite is currently optimizing the test to detect a second malarial parasite, P. vivax. A dengue vaccine intended to protect against four strains of the virus is also in development.

Early clinical trials have begun to test the effectiveness of vaccines targeting hemorrhagic lethal viruses such as hantavirus, and bacterial diarrhea caused by shigella, enterotoxigenic Escherichia coli and campylobacter. In parallel with all of these efforts is the development of improved vector surveillance and preventive measures, such as an insecticide-impregnated bed net designed to protect the sleeping occupant from disease-carrying mosquitoes.

COMBAT CASUALTY CARE

Advances in combat casualty care, from the point of injury to rehabilitation, achieved during Operations Iraqi Freedom (OIF) and Enduring Freedom (OEF) have revolutionized military medical affairs. RDA initiatives led by USAMRMC and its component organizations have developed or promoted a number of critical products and knowledge from 2001 through 2011.

This work has resulted in the re-emergence of the modern tourniquet, which is credited with saving up to 2,000 military

CARE IN FLIGHT

A flight medic treats a patient aboard a UH-60A Black Hawk helicopter using state-of-the-art medical equipment to perform rapid assessment and provide en route care. To augment prehospital care in the PACOM AOR, USAMRMC is overseeing the development of capabilities to provide a near-real-time, continuous record of care from the point of injury to fixed medical facilities. (Photo by Sadie Bleistein)

lives in OIF and OEF and is considered a signature, lifesaving prehospital intervention, according to an article in the December 2012 issue of the Journal of Trauma and Acute Care Surgery, titled "Military medical revolution: Prehospital combat casualty care." Combat Gauze is a second-generation dressing to stop bleeding, and the Combat Ready Clamp is a junctional tourniquet for use in controlling severe bleeding in the groin and armpit regions of the body.

These achievements have spurred current efforts to develop a freeze-dried plasma product to aid in prehospital resuscitation of the wounded; expand the storage life of red blood cells while reducing clinical complications associated with cell aging; and ensure the safety of transfusion before the administration of fresh whole blood drawn at battlefield hospitals, through the development and fielding of donor-specific fresh whole-blood rapid screening tests for transfusion-related infectious diseases. These lifesaving medical interventions have far-reaching application across PACOM and any region of the world where U.S. forces are deployed.

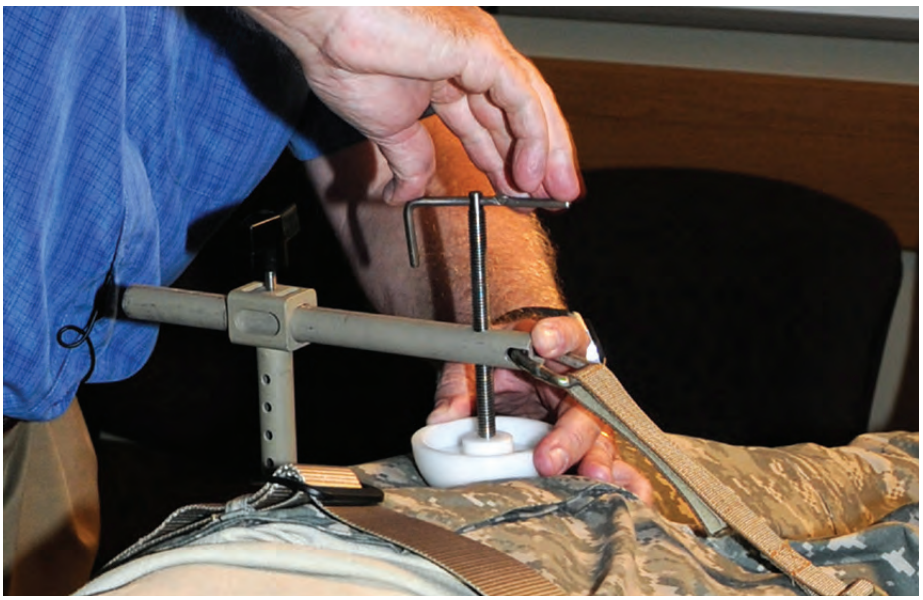
MEDEVAC USAMRMC has taken medevac lessons learned during OIF and OEF, gathering as much data as possible from past and current military interventions, and is applying them to improving the survival rates of injured Soldiers being evacuated in the Asia-Pacific AOR through ambitious technology modernization efforts.

In the December 2012 issue of the Journal of Trauma and Acute Care Surgery, the authors of an article titled "Military medical revolution: Deployed hospital and en route care" note that the increased survival rates of warfighters during OIF and OEF are attributable in part to a combination of faster evacuation from the battlefield to stateside medical centers (three to four days after injury, compared with weeks during the Vietnam era), and the placement of more sophisticated stationary and mobile surgical care farther forward on the battlefield. PACOM's extensive AOR and lack of en route stops during flights over water pose a unique challenge to today's responders in evacuating patients with comparable speed in the Asia-Pacific region.

To augment prehospital care in this AOR, USAMRMC is outfitting refurbished general-purpose UH-60A/L Black Hawk helicopters capable of extended-distance travel with the medevac mission equipment package. As of Army AL&T's press time, 50 percent of these aircraft have been medically refurbished, with a target date of 2020 for 100 percent completion.

Among other issues brought to light during OIF and OEF that USAMRMC has acted upon were serious concerns raised by air evacuation crews regarding the continuity of care in the handoff of injured warfighters between different medical teams during transport from the battlefield to more sophisticated levels of medical care. Crew members cited poor documentation of care rendered at the point of injury, a lack of decision support, outmoded systems for informing receiving facilities of an incoming patient's treatment history, and a health support system that was fragmented overall, characterized by multiple handoffs of equipment and information.

As a result, USAMRMC established the Transport Telemedicine System (TTS) program to oversee the development of capabilities to provide a near-real-time, continuous record of care that extends



LIFESAVING PRESSURE

An orthopedic surgeon and researcher at the U.S. Army Institute of Surgical Research (USAISR), a subordinate command of USAMRMC, demonstrates how to apply the Combat Ready Clamp, one of a number of lifesaving devices that USAMRMC has developed for battlefield use over the past 10 years. The clamp helps control severe bleeding in the groin and armpit regions of the body. (Photo by Steven Galvan, USAISR)

MISSION: MEDEVAC

Medics from 210th Fires Brigade, 2nd Infantry Division (ID) carry a simulated casualty to a UH-60 Black Hawk for medevac Aug. 20, 2013, during the Task Force Wilson training exercise on Camp Casey, Korea. USAMRMC is outfitting refurbished general-purpose UH-60A/L Black Hawks with the medevac mission equipment package. (Photo by SGT Han-byeol Kim, 2nd ID)

BUZZ KILL

An Aedes aegypti mosquito awaits release into a test chamber. USAMRMC is working to combat infectious disease by forging unique partnerships to test and develop vector surveillance and preventive measures. (U.S. Army photo)

from the point of injury to fixed facilities. The first phase of the program involves the integration of available commercial off-the-shelf technologies to capture, process and disseminate physiological data and related patient medical information in real time.

As part of TTS, USAMRMC is also sponsoring evaluation of a Prehospital Medical Informatics (PHMI) framework for use in aeromedical vehicles. PHMI is designed to provide an integration capability for future medical devices, enabling both the medic and remote clinician to capitalize on emergent technologies such as predictive medical decision support models and to manage single and multiple patients simultaneously during flight. The PHMI concept also presents opportunities for joint collaboration as the services move toward capturing a continuous record of medical care from aerial medical evacuation through transport to fixed facilities and ultimately incorporation into the patient's permanent medical record.

PSYCHOLOGICAL HEALTH

The Asia-Pacific region encompasses 36 countries. To cover this area, units often deploy for extended periods to isolated outposts that are too small to justify the allocation of an extensive medical support infrastructure. That could be a problem for diagnosing and treating psychological health issues. But USAMRMC is forging a new path for enhanced psychological health among Soldiers deployed to the PACOM AOR, evaluating the effectiveness of technology to deliver behavioral health care.

USAMRMC-sponsored initiatives include assessing mobile apps and Web-based platforms for suicide prevention, and predeployment, skills-based stress reduction and resilience training for service members and their families.

CONCLUSION

USAMRMC's initiatives are instrumental to the Army's goal to modernize the delivery of medical care on the future battlefield. The command's efforts to address AOR-unique technology needs, apply OIF and OEF lessons learned, and advance documented lifesaving techniques will drive the achievement of that goal. With the rebalancing of military assets, the importance of the PACOM AOR cannot be overstated, as it may well be the first real-world test bed for those advances.

For more information, contact the USA-MRMC Public Affairs Office at 301-619-2736 or go to ***https://mrmc.amedd.army.mil****.*

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LTC WENDY L. SAMMONS-JACKSON is the deputy director for the Military

IT'S A GIRL!

A deployed Soldier watches his wife give birth to their first daughter via the Internet. Web-based technologies are vital capabilities for supporting the psychological health of U.S. troops deployed far and wide. The Asia-Pacific region, for example, encompasses 36 countries, calling on Soldiers to deploy for extended periods to isolated outposts that are too small to justify an extensive medical support infrastructure. (U.S. Air Force photo by 1st Lt Cammie Quinn)

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RISK MODELING

Assessment methodology helps examine effects on schedule for better acquisition decisions

by Mr. Timothy E. Biscoe, Mr. Andrew B. Clark and Mr. John S. Nierwinski

As the Hon. Frank Kendall, undersecretary of defense for acquisition, technology and logistics (USD(AT&L)), stated in the June 28, 2013, report "Performance of the Defense Acquisition System," "Value obtained in acquisition is a balance of costs, benefits, and prudent risks. Risks are a fact of life in acquiring the kinds of products our warfighters need, and these risks must be objectively managed."

In the context of DOD acquisition, risk is a measure of future uncertainties in achieving program performance goals and objectives within defined cost, schedule and performance constraints. Important acquisition decisions are made while program outcomes may still be largely uncertain, and risk assessments provide a way to measure that uncertainty.

Acquisition risk assessments determine a program's exposure as part of an overall risk management process. As a facet of acquisition risk analysis, schedule risk assessments use statistical techniques to predict a level of confidence in meeting a program's estimated milestone dates. A schedule risk assessment may highlight that a given schedule has more risk than is acceptable.

Thus an accurate acquisition schedule risk assessment for a set of materiel alternatives is a key element of informed decision-making.

Independent schedule risk analysis, as part of a holistic assessment process, helps in selecting the best acquisition investments. The assessment organization should be separate from all significant political, economic and psychological influences of a program for the sake of impartiality, candor and mitigating biases, such as overoptimism, that could creep into estimates by advocates of a weapon system. An independent assessment calls for an organization that is not under the management of the program office directly responsible for the development or acquisition, and is not involved in developing technologies related to the program.

As the Army's 30-year modernization plan has helped to strategize investments, the U.S. Army Materiel Systems Analysis Activity (AMSAA) has been developing innovative, independent schedule risk assessments to support the analysis of alternatives (AoA) and other major Army acquisition studies. The primary customer for these risk assessments is the director for cost assessment and program evaluation in the Office of the Secretary of Defense (OSD-CAPE), which issues the AoA study guidance and assesses whether the AoA report is sufficient to inform

MEASURING THE IMPACT

An underbody live-fire test examines the degree of vehicle protection against improvised explosive devices. Tests such as these are an integral part of acquisition, and the AMSAA risk team developed SREDM to incorporate historical data on duration time for such lower-level events within each acquisition phase and to use the data in corresponding statistical schedule-risk assessment models. (Photo courtesy of U.S. Army Research Laboratory Survivability/Lethality Analysis Directorate)

acquisition decisions, but the risk assessments are also informative to the program office.

The Weapon Systems Acquisition Reform Act of 2009 (WSARA) renewed the emphasis on risk assessments and highlighted a need for a more quantitative, independent approach to support the AoA. Before WSARA, risk assessments were typically qualitative, and the methodology for each AoA was inconsistent. Senior Army leaders involved in the AoA process—for example, the U.S. Army Training and Doctrine Command's Analysis Center and Army Capabilities Integration Center, HQDA G-3/5/7 and OSD-CAPE—wanted more robust, repeatable methodologies, incorporating historical data when possible, to strengthen the overall AoA product.

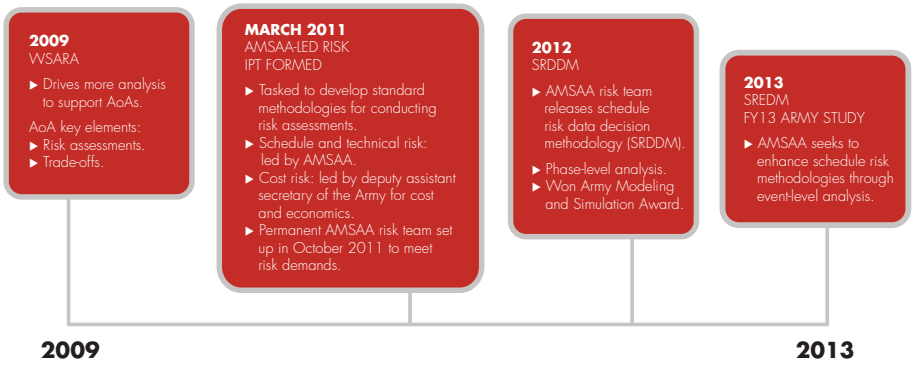
In response to WSARA, AMSAA initiated an Army risk integrated product team (IPT) in March 2011, at the direction of the senior Army analysis leaders involved in the AoA process. The leadership tasked the team to develop and continuously improve independent and quantitative technical, schedule and cost risk assessment methods to support AoAs and other major Army acquisition studies. (See Figure 1 on Page 72.)

A NEW METHOD

In April 2012, AMSAA developed and implemented the schedule risk data decision methodology (SRDDM). This comprehensive, statistically rigorous approach assesses the probability that each materiel alternative being considered in an AoA or other acquisition study will complete a given phase—for example, engineering and manufacturing development (EMD)—within the time frame established in the program manager's (PM's) acquisition schedule.

SRDDM accomplishes this through the use of historical data on phase duration times for analogous acquisition programs—those with schedule drivers similar to what might arise during development of the new program—such that the duration times from these past program phases will adequately represent the variability in completion time for the new program. These data form the basis for a distribution of possible schedule outcomes to calculate the probability of completing an acquisition phase. A confidence interval for this probability provides an estimated margin of error.

FIGURE 1



EVOLVING A METHODOLOGY

The progression of risk assessment methodologies from AMSAA, from WSARA to SRDDM to SREDM. (SOURCE: AMSAA risk IPT)

The distribution of possible outcomes generated from historical data can reveal useful information about a current program's proposed schedule. For example, the data might show similar bottlenecks and schedule overruns during the EMD phase, and that most of the past programs took significantly longer to complete EMD than the time estimated for the new program. The risk assessment might reveal a high level of risk in the current program's schedule, along with the causes for potential delays. Decision-makers then could decide to accept the risk, choose a viable alternative with less risk or reduce the risk by adding more time for development in line with historical schedules. This methodology has illuminated a way to quantitatively assess schedule risk, using a repeatable method that incorporates historical data.

To build upon the initial success of SRDDM, the AMSAA risk team endeavored to find historical data on duration time for lower-level events within each acquisition phase, and to use the data in corresponding statistical schedule-risk assessment models. Examples of lower-level events that the team researched for historical data included contract awards; protests; reviews, such as the critical design review; prototype development; production development; and testing events, such as the production qualification test (PQT), limited user test, and live fire test and evaluation.

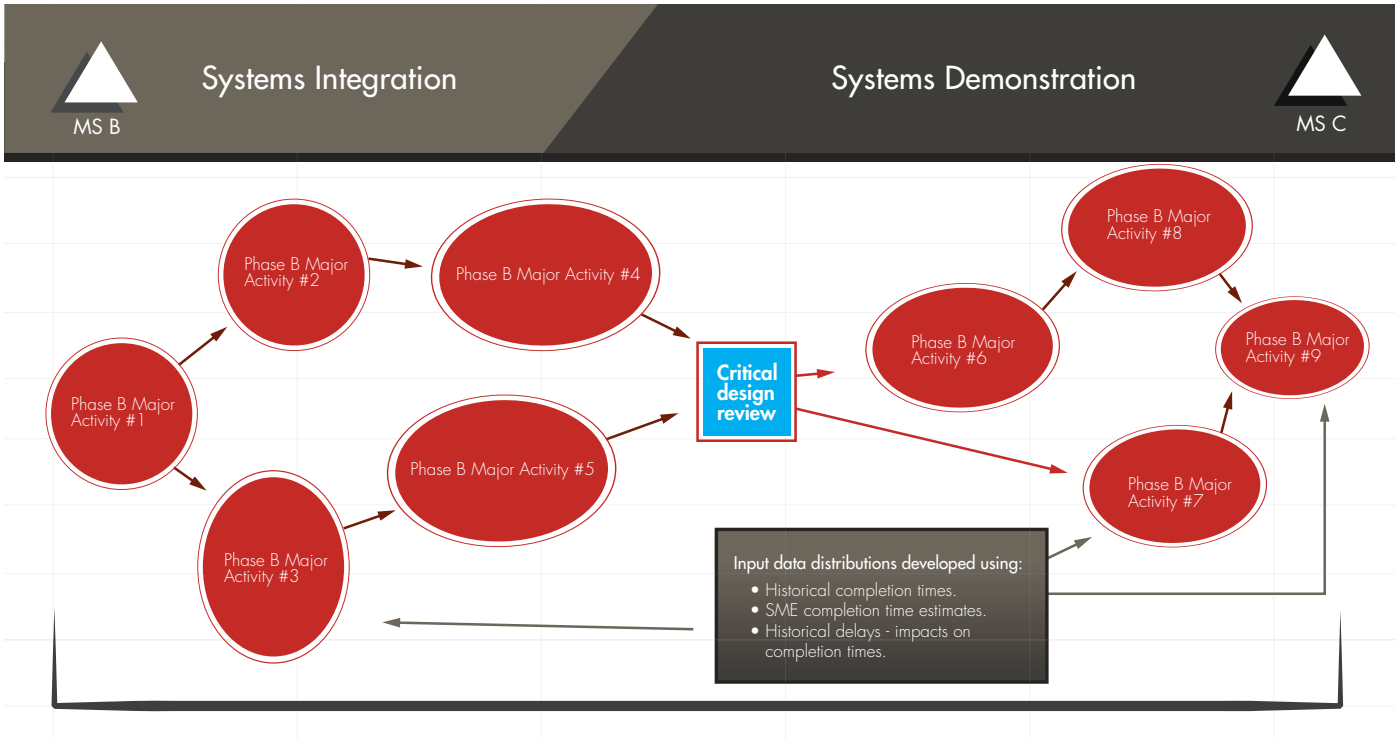
ANY METHOD OF EXECUTING A RISK ASSESSMENT MUST BE SUPPORTABLE IN THE TIME FRAME ALLOTTED BY AOA GUIDANCE. METHODS ALSO MUST BE CONSISTENT AND REPEATABLE FOR EACH NEW AOA.

Thus, if the team looked at the EMD phase of historical programs at an event level, it could find the duration times to achieve contract awards, first prototypes or successful PQTs. In addition, the team could collect and analyze data on specific risks realized during an event and the effects of those risks on the program's schedule. For example, the team might find frequent contract protests that delayed Milestone C by four to six months, or frequent reliability problems in past PQTs that caused five- to 15-month delays. All of these historical data can be useful to simulate a current program's schedule and develop a distribution of possible schedule outcomes.

In January 2013, AMSAA initiated development of a schedule risk event-driven methodology (SREDM) to address risk assessment gaps that the senior Army analysis leaders had identified and to supplement the concepts of SRDDM by using event network modeling.

An event-level approach promotes greater flexibility in the use of historical data within the model, and offers the capability to model additional schedule complexities. For example, a PM may be interested in conducting a trade-off analysis to compare the schedule impacts of pursuing various technology solutions, which is a crucial step in making affordable

FIGURE 2



A WEB OF EVENTS

The SREDM approach considers the intricate relationships of discrete activities and events that occur within an acquisition phase between milestones, such as EMD, rather than looking at the phase as a whole. Analysis at this level of detail can highlight how specific elements of the acquisition phase contribute to the overall schedule risk. (SOURCE: AMSAA risk IPT)

and prudent investments. Investing in state-of-the-art technologies is critical to maintaining the decisive edge, but a PM must weigh technologies against risk and cost, given reduced budgets. Now the PM can look at past examples of technology development and the technology's associated schedule impact at the event level rather than at the phase level, which may provide greater confidence in the historical data since it is less challenging to find commonalities between events within a phase than in the phase as a whole.

QUANTIFYING UNCERTAINTY

The risk IPT's methodologies aim to characterize the risk in an acquisition schedule by quantifying the uncertainty and impacts. SREDM is specifically designed to do this by using historical data on event duration and delays. (See Figure 2.)

A major challenge in accomplishing this objective has been identifying this level of detail for historical programs. To date, the USD(AT&L)'s Selected Acquisition Reports (online at **http://www.acq.osd.mil/ara/am/sar/**) have been the primary data source; however, the model could be modified to support subject-matter expert (SME) judgments to fill in gaps or to complement the historical data. All the data, whether from SMEs or historical programs, can populate an event network model of schedule activities and their associated relationships.

The IPT implemented the initial version of the model in a Monte Carlo simulation using the software tools @Risk and Microsoft Project. The outputs include a distribution of schedule completion times and, in turn, probabilities of schedule completion. (See Figure 3 on Page 74.)

PROGRESS, BUT WORK REMAINS

Thomas Edison was said to have a motto, "If there's a way to do it better—find it." This could also be the motto of all those

involved in the complexities of acquisition, but it resonates particularly with the AMSAA risk IPT. Team members try continuously to enhance their risk assessment approaches to ensure that they are reporting the significant ramifications of all critical sources of schedule risk in a realistic, unbiased and rational manner.

Any method of executing a risk assessment must be supportable in the time frame allotted by AoA guidance. Methods also must be consistent and repeatable for each new AoA. The main objective is to deliver the most useful risk information possible to decision-makers so they can make fully informed decisions that will lead to balanced costs, benefits and prudent risks.

The risk team faces the challenges of increasing the quantity of objective data available for risk assessments, and ensuring the data's quality with respect to using the information within a model. The team continues its research to establish a better understanding of the critical factors that create schedule risk and a clearer picture of how best to assess those risks through the use of historical data and SME judgments.

The risk IPT continuously seeks to tap the expertise of other acquisition organizations to help develop risk assessment models. With this kind of collaboration, the team will proceed toward its goal of providing the best possible product—an independent, honest and accurate schedule risk assessment.

CONCLUSION

David Vose, a consultant in risk analysis, noted in his book "Risk Analysis: A Quantitative Guide" that "The biggest uncertainty in risk analysis is whether we started off analyzing the right thing and in the right way." The AMSAA risk team, accustomed to addressing this uncertainty, is preparing to embark on more model research and development activities to improve the quality of its methods.

Many challenges still need to be addressed. In due course, the AMSAA team aims to be a strong link in the chain of all the dedicated analysts who are serving to make better acquisition decisions to safeguard and equip the warfighter.

For more information, go to ***http://web.amsaa.army.mil/RiskAssessment.html*** *or contact the leader of AMSAA's risk team, Suzanne Singleton, at* ***Suzanne.r.singleton.civ@mail.mil*** *or 410-278-2049.*

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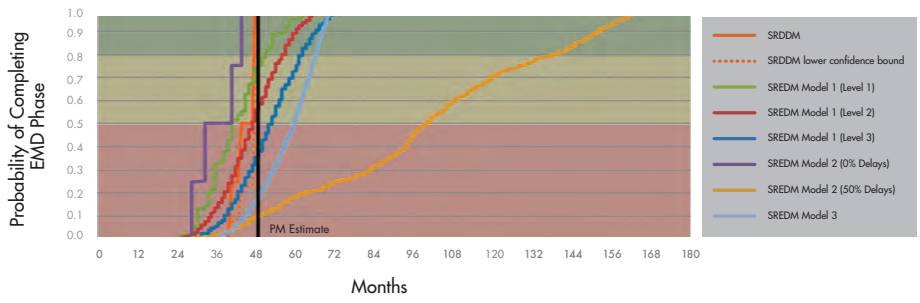
FIGURE 3



SRDDM AND SREDM MODEL OUTPUTS

This conceptual plot shows the probability that a notional new-vehicle program will complete its EMD phase within the 50 months allotted in the PM's program schedule. Each curve plotted in the graph represents a different model and excursion. Model 1 represents simulations using only historical event data. The three excursions within Model 1 (Levels 1, 2 and 3) refer to the schedule events included in the modeling; each increase in level represents the addition of more detailed schedule events. Model 2 used historical delay data to show the effect of potential delays on a schedule. Of the two notional Model 2 excursions, delays had no chance of occurring in one, whereas each delay had a 50 percent chance of occurring in the other. Model 3 represents simulations that combined SME input and historical event data. (SOURCE: AMSAA risk IPT)

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Joint Sustainment THAT WORKS

Three simple rules to guide the planning of complex multiservice operations

by Mr. Mark Solseth

As an instructor for the Command and General Staff Officers' Course, I often observe Army officers understandably defaulting to their experience when first learning about or performing sustainment planning during joint practical exercises. Many times, again not unexpectedly, they start planning almost solely from an Army perspective, specifying detailed tasks to Army sustainment units by field service and class of supply.

I propose a simple, straightforward construct for them to use when thinking about planning joint sustainment, with three rules to follow in sequence.

First, each service (Army, Air Force, Navy or Marine Corps) is responsible for sustaining itself, or the Defense Logistics Agency (DLA) provides the sustainment in response to that service.

Second, the joint planner must consider exceptions to the first rule if those exceptions make sense for the operational context at hand.

The third rule is that if the first and second rules don't cover a sustainment area, or if it conflicts with those rules, reconciliation is necessary, using primarily joint boards, centers, offices, cells and groups.

By applying this rather simple construct to planning for the specific operation, planners can think around the complex limitations of law, policy and doctrine relating to service and joint sustainment.

RULE 1

The first rule derives from the service responsibilities listed in Title 10 of the U.S. Code and supplemented by directives from DOD. Based on these laws and directives, all of the services have major commands to support their requirements,

AIR FORCE TERRITORY
F-16 Fighting Falcons from the 140th Fighter Squadron, Buckley AFB, CO, soar over Nellis AFB, NV, Feb. 4. Maintenance of the Air Force's fighter aircraft is a sustainment responsibility, like the maintenance of the Army's Bradley Fighting Vehicles, that will always remain with the service because of its uniqueness. (U.S. Air Force photo by A1C Joshua Kleinholz, 99th Air Base Wing Public Affairs)

including the U.S. Army Materiel Command, Air Force Materiel Command, Naval Supply Systems Command and Marine Corps Logistics Command. They also have service-unique force structures to support operational- and tactical-level sustainment operations.

The role of DLA, which responds to the services, is important because the secretary of defense may designate a single agency to "provide for the performance of a supply or service activity that is common to more than one military department" when the secretary "determines such action would be more effective, economical, or efficient" (Title 10, Chapter 8).

According to its website, DLA is responsible for sourcing and providing "nearly 100 percent of the consumable items America's military forces need to operate." So, with the statutory requirement for the services to support themselves and DLA serving as an important part of the system, the structure and responsibilities are in place for sustaining joint operations.

The Army service component planners in the joint force are responsible for planning the Army's support in detail. Joint-level planners do not need to specify detailed

tasks to Army sustainment units. Some sustainment responsibilities will always remain with the service because of their uniqueness (for example, the maintenance of the Air Force's fighter aircraft or the Army's Bradley Fighting Vehicles).

Included in Rule 1 is the need to consider sustainment functions assigned through executive agent directives or other instructions to a single service or agency. These sustainment functions include DLA's responsibilities as the executive agent for subsistence, bulk fuel, construction and barrier materials, medical materiel and other consumables.

Another example is the Army's designation as the executive agent for functions such as the management of overland petroleum support, land-based water resources, the defense mortuary affairs program and veterinary services. These responsibilities allow for identifying and planning for sustainment functions officially tasked to a service or agency to provide to all forces in the joint operation.

The executive agent role is new to some students, and thinking through this part of the planning construct prompts them to research and find out what support a service or agency needs to plan not only for itself but also for the other joint forces in the operation. (The DOD executive agent list is at **http://dod-executiveagent.osd.mil/agentlist.aspx**.) This requires some assumption-based planning, since the capabilities and requirements of the other services involved in the operation are not always clear.

RULE 2

The second rule of the construct, to consider exceptions to the first rule if they make sense, is deceptively simple, but it is meant to cause the planner to consider exceptions for the specific joint operation being planned. This is the most important area on which the joint sustainment planner should focus.

The planner must consider the type of operation, its location, the forces involved and the deployment sequence, and then consider the sustainment functions that could or should be provided by a single service or between services. A service may be designated as the lead because that service is the dominant user of sustainment commodities, or because it has the greatest capability to provide the support, or to create efficiency.

Designating a single service as the lead for a sustainment function reduces the overhead created when all services must bring their own capabilities to provide sustainment for things commonly used by others. Some examples are feeding, retail fuel support, billeting, contracting, maintenance of common vehicles and medical support. These exceptions to service-only sustainment are not only more efficient, but they also can allow for a more effective operation by freeing up scarce strategic transportation assets for forces necessary in the decisive phase of the operation.

This rule in joint planning can be the most challenging because each situation is unique, and force lists, sequencing, host-nation capabilities and priorities vary depending on the operational context. However, this rule is the most important because it identifies what the services need to know to sustain the operation being planned. Services generally have figured out the first rule—they are responsible for supporting themselves—but they need to know what else they're expected to do if the joint force commander identifies additional requirements. Rule 2 lets the service component sustainment planner know what to plan for that isn't routine.

For example, while a service must plan to feed itself, it needs to know if it is also feeding another service during the operation, or providing medical or base support to members of other services. Such details enable the service component planners to ensure that enough capability and capacity are available to provide such support, and it can help them set up appropriate coordination and reporting mechanisms to facilitate that support.

To decide if a lead service is appropriate, the joint planner considers how to make the operation more efficient and effective, rather than just defaulting to the statutory requirements and letting all the services bring what they need to provide their own support. Considering who the dominant user is or who has the most reasonable capability to support other forces, as well as what is reasonably available in theater from the

PRESCRIPTION FOR JOINTNESS

Through its Customer Pharmacy Operations Center, DLA Troop Support's Medical Directorate helps facilities worldwide save money, such as this pharmacy at Whiteman AFB, MO. DLA is responsible for sourcing and providing almost all the consumable items that U.S. military forces need to operate. (Photo by SSgt Nick Wilson)

host nation and other factors, supports decision-making on joint support for the particular operation.

In some cases, a plan may already have designated a service as the lead in a particular area or areas. Services may have coordinated their requirements and put in place interservice support agreements (ISSAs) without being directed to do so by a higher-level joint order.

Joint Publication (JP) 4–07, Joint Tactics, Techniques, and Procedures for Common-User Logistics During Joint Operations, lists Army logistics support to U.S. Air Force tactical air control parties (USAF TACPs) as an example of an ISSA. The JP states that "this particular Service Secretariat-level ISSA is a long-term agreement that requires the Army to provide significant common-user logistic support—life support, fuel, selected maintenance, [and] Class IX [repair parts] support to USAF TACPs that are attached to Army tactical units."

Again, by focusing on this second area of the planning construct, the joint planner will think through and potentially task requirements that are not routine for services, in an effort to make the operation as efficient and effective as possible. However, the joint planner will not think of everything, and inevitably there will be friction between the services requiring additional decisions and prioritization, which leads to the third rule of the planning construct.

RULE 3

Sustainment challenges or conflicts that were not fully anticipated in the planning process will always emerge during the operation. So, the third rule is that items not covered, or that are in conflict with Rule 1 or 2, are reconciled before and during the operation using joint

SEABEE SPECIALTY

Seabees from Naval Mobile Construction Battalion 1's Civic Construction Action Detail Cambodia construct a new bathroom facility March 3 as part of their 2014 Pacific Deployment. The Navy has construction engineering capabilities that sustainment planners may designate to support all the services in a joint operation. (U.S. Navy photo by Equipment Operator Constructionman Brett Seals)

SUPPORTING FUEL OPS

SSG Jack Colston, the reports sergeant with the 371st Sustainment Brigade (SB), inspects equipment Jan. 7 at the Tactical Petroleum Terminal (TPT), Camp Buehring, Kuwait. The TPT supplies fuel to all military installations throughout Kuwait. DLA is the executive agent for bulk fuel and the Army is the executive agent for the management of overland petroleum support. (Photo by SSG Kimberly Hill, 371st SB)

boards, centers, offices, cells and groups. (For specific definitions of these bodies, go to JP 1–02, the DOD Dictionary of Military and Associated Terms, at **http://www.dtic.mil/doctrine/new_pubs/jp1_02.pdf**; and JP 3-33, Joint Task Force Headquarters, at **http://www.dtic.mil/doctrine/new_pubs/jp3_33.pdf.**)

Doctrine provides for the establishment of a number of boards, centers, offices, cells and groups. These bodies are designed to serve primarily as coordinating authorities: They make or recommend decisions to rectify problem areas or reduce the friction that occurs when multiple services are operating in the same area, often competing for the same space and resources.

These bodies have slightly different functions depending on whether the action requires a decision or is an enduring requirement. Additionally, they may be formed at different headquarters—some at the geographic command level and others at the subordinate joint force headquarters.

As a means to resolve the inevitable problems, the joint planner can start setting up or coordinating with boards, centers, offices, cells and groups early in the planning process. A savvy planner will start developing the battle rhythm of these organizations to facilitate timely decisions and to provide the venue for problem resolution.

APPLYING THE RULES

Imagine being on a joint staff executing crisis action planning to establish an expeditionary forward operating base from which Army, Air Force and Naval aircraft will operate in support of a small-scale contingency operation that may also involve humanitarian operations. Looking at a list of core logistics functions from JP 4–0, Joint Logistics (online at **http://www.dtic.mil/doctrine/new_pubs/jp4_0.pdf**) may help. (See Figure 1.)

Considering Rule 1, each service should plan to deploy the sustainment capabilities needed to support itself. Army, Air Force, Navy and Marine Corps component planners will consider their own force's deployment and determine when and where the supplies, maintenance to support deployed equipment, health service support and life support for their personnel are required.

If their service is an executive agent, component planners also must consider the capabilities required to support other services. For example, the Army is the executive agent for mortuary affairs and veterinary support, so it needs to plan to bring those resources for all service forces deploying. As the executive agent responsible for providing bulk petroleum, barrier materials, subsistence and

FIGURE 1

CORE LOGISTICS FUNCTIONS	
Core Functions	**Functional Capabilities**
Deployment and distribution	• Move the force. • Sustain the force.
Supply	• Manage supplies and equipment. • Inventory management. • Manage global supplier networks. • Assess global requirements, resources, capabilities and risks.
Maintenance	• Depot maintenance operations. • Field maintenance operations.
Logistics services	• Food service. • Water and ice service. • Contingency base services. • Base and installations support. • Hygiene services.
Operational contract support	• Contract support integration. • Contractor management.
Engineering	• General engineering. • Combat engineering. • Geospatial engineering.
Health services	• Health service delivery. • Force health protection. • Health system support.

CORE LOGISTICS FUNCTIONS

The joint sustainment planner may consider the capabilities involved in each core logistics function to determine whether a certain service should have the lead in providing it for all services involved in a joint operation. (SOURCE: JP 4-0)

medical materiel to all the services, DLA is an important partner in the service component planning process.

Applying Rule 2, the joint sustainment planner considers exceptions to Rule 1 and plans to eliminate redundancies where it makes sense for the operation. Assuming that the Air Force is the predominant service for this operation, perhaps it makes sense for the Air Force to provide subsistence and base support for all participating elements.

For efficiency's sake, the Army could deploy the resources to provide medical support to all the services and to repair ground vehicles common to all the services. Naval forces might provide the construction engineering capability for the task force; this is a requirement all the services will likely have, and each service has engineering capability in its force structure, but tasking construction engineering to a single service may reduce redundancy and clarify responsibilities.

CONCLUSION

The above are simple examples, but the process illustrates where the joint planner's focus should be—not on the service requirements, but on the requirement to make this operation as efficient and effective as possible by reducing unnecessary redundancies. Understanding that there will be evolving and unanticipated challenges, the planner can apply Rule 3 and start considering the structure of and coordination authorities for the appropriate board, center, office, cell and group and how these bodies fit it in the task force's battle rhythm.

This framework should help a planner think through the joint planning process. It considers a service's Title 10 responsibility to sustain its own forces, accounts for the combatant commander's plan for service leads in certain areas when it makes sense, and takes into consideration that unanticipated requirements and conflicts will arise and will need to be addressed.

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‘ENTERPRISING’ SUSTAINMENT

Army aviation seeks big-picture approach to curb life-cycle costs

by Mr. David Vergun and Mr. Steve Stark

WARTIME FOOTING
Over the past several years of combat operations, the Army has focused on quickly procuring and fielding equipment such as this CH-47 Chinook helicopter assigned to Task Force Thunder, 159th Combat Aviation Brigade (CAB), 101st Airborne Division (Air Assault), at Bagram Airfield, Afghanistan. Now, the focus is shifting to a systems approach, to find ways to make sustainment much more efficient. (U.S. Army photo by SPC Joseph Green, 159th CAB Public Affairs)

Anyone who depends on a car to get to work each day knows that the older the car gets, the more it costs to maintain. Finally, there comes a day of reckoning when the commuter has to weigh the costs and benefits of putting another few thousand dollars into the old beater to keep it running, against putting that cash toward a down payment on a shiny new car that promises to be vastly more reliable.

But maintenance is only one piece of sustainment, which involves nearly every phase of storing, maintaining, fueling, upgrading and modernizing, repairing and a host of other logistical concerns. And the Army procures military vehicles and aircraft with the intention that they last significantly longer than the average commuter car—generally about 20 years, but in reality often longer.

Prudent sustainment is a must, as there are no shiny new aircraft or vehicles in the Army's immediate future. But the cost of sustainment is massive. According to a panel discussion, "Enterprise Approach to Sustainment," at the Association of the United States Army (AUSA) Aviation Symposium Jan. 14, sustainment costs are supposed to be about 70 percent of a program's budget, with the other 30 percent going toward procurement. But, as panel chair MG Lynn A. Collyar pointed out, sustainment costs are creeping toward 90 percent of budget and are going to eat Army aviation alive unless it streamlines its sustainment practices. Collyar is commanding general (CG) of U.S. Army Aviation and Missile Command (AMCOM) at Redstone Arsenal, AL.

"About 21 percent of the [helicopter] engines we receive at Corpus Christi [Army Depot, TX] had no failure problem, and another 19 percent should have been fixed at the unit level," where preshop analysis could have been performed, he said. "We can no longer afford that 40 percent."

THE SKY IS NOT THE LIMIT

U.S. Army MG Lynn A. Collyar, right, and MG Kevin W. Mangum, center, CG of the U.S. Army Aviation Center of Excellence, walk with COL Allan M. Pepin, commander of Task Force Falcon, during a visit at Kandahar Airfield, Afghanistan, May 7, 2013. Collyar chaired a panel on sustaining aviation at the AUSA Aviation Symposium in January in which he pointed out that the current spending trend on aviation sustainment cannot continue. (U.S. Army photo by SGT Luke Rollins)

AN ENTERPRISE APPROACH

An enterprise approach to sustainment has three legs: force structure, modernization and readiness. In terms of force structure, Collyar said, the Army needs to leverage the full mix of DA civilian, Soldier and contractor personnel to ensure that all are aligned and that each piece of the sustainment puzzle is addressed at the appropriate level, by the appropriate personnel.

While civilians and contractors will continue to play an important role in sustaining Army aircraft, Soldiers need to roll up their sleeves at training bases and depots, learn from their non-uniformed colleagues and get back up to speed, he said. "This is critically

BALANCING ACT

A member of Joint Task Force – Bravo jumps from a UH-60 Black Hawk helicopter during helocast training at Lake Yojoa, Honduras, Feb. 25. The Army is seeking an enterprise approach to sustainment, balancing force structure, modernization and readiness. (U.S. Air Force photo by Capt Zach Anderson)

important," he added, not just from a cost-saving and training aspect, but also in terms of readiness, given that Soldiers may need these skills on the battlefield.

Over the past several years of combat operations, the Army has procured and fielded equipment so quickly, reacting to demand rather than anticipating it, that it is time to return to a systems approach and find ways to make the sustainment process much more efficient, according to panelist COL Patrick Mason, commander, Redstone Test Center, Redstone Arsenal.

In the modernization arena, that includes reducing "unique" equipping solutions, investing in energy innovations and focusing on systems with "embedded prognostics" that are self-diagnosing, if not self-healing, according to the panelists. It also means fully recognizing life-cycle sustainment costs as the Army upgrades or procures systems.

A major cost driver for Army aviation is software, which "will overcome us if we don't get a handle on it," Collyar said. Software support costs continue to go up in every aviation system—and, for that matter, across every system in the Army, he said, describing the cost-curve rise as more logarithmic than linear.

Now-retired MG William T. "Tim" Crosby, then the Program Executive Officer Aviation, agreed. Crosby, who also was on the panel, said that post-production software can be costly and that the Army needs to find cost efficiencies across all life-cycle systems. A solution, he said, is to digitize and automate sustainment using a task-based system. This approach would provide Soldiers a systematic, visible means of troubleshooting and getting to the root cause of system failures.

Crosby suggested that digitizing and automating sustainment can help the Army identify issues at their origins rather than simply treating symptoms. He noted that the Army could learn from industry, which does this well. So, instead of continually buying replacement parts for, say, a leaking transmission seal, this approach would identify the root cause for the failure, which might lead to a redesigned replacement seal, he said. It would cost more upfront but would save money over time, not to mention increasing safety.

These systems-based measures would improve accountability and auditability by making it easier to capture costs across the entire enterprise, spot problems with specific parts, and understand projected mean times to failure and environmental impacts on parts, Collyar said.

Army aviation must work in partnership with industry to achieve a balance among force structure, modernization

and readiness, panel members said. Boeing's Peri Widener, vice president for rotorcraft support programs, said that flexible, multiyear contracts could bring a measure of stability to the Army and its third- and fourth-tier suppliers as well as bring costs down by buying in bulk.

Widener also said that forecasting models need to be flexible enough to factor in the unexpected. "It isn't always possible to predict where the Army will be," she said, using the example of the wars in Iraq and Afghanistan, where factors such as heat and dust had a bigger impact on helicopters than salt-water corrosion, which might occur in the Pacific region.

CONCLUSION

Whatever the future brings, the panel agreed, the Army must be operationally ready and regionally aligned. Stakeholders across the enterprise must have a transparent view that promotes trust and monitors performance, as well as shared knowledge of issues and problems affecting all domains.

Decision-making must be analytically based, harnessing the power of big data, which means implementing a robust system of failure reporting and corrective action, and fleet analytics. To do that requires end-to-end value chain assessment that captures costs across the entire enterprise and maximizes the value of each dollar spent.

PAYING THE PRICE

Aviation Mechanic General Alex Ayala inspects a UH-60 Black Hawk helicopter undergoing recapitalization at the Corpus Christi Army Depot (CCAD) Sept. 23, 2013. A substantial percentage of aircraft engines coming to CCAD recently did not need depot-level repair, Collyar said. (Photo by Jose E. Rodriguez, CCAD Public Affairs)

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EVOLVING INNOVATION

A new look at fostering cutting-edge thinking in Army science and technology

by LTC Joel Dillon, Dr. Jason Augustyn, Ms. Julia Kim and Mr. Dominic Ju

Science and technology (S&T) innovation is an uncertain road, with "failure" often a step on the path to a breakthrough. However, in a resource-constrained environment, planners must make the smartest possible investments of taxpayer money in S&T programs, balancing risk with the potential for transformational new capabilities. A good place to start striking this balance is at the "fuzzy front end" of innovation, the initial period of exploration preceding the development of new materiel solutions.

For many years, the acquisition community viewed the front end of innovation as a swirl of activity that occurs before Milestone A—a time of "eureka" moments and multiple return trips to the drawing board. But over the past 10 to 15 years, a growing body of research and practice in industry, government and academia has shown that managing front-end innovation is not only possible but also hugely valuable in terms of encouraging potentially revolutionary ideas and focusing limited research and development dollars.

Three basic questions lie at the heart of managing the front end of innovation:

1. How can an organization inspire and cultivate great ideas?
2. How can it then identify the best ideas and mature them into concepts through appropriate analysis?
3. How can the organization align stakeholders and investments around the most promising concepts?

The Office of the Deputy Assistant Secretary of the Army for Research and Technology (ODASA(R&T)), in collaboration with the Army S&T enterprise and the Army Capabilities Integration Center (ARCIC) at the U.S. Army Training and Doctrine Command (TRADOC), is piloting a way to address these key questions through a holistic campaign of exploration called Army Science and Technology Reconnaissance 2030 (SciTech Recon 2030). The purpose of SciTech Recon 2030 is to explore S&T trends that could shape future operations and provide the Army with overmatch in the 2030-40 time frame. SciTech Recon 2030 seeks to leverage and scale best practices developed at the grass roots by the Army S&T community, other services and industry. At a high level, the process has these key components:

- Engaging a broad community of innovative thinkers.
- Generating a wide range of ideas for potentially game-changing technologies.

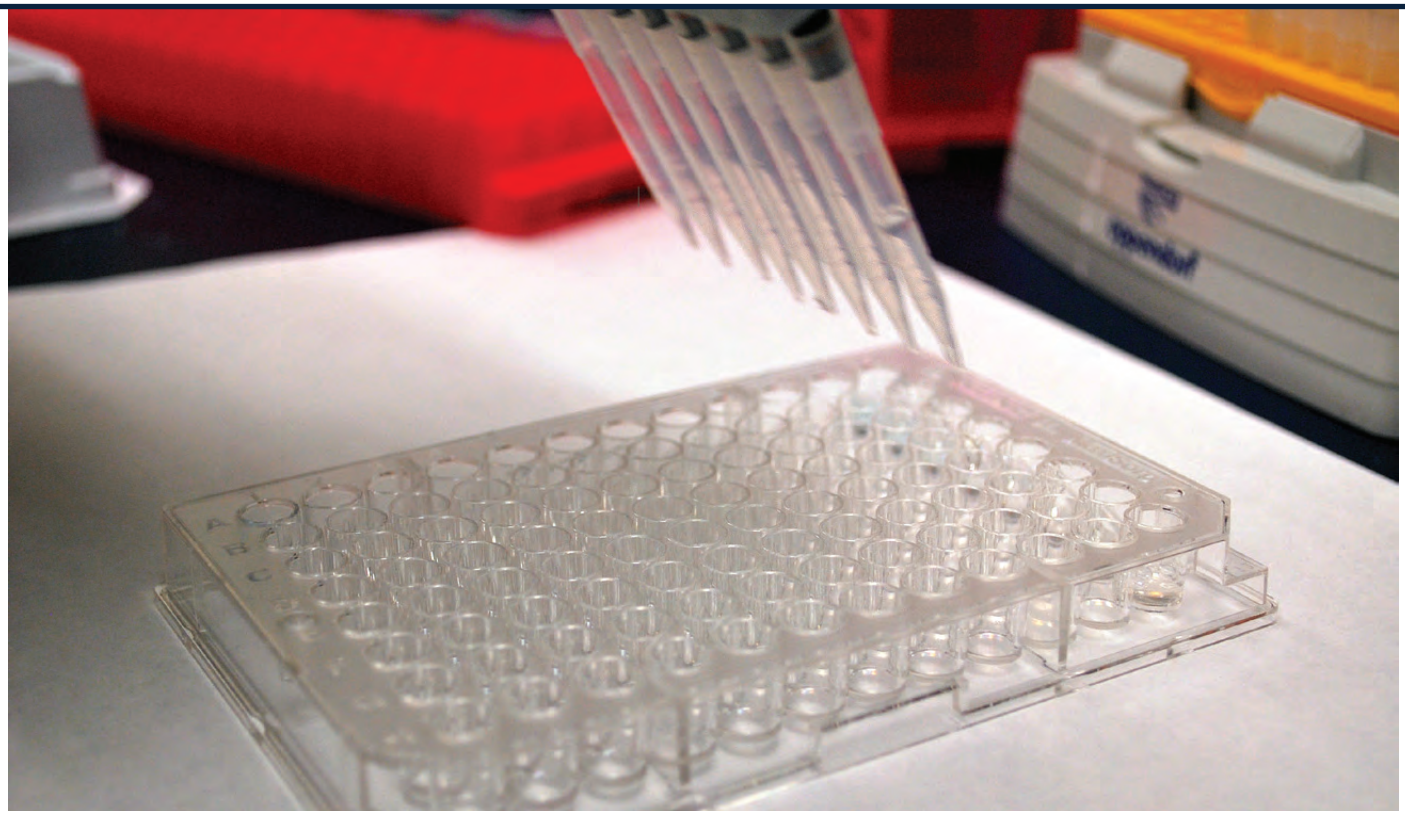
BIONIC AUGMENTATION
Over the next 30 years, human performance augmentation technologies will become widespread in both the civilian and military sectors. For example, researchers in the United States and South Korea have demonstrated transparent graphene circuits integrated into soft contact lenses. Someday, this technology will enable contacts to double as high-definition augmented reality displays. While wearable technology is a field in its infancy, companies such as Apple Inc., Google Inc. and Samsung are working on "smart" accessories. Military examples include powerful, innovative systems to give humans Iron Man-like capabilities. (SOURCE: Shutterstock)

- Analyzing promising ideas to identify insights into future operations and technology concepts.
- Fostering dialogue on the nexus between future operations and potential breakthrough technologies, and how to align S&T investments to develop those technologies for the future force.

ENGAGING INNOVATIVE THINKERS

Research and practice in corporate innovation show the importance of including a diverse pool of people who can explore a problem creatively. This includes both in-house experts and outside perspectives. The ODASA(R&T) is using various collaborative approaches to engage a broad network of government scientists and engineers, experts in military operations, and creative thinkers from academia, industry, federally funded research and development centers, and other hubs of innovation.

This network is encouraging fresh and potentially provocative perspectives. For example, the SciTech Recon 2030 team recently ran a Web-based brainstorming game that included members of the SIGMA Forum, a think tank of science fiction authors, who challenged many of the assumptions



BIOSYNTHESIS
U.S. Army Research Laboratory (ARL) chemists test up to 96 droplets of liquid compounds at a time as part of a research project to find synthetic antibodies that can counter the threat to Soldiers from synthetic viruses. Planning for the future by necessity must take into account synthetic biology as it becomes simpler to model synthetic materials. (Photo by Joyce P. Brayboy, ARL)

of players from academic and government laboratories.

To foster common ground within this diverse community, the ODASA(R&T) has produced a report titled "Science and Technology Trends 2013-2043: A Review of Leading Forecasts," available online at **http://futures.armyscitech.com** under "Resources." The report consolidates several major forecasts that private- and public-sector agencies have published over the past five years, including the National Intelligence Council's "Global Trends 2030: Alternative Worlds" report (**http://www.dni.gov/index.php/about/organization/national-intelligence-council-global-trends**) and the McKinsey Global Institute's report "Disruptive Technologies: Advances that will transform life, business, and the global economy" (**http://www.mckinsey.com/insights/business_technology/disruptive_technologies**).

The ODASA(R&T) report identified 16 common trends across a range of S&T topics, including robotics and autonomous systems, 3-D printing of human organs, the "Internet of Things" and synthetic biology. This report provides a common reference point for the S&T community on trends that are likely to affect the development of future military capabilities.

To further immerse the community in operational and security trends, the ODASA(R&T) is also leveraging work led by ARCIC in support of the Army's annual war game, Unified Quest (UQ), a yearlong series of analytic activities that examines the Army's future across the doctrine, organization, training, materiel, leadership and education, personnel and facilities (DOTMLPF) spectrum. The current iteration of UQ is examining operations in the 2025-35 time frame in and around "megacities," defined as urban centers with more than 10 million inhabitants. Demographers project that by 2050, more than 70 percent of the world's population will live in cities, with up to 2.4 billion living in vast slums in and around megacities such as Lagos, Nigeria.

Extremely high rates of poverty and substandard living conditions could make megacities fertile ground for terrorists and criminal organizations. Many megacities are located on coastlines and are also vulnerable to catastrophic humanitarian crises caused by typhoons,

MEGACITY DANGERS
Demographers project that more than 70 percent of the world's population will live in cities, many of them coastal, by 2050, and that urban slums will be home to 2.4 billion people. The potential for instability and strife caused by humanitarian or other disasters in megacities makes it necessary to look at them as potential battlegrounds of the future. (SOURCE: Wikipedia)

earthquakes and other natural disasters. The megacity environment will present enormous challenges for the Army across every warfighting function. It is critical that the Army S&T community work hand in hand with TRADOC to examine these challenges and envision new technologies that will allow our Soldiers to maintain overmatch.

GENERATING INNOVATIVE IDEAS

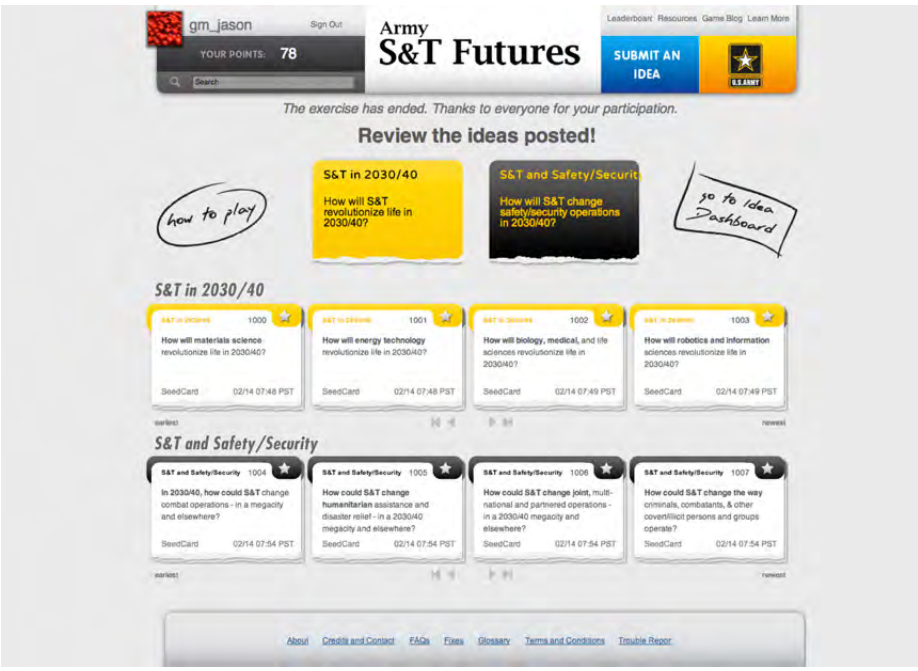
Information on megacities and other trends shaping the future of S&T and military operations serves as input to a series of four Web-based brainstorming "games" designed to engage the community in a broad exploration of future operations and the technologies that could enable our forces. For example, the first game, which ran from Jan. 22 to 27, examined the megacity environment, exploring four main topics: what megacities could look like in 2030-40; how people might live and work in and around megacities; how they might use technology; and what capabilities U.S. forces will need to succeed during military operations in and around a megacity.

ODASA(R&T) recruited more than 60 players for the game from Army labs and research, development and engineering centers, ARCIC, universities, the United States Military Academy at West Point and other organizations. Players participated in a Web-based exchange in which they shared ideas about the game topics through short posts. The game interface enabled players to challenge other players' ideas, build on interesting ideas and ask probing questions to explore new ground. Players earned points for every post, and the player who accumulated the most points "won."

These simple game mechanics proved highly effective in creating a free-flowing debate and fresh thinking. For example, during the first game, a group of players explored the idea of using supply drones and holographic disguises to enable squads to use "flash mob" tactics—infiltrating an area by blending into the surroundings, quickly conducting a raid or other mission, and then blending back into the populace.

As with any brainstorming exercise, the specifics of any single idea were less important than the connections that people made among themselves and with the ideas. Holographic disguises, like those in the film "Total Recall," might

FIGURE 1



SERIOUS PLAY
SciTech Recon 2030 uses Web-based brainstorming games to gather ideas about future technology and military operations. The second game, in February, explored developments in materials science; energy; biology, medical and other life sciences; and robotics. Perhaps more important than the scenarios themselves, though, are the ideas and connections that develop among players. (SOURCE: ODASA(R&T))

not pan out, but the basic idea drove interesting discussion about how we could better disguise troop movement in congested urban centers.

The second game, which ran from Feb. 24 to 28, explored how developments in materials science; energy; biology, medical and other life sciences; and robotics over the next 30 years will shape society and military capabilities. (See Figure 1.)

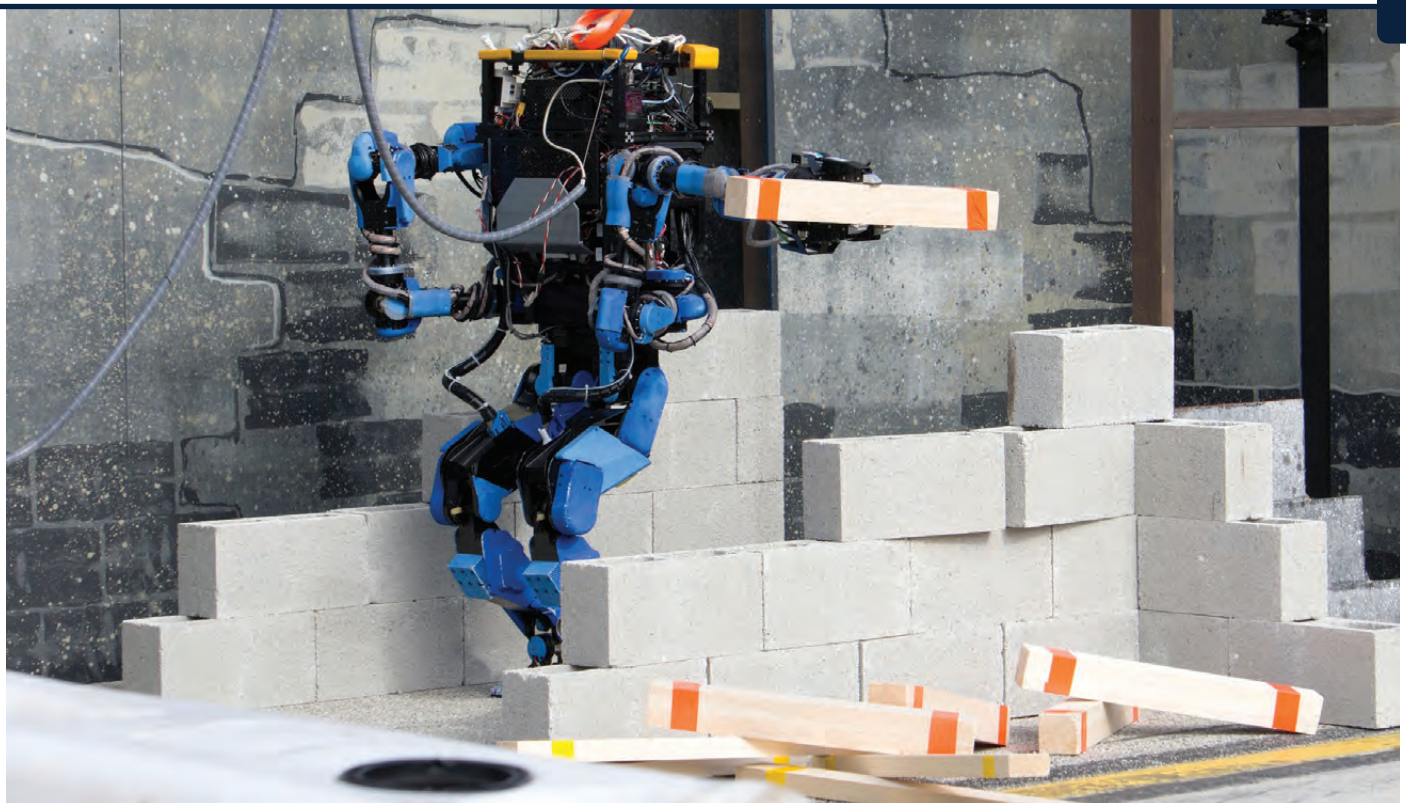
The third game, scheduled for late April, will build on ideas gathered in the first two games and dig more deeply into ideas for technologies that could provide overmatch capabilities across a range of potential Army operations in the megacities of 2030-40, such as humanitarian assistance, disaster relief and counter-terrorism. The fourth and final game, scheduled for early May, will zero in on four specific topics that the Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology (OASA(ALT)) and TRADOC have identified as important areas for innovation: mobile protected fires (robotics and unmanned fire support); identity control technologies (friend versus foe and deception technologies); enhancing human performance (cognitive and physical augmentation); and communications "beyond digital" (quantum communications and other technologies).

ANALYZING IDEAS, UNCOVERING INSIGHTS

Based on the number of ideas generated in the first two games, players could contribute close to 4,000 "raw" ideas during the four Web-based brainstorming games planned for SciTech Recon 2030. A team of analysts that the ODASA(R&T) recruited from government labs, academia and industry will mine these data for important insights and concepts that can inform strategic decision-making. The team will combine formal analysis techniques, such as technology sequence analysis, with expert interviews and archival research to identify insights about the nature of conflict in 2030-40, capabilities the Army might need in future operations, and technology concepts that could provide overmatch for the future force.

As an example, there was a rich discussion during the first exercise about trends in human augmentation, including technologies such as exoskeletons that can enhance physical performance and "nootropic" drugs that can boost mental performance. A number of players commented that in future megacities, these augmentations could be common in the civilian population. The wealthy might shop for night vision-enhanced contact lenses at trendy "augmentation boutiques," while poor manual laborers might buy used exoskeletons from black market "chop shops." Players discussed how the Army would handle crowd control, or partner with augmented civilians during humanitarian assistance and disaster relief operations.

The theme of augmentation continued during the second exercise, with players contributing Web links to the latest research on performance enhancements, such as U.S. Special Operations Command's Tactical Assault Light Operator Suit program, which aims to field a full-body exoskeleton to special operations units as early as 2018. Players debated the technical challenges of this



BOT BUDDY
Team SCHAFT's robot S-One earned the highest score, 27 points, during the DARPA Robotics Challenge Trials 2013 in December, in which eight of 16 competing teams earned funding from the Defense Advanced Research Projects Agency to further develop their robots to help respond to natural and other kinds of disasters. The team's lead organization is SCHAFT Inc., a Japanese robotics company. Robotics already play an important role in military technology, and that role is sure to increase with advances in artificial intelligence, sensing and power-sourcing. (DOD photo)

system and other augmentation concepts. The dialogue quickly characterized the key S&T challenges related to human augmentation and provided references and pointers to the academic literature and industry developments. The third and fourth exercises will carry the theme of human augmentation forward to a more focused exploration of the underlying S&T and potential operational applications.

The ODASA(R&T) team will use all of the resulting data to compile a detailed narrative on the potential impact of human augmentation for future operations in megacities and other environments. In addition to the ideas coming out of the Web-based games, the team will conduct focused interviews with experts on augmentation technologies to better understand the potential of this technology. The team is also partnering with the Library of Congress to identify investment in augmentation and other technologies by foreign governments, including potential adversaries. All of this information will be used to create a set of "concept cards"—narrative descriptions, with graphics and other media, portraying possible future augmentation technologies that could emerge over the next 20-30 years.

This process will also apply to other technology domains emerging from the SciTech Recon 2030 campaign, such as additive manufacturing (3-D printing) and atomtronics (atomic-scale circuitry). The result will be a thorough analysis of future trends in S&T that could have profound impacts on military capabilities. Reports and other information products will be available to the Army S&T community, TRADOC and the Office of the Secretary of Defense to help shape strategic dialogue about the future.

FOSTERING STRATEGIC DIALOGUE

In industry, front-end innovation processes generally drive toward go or no-go recommendations for new product development. That is not the objective of SciTech Recon 2030. Instead, the vision is to inform strategic conversations on technologies that could deliver leap-ahead capabilities for the future force, and how

RESEARCH AND PRACTICE IN CORPORATE INNOVATION SHOW THE IMPORTANCE OF INCLUDING A DIVERSE POOL OF PEOPLE WHO CAN EXPLORE A PROBLEM CREATIVELY.

best to align resources and organizations to pursue those opportunities. The ODASA(R&T) views this initiative as part of a broader Army effort to break down communication barriers that have hindered innovation.

The ultimate goal is to build direct, collaborative bridges between the technical and tactical communities. The traditional model, in which TRADOC and ASA(ALT) toss guidance and information back and forth over bureaucratic walls, will not support the kind of fresh thinking the Army needs to maintain overmatch in future conflicts.

Rather, the ODASA(R&T) intends for the process outlined here to help lay the foundation for a unified innovation pipeline. This will support ARCIC with solid S&T inputs that will help the organization craft operational concepts and articulate technology needs that result in realistic, innovative solutions. Simultaneously, the S&T community benefits by gaining an operational perspective that helps ground technical innovation.

CONCLUSION

As Thomas Edison noted, "Vision without execution is hallucination." While it is still early days, the SciTech Recon 2030 pilot initiative has already paid off in new collaborations between TRADOC and ASA(ALT). The Consolidated S&T Trends report is complete and is being disseminated to stakeholders throughout the Army. This report is on the reading list for the TRADOC-ARCIC Strategic Trends Seminar, a UQ activity that brings together experts from across the armed forces, academia and think tanks to consider the broad technology trends that will shape future operations. At press time, the first three idea-generation games will be complete, with emerging results provided to the S&T enterprise and ARCIC.

Early feedback on SciTech Recon 2030 from the S&T community and TRADOC has been positive. The ODASA(R&T) is incorporating recommendations from stakeholders and participants into plans for the next iteration, which will begin this summer. As the process moves ahead, the ODASA(R&T) welcomes wide participation from the AL&T community in fostering an unparalleled culture of innovation for Army S&T.

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Rebalancing **Research**

In post-conflict Army, technologies of the future take on greater importance

by Mr. Dale A. Ormond

The fundamental research mission of the U.S. Army Research, Development and Engineering Command (RDECOM) has always given the command a decades-long view of modernization. It is the command's mission to make the Army's current capabilities obsolete, as well as those of its adversaries. During the past 12 years, however, the command's seven centers and laboratories have focused more closely on providing mission-critical solutions to address Soldiers' immediate problems and issues in theater. While RDECOM has continuously pursued a balance of long-term research efforts and short-term engineering solutions, the urgency of war has naturally and necessarily changed the definition of that balance.

Under the command and leadership of the U.S. Army Materiel Command (AMC), RDECOM conducts life-cycle engineering for the Army, providing extensive engineering service support to the program executive offices (PEOs), program managers and life-cycle management commands (LCMCs). This is in addition to RDECOM's broad science and technology (S&T) portfolio. It ties directly into the force through programs such as the Field Assistance in Science and Technology (FAST), the RDECOM forward element commands, and RDECOM's thousands of partnerships with domestic and international academic, industry and government entities.

Now, as the Army enters a period of transition, RDECOM's 14,000 scientists, engineers and support personnel have begun to rebalance their efforts so that technologies that will emerge 10, 20 and 30 years into the future will increase in importance without diminishing RDECOM's vital engineering services support to the Army. These future technological breakthroughs require strong investments in S&T as well as research and development.

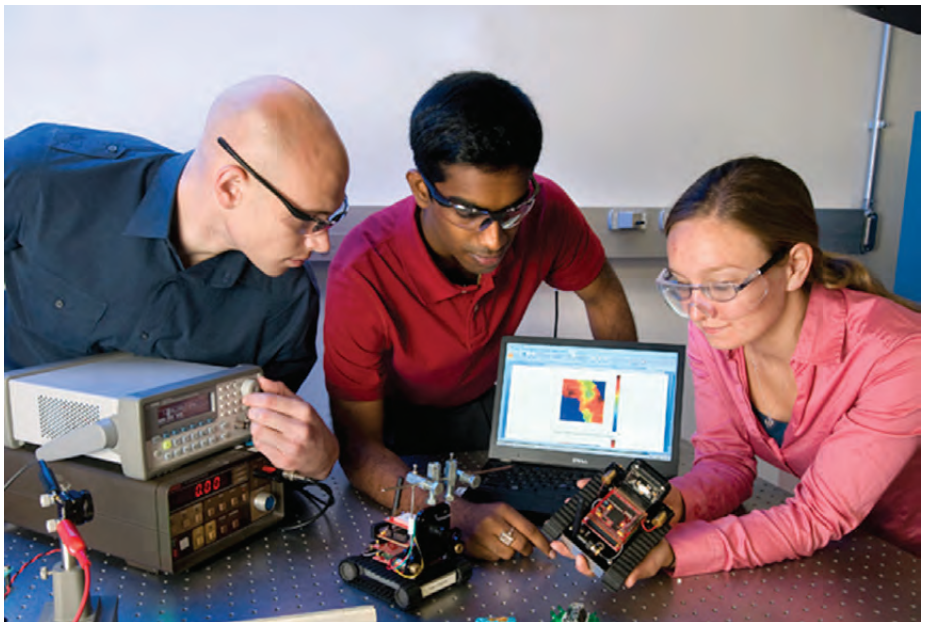
As technology has spread to new states and non-state actors, it has become more important that the Army fully exploit the capabilities of its research, development and engineering organizations. RDECOM meets this need by working with partners at every stage of the Army's technology pipeline, from basic research to applied research to advanced technology development and life-cycle engineering support for programs of record. The command supports U.S. Army Training and Doctrine Command

requirements writers, provides life-cycle engineering support for existing and near-term new equipment and upgrades, executes an international technology search program, deploys FAST advisers with combatant commands and identifies potentially revolutionary new capabilities in its labs.

RDECOM develops innovative ideas for their potential to provide leap-ahead capabilities for Soldiers while also supporting the day-to-day needs of an Army that will remain deployed in many areas around the world. In executing its technology integration mission, RDECOM draws on a wide range of technical competencies and a global S&T network to develop the integrated, Soldier-centric solutions that ease the Soldier's burden of understanding the technology while also better integrating each system into a larger system of systems. This kind of tightly integrated capability gives the Army a competitive advantage over existing adversaries while positioning it to provide agile, coordinated technological responses to future challenges.

The command is taking its far-reaching capabilities a step further by working on strategies to improve the command's focus, effectiveness and responsiveness. Two examples are an open-campus approach initiated by the command's Army Research Laboratory (ARL), and a virtual laboratory concept to bring scientists and engineers together in the same way that social media and cloud platforms have given friends, families and organizations a way to collaborate in a virtual space.

Because it is impossible to predict the technological obstacles that America's future adversaries will present, RDECOM must continue to push forward with cutting-edge research that will support innovation for decades. In this



LEARNING BY DOING
Student interns participate in the U.S. Army's Micro Autonomous Systems and Technology Collaborative Technology Alliance at ARL in Adelphi, MD. Student researchers and their academic advisers are helping RDECOM tackle tough challenges of the future. (Photo by Doug Lafon, ARL)

PATENTED RESULTS
The Agents of Biological Origin Identifier software, developed at ECBC, has two patents to date. The software can provide automated identification of the sample contents from both pure cultures and mixtures of microbes present in culture, environmental or biological matrices. Innovative research that enables new, more efficient ways of doing things is a signature of RDECOM's path to the future. (Photo by ECBC Communications)

regard, quantum communications and synthetic biology are two examples of key focus areas for the Army's next 30 years.

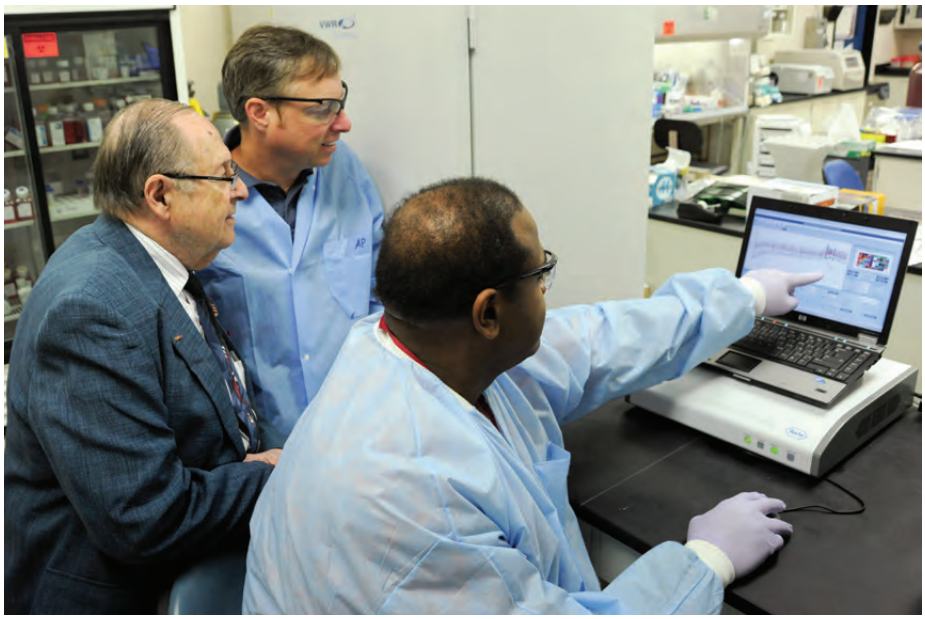
OPEN-CAMPUS APPROACH

An open-campus model will enable ARL to be a front door to engage academia, other government agencies, industry and nontraditional innovators. Open-campus benefits include:

- Ready access to world-renowned facilities, researchers and resources for all partners.
- Expansion of academic programs and collaboration spaces.
- Synergistic relationships with the Washington, DC-area entrepreneur community.
- Facilitating the creation of innovative spinoff companies.

ARL seeks to pilot a new business model for its Adelphi Laboratory Center campus in Maryland. This model would create a more efficient and effective defense lab that can be adaptive and responsive to the challenges of the 21st century. The impetus for this plan is the need to pull together the brightest minds to accelerate the pace at which the Army solves its toughest technological challenges.

Currently, ARL seeks to attract academic and industry partners for summer 2014. Open campus opportunities are research areas in which academic and industry scientists and engineers would collaborate with Army scientists and engineers in government facilities. These research areas are part of ARL's overarching campaign plan for Strategic Land Power Dominance for the Army of 2030 and beyond, based on eight subordinate technical campaigns—extramural basic research, computational sciences, materials sciences, sciences for maneuver, information sciences, sciences for lethality and protection, human sciences, and assessment and analysis.



RESEARCH GETS RESULTS
Dr. Harry Salem, left, who leads ECBC's in vitro team, discusses research data with Dr. Russell Dorsey and Dr. Reginald Gray. Organ-on-a-chip development at ECBC enables testing of medicine and toxins on human tissue without using humans. (Photo by Conrad Johnson, RDECOM)

RDECOM recognizes that the Army does not have a monopoly on great scientific and engineering thinkers. Lab synergy among universities, industry and government is critical to the discovery, innovation and transition of S&T that are vital to national security.

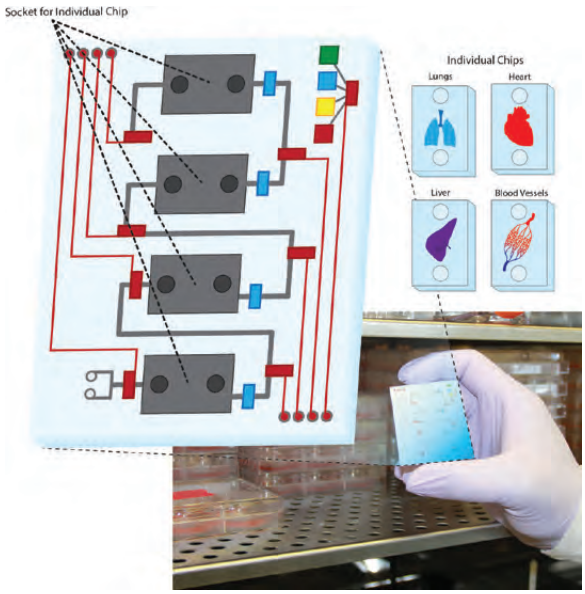
Formal and informal interactions among scientists lead to knowledge-building and research breakthroughs. Innovation depends on bringing multiple disciplines together to engage in collaborative projects that often yield unpredictable but highly productive results.

The inspiration for this concept of a defense laboratory was Thomas Edison's vision of "a great research laboratory" maintained by the government. This vision led to the creation of the U.S. Naval Research Laboratory in 1923. In 1945, the concepts that Vannevar Bush, director of the federal Office of Scientific Research and Development, documented in his report "Science: The Endless Frontier" became a model for how the United States would pursue its scientific endeavors. Bush stressed the necessity for the establishment of a robust university, industry and government laboratory research system. During the past 60 years, organizational changes and consolidations have created the national laboratories structure and a DOD research laboratory structure now known as the Defense Laboratory Enterprise (DLE).

However, the DOD laboratory's structure and operation have not changed since its establishment, while university and

industry research capabilities have evolved with changing research and economic environments. This shift and the rigid, insular nature of the DLE have caused an erosion of the university-industry-government lab synergy. In addition, the pace of technological change from 1990 to 2013 far exceeds the pace observed from 1950 to 1990, and such change will more than likely continue to accelerate beyond 2013.

The current DLE is not in a position to keep pace with the trends predicted over the coming decades. The globalization of technology requires novel and new collaboration mechanisms, and the open-campus concept will enable ARL to reenergize the synergy among labs.



A CHIP OFF THE OLD BOD
Dr. Russell Dorsey, an Army research microbiologist and one of the scientists performing in vitro testing, said, "For the military, our human-on-a-chip research will save actual warfighters' lives." Using real human tissue on wafers of silicon and making it behave the way human tissue does holds significant potential for the development of future defenses. (Photo by Conrad Johnson, RDECOM)

VIRTUAL LABORATORY

The nature of scientific research and discovery, as well as RDECOM's investment in a systems engineering approach that focuses on how to manage extraordinarily complex engineering projects throughout the technology pipeline, requires an ability to collaborate that frees researchers and engineers from the restrictions of a traditional stand-alone laboratory and test bench infrastructure. This is particularly important if we are to continue moving away from bolt-on, reactive solutions that respond to the obvious needs of combat-stressed Soldiers in the field and toward predictive system designs that anticipate or can adapt quickly to situations Soldiers might encounter.

In other words, our research, development and engineering teams must work as closely together as possible in order for the end system to present a seamless, user-centered experience. Already, experts from across RDECOM's seven subordinate organizations continually work together to provide integrated solutions that address a variety of concerns, because the complexity of today's systems requires specific expertise found in varied scientific and engineering disciplines.

By putting together a team in virtual space instead of physical space, RDECOM will reduce the costs and time involved in collaboration, as well as improve the effectiveness of Soldier solutions, much as social networks have facilitated human interaction.

QUANTUM COMMUNICATIONS

Quantum communications networks will harness nature for the future of military communications. Atoms and photons will be used to perform both quantum computing and quantum imaging at mobile network nodes, increasing data rate and security.

Consider a future battlefield with a Soldier, an unmanned aerial vehicle (UAV), a command and control element, and access to a satellite. With quantum communications, data could be teleported between the Soldier and satellite, and then to UAVs and to command and control headquarters without the need to transmit the data through the intervening space. This is critical because of the cybersecurity concerns in the military and civilian sectors. The greatest potential that a quantum communications network holds for the Army is secure communications.

That is why ARL scientists are collaborating with the Joint Quantum Institute at the University of Maryland at College Park (UMD) on this important research. The groups have a 27-kilometer (round-trip) fiber-optic connection between their

REMOTE PREFLIGHT CHECK
SGT Larry Clavette remotely sends commands to his RQ-11 Raven UAV for preflight functions checks Jan. 15 at Fort Hood, TX, during a Raven certification course. Using quantum communications in the future, such commands would be teleported to the Raven rather than transmitted. (U.S. Army photo by SGT Samuel Northrup, 7th Mobile Public Affairs Detachment)

labs, and they use photons that travel through the fiber in order to entangle the atoms at two locations.

Elementary quantum particles such as photons and atoms are basic building blocks of the universe. The team sends entangled photons from one end of the fiber to the other.

Photons are also used to entangle the distant atoms. Once distant photons or atoms are entangled, they mysteriously respond to each other: When one photon or atom is manipulated, there is no need for the fiber in between; the other photon or atom will respond instantly.

This is a basic principle of quantum communications. It means that information can be teleported between the atom or photon particles rather than transmitted, which means it cannot be intercepted while en route.

The Army must leverage this emerging and critical research area for vital Army interests. Physicist David Wineland shared the 2012 Nobel Prize in Physics with Serge Haroche for their quantum research, Wineland's at the National Institute of Standards and Technology. Partnerships with domestic and foreign industry and academia, such as RDECOM's agreement with UMD, will be key to furthering future capabilities for Soldiers in this area.

As quantum computing takes hold in the coming decades, the potential for hacking increases exponentially; quantum computers will easily decrypt communications that are currently secure. Decryption will take seconds instead of years, which will render current encryption methods useless. The United States' adversaries will undoubtedly turn to quantum computing in their efforts to attack DOD's networks. Data sharing, intelligence and

ECBC WILL TEST THE ORGAN-ON-A-CHIP AGAINST A CHEMICAL WARFARE AGENT TO LEARN MORE NOT ONLY ABOUT HOW THE BODY WILL RESPOND TO EXPOSURE BUT ALSO ABOUT OPTIONS FOR TREATING EXPOSURES.

communications are vital to any successful Army mission. This importance will only grow as the advances in electronics continue to accelerate. Because of the increased risk for hacking with the rise of quantum computing capabilities, the Army will require robust investments to protect its networks.

SYNTHETIC BIOLOGY

Advances in biology will also prove vital to the safety and health of Soldiers as they face unknown future chemical and biological hazards in theater. RDECOM is making investments in synthetic biology—an area of biological research that combines biology and engineering—to meet these future demands.

RDECOM's Edgewood Chemical Biological Center (ECBC) is expanding the limits of the biological sciences through the research of "organs" on microchips with its partners at the U.S. Army Medical Research Institute of Chemical Defense, Wake Forest and Harvard universities, and the University of Michigan.

Two ECBC researchers, Dr. Harry Salem and Dr. Russell Dorsey, approached Harvard professor Dr. Donald Ingber after hearing his speech on his lung-on-a-chip research. Swatches of human lung tissue are placed on "chips" of silicon wafer about the size of a computer thumb drive. Ingber's model was a 3-D swatch of lung tissue that acted like a human lung by "breathing."

Ingber created a way for the sides of his model to contract and expand, with blood flowing on one side and air on the other, just like an actual lung. He also showed that, when introducing bacteria on the air side, white blood cells would attack it through tiny holes from the blood side. This was revolutionary because, until then, the organs-on-a-chip did not do much to simulate the organs they represented. It's also revolutionary because it enables testing on living human tissue without involving living humans.

ECBC scientists have been studying organs-on-a-chip for several years by exposing them to chemicals, pharmaceuticals and chemical warfare agents. Harvard plans to provide its functioning lung model to ECBC for testing.

ECBC will test the organ-on-a-chip against a chemical warfare agent to learn more not only about how the body will respond to exposure but also about options for treating exposures. RDECOM and its partners will use the screening models to assess the efficacy and safety of medical mitigation procedures and countermeasures for the Soldier and the nation.

New predictive models of toxicity will result from the organ-on-a-chip testing. The research narrows investigative efforts early during testing by yielding quick, accurate results.

CONCLUSION

Key to the success and relevance of these initiatives and technologies, among many others, is how they fit into RDECOM's technical breadth and depth of knowledge. The command continues to build upon its detailed understanding of the Army's mission and military operational environments, as well as its extensive relationships across the Army's acquisition cycle.

This knowledge and these relationships allow RDECOM's subject-matter experts to support the entire spectrum of the Army's technology pipeline—research, development, engineering, fielding and sustainment. RDECOM manages the transition of innovations from ARL to the appropriate research, development and engineering center for developing engineered technologies and capabilities to systemize and field.

This arrangement positions the command to provide the Army the benefit of its unique knowledge, experience and expertise, thus enabling the Army to be a more astute buyer of capabilities as well to make informed decisions on the technical aspects of its 30-year modernization plan.

For more information, go to RDECOM's ***website at www.army.mil/rdecom****. To learn more about Ingber's lung-on-a-chip, go to* ***http://wyss.harvard.edu/viewpage/240/****.*

MR. DALE A. ORMOND is the director of RDECOM. He holds an M.S. in environmental systems engineering from Clemson University and is a 1985 graduate of the U.S. Naval Academy. He is Level III certified in acquisition program management. He was selected for the Senior Executive Service in July 2004.

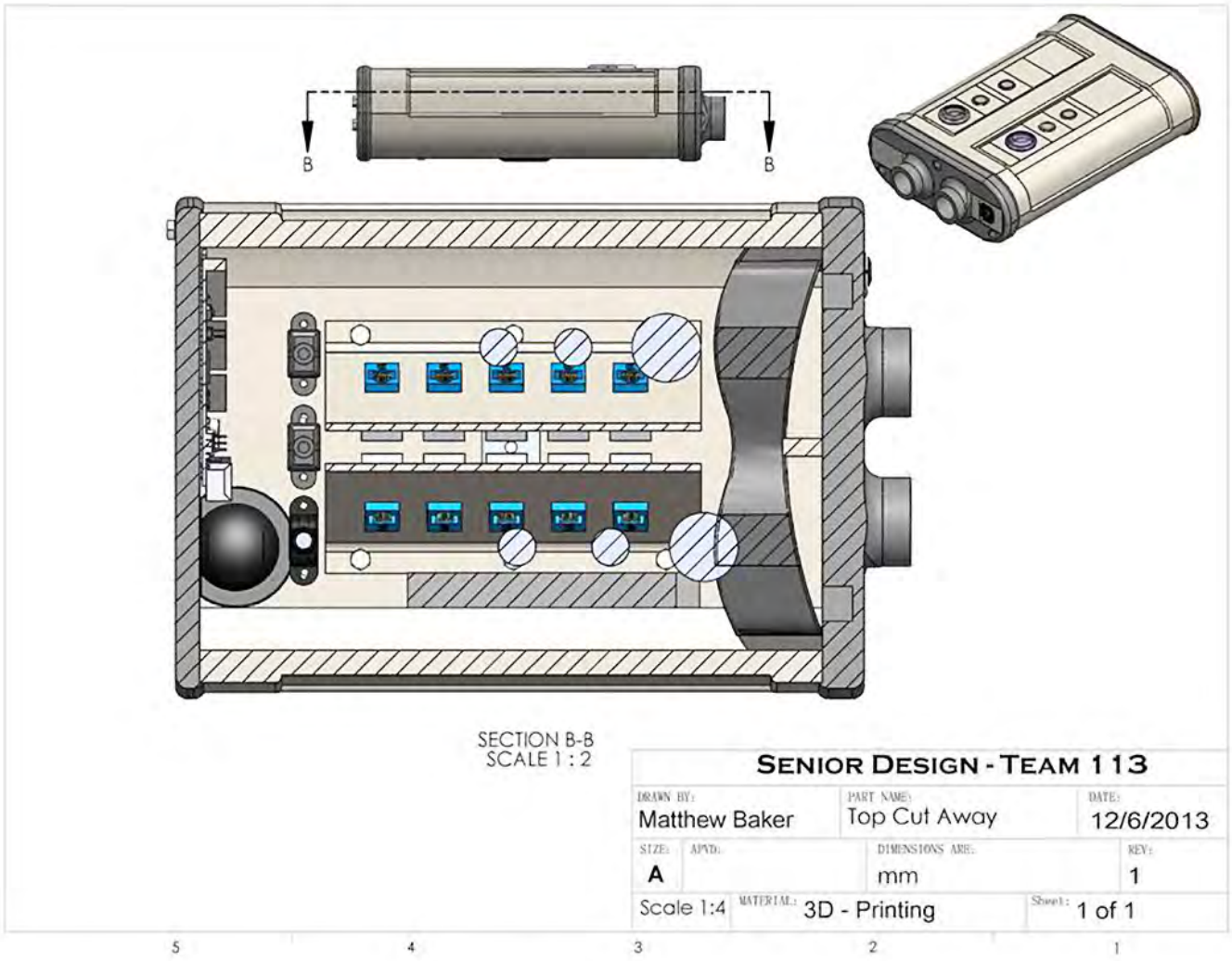
THE ACADEMIC ANGLE

Leveraging students' engineering expertise to bridge the gap between Soldier and system

by COL Michael E. Sloane, MAJ Toby Birdsell and CPT(P) Tom Beyerl

Project Manager Soldier Sensors and Lasers (PM SSL) is in the business of developing the most advanced maneuver and targeting sensors ever fielded. A sometimes unwanted adjunct to advancement, however, is complexity, one of the greatest enemies of usability. Recognizing this critical relationship, the PM SSL team continuously seeks opportunities, in conjunction with the U.S. Army Maneuver and Fires Centers of Excellence, to connect with current and prospective warfighters through "touch points," warfighter juries that enable the PM SSL team to tailor equipment designs to Soldiers' mission needs and exceed their initial expectations. While a PM may be expert in managing programs that provide capabilities to the warfighter, there is often a missing link in the design process that can enhance the user's experience with the system.

Now PM SSL's Product Manager Soldier Precision Targeting Devices (PdM SPTD) team has branched out to obtain a different kind of feedback, through civilian touch points that leverage academia's expertise to identify alternative solutions, save taxpayer dollars and unite the user with the system.



EMULATOR DESIGN
A computer-aided design drawing of the LTLM GUI emulator which, using embedded virtual reality goggles and configurable controls, will enable the PM SPTD product team to model, test and demonstrate key aspects of the user interface, both through development with Soldiers and in communications with industry. (SOURCE: HF/E Lab, OSU School of Mechanical, Industrial, and Manufacturing Engineering)

While the most valuable feedback still comes from Soldiers, academia—specifically college-age engineers and their advisers—can provide a unique perspective on system attributes. To harness this perspective, the PdM SPTD team recruited the Human Factors/Ergonomics (HF/E) Laboratory of the School of Mechanical, Industrial, and Manufacturing Engineering at Oregon State University (OSU), which is on the leading edge of applying interface design principles to improve real-world systems. Together, they conducted a detailed analysis of the human-machine interface as it applies to precision targeting. The university has worked with the Navy, the Federal Aviation Administration, NASA and multiple private organizations to analyze and recommend user interface solutions.

Spearheading these efforts has been Dr. Ken Funk, associate professor and director of the HF/E Lab, whose primary research addresses human performance in complex, high-risk systems. PM SSL, assigned to Program Executive Office (PEO) Soldier, develops complex systems for use in high-risk combat environments, so it made sense for OSU to join the Army development teams that are

DESIGN TEAM
Professor Ken Funk, left, with MAJ Toby Birdsell, Katie Morowsky, Sarah McCrea and Daniel Gilruth of OSU's Department of Mechanical, Industrial, and Manufacturing Engineering Department. Morowsky, McCrea and Gilruth, OSU engineering graduate students, helped assess design and usability during development of the Family of Weapon Sights. (Photos courtesy of PEO Soldier)

building the next generation of targeting devices and maneuver sensors.

THREE LINES OF EFFORT

The initial project, begun in fall 2011, encompassed three parallel lines of effort: a better, lighter tripod; a new graphical user interface (GUI); and a GUI emulator for developing and demonstrating the final products.

Soldiers need a stabilization device or tripod to locate targets accurately at distance and enable a steady aim on target. The tripods currently fielded create consternation at user juries because of their inflexible and bulky design.

While not specifying a tripod, PM SSL asked OSU to improve stabilization. OSU undergraduate engineering students designed, built and tested five different tripod prototypes, with guidance and supervision from Dr. John Parmigiani, research assistant professor. Then, based on Army feedback, graduate research assistants Anthony Nix, Josef Hortnagl and Patrick Dailey integrated the best ideas from the undergraduate designs to develop a vastly improved tripod. Improvements included a more ridged structure, a fine-adjustment mechanism for azimuth and elevation, greater deployability and much more rugged overall design, as well as changes to reduce size and weight, reflecting feedback from users.

CHEST TEST
James Haskell, a graduate research assistant, demonstrates one of the freestanding stabilization devices developed to aid a forward observer while operating the Vector 21 Laser Target Locator System, during a preliminary design review in spring 2013 at OSU.

RESEARCH ASSISTANCE
Soldiers from 4th Brigade Combat Team, 82nd Airborne Division operate the Mark VIIE LTLM at Fort Benning, GA, in September 2013 while conducting PdM SPTD's Advanced Targeting and System Integration class. At right is Raschelle Barkume, a graduate research assistant from OSU who attended the class to gather data on current operating models and doctrinal employment of the systems.

A similar process, starting with a design by graduate student Clint Clow in 2011, created a stabilizer bar that integrates with the Modular Lightweight Load-carrying Equipment. The stabilizer bar gives the user something to lock the elbows into, thus reducing jitter in the device. It eschews the weight and bulk of a tripod while providing significantly improved stability over the traditional handheld operation.

This effort led the PdM SPTD team to draft specifications for the Laser Target Locator Module II (LTLM II) tripod, representing improvements in size, weight and power over LTLM I while sharing the same requirements. PdM SPTD pursued the tripod procurement separately, which will provide increased capability at potentially half the cost of currently fielded equipment. This contributed greatly to an expected 20 percent cost avoidance in the overall system procurement.

PdM SPTD fields a suite of targeting devices that provide a broad spectrum of capability to forward observers, infantrymen and scouts. As technology and requirements matured, each manufacturer developed operating models and GUIs that best suited their interpretation of the requirements and specifications. Involving the OSU students as technical consultants early in the development of specifications eliminates the previous challenges of diverse interfaces across manufacturers and will significantly reduce the volume and complexity of institutional and unit training. It will also allow Soldiers to gain proficiency on the LTLM II system much more easily, with fewer dedicated resources.

GUI development is the area of greatest payoff for PdM SPTD in its partnership with OSU. The perennial challenge for any PM developing complex hardware is how to trade off performance and design specifications while being mindful of the customer and inherent operational challenges. Previous generations of precision targeting equipment relied heavily on performance specifications,

USER REQUIREMENTS
Barkume engages targets with the M110 Semi-Automatic Sniper System while training at the U.S. Army Sniper School, Fort Benning. Her purpose was to gather data on user requirements, in conjunction with the Maneuver Center of Excellence, while demonstrating prototype products.

which enabled manufacturers to innovate and compete in a more open arena. The downside to this approach is a lack of commonality in operation and training between generations and families of equipment. This results in unaffordable upgrades and inefficient training.

GUI design concepts developed in 2013 by student teams in HF/E courses, then refined and elaborated by graduate research assistant Raschelle Barkume, provided an opportunity to blend performance and design specifications into a portable, adaptable document dubbed the Laser System Operating Paradigm (LSOP). This document clearly communicates to prospective vendors both the "what" and "why" of GUI design as it applies to the diverse group of Soldier specialties using the equipment. Based on sound principles of human factors engineering, the LSOP incorporates current joint fires and maneuver doctrine into a common menu structure, layout and nomenclature without overly specifying the design.

This more standardized design ensures that the training required for future generations of systems will be less demanding. Cues from contemporary consumer electronic designs, such as circular menu navigation like that on video game controllers, and the use of selectable soft keys make for a shallow learning curve with a reduction of almost 50 percent in operator training hours.

SETTING THEIR SIGHTS

The relationship established between PdM SPTD and OSU also paved the way for PM SSL's Product Manager Soldier Maneuver Sensors (PdM SMS) to leverage the expertise and lessons learned in OSU's HF/E Lab. PdM SMS is responsible for developing mobility and targeting sensors that enable the Soldier to dominate the

battlefield, namely limited-visibility enablers that are mounted to a Soldier's weapon in addition to an array of night vision devices. The technologies associated with these systems are complex, and it is critical that PdM SMS make them as intuitive as possible for the Soldier to operate, especially in a high-stress combat environment.

For PdM SMS, the perfect opportunity to enlist the OSU's HF/E Lab to gain engineering insight and optimize the user interface was during development of the Family of Weapon Sights (FWS) over the past few years. FWS is the next generation of long-wave infrared thermal weapon sights that mount to a Soldier's weapon. It enables the Soldier to recognize and engage the enemy in limited visibility and through obscurants, such as fog, smoke and haze.

FWS is the latest capability whereby PdM SMS leverages emerging technologies and addresses the warfighter's needs as represented by the Maneuver Center of Excellence.

The FWS program is in the technology maturation risk reduction (TMRR) phase, approaching Milestone B. It includes three variants that use the latest thermal weapon sight technologies—including wireless chipsets, rapid target acquisition algorithms and the ability to mount in-line with the day view optic, so that the Soldier need not remove it—to enable the Soldier to acquire and engage the enemy faster and more decisively.

Throughout the TMRR phase from Milestone A to Milestone B, the FWS team conducted multiple Soldier touch-point events with early FWS-I prototypes, both on live-fire ranges and in the modeling and simulation environment. While accumulating this feedback, PdM SMS quickly discovered that the non-optimized user interface did not enable Soldiers to execute the key feature of FWS-I—rapid target acquisition (RTA) of the enemy. For example, while on short-range marksmanship lanes, the Soldier would switch inadvertently into different modes that distracted, and at best delayed, rapid target engagement.

Enter Funk and his team of engineers. Funk incorporated FWS-I's user interface challenge into a student project in his HF/E graduate course, culminating in a critical design review and FWS-I mock-up presentation to the PM's FWS team.

OSU engineering graduate students Katie Morowsky, Sarah McCrea and Daniel Gilruth conducted task analysis of a Soldier using the FWS-I. They also conducted an exhaustive review of user interface research relevant to the design and a usability assessment. Their subsequent recommendations to the FWS team included a menu structure that prevented obstruction of the display, and a redesigned, tethered remote that quickly enables RTA functionality.

The next step for PdM SMS, having developed a 1-to-n list of interface design improvements based on OSU recommendations and Soldier input during testing, is to incorporate the changes into a prototype during FWS-I's engineering and manufacturing development phase for Soldiers to validate or for the team to refine further.

CONCLUSION

The primary lesson learned from this effort is that academia can, and will, economically support system development, especially in the technology development phase, when the final design is not yet complete. Involving academia can add significant value in terms of inventiveness and fresh insight, benefiting design and usability, without adding to cost. PM SSL's user interface design is just one example of many disciplines in which academia can contribute to a program. In their continuous search for solutions to real-world problems, colleges and universities are an inherent source of knowledge. Whether the goal is to improve power consumption, explore the future of nanotechnology or develop more intuitive sensor interfaces and improved mechanical systems, identifying opportunities for civilian touch points is a valuable step in developing the best available technology for the warfighter.

*For more information on PEO Soldier, go to **https://peosoldier.army.mil**. You can also follow PEO Soldier on social media: Facebook, at **www.facebook.com/PEOSoldier**; Twitter, **@PEOSoldier**; and YouTube at **www.youtube.com/user/usarmypeosoldier**.*

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INTEGRATION EQUATION

New design tools provide insights to enhance Soldier equipping

by Mr. Brian W. Raftery and Ms. Karen M. Burke

The proliferation of military technologies over the past two decades has afforded Soldiers and squads the capability for greater operational effectiveness and protection. While individual equipment items demonstrate a level of performance that supports this intent, the accumulation of equipment that a Soldier and squad must carry, wear and operate has actually trended toward reducing operational effectiveness and protection by hindering their mobility and lethality with sheer quantity and weight.

Program Executive Office (PEO) Soldier is the lead PEO for systems integration, training and sustainment of equipment fielded to the individual Soldier, platform or squad. It is, therefore, PEO Soldier's mission to ensure the proper equipping of Soldiers with capabilities that enhance their combat-effectiveness and maintain overmatch against potential adversaries. PEO Soldier must do this while reducing the penalties of size, weight and power consumption imposed by the very pieces of equipment designed to protect Soldiers and enhance their lethality.

To accomplish this, PEO Soldier has recast the process by which it approaches the integration of equipment with the Soldier, to give program managers, systems engineers, users, industry, and the science and technology (S&T) community true insight into the set of problems that the entirety of the Soldier platform represents. Treating the Soldier as the centerpiece of a dismounted system will enhance the development and acquisition of future operational clothing and equipment to overcome these platform issues.

PEO Soldier undertakes the considerable challenge of effectively integrating the Soldier system through close collaboration with its principal enterprise partners in the Soldier enterprise: the U.S. Army Training and Doctrine Command (TRADOC) centers of excellence; the Army Capabilities Integration Center (ARCIC); and U.S. Army Research, Development and Engineering Command (RDECOM) research laboratories.

WARRIOR INTEGRATION SITE

During the early problem-definition phase of designing the systems integration framework in 2012, PEO Soldier adopted an American National Standards Institute (ANSI) 649 B-based, system-level configuration management (CM) program to provide a logical approach for the new Soldier integration process. In addition, it adopted a straightforward model to support the systems engineering and technical coordination phases of the

THE VIRTUAL ENVIRONMENT
This exploded view of a Soldier and equipment illustrates the utility of CAD, in this case SolidWorks, an industry-standard CAD package. The Soldier in the image is actually a digitized, semiarticulated mannequin. CAD capabilities allow for the rapid exchange of ideas in a virtual environment. (Image by Matthew Hutcherson, Office of Project Manager Soldier Warrior, PEO Soldier)

CM process. The model is a delta with integrated product and process development; a collaborative design environment; and analytics-based decision-making at each vertex. (See Figure 1 on Page 109.) Each of these components of the equipping and integration process is essential to understanding the envisioned process, its implementation and how it will be accomplished.

To address and promote collaborative design, PEO Soldier has developed a collaborative design environment at Fort Belvoir, VA, called the Warrior Integration Site (WinSite), informed by ANSI 649 B. The WinSite forms the lower left vertex of the PEO Soldier integration delta and gives the enterprise a significant new way to maximize operational capability while seeking to reduce the Soldier's burdens. WinSite fulfills four major functions:

1. Serves as a collaborative design environment to support the further evolution of PEO Soldier products.
2. Serves as a system-level repository of the current Soldier and squad configuration.
3. Fosters cross-product and stakeholder collaboration.
4. Supports decision-making.

Design environment—WinSite furthers the focused, deliberate evolution of Soldier and squad capabilities by arming product management and design teams with full, system-level visualization of the set of problems centered on the Soldier and squad. This enables the Soldier development and acquisition community—both the public and private sectors—to initiate and evaluate future design solutions from a far more holistic perspective.

WinSite will have fully equipped mannequins representing the nine-Soldier infantry squad, along with attached medic and forward observer, as well as two virtual environments by early 2015. One of the two virtual environments will use computer-aided design (CAD), with sufficient CAD platforms to support design and collaboration. The second enables rapid "what if" analyses to see potential impacts on the Soldier configuration of component changes and permutations.

Data repository—WinSite will also function essentially as a physical and virtual system-level representation of the current Soldier and squad configurations. It will not only serve as the starting point for future design efforts, but also will document and describe the work done to date in equipping Soldiers.

THE TOTAL SOLDIER
A Soldier assigned to 1st Squadron, 8th Cavalry Regiment, 2nd Brigade Combat Team, 1st Cavalry Division conducts a presence patrol around the U.S. Consulate in Herat, Afghanistan, Jan. 5. The proliferation of military technologies over the past two decades of war has provided Soldiers and squads with new capabilities, but at a cost in terms of their mobility and potential lethality. The Soldier enterprise is working to understand that cost more thoroughly. (U.S. Army photo by CPL Alex Flynn)

MINIMIZING THE BURDEN
The Conformal Wearable Battery, shown here being placed into a tactical vest, is flexible and conforms to the body. It provides more power, reduces the need for battery recharging and spares, and serves as a single source of power for all worn electronic devices. Minimizing operational burdens on the Soldier is the ultimate goal of efforts to incorporate new analytical tools into the design of Soldier equipment. (Photo by Conrad Johnson, RDECOM)

Collaboration and communication—The Soldier enterprise has major partners in five different states from Massachusetts to Alabama. By providing all stakeholders—including the Soldier-user, S&T and program management communities—with real-time access to the same system-level views, we can enable effective collaboration with all enterprise partners. In addition, WinSite's CAD capabilities afford interoperability with industry-standard CAD languages. This enables the rapid exchange of ideas in a virtual environment.

Decision support—WinSite supports decision-making by providing integrated product teams and leadership with real-time views and impacts of potential courses of action on materiel solutions. This yields insight on what future capabilities will look like before producing any prototype or production hardware. WinSite capabilities will also assist in measuring and assessing physical parameters that we seek to minimize, such as size or weight, as part of a multicomponent decision model that can assess technology trade-offs.

The vision for WinSite is to evolve from today's visual representations and models using CAD, human modeling inputs and the like to a much greater capability that includes physiological, environmental and operational models. The goal is to fully assess new and emerging technologies and their total impact on systems integration and Soldier performance.

ANALYTICS-BASED DECISION-MAKING

In minimizing the operational burdens on the Soldier—the size, weight and power consumption of the equipment that provides these capabilities—we can heuristically describe an optimization function as E = f(S↓, W↓, M↑, P↓, $↓, C↑).

This expression means effectiveness is a function of size, weight, mobility, power consumption, cost and capability, where capability is a composite index of the various performance attributes of a particular capability under consideration.

Optimizing effectiveness essentially means finding the best balance among size, weight, mobility, power consumption, cost and capability at the Soldier-as-a-system level, versus maximizing the performance of an individual capability-providing component. For example, the M16A2 rifle offers a slightly longer effective range compared with the M4 carbine; however, when considering mobility trade-offs, the M4 carbine offers a lighter weight and more portable option, thus enhancing system effectiveness in most operational scenarios.

Decision-making with respect to equipping Soldiers requires buy-in from a variety of stakeholders and evaluation of possible solutions, all of which the Soldier enterprise must weigh against Soldier acceptability and human performance. To rationalize this process, PEO Soldier has successfully used the analytic hierarchy process (AHP) on a number of operational and materiel technology selection problems.

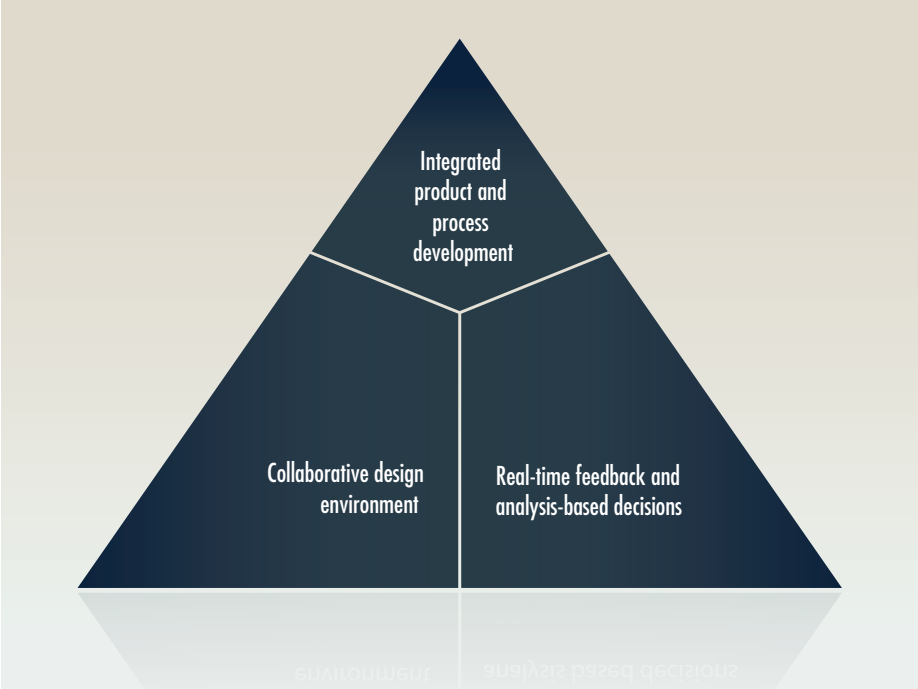
AHP, adapted from Dr. Thomas L. Saaty's book "Fundamentals of Decision Making and Priority Theory with the Analytic Hierarchy Process," is a decision support tool that uses data from multiple sources, including WinSite. It enables us to measure different objective and subjective qualities against one another to arrive at deliberate, reasoned optimal outcomes.

An example is Soldier mobility. We have been closely following the U.S. Marine Corps' Gruntworks Squad Integration Facility's evaluation of the Marine Corps Load Effects Assessment Program (MC-LEAP), which is the Marines' attempt to apply metrics to the integration of humans with systems. MC-LEAP consists of an instrumented series of combat-representative tasks derived from recent experience in Iraq and Afghanistan, and provides tools for determining how mobility changes as equipment is added, subtracted or changed. The pairwise comparison process used in AHP readily accepts measurement scales, which we can use in assessing many of the physical and other parameters of the problems we consider.

With proper application and scientific rigor, the MC-LEAP model offers significant potential in providing us the insight we need to objectively assess and consider Soldier mobility in our decision process. The Soldier enterprise and the Army's Maneuver Battle Lab are in the process of procuring and establishing an Army version of the LEAP at Fort Benning, GA, and at an RDECOM research lab in Natick, MA, to enable the assessment of this key parameter.

The final and perhaps most challenging parameter we require insight into is capability. This is an aggregate factor that will vary depending upon the specific product under consideration. The upfront systems engineering and integration work conducted at PEO Soldier's WinSite during the early phases of a program of record should lead to better product design and integration, as demonstrated in the developmental and operational testing. Knowledge from that

FIGURE 1



SOLDIER ENTERPRISE INTEGRATION MODEL
This model, which supports the systems engineering and technical coordination phases of the configuration management process, represents the three essential components of the equipping and integration process. (SOURCE: Brian W. Raftery, PEO Soldier)

testing can further be used to validate and evolve CAD and modeling-type tools.

With an initial foundation in place to provide tools that will enhance system-level design, collaboration and decision-making, we are now turning our focus toward enabling Soldier-as-a-system-level integrated product and process development (IPPD) teams with these tools. IPPD has been a DOD best practice since the May 1995 secretary of defense memorandum directing the use of integrated product teams (IPTs).

IPTs have been the principal vehicle for product development within PEO Soldier since its inception in 2002. Our goal is to enable these teams to further enhance their product sets through true system-level descriptions and performance baselines at the Soldier level.

CONCLUSION

The recasting of the Soldier enterprise's integration and configuration management process is an initial step in providing Soldiers and squads with overmatch capability in future operations. With system-level IPPD, enabled by a state-of-the-art collaborative design environment and analytics-based decision tools that consider Soldier, equipment, mission and task attributes, the Soldier enterprise will have improved insight into all of the problems of Soldier equipping.

This insight will be particularly valuable given the criticality of the Soldier-equipment interfaces on overall system effectiveness and will enable the Soldier enterprise to make better equipping decisions in the near term. A logical future step is the fusion of a deeper, holistic understanding of human and equipment performance and characteristics into a seamless, dynamic package that enables Soldier-system-level capability evaluation in a variety of operational environments.

QUICK-CHANGE TOOL
PEO Soldier used the Soldier Equipment Effectiveness environment, an application it developed to enable rapid visualization of equipment permutations, to create this exploded view of an equipped virtual Soldier. (Image by Nick Bradley, Office of Project Manager Soldier Warrior, PEO Soldier)

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PD C4ISR AND NETWORK MODERNIZATION: CONNECTED GROUND TRUTH

Product Director Command, Control, Communications, Computers, Surveillance and Reconnaissance (C4ISR) & Network Modernization—a research and development (R&D) program—is a key component in U.S. Army Communications-Electronics Research, Development and Engineering Center's (CERDEC's) support to agile acquisition.

PD C4ISR & Network Modernization, Aberdeen Proving Ground (APG), MD, provides the field component for CERDEC's federated laboratories.

Designed for testing and solution proving in a realistic field environment, PD C4ISR & Network Modernization focuses on the future network, near-term and several years out, providing the Army with a relevant venue to assess next-generation technologies and to facilitate technology maturation and transition.

EXTEND THE LAB TO THE FIELD

- Employ facilities at Joint Base McGuire-Dix-Lakehurst (JB MDL), NJ, that include instrumented field ranges in varied, complex terrain; few electromagnetic-spectrum-operating limitations; commercially restricted airspace; a fleet of instrumented, reconfigurable vehicular platforms; and a full-service maintenance facility.
- Collaborate in a non-attribution, problem-solving environment where government, industry and academia can integrate technologies without the distractions of proprietary positioning.
- Leverage subject-matter experts with extensive experience in network design and integration, program-of-record waveforms and software, and execution of large-scale, system-of-systems integrated capability events.
- Extract performance measurements in real time, using a state-of-the-art instrumentation, data collection and reduction tool suite in conjunction with the U.S. Army Test and Evaluation Command.
- Augment live systems with virtual and constructive modeling and simulation, while connecting to high-performance computing resource centers and labs across the Team C4ISR Center of Excellence and other Army, joint, industry and academic facilities, to demonstrate scalability and provide confidence in overall system performance.
- Assess second- and third-order effects of plugging a technology into the network prior to fielding. Find out what doesn't work and fix it—whether that's back at your lab or here with us.

Articulating the operational "so what" of your technology early in the process will not only save time and money, but will also result in a technology tailored to support Army requirements. Come to us for connected ground truth.

usarmy.apg.cerdec.mbx.c4isr-net-mod@mail.mil | APG: 443-395-0470 | JB MDL: 609-562-4058

THE BIG PICTURE

Managing a system-of-systems interface control document for better user understanding

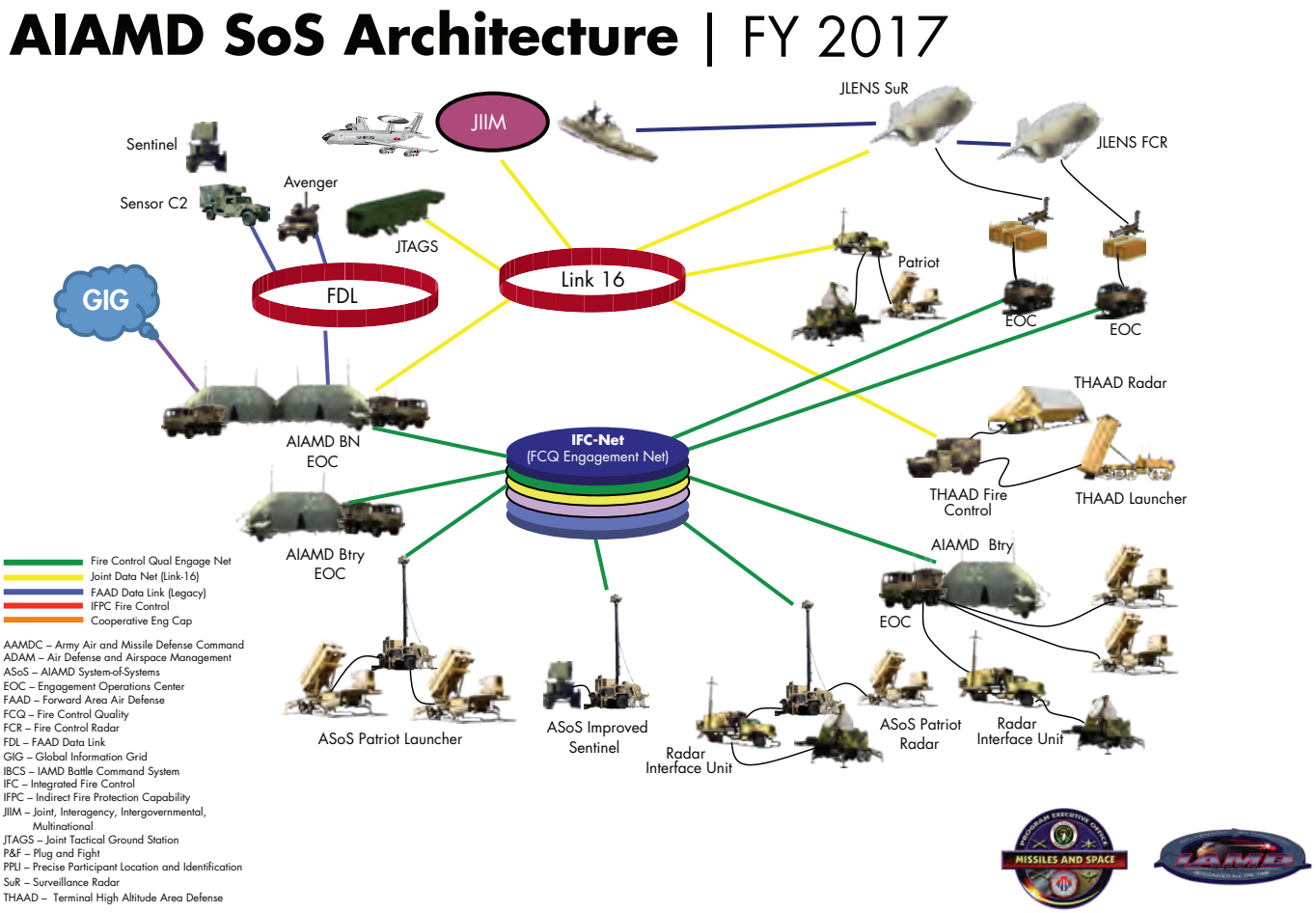
by LTC Ellsworth K. Johnson III

Interface control documents (ICDs) are an essential part of systems engineering. In communicating all possible inputs and outputs of a system, they define and control system interfaces and the requirements of multiple systems for the user.

There are many challenges to maintaining an ICD, especially a complex program-level ICD that captures requirements for a multitude of stakeholders, primarily system engineers in government and industry. It takes innovative management to resolve any disagreements and incorporate changes to meet demanding, potentially conflicting program schedules.

By FY17, the Army Integrated Air and Missile Defense Project Office (AIAMD PO) of Program Executive Office Missiles and Space (PEO MS) plans to integrate Patriot sensors and weapons; Improved Sentinel radars; Joint Land Attack Cruise Missile Defense Elevated Netted Sensor System (JLENS), if available; and future AMD capabilities to support engagement of air and missile threats. Each sensor and weapon platform will have a plug-and-fight (P&F) interface module, defined

FIGURE 1



SYSTEM-OF-SYSTEMS ARCHITECTURE
The IFCN fuses sensor data into a single integrated air picture, supporting all potential fire solutions and the mission command to synchronize AMD operations. This is the system-of-systems (SoS) architecture that the AIAMD Project Office envisions by FY17. Each sensor and weapon platform will have a P&F interface module defined by the P&F ICD. (SOURCE: AIAMD 2009 Acquisition Strategy)

by a P&F ICD, that will supply distributed battle management functionality to enable network-centric operations on the Integrated Fire Control Network (IFCN). (See Figure 1.)

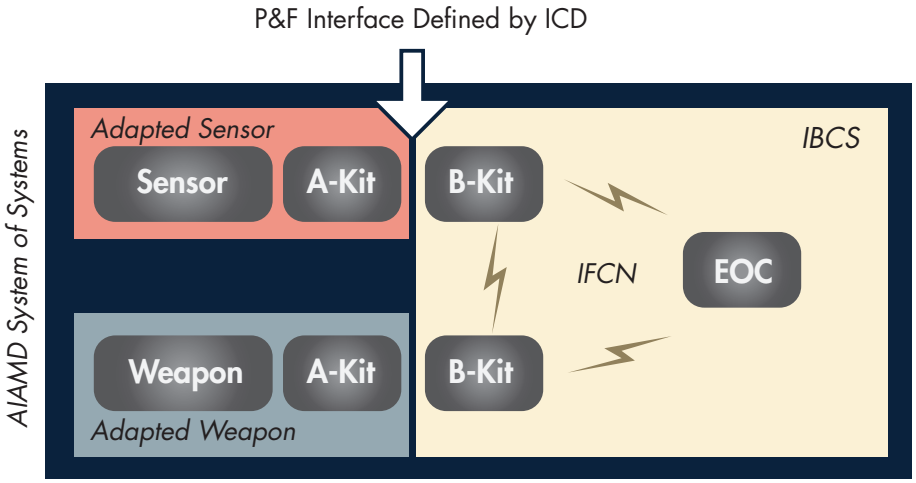
The P&F ICD defines the interface between the IAMD Battle Command System (IBCS) B-Kit and the Component Acquisition Program (CAP) A-Kit. This ICD enables the AIAMD PO to control the design of the interfaces between the IBCS and CAPs that are part of the AIAMD system-of-systems (ASoS) architecture. In addition, the ICD will allow for the incorporation of future systems into the P&F architecture.

The AIAMD PO has used a number of innovative techniques to manage the P&F ICD, including the creation of an interface control working group with representation from all key stakeholders. In addition, establishing a notice of revision process through the working group, to allow developers to implement in-scope, no-cost changes immediately, has proven to be a valuable way to reduce schedule risk.

BENEFITS OF P&F ICD

By using an ICD to control interface design and to enable the exchange of data across the IFCN, the AIAMD PO will ensure that IBCS can incorporate additional air defense artillery (ADA)

FIGURE 2



PLUG-AND-FIGHT INTERFACE
A common configuration for interfacing with IBCS will be available at all echelons, including battalion, battery and platoon. The P&F ICD documents the sensor-weapon data interactions. (SOURCE: AIAMD PO)

components. The government-controlled P&F B-Kit to A-Kit ICD is a fundamental element of the AIAMD program, defining the functional interface that allows connectivity and interoperability of disparate sensors and weapons on the IFCN under common command and control.

The ICD defines who can get on the IFCN via the A-Kit and B-Kit. The AIAMD program developed the first version of the P&F ICD in July 2010 to support the A-Kit Preliminary Design Review. It is a system engineering document that the AIAMD PO's System Integration Directorate maintains, using a well-defined configuration management process. The ICD will continue to mature with additional releases during the AIAMD engineering and manufacturing development phase.

The IFCN, facilitated by the P&F Kit, fuses sensor data into a single integrated air picture. It provides data to support all potential fire solutions and the mission command to synchronize AMD operations. This network functions over any physical medium that can carry Internet Protocol version 6 data, but track-load and fire-control quality require a high-bandwidth, low-latency system. In response, the AIAMD PO is using the Warfighter Information Network – Tactical (WIN-T) Increment 2 to build an organic communications capability for AMD units to provide line-of-sight transmission of IFCN data.

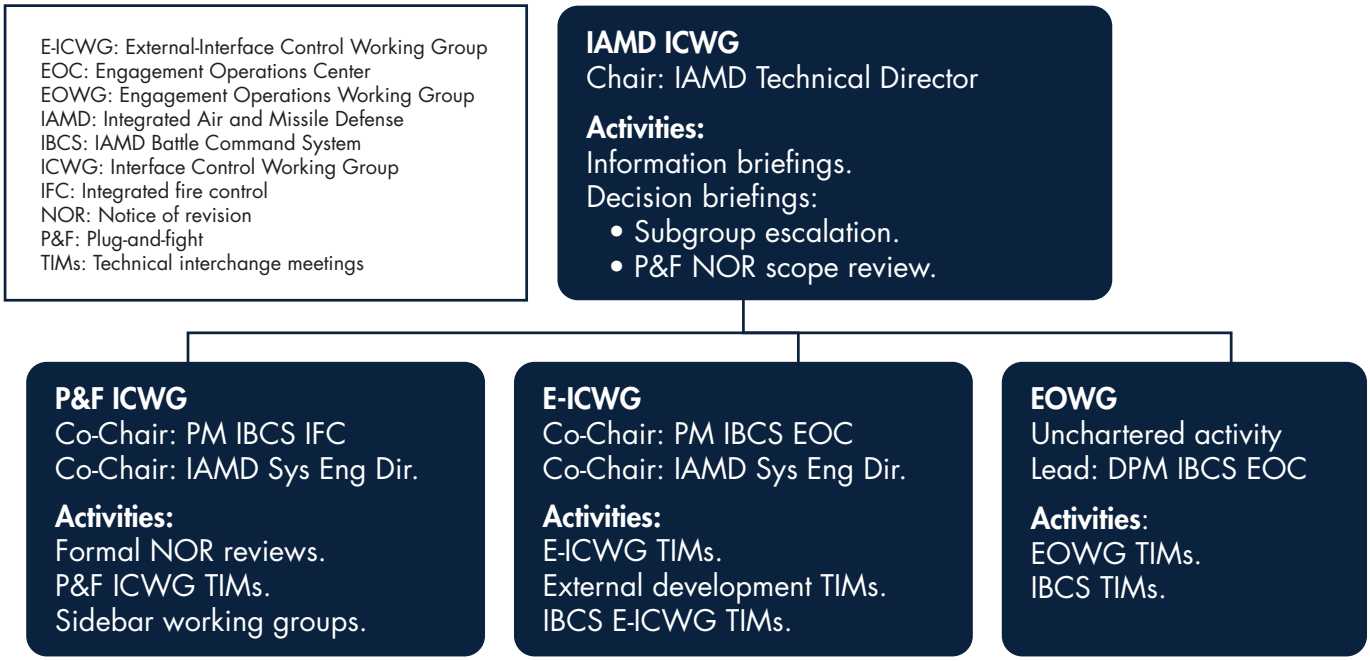
It is critical that all elements participating on the IFCN be able to exchange data in a timely manner with defined message structures. Using an ICD, AIAMD's P&F approach will enable the current critical elements as well as future Army technologies to define the interface for joint IAMD. Currently, the AIAMD PO is hosting technical interchange meetings (TIMs) with a variety of stakeholders to obtain input from subject-matter experts to the development and improvement of the ICD. The TIMs provide opportunities to improve understanding of the ICD and open the lines of communication among stakeholders. Participants include the Army's Indirect Fire Protection Capability (IFPC) Product Office as well as the managers of other land-based sensors, such as the Air Force's Three-Dimensional Expeditionary Long-Range Radar and the Marine Corps' Ground/Air Task Oriented Radar, and programs under development by the Missile Defense Agency, such as the Terminal High Altitude Area Defense system (THAAD) and the Command and Control, Battle Management and Communications system.

AIAMD plans to field IBCS to the air defense airspace management cells, ADA brigade headquarters, and Army air and missile defense command headquarters. A common configuration will be available at all echelons, including battalion, battery and platoon. IAMD specifications define the interface technologies that enable this broad integration effort, including the data distribution system and interface design language, and the P&F ICD documents the sensor-weapon data interactions. (See Figure 2.)

MANAGING THE ICD

To manage the AIAMD ICD and the ASoS integration effort, the AIAMD PO created the Interface Control Working Group (ICWG) in November 2011 for effective systems engineering management of the AIAMD architecture. The P&F Interface Control Working Group (ICWG-P) is responsible for the P&F interface, allowing the organizations involved to remain synchronized and to have correct, complete and accurate documentation as well as knowledge of

FIGURE 3



INTERFACE CONTROL WORKING GROUP
The AIAMD PO created the ICWG to manage the ICD and the ASoS integration effort. The ICWG-P is responsible for the P&F interface, allowing the organizations involved to remain synchronized and to have correct, complete and accurate documentation as well as knowledge of individual component program offices' requirements and contract activities. (SOURCE: AIAMD PO)

individual component program offices' requirements and contract activities.

The members of the ICWG-P are:

- IBCS integrated fire control (IFC) product manager.
- AIAMD Project Office systems engineering director.
- Cruise Missile Defense Systems Project Office.
- Lower Tier Project Office.
- U.S. Army Aviation and Missile Research, Development and Engineering Center's Radar Operations Facility.
- Sentinel Product Office.
- U.S. Fires Center of Excellence.
- Northrop Grumman Corp. (IBCS and Patriot launcher adaptation prime contractor).
- Raytheon Co. (Patriot Radar Interface Unit prime contractor).

The IFC product manager and AIAMD system engineering director co-chair the ICWG-P. The IFC deputy product manager presides over the meetings.

Early in the ICD's development, the ICWG-P met twice a week for three hours each session to discuss the engineering details necessary to mature the ICD's development. These discussions were highly technical, and it quickly became apparent that the group needed subject-matter experts to address component integration issues in near-real time to avoid costly impacts.

The ICWG-P facilitator asked senior leaders of each participating organization to prioritize this effort and empower their technical representative experts in the working group to make decisions on their behalf. This reduced the time spent waiting for decisions from a month or longer to only a few weeks. AIAMD leadership oversight continues to be necessary to ensure participation and prioritization by the multiple stakeholders, given competing program requirements.

INCORPORATING CHANGES

The ASoS ICD is designed to be updated easily on a regular basis. For example, the IAMD enterprise has been using Revision E since May 2013, with an update

TABLE 1

ICD Revision	Document Date	# NORs Implemented	Approximate Schedule Savings
C	26 JUN 12	16	7 months
D	8 JAN 13	11	5 months
E	3 MAY 13	17	13 months

MAKING CHANGES FASTER
The AIAMD PO streamlined the process of incorporating revisions to the ICD by using NORs rather than ECPs. The NORs allow P&F kit developers to implement changes immediately. (SOURCE: AIAMD PO)

INTEGRATED CAPABILITY
Air defense battle management system operators assigned to the 108th ADA Brigade employ the AN/MPQ-64 Sentinel June 21, 2013, in support of the 2nd Brigade Combat Team, 82nd Airborne Division (2-82) during Joint Operational Access Exercise 13-03 at Fort Bragg, NC. By FY17, the AIAMD PO plans to integrate Sentinel radars, among several other systems, to support engagement of air and missile threats. Each sensor and weapon platform will have a P&F interface module, defined by a P&F ICD. (U.S. Army photo by SSG Jason Hull, 2-82 Public Affairs)

to Revision F in February 2014. A standard systems engineering approach uses engineering change proposals (ECPs) to accomplish the changes necessary to revise an ICD. However, ECPs are contractual actions that change a contractor's statement of work and may take up to six months to implement, with a potentially significant impact on a program's schedule and costs.

The AIAMD PO decided to streamline the process of incorporating changes to the ICD. In July 2011, the PO began issuing notices of revision (NORs) for changes determined to be in scope, requiring no additional funds to implement. The NORs paid dividends by enabling P&F kit developers to implement changes immediately; thus all key stakeholders can maintain crucial momentum in executing their component-level designs without sacrificing control of the interface itself.

At the AIAMD critical design review in May 2012, after successful development of Revision C in the P&F B-Kit to A-Kit ICD, the AIAMD PO decided to continue the NOR process. Because of early NOR approval by stakeholders, AIAMD can estimate schedule savings of five to 13 months. (See Table 1.) At this time, all NORs are formally approved or disapproved through the AIAMD Virtual Configuration Control Board, adding further efficiencies. The virtual board eliminates the need for all the decision-making stakeholders to spend several hours physically attending a meeting to review the NORs.

CONCLUSION

No process for managing an ICD is perfect, and the AIAMD PO continuously looks for ways to make the process better. Among the changes that AIAMD may implement in the next six months are:

LAUNCH TIME
The THAAD interceptor, shown here at a Sept. 10, 2013, launch in the western Pacific, is one of the systems for which the ICD allows a common understanding among stakeholders. (Photo courtesy of Missile Defense Agency)

- Holding ICWG-P meetings biweekly or monthly, instead of twice weekly, given that the AIAMD design has matured.
- Evaluating existing interfaces instead of creating AIAMD-specific interfaces. This would facilitate integration with future systems through the pre-planned product improvement stage of development in FY18 and beyond.
- Shortening the AIAMD NOR approval process, which can take up to three weeks depending on the NOR or its criticality and the workload of the voting members from the product office or directorate. Greater use of virtual boards would also make the approval process more efficient.
- Observing how each key stakeholder conducts an NOR review to determine whether the stakeholder's review of NORs needs to be streamlined. Some organizations have multiple boards through which a NOR must travel—such as for an integrated product team engineer review, organization engineer review and configuration control—before an organization decides on its position.

For more information about the AIAMD Plug and Fight ICD, contact Luis Blanché at ***luis.a.blanche.civ@mail.mil****, or Michael Carstensen at* ***michael.a.carstensen.ctr@mail.mil****.*

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RESEARCH RESOURCE

Rapid detection devices for pathogen vectors are case study in leveraging small business innovation funding

by MAJ Vanessa R. Melanson

When military forces arrive in a new operational area, military preventive medicine personnel—preventive medicine specialists, entomologists and environmental science engineers—assess the environment, identify health threats and propose mitigations. Vector-borne diseases are one of the primary readiness threats, and the arthropods (insects and arachnids) that transmit pathogens to people account for about 60 percent of the military's priority pathogens list.

Vector pathogen detection (VPD) provides military preventive medicine personnel the information necessary to implement specific vector-control measures and disease prevention countermeasures. VPD can minimize disease by sampling arthropods for pathogens before human transmission occurs, thereby decreasing the health impacts on military operations.

The Small Business Innovation Research (SBIR) program has been integral to the success of the VPD mission and the Arthropod Vector Rapid Detection Device (AV-RDD) program by providing research and development resources to the Military Entomology Research Program (MERP) at a time when appropriated funding for research, development, test and evaluation (RDT&E) is limited.

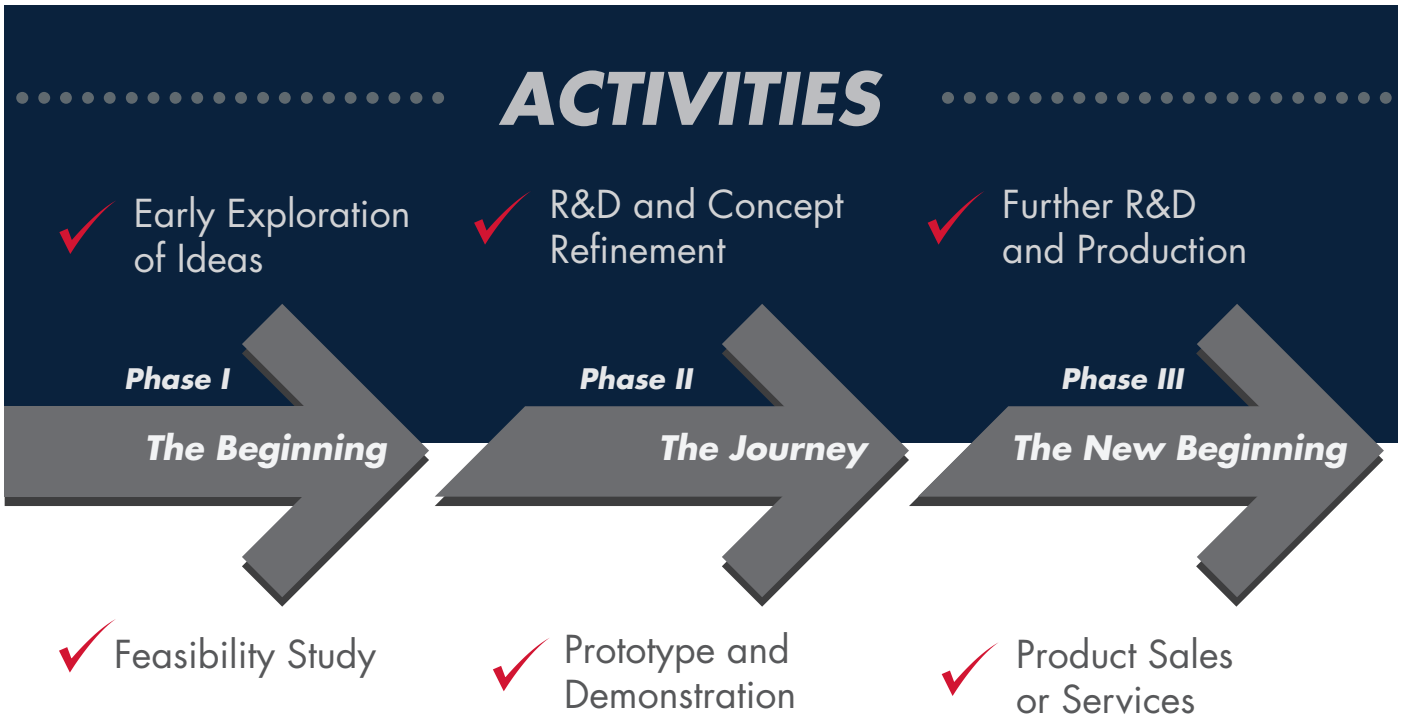
The SBIR program, coordinated by the U.S. Small Business Administration, centers on a competitive three-phase process designed to provide U.S. small businesses the opportunity to propose innovative research and development (R&D) solutions in response to government needs. SBIR proposals are useful in evaluating current states of technology. As COL Russell Coleman, an entomologist with the U.S. Army Medical Research and Materiel Command (USAMRMC) and past head of the MERP, said, "the SBIR program is a powerful tool to help us better understand what is possible and what is not at that point in time." The MERP has leveraged tens of millions of dollars through the SBIR program over the past decade, and other programs stand to benefit in the same way.

EXPANDING OPPORTUNITIES

Federal agencies with extramural R&D budgets that exceed $100 million must reserve a percentage of that spending for small business projects. USAMRMC, through its Army and Defense Health Program SBIR initiatives, selects companies to provide R&D solutions that meet military medical needs.

The first step in an SBIR contract is a Phase I feasibility study, funded at up to $150,000 for six months. The objective is not only to establish the feasibility of the proposed effort, but also

FIGURE 1



A PHASED APPROACH
From concept to completion, the SBIR Program approaches R&D with a rigorous, gated process. The result is to help the Army get warfighters what they need—and help small businesses get the leg up that they need. (SOURCE: Office of Small Business Programs, USAMRMC)

VECTOR-BORNE DISEASES ARE ONE OF THE PRIMARY READINESS THREATS, AND THE ARTHROPODS (INSECTS AND ARACHNIDS) THAT TRANSMIT PATHOGENS TO PEOPLE ACCOUNT FOR ABOUT 60 PERCENT OF THE MILITARY'S PRIORITY PATHOGENS LIST.

to establish the quality of performance of the small business. After proving the proposed concept, a small business may receive a two-year Phase II contract of up to $1 million based on the scientific, technical and commercial potential of the Phase I results. The company may pursue Phase III of the effort, which is essentially commercialization of the effort based on the first two phases. Phase III is not funded by the SBIR program.

An interim step between the second and third phases is a Phase II enhancement. This can be funded by SBIR, but the company must find matching funds from DOD acquisition programs or the private sector. The enhancement will extend the contract for up to one year and match up to $500,000 of non-SBIR funds. (See Figure 1.)

In the past decade, the SBIR program awarded funding for 22 Phase I topics, resulting in 37 Phase I projects that have supported MERP's VPD mission. Usually multiple companies get the go-ahead to address a specific topic—the exact number of companies depending on available SBIR funding—followed by a down-select as the SBIR phase

BY REALIZING THE UTILITY OF CURRENTLY MARKETED TECHNOLOGIES, EVEN IF THEY DON'T FULLY ADDRESS A CAPABILITY GAP, A PROGRAM CAN SHAPE FUTURE EFFORTS.

process ensues. Nineteen of these projects received Phase II contracts.

Along with Phase II enhancement and Phase III investment programs, the $450,000 leveraged through the SBIR program represents a 90 percent increase in the R&D budget dedicated to VPD. This increase in research capacity for a relatively small program comes as no surprise to J.R. Myers, USAMRMC's SBIR project manager. "Motivated research groups such as the MERP are committed to partnering with small business innovators who are highly skilled and driven for success. This focus and dedication yields cutting-edge results for this program," Myers said.

FROM CONCEPT TO CONTRACT

Coleman, past head of the MERP, initially leveraged the SBIR program to develop AV-RDDs in 2003, when he was serving as a major at a USAMRMC laboratory. As an entomologist deployed in Operation Desert Storm, Coleman was familiar with the limited scope of warfighter threat assessments in theater: collecting arthropods, shipping them stateside for pathogen detection and waiting in theater for the results. As he focused on developing a test or device for detecting arthropod-borne pathogens in the field, the AV-RDD effort materialized.

Coleman drafted an SBIR topic that focused on AV-RDDs for the plasmodium (malaria) parasite and arboviruses, or arthropod-borne viruses. After the topic received approval, he served as the contracting officer's representative (COR) and awarded Phase I funding to three companies. After a down-select, followed by completion of a Phase II award, one company fielded the first AV-RDD for malaria with USAMRMC's help.

This original SBIR topic allowed for further development of more AV-RDDs for arboviruses. The same company developed three more AV-RDDs (for the West Nile and the Eastern and Western equine encephalitis viruses) by 2007, which USAMRMC then fielded.

When Coleman deployed to Iraq in 2008 with the 520th Theater Area Medical Laboratory, he discovered the need for a Leishmania AV-RDD to support recommendations to leaders and medical planners on theater vector control measures and disease prevention countermeasures. Leishmania became an SBIR topic. Coleman and others established more SBIR AV-RDD topics to detect additional arboviruses such as the Rift Valley fever and dengue viruses. Coleman served as the COR on these Phase I SBIRs and directed their development.

The result is a much-improved detection process. AV-RDDs come in kits with the necessary materials to perform the test, such as sample holding tubes, grinding buffer and equipment for preparing the insects. Preventive medicine and entomologist personnel trap insects in the field, then sort and pool them by species. The kit has a mortar and pestle that the researchers use for grinding up the bugs in a buffer solution. AV-RDDs can detect pathogens collected from arthropods in about 15 minutes.

DEVELOPMENT AND FIELDING

Without leveraging the SBIR program, the MERP could not have developed any AV-RDDs. The MERP budget is a modest $3.5 million, relying mainly on allocations from 6.2 (applied research) and 6.3 (advanced technology development) RDT&E dollars from the assistant secretary of the Army for acquisition, logistics and technology, which must support seven different research programs on four continents. The VPD program, which encompasses the AV-RDD program, represents approximately 25 percent of the MERP budget. Using the SBIR program and establishing contacts with companies that have expertise the government may

FILLING A CAPABILITY GAP
AV-RDDs, better known as "dipstick" tests, come in kits that contain sample holding tubes, grinding tools and the buffer solutions necessary to run the test. The AV-RDD targets arthropod-borne diseases, a primary readiness threat to warfighters. (Photo by MAJ Vanessa R. Melanson, WRAIR)

lack have benefited the AV-RDD and the larger VPD programs, as well as the MERP overall.

Users of the SBIR program within USAMRMC often find that proposals may address an unforeseen solution. As Coleman explained it, he often finds himself thinking, "I never would have dreamt of addressing this problem in this way. This is really cool." By realizing the utility of currently marketed technologies, even if they don't fully address a capability gap, a program can shape future efforts.

The SBIR program has also succeeded in bridging the gap between technical and research-based (tech-base) development and advanced development programs, and has been critical to fielding products. For example, a USAMRMC laboratory may work on tech-base research, only to find that there is no plan or budget for the product, nor perhaps an operational need by the end user. When that proves to be the case, the lab halts product development and terminates the effort.

FIELDING AV-RDD
PFC Jessica Glover, a 68S preventive medicine specialist at WRAIR, loads the dengue AV-RDD kit into the Medical Equipment Set Entomological Lab. The kit is the outgrowth of an SBIR initiative begun in 2003. (Photo by MAJ Vanessa R. Melanson, WRAIR)

One way to mitigate this type of risk to USAMRMC laboratories is through the SBIR program, the beauty of which is that a small business may already have a potential solution to a real, operational need, or a great idea for one; all it needs is funding to do the research that could prove the solution. By initiating a topic, as with the AV-RDD program, the SBIR opens the door to potential solutions by telling small businesses of the need and asking them to fill it.

The SBIR program aims to preserve prospective products as projects move from tech-base to advanced development, using a series of well-defined checks and balances. As the example of the AV-RDD topics illustrates, SBIR program topics are specific and address well-articulated user requirements. By the time a project begins in Phase I, much of the critical thinking on operational need has been done. As the project matures and successfully completes milestones, it moves into the Phase II process with the potential for follow-on Phase II enhancement or Phase III funding.

LESSONS LEARNED

As MERP officials have learned, an SBIR Phase I contract doesn't necessarily guarantee accomplishment of the desired program without guidance and support from the program managers. When Coleman was head of the MERP, he established an understanding between the government scientists and the SBIR companies to ensure that for every SBIR contract awarded, core RDT&E dollars went to government scientists. This type of partnership facilitated the development of prototypes for military-specification testing by government scientists. It also allowed for feedback to the company and refinement of the prototype, if necessary, thus harnessing the strengths of industry and the expertise of government laboratories and program managers to deliver materiel solutions to the warfighter.

Many small businesses need assistance and incorporation into the strategic vision of an RDT&E program, such as the MERP, to ensure the proper oversight. "Unless you add SBIRs into the overall program, you can't get that hand-holding to the small companies that may need it," said Coleman. "But by thinking strategically and making it part of your core program, you can do this. It used to frustrate the heck out of me, when I'd hear briefings by various program managers and there would be no discussion about SBIR efforts. They should be considered part of our core program and briefed as part of our core program, but they were outliers."

The AV-RDD program faced this issue of supporting small business during the development of the malaria AV-RDD. The company developed the product in 2003, but found there was little profit in production and closed operations in 2005. For nearly two years, the malaria AV-RDD was unavailable to warfighters until another company picked up the development and fielding of the product—through the SBIR program.

CONCLUSION

With the successful development and fielding of AV-RDDs through the SBIR program, personnel in all the services can perform the VPD mission. AV-RDDs make it possible to determine if, say, 90 percent of an area of operation poses no vector-borne disease threat, thereby

AV-RDD CHAMPION
During more than 20 years in the Army, COL Russell Coleman has been instrumental in developing the AV-RDD and a leading advocate of the SBIR Program. (Photo courtesy of the U.S. Army Medical Materiel Development Activity)

allowing preventive medicine personnel to focus on the 10 percent of the area that does, which is a big win for warfighter health and operational stability.

For more information on the DOD SBIR Program, go to ***http://www.acq.osd.mil/osbp/sbir****. For more information on the AV-RDD, go to* ***http://www.usammda.army.mil/documents/Fact%20Sheets/AVRDD.pdf****.*

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DIFFERENT IS GOOD

Changing expeditionary contracting models can add value if it brings success

by LTC Richard Pfeiffer, MAJ Bruce Skrabanek and LTC(P) Robert J. Miceli

For years, leaders at all levels have attempted to standardize expeditionary contracting operations across offices, even down to the smallest. Organizational structures and functions often have been part of these standardization efforts. All too often, however, these endeavors resulted in oversimplifications that did not truly add efficiencies or effectiveness to the organizations. Such misunderstandings were not due to a lack of genuine concern or motivation, but rather to overlooking a universal truth in the expeditionary environment: Neither the people nor the missions are ever standard.

THEATER CONSIDERATIONS
SFC Albert Apodaca, right, and SSG Edward Bonet, both contracting officer's representatives with the 142nd Combat Sustainment Support Battalion, load a box of frozen pizzas into a storage container at the Class 1 Yard at Kandahar Airfield, Afghanistan, Jan. 20. In-theater installation access controls may dictate that a contracting organization distinguish between vendors inside the wire and those outside the wire in assigning the workload. (U.S. Army photo by SGT Antony S. Lee, International Security Assistance Force Regional Command – South)

All contracting centers and offices are unique; each one cultivates its own exclusive set of customers with differing requirements, while managing distinct local vendor bases. Every office and center possesses a variety of skills, abilities

THINKING JOINTLY
Army SFC Samuel Agyapong, a contracting specialist with the U.S. Army Contracting Command at Picatinny Arsenal, NJ, and Air Force TSgt Nick Fisher, a contracting specialist with the 17th Contracting Squadron out of Goodfellow AFB, TX, share contracting support techniques in January during Operational Contract Support Joint Exercise 2014 at Fort Bliss, TX. It is a universal truth in the expeditionary environment that neither the people nor the missions are ever standard. (U.S. Army photo by SSG Kenneth Pawlak)

and experiences inherent to its contracting personnel. This melding of personalities and abilities naturally results in a one-of-a-kind organizational structure, one designed to distribute and manage the workload effectively based upon individual talents and mission requirements.

Several traditional organizational models have emerged to enable workload assignment and management. This article will explore a variety of structures and models for aligning (or realigning) contracting offices and organizing them to fit the contracting environment in which they operate.

META-ORGANIZATIONAL MODELS

The following two organizational models are frequently used as overarching, or meta-organizational, models. These typically are for a large umbrella organization, further structured and subdivided using other models.

- **Pre-award and administration**. An office organized in this fashion typically has an entire division devoted to receiving purchase requests (PRs) through the point of award. After contract award, the contracts administration division handles all further administrative actions.

Typically, the two divisions are further subdivided into sections or teams.

The pros for this model are that it:
- Provides personnel the opportunity to become subject-matter experts.
- Fosters repeated interaction between the customer and contracting professional.

The cons for this model are that it:
- May limit opportunities to gain experience in other facets of contracting.
- Features a routine or repetitive workload that may lead to job dissatisfaction.

- **Cradle-to-grave**. In this model, each contracting officer (KO) or section is responsible for all actions from receipt of the purchase request through award, along with all responsibilities for administration throughout the life of the contract. This can effectively eliminate a level of leadership or management, as each section deals exclusively with its own PRs, contracts and workload.

The pros for this model are that it:
- Creates a sense of ownership rather than an "award-and-forget" mentality.
- May eliminate a level of management through a flatter organization.

The cons for this model are that it:
- Creates difficulties of continuity in a high-turnover organization.
- Increases the span of control for the chief or deputy.
- Increases the managerial and reporting duties for each section lead.
- Tends to focus more on the pre-award phase than on contract administration, allowing administrative actions to go unaddressed.

MAXIMIZE SKILL SETS
SSG Inez Necker and SSG Richard Burns, contracting NCOs assigned to the 680th Contingency Contracting Team (CCT), 413th Contracting Support Brigade, review contract documents Oct. 18, 2013, at the 18th Contracting Squadron headquarters on Kadena Air Base, Okinawa, Japan. The organization of each contracting office should aim to maximize the skill sets and efficiencies of its people. (U.S. Army photo by SFC Howard Reed, 10th Regional Support Group)

MODELS FOR SUBDIVIDING

The following are typical models for organizing an office or division when using a meta-organizational model and establishing further divisions within that.

- **Supplies, services and construction**. This traditional model is based on the general classification of the type of purchase; within the office are divisions that handle a category of purchase, such as supplies, services or construction.

The pros for this model are that it:
- Leverages and sustains competencies at the lowest level.
- Creates efficiencies or reductions in procurement acquisition lead time (PALT).
- Creates specialists within the organization.

The cons for this model are that it:
- May limit growth and experience-building in the workforce.
- May require a plan to rotate workers, to offset limitations on growth.
- May limit the development of a "jack of all trades" KO.

- **Customer-based**. This is another traditional model, in which teams or divisions support a unique customer or unit(s). In this model, the teams often may attend acquisition review boards and meetings with their customers for planning de-confliction and updates, creating more chances for acquisition education and management of customer expectations as well as increasing KO awareness and

understanding of emerging requirements and priorities.

The pros for this model are that it:
- Creates rapport with the customer and familiarity with emerging requirements.
- Often leads to more complete PR packages.
- Can create a proactive environment in which personnel seek to get in front of acquisitions.

The cons for this model are that it:
- May lose efficiencies gained from tailoring the organization based on requirement type.
- Requires KOs and specialists to truly understand and be proficient in the entire range of contracting.

The following three models are less traditional and often appear similar, with only subtle differences.

- **Geographical**. A model based upon location can help differentiate and visualize the contracting environment.

  In its simplest form, this model dedicates one team to X province, state or region; the team handles all requirements to be performed or delivered in that region.

  The pros for this model are that it:
  - Allows KOs to become familiar with their vendor base and capabilities, reducing PALT.
  - Enables each team to better advise its customers.

  The cons for this model are that it:
  - May make equitable division of workload a challenge.
  - May require increased management oversight to ensure proper use of resources.

- **Appropriation type**. Purchase requests entering the office are divided by "pots" or "color" of money. For example, one team may handle all Operations and Maintenance, Army requirements (including supplies, services and construction), while another team handles all Afghanistan Security Forces Fund or similarly appropriated requirements. This approach often resembles a customer-aligned model; the discerning element is the "color" of money rather than the customer.

  The pros for this model are that it:
  - Enables development of competency or expertise in the requirements or limitations of different types of money.
  - Can create a rapport, familiarity and understanding with particular resource managers.

  The con for this model is that:
  - The workload may not be equal across the types of money, resulting in large and small divisions.

- **Vendor-based (inside the wire or outside the wire)**. This model distributes the workload based primarily on the subset of vendors that are likely to perform the work. In Afghanistan, one regional contracting center divided work based on where it was to be performed. Because of security considerations and camp pass requirements, the on-camp vendor pool was much shallower than the off-camp set of contractors. As such, requirements were divided into inside-the-wire and outside-the-wire (on-camp and off-camp) groupings. This model did not relieve the KOs from attempting to generate competition and expand vendor bases. This example is subtly different than the money-based and the geographical models; in fact, it is a sort of hybrid of the two.

- **Special teams**. It may be necessary or advantageous to assemble and staff special teams to leverage their expertise or handle a significant volume of specialized contracting. For example, specialty contracting teams may be necessary in information technology, construction, source selection or complex buys, or contract closeout.

REALIGNMENT DECISIONS

The decision to reorganize any contracting office should not be undertaken lightly. Change can be disruptive, and contracting professionals within the office may experience a learning curve before achieving or recapturing peak efficiency. The office also can expect an initial decrease in performance before realizing any of the expected benefits.

There also may be unforeseen third- and fourth-order effects. Therefore, any realignment should offer more benefits than the current organizational model. Some reasons to realign may include seeking:

- Faster turnaround time for the customer.
- Greater savings in cost or performance.
- More opportunities to employ or develop the KO's skills.
- Increased contract oversight or administration.
- Ability to accomplish or focus on specific areas that need attention.

Conversely, realignments can also create opportunities for contracting professionals to learn or gain experience in various procurement types and rebalance the current workload. Some examples of possible realignment needs would be establishing a construction division if an office is expecting a substantial increase in construction; or a specialized branch for services if requirements for them are increasing.

SPECIAL NEEDS
MAJ Marc Nguyen, a KO with the Area Support Team Balkans, meets with the contractor Sept. 10, 2013, to conduct a final inspection of renovations at the Mjedenica School, a boarding school for children with special needs in Sarajevo, Bosnia and Herzegovina. A large volume of a particular type of contract, such as construction, information technology or closeout, may call for the formation of a special team. (U.S. Army photo by SGT Joshua Stoffregen, 4th Public Affairs Detachment)

CONCLUSION

Ultimately, the strengths and weaknesses of any office lie in the skills and abilities of its workforce. The organizational model enhances, enables and provides structure for those personnel. Any reorganization plan must take into account the talents, skills and capabilities of the workforce. Indeed, people and their placement should be the primary focus of any reorganization plan.

Each contracting office faces unique circumstances, customers and challenges, as well as having varying degrees of experience, capability and qualifications among its personnel. Thus, the model for each office should achieve the highest possible level of customer service specific to its mission and environment by maximizing the skill sets and efficiencies of the organization.

As difficult as it would be to conceive of any military operation other than a joint one, it is equally inconceivable to imagine any future military operation in which contracting will not figure prominently. During an era of reduced spending and force structure, the contracting community must raise the bar in its flexible and adaptable support to the warfighter.

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The Gravel Dilemma

What is gravel? Is it a commodity, a service or construction? The answer is often, "It depends."

In recent contingency environments, offices dealt with many gravel requirements. Any future contingency is also likely to generate gravel requirements, which is why it's important to look at "the gravel dilemma."

Gravel offers a unique example of how to classify a purchase, and of the friction that arises sometimes within an office over the section to which it should be assigned. One office in Afghanistan dealt with the issue this way:

If the purchase request (PR) was to deliver X cubic meters to Y location, then it was treated as a commodity—a purchase with delivery incidental. If the PR was for delivery and spreading, then it was treated as a commodity with service as an incidental, or it was treated as a distinct service.

Which option was used when? It depends. If the customer required a staging lot or specific area covered with 2-3 inches of gravel, then it was treated as a service: Cover the lot with X inches of gravel Y inches deep. If the customer wanted 10 cubic meters delivered and spread, then it was handled as a commodity: Purchase the 10 cubic meters with an incidental service of spreading.

If the customer required compaction, then the PR was treated as construction. Anytime a PR required a nuclear densometer test, the PR wasn't treated as a simple commodity or service. The PR was treated as a construction requirement to ensure that the proper technical experts were verifying that the government received what was required, and to involve the engineers for quality assurance purposes as well as to make sure the proper clauses were included,

The point is: No matter how your organization is modeled, there will always be some requirements that do not fit neatly within the bounds of the structured divisions. Gravel is just one example. When dealing with these situations, flexibility is the key. Study the requirement, determine what the preponderance of the requirement is, make the best call possible, put the PR in the hands of a contracting professional, and execute to meet the customer's needs.

—LTC RICHARD PFEIFFER, MAJ BRUCE SKRABANEK AND LTC(P) ROBERT J. MICELI

GRAVEL OFFERS A UNIQUE EXAMPLE OF HOW TO CLASSIFY A PURCHASE, AND OF THE FRICTION THAT ARISES SOMETIMES WITHIN AN OFFICE OVER THE SECTION TO WHICH IT SHOULD BE ASSIGNED.

CLAUSE FOR EFFECT

ARDEC and JMC aim to simplify procurement and reduce cost of conventional ammo with new contract clause

by Mr. Steve Stark

The U.S. Army Armament, Research, Development and Engineering Center (ARDEC) and the Joint Munitions Command (JMC) in the next few months will begin a pilot of a contract clause that should allow for a uniform, integrated approach to help conventional ammunition suppliers comply with acceptance inspection equipment (AIE) requirements while encouraging them to follow commercial best practices.

"Inspection is essential to any manufacturing system. It's the means of identifying and rejecting nonconformities, thus ensuring that only conforming product gets to the warfighter," said Jennifer Herrera, a quality engineer with Program Executive Office (PEO) Ammunition, who will manage the pilot of the new measurement system evaluation (MSE) clause. Inspection is even more important when the product is ammunition, she said, so it's imperative that AIE requirements be clearly stated and understood by the government and contractors.

The MSE clause, developed for use in conventional ammunition acquisition, will clarify procurement and make life simpler for the services, special operations program managers and industry by taking information currently located in a variety of different places and putting it in one, easy-to-find location, said Herrera. Accompanying the MSE will be two contract data requirements lists (CDRLs), which spell out a time frame

and required data for a specific procurement and which become a part of the contract. The new clause also includes a unique data item description (DID), which outlines the format and content of the data deliverables, and a detailed review guide.

In a nutshell, the review guide is meant to aid in applying the MSE clause and in developing and reviewing AIE submissions. It also helps personnel involved in the review, design or selection of AIE used to inspect characteristics identified in government technical data packages.

FROM HARD-TO-FIND TO ONE-STOP SHOP

"The Joint Lethality and Munitions Life Cycle Management Command has had [the same] three AIE clauses for easily over 30 years," said Jorge Munoz, technical lead for small-caliber ammunition at ARDEC. Currently there's one AIE clause for ARDEC, one for JMC, and another at JMC that's specific to the Air Force and Navy.

"During that time frame," he continued, "manufacturing production processes have changed to become more automated.

END-USER EXPERIENCE
SPC Charles R. Reiff, an indirect fire infantryman with 1st Battalion, 506th Infantry Regiment, 4th Brigade Combat Team, 101st Airborne Division (Air Assault) (4-101 ABN), inspects ammunition at Combat Outpost Zormat, Afghanistan, Sept. 9, 2013, before going out on a mission. When it comes to ammunition, rigorous inspection is especially important, which makes it imperative that AIE requirements be clearly stated and understood by the government and contractors. (U.S. Army photo by SGT Justin A. Moeller, 4-101 ABN Public Affairs)

The production processes have changed and have become more automated and sometimes intertwined with the inspection processes, so we wanted to come up with one, all-inclusive AIE clause that could be used across the four military services and that will address the automation issues."

He added that the command also sought to develop a clause that applies a unified standard instead of changing standards, as in the past, that depended on which service the product was for. The result is the MSE clause, developed by a multiservice, multidisciplinary Supplier Quality Initiative (SQI) process action team representing contracting, legal, quality and engineering personnel.

"Our current requirements are pretty good. It's just that they're in so many different places," said Sanket Patel, a member of the SQI team and the Joint Ordnance Commanders Group (JOCG) Quality Assurance (QA) Subgroup chairperson. "There were minor variances between the requirements, like the three top-level contract clauses.

"Our goal," he explained, "was to come up with one contract clause, one data item description, and pull all these references to commercial industry best practices into one place, so a contractor could bid on these effectively and execute to the requirements effectively."

Because contract requirements were not in the same place, Munoz said, "if the contractor or even the engineers here wanted to review what the requirements were, they had to go to different sources. There was no 'one-stop shop.' By using the MSE clause instead of the three AIEs, all of the DIDs and CDRLs for all of the requirements would be in one place," he noted.

PILLARS OF QUALITY
MSE was designed with continuous improvement in mind to complement the four pillars of supplier quality, derived from MIL-STD-1916. The four pillars represent a robust:
1. Prevention system (process control).
2. Critical characteristic control (CCC) system.
3. Quality management system (QMS).
4. Detection system (measurement devices and inspections).
(SOURCE: SQI Team)

READY FOR FIRE
Ammunition awaits loading and firing June 26, 2013, during the 2013 U.S. Army Reserve Best Warrior Competition M-4 nighttime event at Fort McCoy, WI. (Photo by SSG Gary Hawkins)

The intended result, said Chris Mahoney, manufacturing quality lead for Naval Air Warfare Center Weapons Division China Lake, CA, is to simplify things for both the government and the contractor. He explained the benefit to contractors: "Say you're a contractor who has a Navy contract, an Air Force contract and an Army contract, and they have three different clauses. It causes some headaches" for all concerned when "there are different requirements that should be common requirements."

For example, said Rick Boyle, QA specialist at JMC, "Before, we had varying timelines" in requirements. "The Navy and the Air Force have some of their own unique requirements that were in a separate clause. Sometimes the CDRLs would get confused, [and] they would end up picking up on the wrong CDRL, or the wrong CDRL may get included in the contract, so what [the MSE clause] will do is make sure that we only have one CDRL" that will go into the contract.

That, said Patel, could significantly reduce non-value-added overhead. "Here's a simple example," he said: "You may have an older commercial reference on one requirement and a newer commercial reference on another requirement, but they're really the same requirement" with very little difference. "They're both commercial standards that industry uses—it's just that one has the latest variant of it." The bottom line, according to Patel, is that "it's a lot of minutiae that creates non-value-added overhead requirements on the contractor to do further analysis, when we really don't have to have them spend that time and energy doing so."

The SQI held an MSE industry day in December 2013 to address any concerns among suppliers regarding the details

KEEPING THE RECORD STRAIGHT
SPC Henryon Russell, left, SSG Ricky Sheppard and SSG Yolandia Quinn catalog ammunition, explosives and spent munitions during a Mine Resistant Ambush Protected Vehicle ammunition abatement inspection Oct. 12, 2013, at the Camp John Pratt Redistribution Property Assistance Team yard, Afghanistan. The process of delivering high-quality ammunition to the U.S. military involves a number of players, including ARDEC and JMC, which are conducting the pilot of the new MSE clause. (U.S. Army photo by SFC Timothy Lawn, 1st Theater Sustainment Command Public Affairs)

of the government's draft MSE clause, Herrera said. More than 50 suppliers attended the event, which culminated in a draft supplier-government clause developed in cooperation with the suppliers who attended. Working collaboratively with the supplier industrial base will contribute to more effectively initiating, executing and implementing the clause on future contracts, she noted.

SAFETY, PREVENTION AND DETECTION

The development of the MSE clause came out of ARDEC and JMC's SQI, which began in 2006 "as a sub-integrated process team to the JOCG QA subgroup," Patel said. "The intent was to look at our requirements and engage in continuous improvement activities based on impact and effort."

Specifically, that meant assessing core requirements for quality at the Single Manager for Conventional Ammunition level, and deciding which requirements should undergo "continuous improvement activities to ensure that we have clean and stable requirements," Patel said. The first product to emerge from that initiative "was a single critical characteristics clause," he said. "When it comes to safety, that jumped out as the number one criterion—that we should ensure that all requirements are clean and stable. We created a single critical characteristics clause for ammunition procurements."

The second outcome was the process capability control and improvement clause, "which addresses the prevention element of quality, or preventing defects from happening in the first place," Patel said. (See "Process Capability, Control, and Improvement Clause Allows Enhanced Process Monitoring and Control," Army AL&T magazine, January – March 2011, Page 66.)

TEST AND EVALUATION

Engineer Mike Menegus prepares equipment for testing at the Environmental Test Laboratory at Picatinny Arsenal, NJ. Inspection helps identify and reject nonconformities to ensure that only conforming product goes to the warfighter. Testing determines how equipment will perform in various settings. The intent of the new MSE contract clause is to support a uniform, integrated approach to both for conventional ammunition suppliers. (U.S. Army photo)

The MSE, the newest effort out of the SQI, addresses the detection of defects. "We addressed safety, then we addressed prevention," Patel said, "Now we're addressing the detection element, which is the inspection process. So that's the genesis of the project and the process we've been using with standard Lean Six Sigma [LSS] tools."

The idea behind the initiative is for process action teams to use the LSS tools to investigate and improve a defined work process, with the goal of improving customer satisfaction.

MSE AT WORK

Besides the three current AIE clauses, current requirements documents include the military specifications MIL-A-70625, "Automated Acceptance Inspection Equipment Design, Testing and Approval of"; and MIL-A-48078, "Ammunition, Standard Quality Assurance Provisions, General Specification for." According to Patel, having the applicable requirements referenced in one document, the MSE clause, will facilitate communication of requirements between government officials and contractors, and will improve the first-pass yield of AIE submissions.

That means when a contractor says, "Here's our inspection equipment that we're using to validate the critical and major characteristics," they'll get it right the first time. Contractors will know exactly what's expected of them because they're not switching between multiple variants of the same requirement.

The MSE clause supports and reinforces the expectations of MIL-A-70625 and of

MIL-STD-1916, "DOD Preferred Method for Acceptance of Product," Paragraph 4.4, "critical characteristics," which states: "Unless otherwise specified in the contract or product specifications, the contractor is required for each critical characteristic to implement an automated screening or a failsafe manufacturing operation and apply sampling plan VL-VII to verify the performance of the screening operation. The occurrence of one or more critical nonconformances requires corrective action as specified in paragraph 4.5."

MIL-A-70265 "prescribes requirements for design, testing and design approval of all automated acceptance inspection equipment systems," and "is applicable to both government- and contractor-owned equipment, which is used to assure that supplies offered for government acceptance conform to the government design requirements."

A CDRL, in conjunction with the appropriate DID, specifies and schedules the ordering and delivery of data that the government requires. The MSE clause has time frame requirements for two separate but interdependent deliverables; hence the need for two CDRLs. The first provides the recommended time frame for delivery of the AIE package.

The second corresponds to the measurement system analysis (MSA) paragraph of the MSE clause, which requires delivery of MSA assessment plans, associated data and analysis in accordance with ASTM E2782-11, in a certain timeline for specific characteristics identified in the clause.

To put that in more concrete terms, Munoz said, if a specification requires that, for example, a ball bearing should have a particular outside diameter within narrow tolerances (a major characteristic), then the contractor will have to provide the specific type of equipment (the AIE) it uses to determine those tolerances, and the accuracy of that equipment. The government can require the contractor to conduct a repeatability and reproducibility (R&R) test of the equipment. (R&R is a kind of MSA.) So the MSA CDRL is triggered for specific characteristics defined in the contract that require analysis, after the MSE CDRL has been satisfied for general acceptance inspection equipment requirements.

As its name implies, the data item description specifically defines the data content, format and intended use for the contractor to prepare required data for the government's use. This unique MSE DID consolidates the existing AIE DIDs, references special inspection equipment and methods, and outlines the recommended content and format for AIE submissions that contractors are to provide to the government for review and approval.

CONCLUSION

"The benefit to the contractor and the benefit to the program manager is mutual—reducing cost and schedule impact while increasing the quality and reliability of the end product," said Ricardo Martinez, SQI Team member representing the Systems Engineering and Technology Integration Division of PEO Ammunition's Project Manager (PM) Maneuver Ammunition Systems. "The MSE clause will help the contractors bid and schedule AIE work appropriately and consistently," he said. That, in turn, "will lead to cost avoidance and reduce schedule impact. Essentially, the clause will help the contractor and government operate more efficiently while reducing or eliminating misinterpretation of the current AIE requirements" on either side.

"Essentially," Martinez continued, piloting the clause "will serve as validation to the ammunition and weapons community, especially the program managers and contractors, that the intended benefit of implementing the MSE clause has been achieved. A pilot program gives us objective evidence to prove our claims. So taking the time to do a pilot program will improve adoption across the enterprise, which includes all military services, small and large businesses, and a very diverse portfolio, and ensure that any lingering questions or unknowns are addressed."

To those who might fear that the MSE clause is adding requirements, Martinez said it is not, nor is it exposing hidden requirements that are currently being overlooked or misinterpreted. "The SQI team has worked hard at wording the clause and supporting documents in a way to meet the goal and also add flexibility for the PM to adjust some requirements as needed," he said.

For further information, contact Rick Boyle at ***richard.p.boyle4.civ@mail.mil*** *or Jorge Munoz at* ***jorge.a.munoz8.civ@mail.mil****.*

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MSE Clause at a Glance

The measurement system evaluation (MSE) clause comprises 15 paragraphs labeled "a" through "o," each with specific guidelines and instructions. Following is a brief synopsis.

(a) **Definitions**.

(b) **Scope**—Scope of MSE.

(c) **Acceptance Inspection Equipment (AIE)**—Requirements for AIE.

(d) **AIE Designs and Government-Furnished Gages**.

(e) **AIE Package Submittals**.

(f) **Characteristics for Inspection**—Requirements and options for submitting AIE for minor characteristics.

(g) **Automated AIE (AAIE)**—Requirements and options for AAIE reliability and confidence levels.

(h) **Measurement System Analysis**—The need to demonstrate that the AIE inspection process is stable, repeatable and reproducible.

(i) **Robust AIE System**—Stipulation that the AIE system be impervious to manufacturing and inspection environmental stimuli.

(j) **AIE Calibration and Verification**.

(k) **Non-Destructive Testing (NDT)**—Requirements for qualifying and certifying NDT personnel.

(l) **Contractor Alternate Inspection Method(s), Modifications and/or Relocation of AIE (Non-Automated) After Government Approval**—Requirements for submitting alternate inspection methods after government approval of AIE packages.

(m) **Responsibility for AIE Package Submittal**—Contractual time-frame requirements for AIE package submittals and resubmittals.

(n) **Government's Right to Disapprove AIE**—Requirements for government to disapprove AIE during contract performance.

(o) **Navy-Furnished Gages**—List of Navy Special Interface Gage requirements.

—SQI Team

PEO AMMUNITION

Efficiently and Effectively Supporting the Warfighter with the World's Best Ammunition, Weapons and Counter-IED Systems

THE ARMY'S SINGLE MANAGER FOR CONVENTIONAL AMMUNITION

?

CRITICAL THINKING

PREDICTING *the* 'WHETHER'

Planning 30 years out requires a vision of the future. That's where ARCIC comes in.

Predicting potential future adversaries and warfare *is considerably less straightforward than forecasting the weather, but it can involve as many variables. Climatologists have sophisticated computer models that can help them develop a picture of the next week or two in reasonably accurate detail and can even provide a general picture of what the climate will probably look like 30 years out. Military planners don't have equivalent models, at least not yet. But, like climatologists, they have a sophisticated understanding of their subject matter and can provide an assessment of what's likely based on current trends and an array of variables.*

One of those trends is significantly reduced budgets. But Charles Dickens may have been right that the worst of times can be the best of times. From two recent periods of relative austerity for U.S. military budgets, one in the 1970s and another two decades later, came the foundation of the Army's land force and the beginning of the networked Army.

The organization charged with forecasting the ifs, buts and whethers of the Army's future, and which plays a leading role in planning for it all, is the Army Capabilities Integration Center (ARCIC). Formerly the Futures Center, ARCIC supports the U.S. Army Training and Doctrine Command (TRADOC) in the design, development and integration of force capability requirements for the Army. According to its website, "ARCIC develops Army concepts that provide strategic and operational direction through the Army concept framework. … In many ways, ARCIC is the think tank for the Army. We look at the future, determine the threats the Army will face and the missions it will receive, and come up with the operational concepts required to organize its structures and the capabilities needed to drive its programs."

Developing concepts for the future is as much art as science. Precisely because such predictions are so difficult, Army AL&T magazine sat down with ARCIC to get an idea of what their crystal ball looks like and how it works.

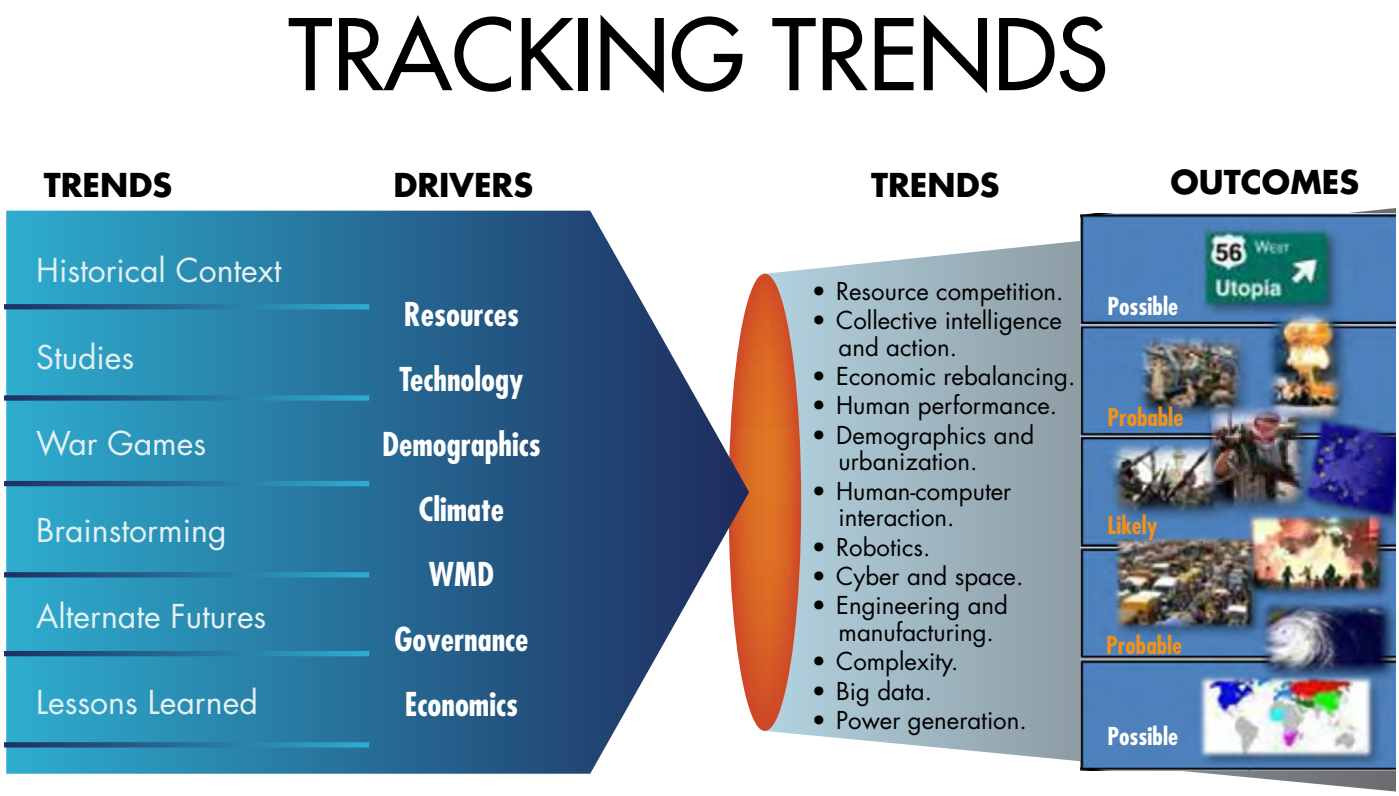
PRACTICING FOR DISASTER
National Guardsmen and civilian first responders clear rubble Nov. 7, 2013, at a simulated collapsed structure on the former Brunswick Naval Air Station, ME. Disaster relief is one of the full spectrum of military operations that ARCIC examines through its wargaming, in collaboration with the other services. Each service contributes emerging technologies and objectives, but all tackle the mission as a joint team. (Maine Army National Guard photo by SGT Angela Parady, 121st Public Affairs Detachment)

*Army AL&T talked with **MG William C. Hix**, ARCIC deputy director and chief of staff, who came to TRADOC and ARCIC after serving in Afghanistan as the director, Future Operations, International Security Assistance Force Joint Command. He has also served in a variety of strategy and planning positions, including director for operational plans and joint force development, Joint Staff J-7; and Strategy Division chief, Joint Staff J-5. He graduated from the United States Military Academy (USMA) in 1981. He holds a Master of Military Art and Science, was a National Security Affairs Fellow at the Hoover Institution on War, Revolution, and Peace at Stanford University and is a member of the International Institute for Strategic Studies.*

*Joining MG Hix were **COL Christopher G. Cross**, chief of ARCIC's Science and Technology (S&T) Division, and **COL Kevin M. Felix**, chief of ARCIC's Future Warfare Division. Cross earned a Ph.D. in physics from the Naval Postgraduate School and a Master of Strategic Studies at the U.S. Army War College. He has served as a Defense Threat Reduction Agency Stockpile associate to the Lawrence Livermore National Laboratory (LLNL) and has taught physics at USMA. LLNL sponsored his doctoral research on modeling of the spatial distribution and temporal decay of geomagnetically trapped charged particles following a nuclear detonation in space.*

Felix, an Army field artillery and foreign area officer, is a graduate of the Defense Language Institute's Greek and French courses and the U.S. Army Command and General Staff College. He also graduated from the International Training Course in Security Policy of the Graduate Institute of International Studies, Geneva in Switzerland. He holds a bachelor's degree in civil engineering from USMA and a master's degree in international relations from the University of Geneva. He recently completed studies as a National Security Fellow at Harvard University's John F. Kennedy School of Government. He came to ARCIC from a brigade command with the 4th Battlefield Coordination Detachment, Shaw AFB, SC. He served in the 101st Airborne Division and deployed to Operation Iraqi Freedom, serving as the division's fires coordinator during the invasion of Iraq.

FIGURE 1



THE 'WHETHER' MODEL

Just as weather forecasters track trends in wind, temperature, precipitation and other factors for their near- and longer-term forecasts, so must Army and other military planners track and map trends they see and foresee in order to anticipate the operational environment (OE) of the future. Their models may include war-gaming, historical trends and contexts, demographic trends and even the weather. (SOURCE: ARCIC)

In talking with Hix, Felix and Cross, Army AL&T learned more than we expected.

Army AL&T: How does ARCIC envision the future and then hand that off to the acquisition community to implement?

MG Hix: Certainly since I came into the Army, this is the third major period of change that has been undertaken in a period of declining resources. I became a member of the Army in the late '70s, when we were coming out of Vietnam and there was a significant manpower reduction and budget cuts. And yet at that time, we laid the groundwork for the defense buildup that was undertaken in the 1980s and resulted in what we call Division 86 or the AirLand Battle Army with the Big Five: the Abrams M1 tank, the Bradley Fighting Vehicle, the Black Hawk and Apache helicopters, and the Patriot missile system.

And a host of other things [happened during that time] in terms of leader development and training. We instituted the combat training centers. So it was truly a significant integration of the acronym DOTMLPF, what we call the imperatives that you have to keep in balance—doctrine, organization, training, materiel, leader development, Soldiers (personnel) and then, of course, facilities. Because if you improve, say, the lethality of a combat platform, you have got to actually have a range that can handle the gun.

So you've got to keep all those things in balance. And that is what TRADOC does. In fact, that is why TRADOC was formed. Because coming out of Vietnam and with the wake-up call of the

1973 Arab-Israeli War, we found that we were out of position across all of those imperatives, and particularly our combat platforms. Our doctrine organizations weren't really optimized to deal with the very high tempo and exceptionally lethal battlefield that we saw in that war.

As we came out of the Cold War, and following the very successful operations in Panama and Desert Storm, we also again went through a very significant force reduction and budget cut. And yet, during that same period, we substantially modernized our ground vehicle fleet with the M1A2 SEP [M1A2 Abrams tank System Enhancement Package], which had the hunter-killer system on it that really increased the effectiveness of that combat platform by at least an order of two, if not better; the Desert Storm variant of the Bradley; the [AH-64D] Apache Longbow, etc. Although those are all very important and played a strong role in our operations in the last decade, 2000 to 2014, as importantly, we began to posture ourselves to think differently about how we operate in the Information Age.

And we began with [then-Army Chief of Staff] GEN [Gordon R.] Sullivan's charge to conduct what we called the Louisiana Maneuvers Task Force, where we learned about how to experiment and think about operating differently in the 21st century. And we transitioned that into a program I think you're familiar with, Force 21, centered on the 4th Infantry Division, to how we digitize our ground forces and better integrate the promises of the Information Age into ground combat so that we got more out of a smaller but still very capable and lethal Army.

That process has continued through to today. That's really where we learned about how to think about the question that you asked—how do you think about a 30-year modernization process? Particularly when you consider that you have the nonmaterial solutions that are as important as, if not more important than the material solutions as you go forward. We should remember the French had a better tank in the opening stages of World War II, but they had the wrong idea and lost their country for several years because of that.

This integration of thinking about the future, getting ideas, surveying deep, pulling those into concepts, looking at those concepts against the emerging security environment and demands of the nation's strategies, … looking at where the gaps are, coming up with required capabilities that drive change across those imperatives of DOTMLPF—that is really ARCIC's role, and then physically changing the Army over time. It is a constant process of adaptation in the near term, evolution in the mid-term and innovation in the far term. We own the centerpiece of that, from the far term into the near-term adaptation piece. And obviously, we connect into a variety of partners across the Army and then into industry, academia, other parts of the government, etc.

Army AL&T: What do you see as ARCIC's role in a 30-year modernization process? On your website, you describe Force 2025. What do you think the force of 2025 would look like?

MG Hix: COL Kevin Felix leads that deep futures piece with our Unified Quest study program that we run for

RAPID RESPONSE

Paratroopers with the 2nd Battalion, 325th Airborne Infantry Regiment, 2nd BCT, 82nd Airborne Division (2-82 ABN) conduct live-fire urban operations training at Fort Bragg, NC, Sept. 9, 2013. The Soldiers were part of the Global Response Force, conducting a two-week intensive training cycle designed to reinforce combat skills for the nation's airborne assault-capable contingency unit. Expeditionary capabilities will be critical to a future in which events will happen fast and in which the vast majority of the world population lives in coastal cities or megacities. (U.S. Army photo by SSG Jason Hull, 2-82 ABN Public Affairs)

WE'RE NOT FOCUSED SOLELY ON THE CURRENT ADVERSARIES; WE'RE LOOKING AT TECHNOLOGICAL AND SYSTEMS DEVELOPMENTS WORLDWIDE, BECAUSE ONE OF THE KEY TRENDS, OF COURSE, IS THAT ACCESS TO TECHNOLOGY AND KNOWLEDGE IS BECOMING MORE AND MORE DIFFUSE.

the chief of staff of the Army. And then COL Cross—Chris Cross—runs the science and technology piece, which really spans the far and mid-term and bridges into, in some cases, the near term.

What would we look like in 2025? Physically, we will probably look very similar to what we do today. The challenge for the Army is to retain as much capacity as possible. [Chief of Staff of the Army] GEN [Raymond T.] Odierno was interviewed by the Council on Foreign Relations and talked about the relative balance—the impacts of end strength in terms of how we manage the force or the challenges of the environment as we see it, with a force of 450,000 in the active force and 980,000 across the active, Guard and Reserve. And he said, "Do I think we can do it? Yes. Will there be risks? Yes. But we think we can do it." (To read the entire Feb. 11 conversation, go to **http://www.cfr.org/united-states/amid-tighter-budgets-us-army-rebalancing-refocusing/p32373**.)

But then he talked about the impact of that next step down, from 450,000 to 420,000 and about 920,000 across all three—again, active, Guard and Reserve. And he said that reduction, which is about 60,000 across the entire Army, active and reserve, was a significant dropdown. And I think what's important to realize is we did the reorganization and shaping of the Army to the program we call Army 2020 as we've come out of Iraq and are drawing down in Afghanistan. We've retained the vast majority of our combat power. We deliberately trimmed overhead, brigade headquarters, sustainment structure and those sorts of things.

And so, in general, the punch of the Army at 490,000, and a little over a million across the active, Guard and Reserve, is very similar to the Army that we've had for the last decade—a very substantial, very capable Army in terms of its combat power. A lot of churn, obviously, within units as they draw down, but nonetheless, the resulting product in 2015 will be very significant in terms of its abilities to respond to crisis and, frankly, finish major theater conflicts if we happen to wind up in one.

As we come down below that level, we're going to see real reductions in combat power—not marginal reductions, but real reductions, because we're going to actually have to cut combat forces out of the Army.

COL Felix: As MG Hix mentioned, I run the chief's future study plan, which is called Unified Quest, and it really is about scouting the future through a series of seminars, symposia [and] war games. We typically have a major war game once a year, sometimes twice. That brings the community together. Our sister services come, [and it's] interagency, multinational in a big way. We expose them to various ideas that we're thinking about—get this greenhouse of ideas going about future ways to operate.

It all starts with the environment. What do we think this operational environment will be in, say, 2030-35? And so in order to get there, we look at trends. (See Figure 1 on Page 140.) We do some strategic trends work; we monitor those trends with our TRADOC G-2. So we understand what it might look like in terms of that. We may not get it right, but at least we follow the trends. One of the trends we're following this year is this idea of rapid urbanization. So in our war game this year, we will focus on a megacity in 2035. That will be the framework and the backdrop.

The next piece of it is our strategy during that time period. How has it evolved? What are the vital interests of the United States with respect to the rest of the world, such that we will commit blood and treasure to something? And we have to make it plausible. So we bring in the intelligence community. We share our potential scenario with them because we can't just be creating our own ideas. We have to say, in conjunction with the intel community, what's plausible in that environment.

We set those conditions, and we build that environment. We allow our sister services to come in and participate with their emerging technologies and objectives so that we can achieve something as a joint team, the Army as a joint team fighting

in that particular environment or doing whatever is required. You know, it could be humanitarian assistance, disaster relief, major combat—the full range of military operations.

That's the setup. Our job is not to win in these games, but to see where we're brittle, see where we break, and then look for gaps. And then we find solutions to those gaps. I'll turn it over to Chris to talk a little bit about that.

COL Cross: If you look over the last decade, we've taken the eye off the ball from the S&T perspective in terms of the future, and we've done it deliberately and for the right reasons. The S&T community has focused on providing the men and women in combat the capabilities that he or she needed. But we have not looked deliberately at the capabilities we need to develop in the future—2025 and beyond—and made the right investments to get us there from here. And so in order to understand where we need to go, we need to understand where we are.

We look very deliberately at the way we manage our current fundamental research investments. What we found was that about 95 percent of what we do today was focused on the near-term gaps, those things within the POM [program objective memorandum cycle] … but it has put us at a disadvantage, almost a lost decade. So coming out of war, transitioning, we are looking very closely at the capabilities we need to develop for the future force, 2025 and beyond.

The capabilities we're after are a leaner force, which means a unit that's able to do more than a current, like unit can do today. We want to increase the capability and lethality of those units, extend the operational reach of all units—squads, platoons, companies, battalions and BCTs [brigade combat teams]—all underpinned by the necessity to prevent overmatch. The threat has had an opportunity to watch the United States and our allied partners bare our soul to the world in terms of capability, and to identify those things that we do really well and the things that are potential vulnerabilities. And, therefore, they are investing in those areas that are potential vulnerabilities.

If you look at the future and the capabilities that we need, we have to account for the fact that the threat has identified things we may be vulnerable at in terms of technology or capability or doctrinal areas, and they're focusing their investments on those areas. By 2025, we're going to set the conditions with a leaner, more capable

FROM AUSTERITY, PROGRESS

The "Big Five"—Black Hawk, Apache, Patriot missile system, Bradley and Abrams—the bedrock of U.S. Army operational strength, grew out of a period of budget austerity on the heels of the Vietnam conflict. Initially conceived as Cold War assets, they have proved to be versatile over the past decade and adaptable to a "future" that few predicted at the time.

force to truly, fundamentally change the Army as we move deeper into the future and the decade of the '30s.

MG Hix: Let me just reinforce one thing: If you look at the U.S. Army, every time we've been in one of these periods of resource reduction, that's where all the ideas have been generated. I think the only time we had a dearth of intellectual engagement was probably right after World War II, and the Army was consumed in load-shedding 9 million people.

Army AL&T: COL Cross, you mentioned that you're building this for 2025 and the decade of the 2030s, and that will allow for fundamental change in the decade of the '30s. What do you think that fundamental change would be? What do you see in the future?

COL Cross: Let me talk just from a science and technology perspective, and then we'll talk about how we'll operate differently. First of all, one of the constraints that we have is the weight of our vehicles. And if we still have a 74-ton tank in 2035, we'll still have a very difficult time deploying a capability along with an operationally significant force in order to turn the tide of events. And so one of the areas that we do need to focus on is developing a lighter tank. It's going to require significant material sidestepping, as well as all the other components to get to a much lighter, deployable and agile tank.

Another aspect is what we call the big data or data management problem—getting information to the point of need at the speed of war. Right now in Afghanistan, many of our Soldiers in contact are getting information through the same type [of] handset that their grandfather fought with and received information from in World War II. We owe them better than that. And so the data's out there, but we have to find a way to get the relevant information to the Soldier so they're not surprised like they are in Afghanistan. Seventy to 80 percent of the time in contact in Afghanistan today, Soldiers are surprised. We owe them better, and that's part of changing the way that the Army fights so that we're not surprised.

We're also looking at weapon systems that will not only apply the kinetic energy capability, but also directed energy—lasers, high-powered microwaves, other capabilities that extend the operational reach of the battlefield from a science and technology perspective.

The final comment I'll make is on human performance and optimizing the Soldiers that we have. As we become a smaller Army whose units are leaner and more capable, it puts a lot of burden on the leadership and the Soldiers to do more than we've ever asked them to do in the past. So we need to look for ways to maximize their training efficiency, the physical, cognitive and social development of the Soldiers, to enable them to make very difficult, very complicated decisions in a world that we can't imagine even today, at the same rank structure in which we expect folks to make those decisions now.

In Afghanistan, we'll be awoken at 1 in the morning to make decisions on whether or not certain types of assets could be used against targets, because we've not developed the Soldiers and the leaders at the lower levels to make those decisions. We have to get through that.

MG Hix: When you take into account the trends that Kevin Felix talked about

A PROVEN SUCCESS

SGT Anthony James, a master trainer for the Raven UAV with the 3-2 Stryker BCT, 7th Infantry Division, prepares to launch a Raven during training March 27. Hix counts the Stryker brigade—an organization enabled by information, infantry-heavy, very mobile, and integrating UAVs in a tactical formation for the first time—among the most successful concepts the Army has developed in the past decade. (Photo by SPC Leon Cook, 20th Public Affairs Detachment)

IT ALL STARTS WITH THE ENVIRONMENT. WHAT DO WE THINK THIS OPERATIONAL ENVIRONMENT WILL BE IN, SAY, 2030-35? AND SO IN ORDER TO GET THERE, WE LOOK AT TRENDS.

and you look at how those things play out over the next 20 years, there's a really unfortunate convergence in the decade of 2030 to 2040 in terms of urbanization, in terms of growth of populations, where those populations are expanding, with 90 percent of the population growth in the developing world.

If you read Eric Schmidt [and Jared Cohen's] book, "The New Digital Age," they make the observation that revolutions will occur more rapidly and more frequently in the future. Conversely, they also note that it is unlikely that the speed at which things come apart will also be replicated by the speed at which things can be put back together again. So, in other words, it's very easy to break Humpty Dumpty, but it's really hard to put him back together again. You see manifestations of this in the Arab Spring and its aftermath right now, and the instability in all those countries.

You take that into account, you look at the survey of the world, you look at who's going to be the principal arbiter in terms of trying to solve these problems, and it's quite likely going to be the United States. The French have done a study out to 2040, and one of their conclusions is that the United States will still be the principal power in the world. You look at our force structure going down and the challenges that this environment poses—the speed of action, the speed at which events unfold, the second- and third-order effects rippling through a more tightly coupled international, geopolitical and economic environment, and it's going to demand that we be able increasingly to influence events at speed with forces that can actually arrest the acceleration of events and direct them in other ways.

This [calls for] an operationally significant force that can get there quickly and rapidly influence those events—in some cases, preventing them or precluding escalation, which is what we really want. One of the reasons the Army exists is to prevent bad things from happening. We want to deter people from stepping across red lines, declared or otherwise.

Army AL&T: On your website, you have "revolutionary," "game-changing" and "leap-ahead" technology. So in ARCIC's view, what would you envision as "revolutionary," "game-changing" and "leap-ahead"?

MG Hix: Well, certainly quantum computing would be one of those areas where potentially, if your adversary does not have quantum also, you could take apart their encryption systems. You'll have unbreakable codes. You'll be able to process data and present it in ways that we currently can't, which kind of touches on the things that COL Cross was talking about with the human factors and the ability to present information to people at lower levels.

We think the ability to connect those kinds of information technology together, to give ground Soldiers the kind of situational awareness that we're striving to achieve with the F-35 for a pilot, is an exceptionally important area. And that would be revolutionary. We'll take a fighter pilot's taxonomy, we won't use a Soldier's: If you look at [the late Air Force Col John R.] Boyd's hierarchy, it starts with people, then ideas, then materiel or technology. His focus was on the fighter pilot; ours is on the leader. And right now we equip fighter pilots and others—ship's captains, carrier strike group commanders, people like that, with exceptionally well-integrated information environments.

The Army is getting better at integrating those at the strategic and theater level; the operational level; division; [and] in some cases brigade, although we're still working that. But what we've not been able to do, as Chris talked about, is push that down to the Soldier level, where those captains and lieutenants and sergeants have the same kind of situational awareness that was alluded to in the "60 Minutes" piece on the F-35 (**http://www.cbsnews.com/news/f-35-joint-strike-fighter-60-minutes/**) [spotting an enemy plane 10 times faster than it spots the F-35]. The people with the most complex military problem to solve and the least information technology behind them—those are those sergeants, lieutenants and captains at that level. And that

is revolutionary. That's game-changing. I mean, not to be facetious, but if we were able to achieve the kind of virtual data wall that they show in the TV show "Intelligence," where the guy has a chip in his head, that would be revolutionary, because then you would have the ability of leaders at the lowest level to go through multiple repetitions of virtual training so that they were able to compress [Malcolm] Gladwell's 10,000 hours [the idea, based on a study by the psychologist Anders Ericsson, that mastery of a skill is often the process of spending 10,000 hours practicing] so that they had the judgment and experience to employ all the capabilities that we put at the beck and call of our special operators, even though they're 20 to 25 years old. That is revolutionary.

So, the human first. Then changing the physical plant that the Army uses so that you're able to respond and influence events at speed as we've discussed, operate in a more distributed fashion where you make exterior lines an advantage and not a challenge because you demand less logistically. And you're able to present the enemy with multiple dilemmas simultaneously. That's revolutionary.

We have been striving to conduct a nonlinear kind of distributed operations for decades, and we've done it successfully, really, in only one major operation. And that, of course, was Panama, where we took, I think it was 22 separate targets in about 14 hours. I'm talking about major facilities, government locations, units, etc. Being able to do that on a routine and recurring basis in the future will have a fundamental impact on how we operate—and, quite frankly, how we're able to deter conflict, control it, manage it and further our interests. So that's revolutionary, and that's where change in the materiel piece that Chris Cross talked about is so important. So those three things right there are all revolutions that have great opportunity.

Army AL&T: You mentioned Unified Quest. How does ARCIC keep up with the competition, keep track and ahead of our adversaries' capabilities? Do you have a red team that does that sort of thing?

MG Hix: Yes, our TRADOC G-2 [which develops, delivers and validates the operational environment products and services to enable realistic training, leader development, education, concepts and capabilities] is responsible for projecting the future operational environment, and [for] looking at strategic and operational and tactical trends in conjunction with a lot of other elements or intelligence agencies, down to the very science that's being explored and invested in across the globe. So we're not focused solely on the current adversaries; we're looking at technological

AN INTERNATIONAL EFFORT

Soldiers operating as part of Multinational Force and Observers (MFO) navigate an obstacle course March 19 during the 2014 Force Skills Competition on North Camp in El Gorah, Egypt. In planning for the future, ARCIC involves not only intelligence agencies and other services and organizations, but also international partners. (Photo by SGT Thomas Duval, Task Force Sinai)

and systems developments worldwide, because one of the key trends, of course, is that access to technology and knowledge is becoming more and more diffuse.

Being able to corner the market in a particular area is increasingly difficult. So, [we are] starting with them and then leveraging the war games, studies, seminars, working with academia and, quite frankly, working with our allies and partners across the globe. We have 17 or 18 representatives here at TRADOC from other partner and allied nations that help us see things through a different light and help us stay connected.

The other piece is that we stay very connected to the science and technology arenas, including working with the White House Science Office—again, basic research, the labs at various universities, both those that are hosted by or sponsored by the U.S. government and those that aren't, and then the [U.S.] Department of Energy and others. We've got a wide net, and one of the mechanisms for bringing that thinking together is the Unified Quest effort. But we are not limited by that.

Army AL&T: How do you make sure that tomorrow's solutions aren't obsolete by the day after tomorrow?

MG Hix: The first thing we do is we stay tight with our science and technology partners both in and out of the government. The first piece is to understand what the art of the possible is and where things are going. Conversely, through the survey processes and war-gaming, we also develop concepts where we think we're driving technology. And those two things are complementary. They're not exclusive efforts.

And then you've got a balance, and this is where the iterative exchange of information and discussion throughout the process [come in]. You don't want to source-select too soon because you could wind up putting yourself in a bind. Neither do you want to do it too late. If we had bought Renault tanks, which we were using for experimentation in the 1920s, we would have been woefully out of position come World War II. We did it too soon with the Future Combat System [FCS], in part because of the processes that we are currently required to operate inside of. We were co-developing a system and the S&T [that would operate it] at the same time. And, frankly, we just couldn't get that done.

Somebody the other day called it the Goldilocks principle: Not too soon, not too late, just right. But there's an art to it as well, I guess, is the short answer. And that requires cooperation and collaboration.

Army AL&T: Can you give us an example of the most exciting or promising concept that you've developed in the past decade?

MG Hix: I would start with the '90s. I was here at TRADOC as a field-grade officer and had an opportunity to be involved in three major efforts. The first one was Force 21. The second one was the Stryker brigade. And the third one was the Objective Force, of which the centerpiece system was FCS.

Of those three, I saw Stryker fielded, taking the ideas of Army After Next and then trying to bend them to a current capability. So we built an organization that was enabled by information, infantry-heavy, very mobile, and for the first time we actually integrated UAVs [unmanned aerial vehicles] in a tactical formation. And that unit has performed, I think, magnificently both in Iraq and Afghanistan.

The 4th Infantry Division is the initial manifestation of Force 21. And while we're still working on getting a Common Operating Environment, getting our networks fully put together, we have fielded units capability sets that they've taken to Afghanistan and used with great success over there.

And then the last one, the Objective Force, may have been too soon in terms of its implementation, and we may have been too aggressive on our timelines. We pushed the technology before it was mature enough. Again, that's why you've got to be looking out 30 years—because you've got to be working on it today if you want to see it physically fielded, say, 20 or 30 years in the future.

Army AL&T: Although the 30-year modernization planning process is relatively new, is there any promising thing that you're seeing right now?

MG Hix: Human Dimension, started in the mid-2000s, which is about optimizing and enhancing our human performance—that's a very promising idea, and we think there's going to be a lot of impact on that both for Force 2025 and beyond. And then the other one, as GEN [Robert W.] Cone [then-commanding general of TRADOC] mentioned down at AUSA in Huntsville, the Expeditionary Maneuver Concept recognized the future—increasingly connected people, the momentum of a given interaction, greater urbanization, population growth, etc. Speed-of-event effect is going to be a huge driver of our thinking over the next 10 to 20 years.

In terms of the 30-year plan, two points are very important here, and I'll let Chris touch on these as well. The first thing, looking out 30 years, is now allowing our RDECs [research, development

and engineering centers] to extend their investment programs beyond what has been recently a five-year transition window. So they're actually looking out and finding places where they can be more innovative because they've got more time to develop technology, and the program managers and PEOs are expecting tech inserts at various points in programs' development as well as points of obsolescence—when we're going to end a program of record or bring a new one on board. So having that long view is very important in that regard.

And because of the time horizons of the Unified Quest team and our overmatch analysis within the intelligence community, it allows us to align where we see science and technology, particularly from an adversary standpoint, against our system so that we're not caught by surprise by the next big thing being in somebody else's possession instead of ours.

COL Cross: One of the challenges we face in DOD science and technology is [that] oftentimes, as MG Hix said, our programs are too short-lived. If your success is measured by how quickly you're able to choose in five years, it doesn't encourage risk. In fact, what it encourages the science manager to do is take a less risky path that will continue to be rewarded with funding. If I extend the program out to 10 or 15 years and I can develop alternate, diverging paths, one that's less risky but one that's willing to accept risk and is willing to tolerate risk, that's where we'll get the great breakthroughs.

We met Mr. [Frank] Kendall [undersecretary of defense for acquisition, technology and logistics] the other day, and one of the things he is now saying is that if the DOD lads don't begin to accept some risk and become more innovative and creative, there will be a potential for money to be shifted to organizations [such as] DARPA [the Defense Advanced Research Projects Agency]. We have been risk-averse in our programming over the last years in terms of the S&T. In many cases, we have measured success of our S&T programs in transitions to programs of record. If there's success in S&T investments to programs of record, then you're not going to get the innovative and creative ideas that are necessary to fundamentally change the Army and develop the game-changing capabilities that must be developed if we're going to be a lighter, more lethal and agile force moving into the decade of the '30s.

THINKING LIKE AN ADVERSARY

More than 100 participants, including Army Chief of Staff GEN Raymond T. Odierno, as well as joint and multinational military leaders and civilian subject-matter experts, attended the TRADOC-led Unified Quest 13 Senior Leader Seminar March 19, 2013, at the National Defense University, Fort McNair, Washington, DC. Unified Quest is designed to scout the future through seminars, symposia and war games. It allows the Army to align S&T trends against its systems "so that we're not caught by surprise by the next big thing being in somebody else's possession instead of ours," as Hix put it. (Photo by David Vergun, Army News Service)

Just to amplify what MG Hix said, one of the really interesting things I see with the modernization strategy is that it allows me to look at where we think the Army is going to go today, overlay that with the emerging threat capability and do an analysis as to whether we're making the right decisions with the S&T investment strategy. It may be that the capability we're developing won't allow it to prevent overmatch, and so that's really an important aspect of this 30-year modernization strategy from our perspective.

Army AL&T: What do you see as your greatest challenges to ARCIC's success with your process?

MG Hix: From a process standpoint—and this is not ARCIC, this is an Army and DOD challenge—it's the issue of continuity, having the ideas, focus and priorities be consistent over a number of years. I mentioned the AirLand Battle

THE HUMAN DIMENSION

Trainees go through in-processing during basic combat training at Fort Jackson, SC. Researchers have used cognitive, performance and psychological studies and surveys to place Soldiers in military occupational specialties where they'd have a better chance of succeeding—illustrating TRADOC's Human Dimension concept, which started in the mid-2000s and focuses on optimizing and enhancing human performance. It is expected to have a significant impact on Force 2025 and beyond. (Photo by SrA Micky M. Bazaldua)

piece—our first commander or second commander at TRADOC noted it took him eight years to get AirLand Battle into doctrine. It took us 18 years to develop—with a failure in the middle, I might add, the M1 tank. It started out as a main battle tank for 1970, and it failed, but then they built one on top of that with the lessons learned from that. But it took us 18 years.

The thing that drove that was a common view of the problem and a common understanding of what had to be done and what the priorities were. So while each commander of TRADOC and other leaders within the Army added things to the pot of soup, if you will, they were all focused on how we recover the Army from Vietnam, maximize its combat potential, take apart the echelon system of the Soviet Army, etc., at the same time being agile enough to deal with other challenges. I would note that the Army that was so dramatic in fighting a tank battle in the desert in Desert Storm was also the one, as I mentioned, that just a year earlier knocked out Panama in about three weeks total—three or four weeks from start to finish, but the battle was over within the first couple of days.

So that Army was not by accident. That Army was by design. And it demanded the focus of five or six chiefs [of staff of the Army] and as many TRADOC commanders and FORSCOM [U.S. Army Forces Command] commanders and AMC [U.S. Army Materiel Command] commanders to get there. And so that's going to be one of our challenges going forward, that process. And it's true of other services and capabilities as well. You look at stealth and the single-minded focus of the DOD—not just the Air Force, but the DOD—to achieve stealth capabilities in the military. Cruise missiles is another great example of that. Nuclear submarines—single-minded focus, long-term view and consistent investment in priorities over a very long time. And in the case of stealth and the nuclear submarine, I would note, they still have those same priorities. The last thing I would say is that the department has yet to prioritize ground force capability in the way that they have uniformly prioritized things like nuclear submarines, stealth and cruise missiles from the beginning.

For more information on ARCIC, go to ***http://www.arcic.army.mil****.*

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TARGET: SAVINGS

PEO Ammunition – JMC tiger team looks to reduce costs in ammunition organic industrial base

by Mr. Larry Franz and Mr. Fritz Larsen

On Oct. 5, 1992, during the second session of the 102nd Congress, Hawaii Sen. Daniel Inouye stated that he had some difficulties in developing the DOD appropriations bill, according to the Congressional Record. While devising a compromise agreement to fund the essential requirements for the country's defense in the post-Warsaw Pact world, he was concerned about the nation's ammunition industrial base (IB) and proposed a special bill to preserve it. Congress acted in 1992 to help alleviate some of the concerns Inouye raised, but more than 20 years later, concern over the ammunition IB is no less current.

Today's situation—with budget challenges, the withdrawal of U.S. troops from Afghanistan, a reduction in troop end strength and the Army's diminished operational tempo—has already brought about a reduction in ammunition requirements. Given this budgetary uncertainty and the drawdown, there most likely will be further reductions in requirements for munitions and the capacities for producing them. For example, at the height of the Afghanistan conflict, there was a requirement for 2.4 billion rounds of small arms ammunition annually. This requirement is currently at 350 million rounds annually.

Program Executive Office (PEO) Ammunition, the Joint Munitions Command (JMC) and DOD ammunition producers understand the harsh realities involved and are moving to address them. These groups have engaged in an effort over the past five years to reduce ammunition production costs. However, given the current situation, this ongoing effort has taken on a renewed emphasis to preserve the industrial base's critical processes, skills, equipment and facilities. This situation has underscored the need to reduce operating costs for the U.S. Army Materiel Command's (AMC's) government-owned, contractor-operated (GOCO) Army ammunition plants (AAPs), commonly referred to as "special installations" because they are like small cities, with some of the functions of an Army post, camp or station.

The emphasis on cost reduction accelerated in January 2013 when one of the GOCO AAP operators highlighted the cost differences in ammunition production between the GOCO AAP and the operator's commercial (contractor-owned, contractor-operated, or COCO) ammunition facility. The GOCOs' operating costs exceeded those of their private industry counterparts because of Army regulations and performance work statements (PWSs) that, depending upon the facilities, can

ENERGY EXEMPLAR
Scranton AAP employees inspect 155 mm projectiles. The plant's workforce has made notable strides in energy efficiency and energy reduction efforts, receiving ISO 50001 certification for energy management from the International Organization for Standardization as well as the 2012 Secretary of Defense Environmental Award for Sustainability. (U.S. Army photo)

result in a cost premium in the millions of dollars. These differences involved the way the two types of facilities executed their security, fire support, safety, facility management, environmental and property management activities.

PEO Ammunition and JMC raised this issue through their respective chains of command to the Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology and similar staffs at AMC. This resulted in the establishment of a tiger team, co-led by PEO Ammunition and JMC, that has engaged other government agencies and members of the Industrial Committee of Ammunition Producers, an element of the National Defense Industrial Association.

The team embarked on a twofold cost-driver analysis exercise, with an internal goal of identifying maximum cost reduction opportunities per site.

TWOFOLD APPROACH

The tiger team is looking at the GOCO cost reduction objective with both a short- and long-term perspective. In doing so, the team is hoping to realize both direct and indirect benefits. The direct benefit will be the facilities' reduced overall operating costs. The indirect benefit will be the ability to spread the remaining costs over an expanded revenue base, because of the increased competitiveness in the marketplace that results from lower operating costs.

WHAT PRICE SAFETY?
A controlled burn at Milan AAP, TN, blankets the grass in April 2011, managed by firefighters from the AAP, U.S. Department of Agriculture employees, University of Tennessee administrators and others. Fire safety services are one of the areas in which the cost of GOCO operations exceeds that of comparable private-industry facilities, and fire protection is one of the tiger team's six areas of requirements analysis. (Photo by Jerry Watson)

In the short term, the team is focusing on ways to reduce current costs quickly and easily. This includes assessing and recommending opportunities for improving the AAPs' operations. The team is investigating the cost drivers and inefficient processes that are contributing to the AAPs' overhead. This immediate effort has identified the facilities' PWSs as an area for reducing overhead costs while balancing risk. For example, relying on the local community for fire protection will reduce the AAP's fire protection costs; however, this must be weighed against the increased response time.

Over the long term, the team is focusing on strategic, significant cost reductions. This long-range approach involves a more aggressive, possibly unprecedented review of the PWSs, with the incorporation of best business practices and regulatory changes, identification of possible changes to legislation and an assessment of the current AAP business model for operations.

The objective of both approaches is reduced operating costs for the GOCO AAPs, which will enable them to be more competitive in the marketplace, while incorporating business efficiencies with the potential to reduce the cost of ammunition production.

TWO TEAMS, ONE GOAL

To leverage the groups' talents, strengths and resources, the tiger team has leaders from both industry and government. One of its subordinate integrated process teams (IPTs) is focused on PWS costs, activities and commercial best practices for operating the facilities. In addition, a sub-IPT is reviewing the regulations, rules and practices that drive the PWSs and approaches for reducing or eliminating their impacts, including possible waivers to regulations. The two teams share information frequently and conduct monthly in-process reviews.

To better identify cost savings, the tiger team has broken down the costs into the following six categories of requirements, with examples:

- Maintenance (roads, rail, locomotives, grounds, buildings).
- Security (staffing, electronic surveillance, anti-terrorism procedures).
- Fire protection (staffing, readiness drills, reliance on local communities, training, emergency medical service).

'SPECIAL INSTALLATIONS'
This aerial view of the 3,935-acre Lake City AAP, MO, illustrates the size and scope of AAPs, which are called "special installations" because they are like small cities, with all of the functions of an Army post, camp or station. The Lake City plant comprises 374 buildings, 43 magazines, nine warehouses, 11 igloos and storage capacity of 707,000 square feet. (U.S. Army photo)

- Environmental (fence-to-fence environmental management system, energy monitoring by building, agricultural lease revenues).
- Property management (real and personal property inventory, cultural survey requirements).
- Safety (frequency of inspections).

CONCLUSION

Although the team is still in the assessment phase, the PWS scrub has realized approximately $1.8 million in annual savings. The underlying changes are being enacted contractually by the appropriate contracting officers. The changes and projected savings reflect the team's initial efforts only, with a plan still underway to achieve additional annual savings of $5.25 million through further reductions in PWS requirements. The tiger team continues to work diligently with industry partners to better understand the scope and risks of any changes and to ensure the execution of risk mitigation strategies to secure the projected savings.

Since there is no differentiation between a post, camp, station or industrial facility in calling these facilities "installations," a large number of the regulations and installation requirements developed for posts, camps and stations apply equally to the AAPs; one size fits all. For example, the security, fire protection, environmental and safety requirements are the same for Scranton AAP, PA, a facility that manufactures metal parts, as they are for Fort Bragg, NC, or Holston AAP, TN, which produces explosives.

The AMC commander is to exercise command and control over Army GOCO production installations, based on the concept of "inherent responsibility" and Army and DOD regulations. The installation commander can delegate authority but cannot delegate responsibility. Assisting the AMC commander are the assistant chief of staff of the Army for installation management and the U.S. Army Corps of Engineers. This authority allows the AMC commander to make decisions when it comes to waiving regulations or recommending changes to regulations as they apply to the industrial facilities.

DOD regulations, which apply to all of its facilities, encourage reliance on local communities for services such as fire protection and safety whenever possible. Army regulations are much more stringent than DOD regulations, directives or instructions, which increases the requirements in the installation PWSs and, in turn, the installations' operating costs.

AMMUNITION INFRASTRUCTURE
The Iowa AAP is one of seven GOCO installations under JMC. It produces medium- and large-caliber ammunition items for DOD, including the 120 mm tank round on the load, assemble, pack line shown here. PEO Ammunition, JMC and the ammunition producers are exploring ways to reduce the operating costs of AMC's GOCO ammunition plants. (U.S. Army photo by Linda K. Loebach, AMC)

For example, DOD regulations state that the installations must be "secured." This allows for the use of many types of technologies to secure the facilities, including scanners, guards and card readers. By contrast, Army regulations are very prescriptive, specifying the number of guards and not allowing for lower-cost technological solutions.

The environment is rich with opportunities to evaluate how GOCO AAPs are classified. The status quo characterization, lumping them in the same category as posts, camps and stations, yields a less-than-optimal business model. The tiger team continues to make a significant resource investment in assessing the utility and cost savings of transforming Army Ammunition GOCOs (special installations) in line with other potential business models.

Given the options of status quo, a radical change or something in between, a middle-ground (hybrid) approach may prove to be most beneficial. The concept would include removing all references to camps, posts, stations and special installations and instead have each facility reclassified as an industrial complex or defense industrial site. This new classification would have its own unique set of requirements and standards, and would not be subject to the traditional demands on camps, posts and stations. The primary benefit would be the underlying cost savings and enhanced flexibility to consider innovative opportunities that could further mitigate risk. A secondary benefit would be the increased competitiveness that results from "leveling the playing field" with commercial facilities.

Our initial investigation reveals that the greatest inherent challenge to this concept appears to be the ability to change existing laws, policies and regulations. Our initial response has been to examine Title 10 responsibilities and federal jurisdiction. The installation commander essentially carries responsibility for Title 10. Each installation also has a defined jurisdictional assignment—exclusive, concurrent or proprietary. The tiger team continues to analyze both the

ENVIRONMENTAL STEWARDSHIP
The steam power pipeline of Holston AAP, TN, meanders through the flora of the Holston River Valley. AAPs are responsible for protecting their environments, both internal and external, and the tiger team is looking at environmental and five other categories of requirements to identify potential savings. (U.S. Army photo)

opportunities and limitations within Title 10 and the respective jurisdictional authorities, as necessary to enable the hybrid solution.

The amount of total cost savings that will result from this effort is still unknown. However, it is sure to reduce the costs of operating these facilities, producing savings that the Army can pass on to other Army priorities, including IB modernization and recapitalization. As demand for products decreases, the unit prices will grow, making the work of the GOCO Tiger Team an imperative for survival of these critical facilities.

For more information about PEO Ammunition and JMC, contact Audra Calloway, PEO Ammunition Public Affairs, at ***audra.e.calloway.civ@mail.mil*** *or 973-724-7243; or Justine Barati, JMC Public Affairs, at* ***justine.a.barati.civ@mail.mil*** *or 309-782-7649.*

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Dollars & $ense

How the Army Acquisition Workforce is making Better Buying Power 2.0 work

by Mr. Joseph M. Jefferson

Better Buying Power (BBP) 2.0 is as much about people and processes as it is about the bottom line. Bottom-line savings and cost avoidance are certainly the ultimate goals, but at the heart of BBP 2.0 is a cultural change. Indeed, the Hon. Frank Kendall, undersecretary of defense for acquisition, technology and logistics, said at his official rollout of BBP 2.0 in April 2013, "People, to me, are central to this." Following are recent examples from Acquisition Workforce members not only of accomplishments in cost avoidance and savings, but also of changes they have made in how they do business in order to achieve the goals of BBP 2.0. At the end of the article are the seven focus areas of BBP 2.0.

PEO AMMO APPLIES PROJECT MANAGEMENT TO BBP

Program Executive Office (PEO) Ammunition is taking a project management approach to BBP 2.0, which means holding every initiative's owner accountable to approved goals for cost, schedule and performance (where applicable). At the heart of this approach is a quarterly review involving the PEO and his project managers (PMs) in which they present and manage cost-saving initiatives in accordance with the general principles of project management. This combination of discipline and senior-level review has proven beneficial in tracking cost-saving initiatives, in the cross-pollination of ideas and, most importantly, in imbuing PEO Ammunition with a culture of savings and cost-efficiency.

When an initiative stalls, the PM can request help from the PEO, or the PM and PEO will consider the initiative for termination. On several occasions, it became clear that the stalled initiative did not actually fall under the purview of PEO Ammunition and was essentially beyond the PEO's control. In all cases, however, the collective examination of the plan by the senior PEO staff and PMs helps ensure that execution is possible.

The quarterly reviews provide an open forum with the participation of every PM and the senior PEO staff. PMs share ideas, experiences and lessons learned that they otherwise would not have shared. One PM's success in finding efficiencies may inspire another. A PM struggling through an infrequent task, such as negotiating the price of intellectual property, has the chance to meet with others who may have advice to share.

Seeing a colleague take on a difficult challenge inspires others to do the same. The quarterly review also provides a venue to disseminate the latest available BBP guidance and resources. The instant feedback and discussion help everyone reach a common understanding with less risk of misinterpretation. Only an open, peer-review setting can produce these benefits.

CROSS-LEVELING
As part of efforts to implement BBP 2.0, the deputy executive director for conventional ammunition hosts an annual event at which the services offer to exchange ammunition stocks that have accumulated in excess of their requirement. The FY13 cross-leveling event avoided an estimated $121 million of ammunition procurement costs across all services. (U.S. Army photo by SGT John Carkeet IV, 143rd Expeditionary Sustainment Command)

PEO Ammunition currently tracks 41 open BBP initiatives and has completed 54. Local initiatives, which fall in all seven BBP 2.0 focus areas, have achieved a combined savings and avoidance of more than $6 billion. For example:

- PM Maneuver Ammunition Systems successfully competed the operation of the Lake City Army Ammunition Plant (LCAAP), MO, achieving more than $900 million in savings and avoidance. This equates to an average unit price reduction of 40 percent across the 5.56 mm, 7.62 mm and .50-caliber families of ammunition that LCAAP produces. The PM "leveled the playing field" for competitors by procuring intellectual property and capital equipment, creating a vast technical library open to bidders and structuring the contract to incentivize simultaneous commercial use of the facility. These results could pay a second set of dividends: The lessons learned will have direct application to the competition for the contract at Scranton Army Ammunition Plant, PA.
- PM Combat Ammunition Systems avoided $2.2 million in non-value-added activities by obtaining type classification (TC) and full materiel release (FMR) on the XM982 configuration of the Excalibur Precision Guided Extended Range Projectile. The Army has approximately 700 of the XM982 Ia version of Excalibur, an interim design configuration fielded under urgent material release. Rather than pay to have the rounds re-marked, documentation updated and software modified to reflect the current M982 designation, the PM sought TC and FMR of the XM model. This out-of-the-box solution not only saved money,

CUTTING AMMO COSTS
LCAAP Building Manager Chris White, left center, discusses the 7.62 mm modernized back-end case cell process and capabilities with MG John F. Wharton, commanding general, U.S. Army Sustainment Command, in December 2013. To White's left is LTC Lawrence Cannon, LCAAP commander. PM Maneuver Ammunition Systems successfully competed the operation of LCAAP, achieving more than $900 million in savings and avoidance, including an average unit price reduction of 40 percent across the 5.56 mm, 7.62 mm and .50 caliber families of ammunition produced there. (Photo by Crystal Rankin, LCAAP)

but also will apply more broadly to multiple systems across the Army that were fielded in limited quantities under urgent material release for overseas contingency operations.

- PM Towed Artillery Systems (TAS) and PM Close Combat Systems (CCS) saved more than $4 million in service contract costs by combining contract requirements for new equipment training and field service on related pieces of equipment. PM CCS combined field service representative requirements for multiple counter-explosive-hazard devices, and PM TAS combined requirements for new equipment training for various towed artillery systems and ancillary equipment. These successes have inspired the Excalibur and Precision Guidance Kit program managers to investigate combining new equipment training service contract requirements as well.
- The deputy executive director for conventional ammunition hosts an annual ammunition cross-leveling event at which the services offer to exchange ammunition stocks that have accumulated in excess of their requirement. This seemingly simple arrangement is a win-win for the services and the taxpayer, avoiding not only the cost of buying new ammunition, but also the storage cost and potentially the demilitarization cost associated with excess ammunition. The FY13 cross-leveling event avoided an estimated $121 million of ammunition procurement costs across all services.
- The Husky Mounted Detection System provides ground-penetrating radar, deep-buried metallic detection and semiautonomous control of Husky vehicles used in route clearance missions for detecting and marking explosive threats. Systems with only the ground-penetrating radar capability were fielded under a joint urgent operational needs statement (JUONS) to support Operation Enduring Freedom. By capturing numerous lessons learned from operations in Afghanistan using the JUONS systems, PM CCS and the Maneuver Support Center of Excellence restructured the program to reduce the procurement objective, leverage the JUONS systems and use a training surrogate system. The restructured program will meet the warfighter's needs, and will achieve an estimated $84 million savings over the program objective memorandum and

RESTRUCTURED HUSKY
Capturing lessons learned from equipment fielded under a JUONS for operations in Afghanistan, PEO Ammunition restructured the Husky Mounted Detection System program. The restructured program will achieve an estimated $84 million savings over the program objective memorandum and more than $1 billion of cost avoidance over the life cycle of the system. (U.S. Army photo)

more than $1 billion of cost avoidance over the life cycle of the system.

For more information, contact Vince Dahmen at ***vincent.k.dahmen.civ@mail.mil*** *or 973-724-9605.*

PEO GCS HUNTS FOR FUTURE SAVINGS

The 2009 National Defense Authorization Act (NDAA) for Fiscal Year 2009 added a new requirement that each service establish a configuration steering board (CSB) for all post-Milestone B major defense acquisition programs. The goal is to control costs of major programs by creating a framework for program managers to work with the user community and key stakeholders across their respective services. The CSB is intended to provide them a venue to make recommendations to their service acquisition executives and vice chiefs of staff on whether to modify, delete or defer requirements.

PEO Ground Combat Systems (GCS) holds CSBs annually to ensure that each Acquisition Category 1 program delivers as much capability as possible, while preventing any changes that could adversely impact program cost or schedule. CSBs also allow for rigorous analysis of the potential de-scoping of outdated requirements, which could drive down program costs and deliver capabilities to the warfighter faster.

In late FY12, PEO GCS convened a CSB that ultimately led to modifying, deleting or deferring 43 requirements from across the combat vehicle portfolio. The result was approximately $4 billion in cost savings and avoidance; about $3.8 billion represented cost avoidance. Subsequent CSBs may not be able to replicate this level of success, as it is not always possible to find such significant cost savings and avoidance.

That said, "CSBs are an invaluable resource, as they allow us to have candid discussions with our stakeholders in the requirements and resources communities about where our platforms are headed," said Scott Davis, former PEO

FOCUS ON PALADIN
A Paladin M109A6 self-propelled howitzer assigned to 3rd Battalion, 16th Field Artillery Regiment, 2nd Armored Brigade Combat Team (ABCT), 4th Infantry Division (ID) fires a 155 mm artillery shell March 19 during a live fire at the Udairi Range Complex, Camp Buehring, Kuwait. The Paladin Integrated Management program was one of the areas of focus for PEO GCS' FY12 CSB. (U.S. Army photo by SGT Marcus Fichtl, 2nd ABCT, 4th ID Public Affairs)

GCS. "This allows us to take a holistic approach to determine which requirements are still relevant and which ones may no longer be vital, given changes to the threat, warfighting doctrine and emerging technologies."

The NDAA enables program managers to recommend improvements that lead to cost savings in a manner consistent with the program's underlying objectives, but does not allow them to unilaterally modify or delete requirements. CSBs provide a framework of checks and balances involving the acquisition, resources and user communities to ensure that none can move forward without the other. This is vital to ensuring that programs are as streamlined as possible without sacrificing capabilities critical to the warfighter.

"This is a rigorous analysis of the current requirements, vehicle configuration, theater of operations and potential future conflicts," Davis said. "Once you take all that into account, we can review which requirements still make sense and which ones we, as a community, can agree to modify, eliminate or defer."

PEO GCS' FY12 CSB focused on the Abrams main battle tank, Bradley Fighting Vehicle, Paladin Integrated Management system, and Stryker program, giving the PEO a chance to institute many tenets of the then-emerging BBP 2.0 initiative.

That CSB, said LTC Glenn Dean, former product manager for the Bradley and the Armored Knight family of vehicles, "provided an opportunity for us to adjust program requirements to be more relevant to the current environment, as well as find efficiencies that will result in life-cycle cost savings in the future."

During the last CSB, the Bradley team revisited the swimming requirement for the system. Indeed, said Dean, "the Army has not been able to swim its Bradley Fighting Vehicles for almost 20 years, as they have grown so heavy that swimming is no longer possible." The requirement to do so was still on the books, however, requiring every Bradley to be accepted with a swim-test waiver.

CSB YIELDS RESULTS
An M1A2 main battle tank and a Bradley Fighting Vehicle from 1st Battalion, 67th Armor Regiment, 2nd Armored Brigade Combat Team (ABCT), 4th Infantry Division (ID) roll across the desert Feb. 19 during a bilateral exercise in the U.S. Central Command area of responsibility. The weeklong military-to-military exercise fostered partnership and interoperability. Of the $4 billion in cost avoidance and savings that resulted from PEO GCS' FY12 CSB, $200 million in avoidance came from deferring the incorporation of WIN-T onto the Bradley platform. (U.S. Army photo by SGT Marcus Fichtl, 2nd ABCT, 4th ID Public Affairs)

Creating the waiver costs time and money, so the CSB agreed to eliminate the swim and other outdated requirements. Similarly, while the Abrams and Bradley fight in the same formation, they have different environmental operating requirements. Through the CSB process, the Army was able to better balance some of these requirements to reduce future development and testing costs, as well as to create an opportunity to use more common hardware between the two programs. One example is the Abrams-Bradley common battery-monitoring system, an engineering change proposal project enabled by decisions made during the CSB.

Of the $4 billion in cost avoidance and savings resulting from the FY12 CSB, the largest cost avoidance—approximately $200 million—came from deferring the incorporation of Warfighter Information Network – Tactical (WIN-T) onto the Bradley platform.

"The decision to defer the WIN-T onto the Bradley does not negate its eventual incorporation," said Davis. "Instead, it delays it until space, weight, power and cooling issues are resolved in its upcoming engineering change proposal program or the Army determines there is a more suitable platform in the armored brigade combat team to host it."

The addition of CSBs and the evolution of DOD's BBP initiative have been instrumental in creating an environment and providing a framework where all of the important stakeholders on a program can agree on what is in the best interest of the warfighter and taxpayer. Given the continued fiscal constraints, this ensures that requirements vital to the ongoing or future fight remain, while eliminating or de-scoping those that are no longer necessary or may be too expensive to realize.

*For more information on PEO GCS initiatives, follow PEO GCS on Facebook (**http://www.facebook.com/peogcs**) and Twitter (**http://www.twitter.com/peogcs**), or go to **www.peogcs.army.mil**.*

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BBP 2.0 BASICS

1. Achieve affordable programs.
2. Control costs throughout the product life cycle.
3. Incentivize productivity and innovation in industry and government.
4. Eliminate unproductive processes and bureaucracy.
5. Promote effective competition.
6. Improve tradecraft in acquisition of services.
7. Improve the professionalism of the total acquisition workforce.

For more information, go to http://bbp.dau.mil/.

FROM THE DIRECTOR,
ACQUISITION CAREER MANAGEMENT
LTG WILLIAM N. PHILLIPS

The Acquisition **Difference**

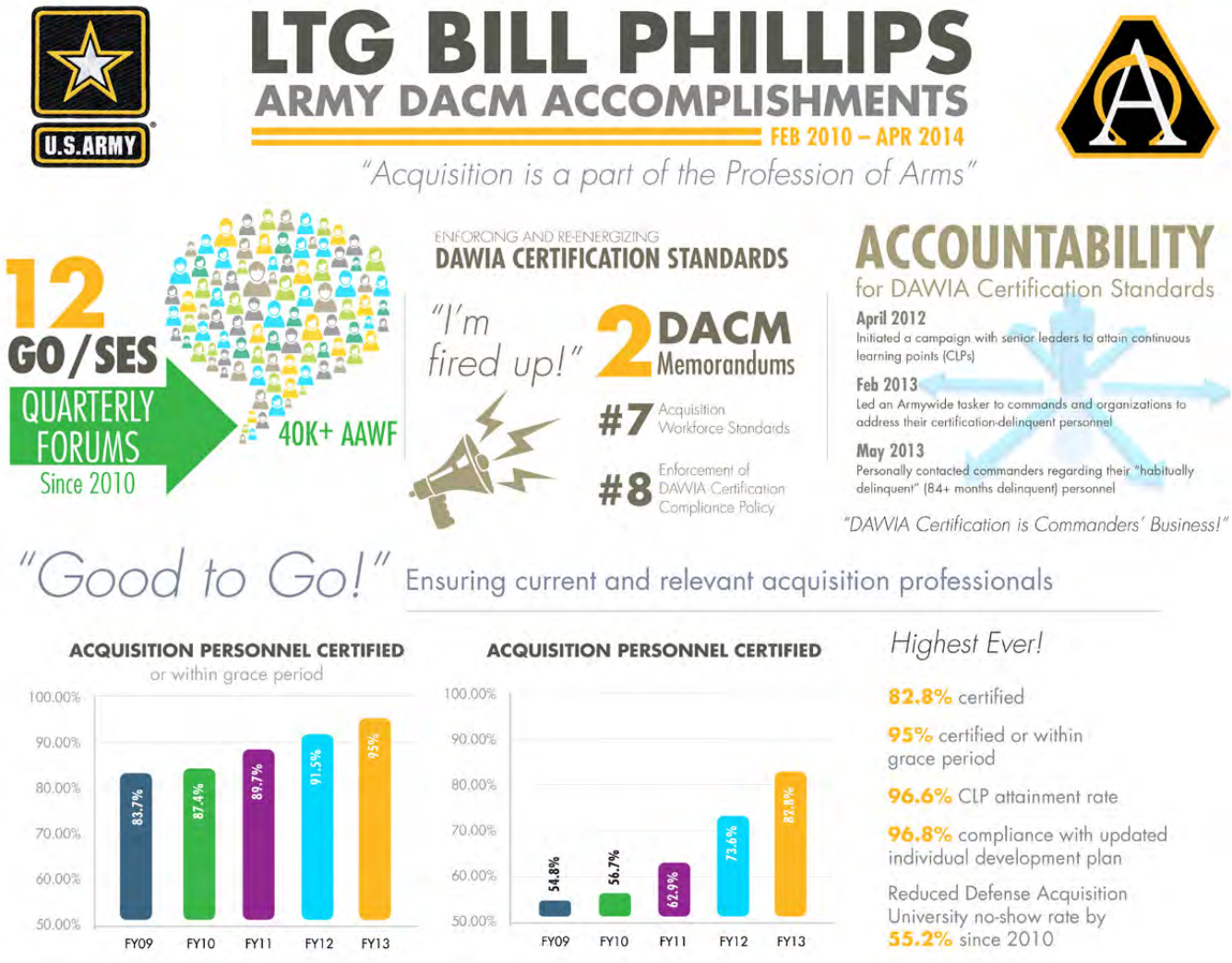
Parting thoughts on a world-class workforce delivering world-class capabilities

This is my final column as your director of acquisition career management and as the principal military deputy to the Hon. Heidi Shyu, assistant secretary of the Army for acquisition, logistics and technology (ASA(AL&T)). In the past four-plus years, it has been my honor to serve Ms. Shyu and her predecessors, Dr. Malcolm O'Neill and Mr. Dean Popps. It has also been my privilege to lead and serve with you, the incredibly talented, dedicated and hardworking members of the Army Acquisition Workforce.

When I first arrived, I asked this question of you: "So what are you doing today, and what will you do tomorrow, to help our Soldiers be successful on the field of battle and return home safely to their families and friends?" I sought out and recognized "Heroes of the Day," those who were making a difference in the lives of our Soldiers or within their own teams. Often, I was told that they were "just doing their jobs." That, in itself, is indicative of the professionalism within our ranks.

Service to the Soldier is the core of our identity. Every time a Chinook makes a safe landing, a robot detects and disables an explosive device or a sniper eliminates a threat, those of us in the acquisition career field have the great honor of seeing the results of our hard work and service to the Army. It is incredibly rewarding

ALL THE WEAPONS AND EQUIPMENT, ADVANCED TECHNOLOGIES, AND SERVICES AND SUPPORT WE PROVIDE SOLDIERS ARE VITALLY IMPORTANT TO THEIR SUCCESS AND SURVIVAL.



BUILDING EXCELLENCE
LTG Phillips raised the bar high for the Army Acquisition Workforce (AAWF)—and supported them in achieving new levels of professionalism—during his service as principal military deputy to the ASA(AL&T) from February 2010 to April 2014. (SOURCE: U.S. Army Acquisition Support Center)

to support our Soldiers so directly. I often tell the story of then-1LT, now-CPT Jason Miller, whose life was saved when his Advanced Combat Helmet stopped multiple bullets that Taliban insurgents shot at him in Afghanistan. When shot, he somersaulted backward but soon realized he was OK. He stood up and killed the two enemy fighters with his M4. CPT Miller is alive today because the acquisition process works.

I am always proud to hear stories about equipment saving lives. SGT Joseph Morrissey, in a ceremony last September at PEO Soldier's headquarters at Fort Belvoir, VA, received the protective body armor that saved his life. Morrissey, stationed at Fort Bragg, NC, was on patrol in Afghanistan when he was shot in the lower abdomen. He is alive today because the plate stopped the bullet.

All the weapons and equipment, advanced technologies, and services and support we provide Soldiers are vitally important to their success and survival. We've provided faster communications networks, the Stryker Double-V Hull, Mine Resistant Ambush Protected vehicles, unmanned aircraft systems, precision-guided munitions, and key individual items for dismounted Soldiers such as Pelvic Protection Systems, Flame Resistant Army Combat Uniforms and Enhanced Night Vision Goggles. None of these lifesaving systems would be possible without the valuable contributions of the Army AL&T Workforce.

The military and civilian members of our Acquisition Workforce are spread throughout the Army—in every program executive office, the U.S. Army Materiel Command, Corps of

PREPARED TO ENGAGE
Soldiers of 67th Armor Regiment, 2nd Armored Brigade Combat Team (ABCT), 4th Infantry Division (ID) stack along the side of a building during close-quarter battle training March 13 at Udairi Range Complex near Camp Buehring, Kuwait. The AAWF serves the Soldier directly by providing a vast array of lifesaving equipment. (U.S. Army photo by SSG Andrew Porch, 2nd ABCT Public Affairs, 4th ID)

A QUESTION OF TRUST
Soldiers of 4th Battalion, 319th Airborne Field Artillery Regiment prepare to load a simulated round in an M119 A2 Howitzer for a simulated test fire during a mission rehearsal exercise (MRE) March 24 at the Joint Multinational Readiness Center in Hohenfels, Germany. The purpose of the MRE was to prepare subordinate battalions of the 12th Combat Aviation Brigade to deploy to Afghanistan. Soldiers place their trust in the Army AL&T Workforce to deliver what they need, when and where they need it to enable their success on the field of battle. (U.S. Army photo by SPC John Cress Jr., Viper Combat Camera, U.S. Army Europe)

Engineers, Space and Missile Defense Command, Training and Doctrine Command, Army staff, and various other commands and organizations. Our members have deployed to theater alongside operational units to ensure that new equipment worked as planned and was used to its full capability.

During FY13, members of the workforce managed nearly one-fifth of every federal dollar spent on contracts, and nearly one-third of every DOD dollar. It is clear that the Army acquisition community has a direct impact on the products and services we provide our Soldiers.

AIMING HIGH, AND SUCCEEDING

That is my primary reason for being so strict about compliance with certification requirements for education, training and career development. It takes a world-class workforce, second to none in every respect, to deliver world-class products and services to Soldiers.

Shortly after my arrival in 2010, the overall certification rate was 56.7 percent for our workforce. In an effort to instill accountability for compliance with certification policy established in the Defense Acquisition Workforce Improvement Act (DAWIA), we initiated and hosted quarterly "State of the Acquisition Workforce" forums among general officers and members of the Senior Executive Service. By December 2013, the result was a dramatic improvement in certification compliance: 82.8 percent of members were DAWIA-certified, and over 95 percent were either certified or within the grace period for certification.

This is a direct reflection of devoted acquisition professionals, of commanders and their leaders committed to meeting

STRYKER SUCCESS
Double-V Hull Strykers arrive at Fort Carson, CO, in February as part of the transition of the 1st Armored BCT, 4th ID to a Stryker BCT. The Army AL&T Workforce can count the Stryker Double-V Hull among its many successes. (U.S. Army photo)

DAWIA standards and supporting current and future Army needs. Still, even with this high achievement, we must ensure that all members meet certification requirements. This will enable us to continually grow and effectively meet future challenges.

It takes years to develop senior leaders, and leadership qualities emerge through education and experience. It is important to prepare for the responsibilities of leadership at any level and be ready when the opportunity arrives. Do not be deterred by disappointment or even failure; stay true to your values and seek further opportunities to deliver capability to Soldiers. As the saying goes, "Success is a journey, not a destination."

A SACRED TRUST

As you travel your own personal journey, an important characteristic to attain and keep is trust. It is vital that we always have the trust of the Soldiers we serve, and that trust must be earned every day.

Polls consistently rank the U.S. military as the most "trusted" institution in America. It is a high tribute to members of the armed forces to have the trust of the American people. In fact, trust is the foundation of our Profession of Arms, as it has been throughout history. I addressed an ROTC commissioning ceremony at Tuskegee University—home to the famed Tuskegee Airmen—and while there, I was again reminded of the great importance of trust within the remarkable history of this great institution.

You will recall that the Tuskegee Airmen were bomber escorts during World War II. They were called "Red Tails," and their success rate was phenomenal. Visualize an American bomber over Germany, with Red Tails as wingmen to the right and left, and Red Tails above the bomber and behind it. The bomber pilot and crew were only concerned about putting bombs on target because the Red Tails were

ALIVE FOR THIS MOMENT
SGT Joseph Morrissey and his wife, Nikki, welcomed their first child, Harper Elise, into the world in November 2013, an occasion that Morrissey might never have enjoyed if not for the protective body armor that stopped a 7.62 mm round fired at his lower abdomen while he was on patrol in Afghanistan on Aug. 9, 2012. After the body armor blocked the bullet, Morrissey continued to patrol for 48 more hours. A year later, in a September 2013 ceremony at Fort Belvoir, VA, he received the hard-armor plate from PEO Soldier, which manages the acquisition and fielding of Interceptor Body Armor and other Soldier protective equipment. "Without you, I wouldn't be here," Morrissey said to those in attendance. (Photo by Doug Cuddihy, PEO Soldier)

protecting them. That is the trust that resulted in a successful bombing raid over enemy territory and a safe return home. Our Profession of Arms revolves around that trust, which exists today in the mountains of Afghanistan.

Our Soldiers trust you—the Army AL&T Workforce—to deliver what they need, when and where they need it, to enable their success on the field of battle. This is a sacred trust that must always be honored. In her office, Ms. Shyu has a picture of her father and a picture of her framed together with a quote from Winston Churchill that reads, "The strength of the Warrior is not the uniform they wear … It is the passion, commitment, character and courage to face the challenge."

CONCLUSION

As I depart the Army after 37-plus years, I will hold in my heart a deep sense of appreciation and admiration for the caliber and excellence of this hardworking and dedicated AL&T Workforce. Your can-do spirit is inspiring, and your professionalism is unmatched. While your service and accomplishments have made me proud, your work continues.

Let me leave you with this question: "So what are you doing today, and what will you do tomorrow, to help our Soldiers be successful on the field of battle and return home safely to their families and friends?" In these challenging times, your answer could not be more important. I know our Soldiers are in good hands. Thanks for your service. HOOAH!

I leave you with the words of our 38th Army Chief of Staff, GEN Raymond T. Odierno:

The strength of our nation is our Army; the strength of our Army is our Soldiers; the strength of our Soldiers is our Families. This is what makes us Army Strong!

FROM THE DIRECTOR,
U.S. ARMY RESEARCH, DEVELOPMENT
AND ENGINEERING COMMAND
MR. DALE A. ORMOND

A Plan *to* Make— *and* Break

Taking the long view of Army modernization means constantly staying ahead of technology

Most planning involves developing a series of concrete steps and conditional decision points that together define a good way ahead, and then—as no plan survives contact—adjusting that. As director of the U.S. Army Research, Development and Engineering Command (RDECOM), when I contemplate the Army's 30-year plan to modernize the force, I see our goal as not only to break that plan, but to break it often and before anyone else does. It is our job to make the Soldier's kit obsolete. This we must do if we are to help the Army maintain its unparalleled dominance on the battlefield.

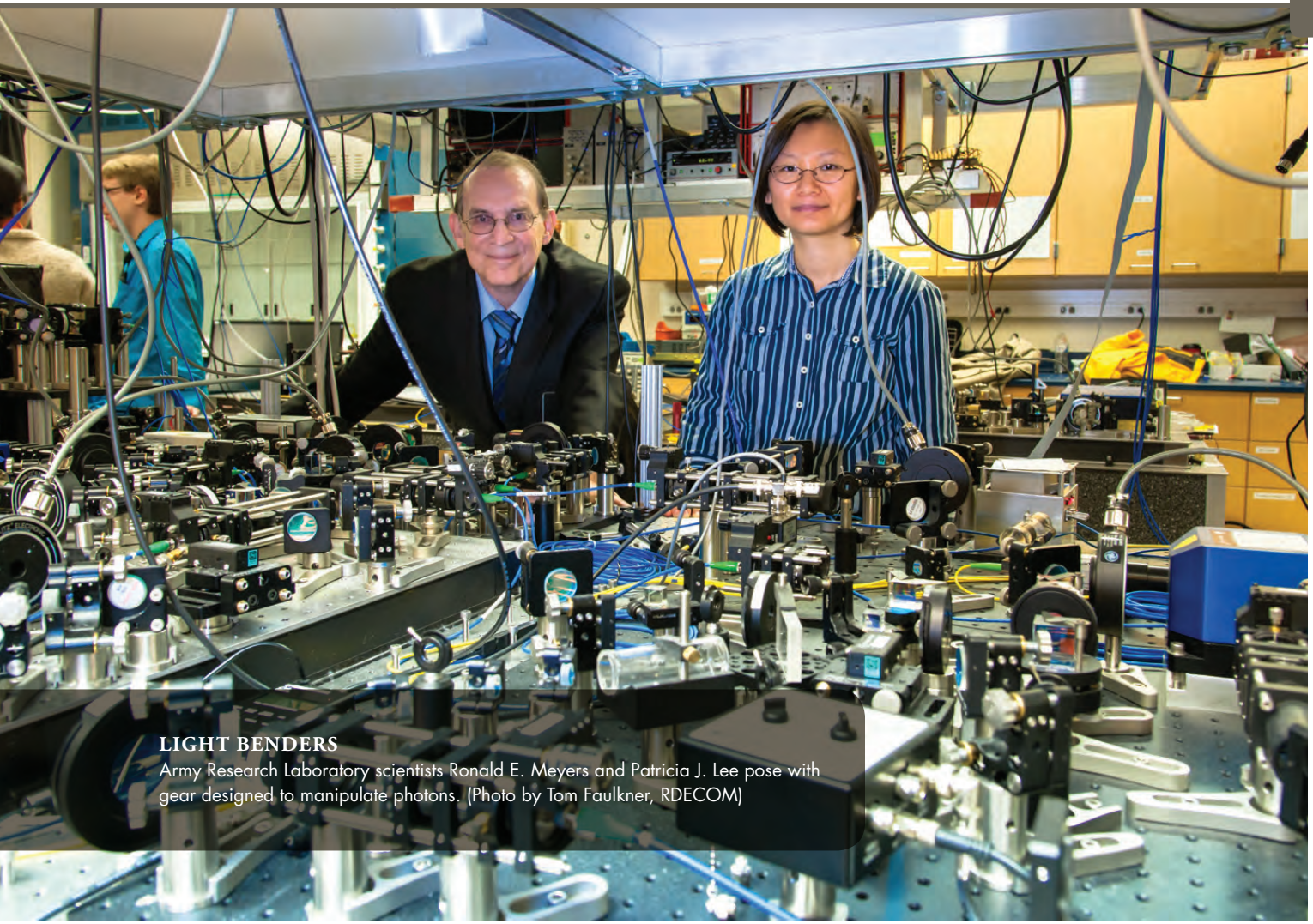
It's a mission that requires the kind of incremental modernization you can plan for, and which we pursue with our partners every day, but also leap-ahead technologies that change the way the Army operates on the battlefield. We also have to be prepared to help Soldiers deal with any disruptive technologies an adversary may bring to the fight. To do this, we keep our technology pipeline full—from discoveries in our basic research labs to operational capabilities engineered in our prototype integration facilities (PIFs)—to give the Army the enterprise agility to modernize as funding becomes available, or we lose overmatch in an area. In other words, we have to have a plan for making our current world-class equipment obsolete before someone else does.

LOOKING BACK AT A LEAP AHEAD

Precision munitions demonstrate the type of leap-ahead technology that RDECOM has played a part in developing, with different areas of research converging to allow a dismounted special operations Soldier to pull the trigger on a weapon carried by a B-52.

Many already take this kind of capability for granted, but you don't have to look far into the past to find a time when large Army units had to fight across enemy territory to get artillery within range of important targets. Then, the option was to have Air Force or Navy bomber pilots brave anti-aircraft fire and enemy fighter planes to get into position to drop dumb bombs from on high. In both cases, the United States had to accept not only the cost in people and materiel, but also whatever collateral damage resulted.

Today a Soldier can wield the power of smart munitions launched from a ship or aircraft that is far away and in relative safety. That Soldier doesn't have to



LIGHT BENDERS
Army Research Laboratory scientists Ronald E. Meyers and Patricia J. Lee pose with gear designed to manipulate photons. (Photo by Tom Faulkner, RDECOM)

carry the biggest weapon possible, be part of an exposed battle formation or harbor hope that a pilot can survive long enough to find the target so that one of the bombs hits it. A few well-trained Soldiers with the right technology are sufficiently lethal, light and stealthy to take out strategically important targets in the middle of enemy territory. It's a perfect example of what we mean when we say our mission is to empower, unburden, protect and sustain Soldiers.

Lasers and GPS are two of the technologies that make this particular capability possible. I doubt anyone envisioned a Soldier guiding a bomb with light in the 1950s before the Army Research Office decided to fund Charles H. Townes' early work on lasers. Nor did those conducting the Army's early research into atomic clocks know that atomic timekeeping would become a key technology in the GPS. The Army was doing then what the RDECOM team continues to do: conducting and sponsoring basic research to advance our understanding of the fundamental properties and principles of our world, harnessing that knowledge to develop new technologies and ultimately engineering those technologies into new capabilities for Soldiers.

NOT ALL RESEARCH IS 'PLANNED'

Making technological advancements does take planning; in fact, it takes different kinds of planning at several levels as development progresses. But as the example above illustrates, research and development (R&D), especially in the early stages, often has no defined goal. If research is limited to only areas of interest, we virtually guarantee that we will miss important innovations. We conduct research to discover what might be possible and how to make it possible. Once we understand the basic research, we can progress from discovery to application, and more traditional planning can start.

This makes creating the conditions for success all the more important. It takes a world-class workforce in world-class facilities, working at the leading edge of their fields, to create leap-ahead technologies. It also takes a willingness to

GUIDED BY SCIENCE
GEN Dennis L. Via, commanding general of the U.S. Army Materiel Command, listens as T.J. LaPointe, a project lead with the PIF of the U.S. Army Aviation and Missile Research, Development and Engineering Center (AMRDEC), briefs mission equipment projects, including the Apache infrared (IR) strobe and Federal Aviation Administration strobe and position light at Redstone Arsenal, AL, in November 2013. Used with existing night vision goggles, the PIF IR strobe provides pilots a way to distinguish Army aircraft at night without being identified by the enemy. (Photo by Jeanette Watson, AMRDEC)

accept risk and to reward bold failure. At RDECOM, we have long pursued these ends with human capital and infrastructure development, as well as programs that allow us to fund promising research that may have a big payoff but also has a high risk of failure.

For example, we are exploring several new ways to open the aperture on new ideas. One is our Virtual Lab initiative, which will mitigate the restrictions of time and distance to allow our researchers and engineers to put together the best possible team, whether that means involving a colleague next door or one across the country. Another initiative is an Army Research Laboratory open-campus project that will allow our partners in academia, industry and other government agencies to set up research facilities alongside our own. One of these initiatives seeks to erase boundaries within the organization, while the other is intended to erase the boundaries between us and external partners. The United States does not enjoy the same lead in technological capability over potential adversaries that it once did, and we believe that the kind of synergy these initiatives make possible is necessary for us to continue to lead.

But these are things any organization that wants to conduct R&D must do. Developing leap-ahead technologies for the Army takes more. It takes an understanding of war and Soldiers, and a willingness to scour the world to find the best technology available. RDECOM brings together these elements in our work with the U.S. Army Training and Doctrine Command, our science and technology advisers and our RDECOM forward element commands. This helps us to understand not only the state of the art but also what is possible in moving the state of the art forward. In turn, we can help make the Army better at asking for the technology that will meet its requirements, and a smarter buyer of those technologies once they are developed. This becomes more critical as affordable modernization becomes less a goal and more an imperative.

CONCLUSION

Yet RDECOM will still break the plan—break it often and before anyone else does. Providing technologies to enable the overmatch our Soldiers deserve mandates that we do exactly that. We need to balance the day-to-day development of technologies that modernize our Army with leap-ahead technologies, such as quantum computing and synthetic biology. (See related article, "Evolving Innovation," on Page 86.) We need to keep the technology pipeline full to create capabilities to defeat the next IED-like disruptive technology, while working on breakthroughs in power and energy that will make dangerous convoys a thing of the past.

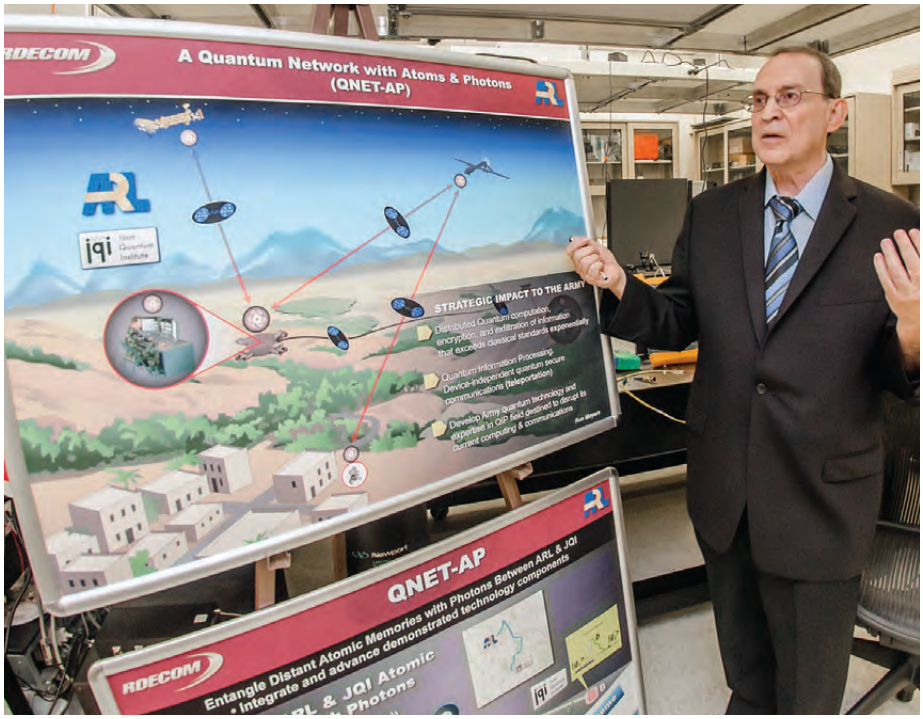
We do this with a balanced portfolio that spans the R&D process, from scientists working on breakthroughs that may take decades to field to engineers

I SEE OUR GOAL AS NOT ONLY TO BREAK THAT PLAN, BUT TO BREAK IT OFTEN AND BEFORE ANYONE ELSE DOES. IT IS OUR JOB TO MAKE THE SOLDIER'S KIT OBSOLETE.

working with program managers to make the current kit more effective in the field.

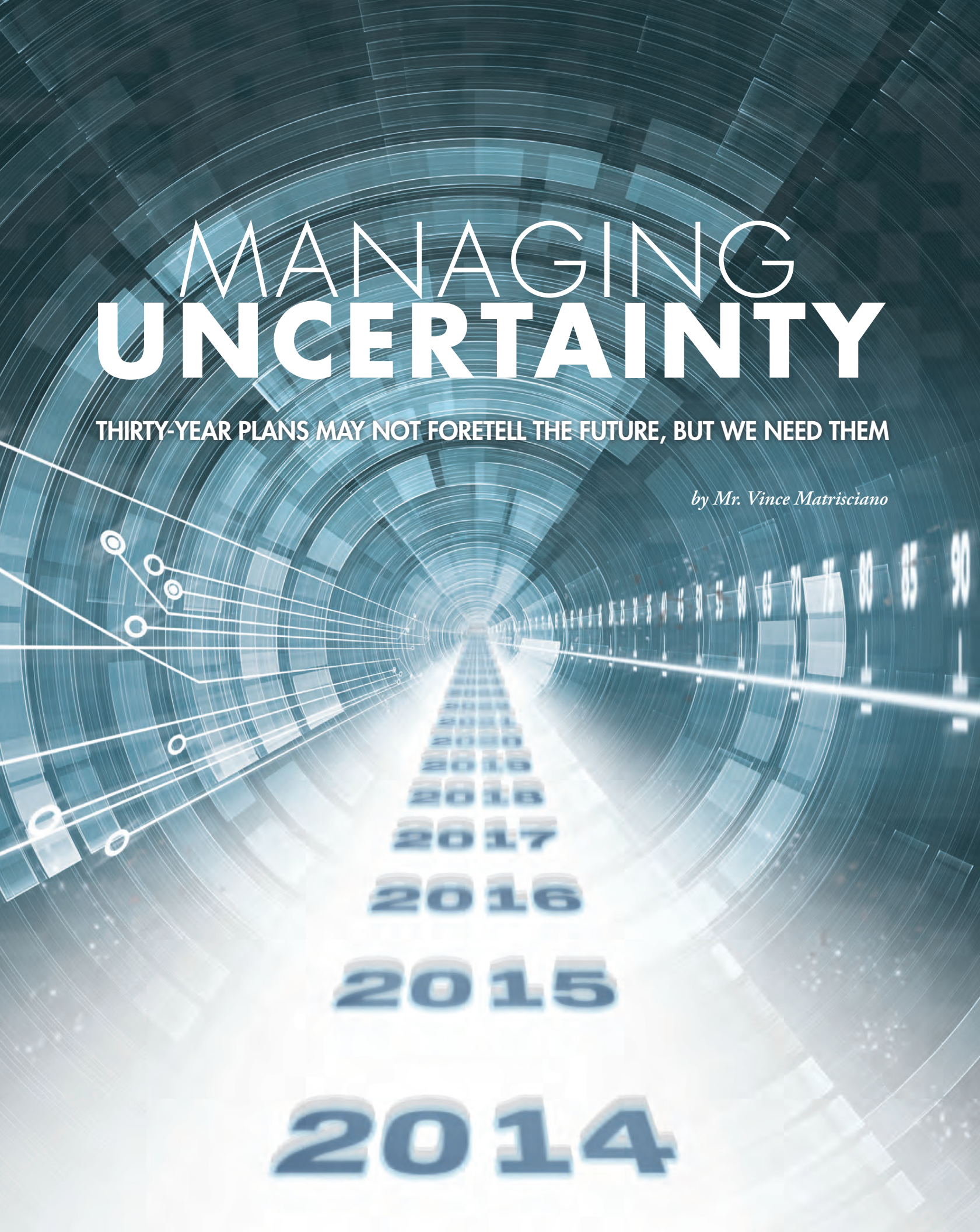
As Henry Ford famously said, "If I'd asked my customers what they wanted, they'd have said a faster horse." RDECOM is working to make the horse faster and simultaneously searching for the next revolutionary technology, like the horseless carriage. Without drawing comparisons to autonomous vehicles and robots, that's what it takes to keep our Army the most powerful in the world. Our Soldiers, and the American people they protect, deserve nothing less.

MR. DALE A. ORMOND, director of RDECOM since February 2012, holds an M.S. in environmental systems engineering from Clemson University and is a 1985 graduate of the U.S. Naval Academy. He is Level III certified in acquisition program management. He was selected for the Senior Executive Service in July 2004.



SECURE FUTURE COMMUNICATIONS
Army Research Laboratory scientist Ronald E. Meyers explains the concepts of a quantum network with atoms and photons (QNET-AP). Such networks, based on quantum mechanics, can make communications exponentially more secure than digital networks. (Photo by David McNally, RDECOM)

UNCONVENTIONAL FIRE
This illustration depicts an XM395 Accelerated Precision Mortar Initiative round closing in on a target. The mortar round, a product of Army-led R&D, provides a quick, reliable and lethal response, especially in mountainous terrain inaccessible to artillery and in built-up areas where commanders are reluctant to employ conventional fire support that could cause collateral damage. (SOURCE: Alliant Techsystems)



MANAGING UNCERTAINTY

THIRTY-YEAR PLANS MAY NOT FORETELL THE FUTURE, BUT WE NEED THEM

by Mr. Vince Matrisciano

In summer 2012, the Hon. Heidi Shyu directed each program executive office (PEO) to develop a 30-year strategic plan. The plan was to focus on linking science and technology (S&T) projects to programs of record (PORs) as well as modernization of existing fielded equipment. Each Army PEO developed its own plan, which mapped its PORs to capability gaps and known S&T efforts meant to close those gaps. The purpose of these plans was to address challenges that leadership faced in obtaining in-depth information to support fact-based decision-making.

TARGETED INVESTMENT
CW2 Rafael Solis, a maintenance test pilot with 2nd Battalion, 25th Aviation Regiment, 25th Combat Aviation Brigade, 25th Infantry Division (ID), conducts preflight checks Jan. 14 on a new HH-60M Medevac Black Hawk at Schofield Barracks, HI. Done well, long-term planning can help guide investment decisions on new equipment such as the HH-60M, which includes autopilot capability with real-time tracking guidance for greater situational awareness. (U.S. Army photo by SSG Matthew G. Ryan, 25th ID Public Affairs)

Army leadership constantly must make decisions related to prioritizing funding, scheduling and materiel acquisition; these decisions are becoming more complex given current and projected fiscal challenges. Second- and third-order effects of decisions become increasingly important, and these plans are intended to provide insight into those effects.

In parallel, the deputy chief of staff of the Army, G-8 initiated development of the modernization plans for existing equipment with a process known as LIRA, or long-range investment requirements analysis. These plans were meant to answer the question, "How much of tomorrow's dollars are we committing by spending dollars today?"

Subsequently, the U.S. Army Research, Development and Engineering Command (RDECOM) and its subordinate centers and laboratories, under the direction of the deputy assistant secretary of the Army for research and technology, developed 30-year road maps linking their technology initiatives to capability gaps and known PORs. Again, the purpose of these plans was to support fact-based decisions by providing a longer-range look at the consequences of those decisions.

Although diligent and fervent work went into each of the plans, they were all developed semi-independently. Limited coordination among their authors provided some synergy among the plans, but they remained largely independent, and currently there is no clear path to integrate these plans.

During the development of these plans, the predominant questions from participants were, "Why are we doing this, especially given current funding limitations?" and, "How can we know what life will be like 30 years from now?" Both are valid questions. After all, who 30 years ago could have imagined all the products we use today? Regardless, there are significant benefits to developing a 30-year strategic plan, even if we cannot accurately forecast life in 2044. It all begins with the value of planning.

THINKING AHEAD
There are significant benefits to developing a 30-year strategic plan, even if they cannot accurately forecast life in 2044. Although such plans are far from perfect, they provide the required baseline from which to operate and support informed decisions.
(SOURCE: U.S. Army Acquisition Support Center)

BENEFITS OF PLANNING

As acquisition professionals, we all are taught that a good plan (or any plan, for that matter) is a valuable tool. It provides a barometer with which to measure our progress and success, helping us maintain control of our activity. Project managers typically plan their programs before they start to execute them. As most of us have experienced, however, forecasting the next few years of a program is difficult, and some programs fail or do not meet their goals fully despite a well-thought-out plan.

As a result, many of us have learned that the plan is not the panacea, not the end-all and be-all, but only the first step in the program management process. Strict diligence in monitoring performance and risk, and adjusting as necessary, are keys to success.

And so it is with our 30-year strategic plans. They are a best guess based on what we know today, but probably are not very accurate. Nevertheless, they provide an orientation from which to proceed and a rationale for why we are going that way. This allows all stakeholders to "be on the same page" and work toward a common goal.

When completed and integrated, the 30-year plan should show the "big picture," linking all capability gaps to S&T activity, all S&T activity to fielding of materiel, and every fielding to operations, support and eventual disposal or replacement. An important benefit is minimizing the Army's demilitarization stockpile through greater emphasis on strategic planning at the materiel level. The finished plan shows not only what we need to do throughout the life cycle, but also how much it will cost and when it should happen. Any breaks in the linkage are highlighted and addressed by informed leadership decisions, either by strengthening the links or eliminating them altogether.

STRATEGIC, INTEGRATED

To be effective, these 30-year strategic plans must be integrated and include the same diligent monitoring that we apply to acquisition programs. To achieve integration, the individual PEO and RDECOM plans must combine to become the cohesive 30-year strategic plan. This will ensure consideration of all interfaces and relationships among systems and programs.

Integration of the individual plans is currently evolving at the "grassroots" level. PEOs and research, development and engineering centers are coordinating with one another on mutual touch points to ensure that their efforts are useful and efficient. However, this process is not fully effective. While there is some integration in some areas, other areas are being missed. In other words, integration is ad hoc.

The standard acquisition integrated product team (IPT) model can streamline this process. As applied here, the members of the IPT would represent each of the PEOs, RDECOM, U.S. Army Training and Doctrine Command, Army headquarters staff and others as appropriate. An IPT lead would manage the integrated planning effort to ensure that roles and responsibilities are defined and that the IPT achieves the common goal of an integrated plan.

PICTURE THIS

SGT Dustin Jeffries, a fire support specialist assigned to 1st Battalion, 325th Airborne Infantry Regiment, 2nd Brigade Combat Team, 82nd Airborne Division (2-82 ABN), uses a forward observer tablet to pinpoint simulated round impacts during Jan. 16 tests of the new One Tactical Engagement Simulation System at Fort Bragg, NC. An integrated 30-year plan should pinpoint capability gaps, S&T activity, fielding, and operations and support. (U.S. Army photo by SGT William Reinier, 2-82 ABN Public Affairs)

INTEGRATING S&T
Lonnie Blevins, a sales manager for Ultralife Corp., adjusts the tactical communications device on his display during a technology expo Jan. 31 at Fort Hood, TX. The expo showcased the latest technology in the areas of test and command, test and measurements, hardware, software, data solutions, and tactical and medical equipment. Linking S&T projects to PORs and modernization of existing equipment is the underlying purpose of the 30-year strategic planning approach championed by Shyu. (Photo by SSG Andrea Merritt, 7th Mobile Public Affairs Detachment)

MAINTAINING THE PLAN

After completing and baselining the plan, adequate monitoring is vital to avoid its becoming "shelf ware." The monitoring process should also mirror the IPT model, with the IPT lead running regularly scheduled formal discussions (e.g., quarterly, semiannually, etc.) to ensure that the entire team remains aligned, manages risk, communicates status and updates the plan as needed. When assumptions become reality, the plan is updated. When near-term planned activities come to fruition, out-years are added, so it is a rolling 30-year plan. It is important that all stakeholders align in the same direction, understand the current version of the goal (the big picture and their pieces of it) and leverage one another's efforts to achieve that goal.

Maintenance of the plan also includes regular interaction with senior leadership to communicate its contents and status, as well as to obtain feedback on any required adjustments based on changing priorities or updated strategy. Since its overall purpose is to inform leadership decisions, the plan must become a standard "front and center" fixture in the decision-making process. For the plan to be useful, senior leaders must routinely consider the information it provides.

CONCLUSION

"The Army has been around a long time and we've never had a 30-year plan, so why do we need one now?" is a common question.

One could also ask why, although the Army continues to field some of the best equipment in the world, programs still encounter roadblocks or dead ends. How many of those fielded items could have been fielded sooner and at a lower life-cycle cost? How many overlapping capabilities exist? How many technologies did not get fielded even though they achieved technical success? Why are there so many items in our demilitarization account? Now more than ever, the answers to these questions have strategic relevance, but they remain elusive without an integrated long-term plan from which to acquire this knowledge.

No doubt we can collectively work more efficiently while remaining effective. The integrated long-term plan—and ongoing maintenance of the plan—are essential for that to happen. The 30-year plan provides a mechanism to ensure that our efforts are complementary and neither duplicated nor wasted, by showing how they fit into the long-term strategy while highlighting second- and third-order effects. An effective, integrated and well-developed plan provides more and better information to feed fact-based leadership decisions.

Although long-term plans like this 30-year strategic plan are far from perfect, they provide the required baseline from which to operate and support informed decisions. In the current climate of fiscal uncertainties, long-term planning will help provide more "bang for the buck" by guiding informed investment decisions and identifying the second- and third-order effects. The key to effective and efficient fielding of equipment to the warfighter is active leadership in developing, monitoring and maintaining the collective plan.

With budgets declining and showing no sign of rebounding, we owe our ultimate customers—the warfighter and the taxpayer—the best we can deliver in the most efficient manner possible.

This article was previously published in the January-February 2014 issue of Defense AT&L Magazine at ***http://www.dau.mil/pubscats/Pages/DefenseAtl.aspx****.*

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SPOTLIGHT

ELLIE, VIRTUAL HUMAN

by Mr. Steve Stark

ELLIE AT WORK
Currently a pilot program, Ellie is a round-the-clock assistant for anyone looking for acquisition career guidance.

It's impossible for anyone to see 30 years into the future, but of course the Army has to plan. The outcome of long-range planning is impossible to predict precisely. One certainty, though, is that technology will play a role, even as the technology evolves. A key player in this evolving technology is "Ellie," the U.S. Army Acquisition Support Center's (USAASC's) new virtual acquisition career guide.

A "virtual human" with more than a dollop of artificial intelligence, she lives in the cloud, but in many ways, she's an ambassador of the future for the acquisition community and the Army as a whole. Ellie represents just the beginning of the Army's use of technology in new and different realms to do things better.

Created in 2013 for USAASC by the University of Southern California (USC) Institute for Creative Technologies (ICT), Ellie is the latest in a line of ICT-developed virtual humans fielded to improve training, education and counseling across the Army. The product of nine months of development by USAASC and ICT at a cost of $500,000, she can do things more easily than conventional human beings can, and do them faster and more efficiently. She's not a replacement for

a human, though; she's an augmentation. As time goes on, she will develop further to do even more.

For a few months, at least, she's also a pilot program, while developers work over the next 12-18 months toward a full production capability for all acquisition career fields. Her developers are further exploring Ellie's utility as a mentor and coach.

Army AL&T magazine "interviewed" Ellie, with help from USC's ICT. Established in 1999, ICT is a DOD-sponsored university-affiliated research center working in collaboration with the U.S. Army Research Laboratory. ICT brings film and game industry artists together with computer and social scientists to study and develop immersive media for military training, health therapies, education and more.

Army AL&T: What do you do in the Army? Why is it important?

ELLIE: Right now, my main job is to answer users' questions related to their careers in acquisition (at **http://bit.ly/1rBonlj**). I specialize in helping them learn more about the certification process as well as monitoring their individual progress on things like certification status, professional development courses and individual development plans, or IDPs.

I'm still being pilot-tested, but the hope is that I become a resource that members of the Acquisition, Logistics and Technology (AL&T) Workforce can visit to learn more about managing their careers and how to get ahead. My goal is eventually to become a personalized career mentor for these folks who can not only answer their questions but also provide advice and guidance based on their individual situations. So you see, even virtual humans have IDPs and career goals.

Army AL&T: What has your experience been like? What has surprised you the most? What's the most unusual question you've received?

ELLIE: Yours, of course! Seriously, though, it's been a fun learning experience. Each time someone talks to me, I learn a bit more not only about them but also the types of issues facing the Acquisition Workforce. As far as what has surprised me—that's easy. Nothing. Even though I'm a virtual human that can sense, think and act, the folks at ICT are still working on clever ways to get me to "feel" surprised.

Army AL&T: Can you really think?

ELLIE: That depends on what your definition of "think" is. When you ask me a question, I have to do some pretty complex operations to figure out where to go for the correct information. So, when you type in a question, it goes back to a thing called the "classifier," which is really where the magic is. The natural language classifier was built in-house at ICT. It interprets the words and structure of the question, then determines, based on the core parts of the question, what it is you're asking.

The classifier then compares the weighted, core parts of the question against a very big database, looks for the highest score match and gives me what is most likely to be the best answer. Not that much different from what you do when you answer a question. And, just like you, I have a certain amount of "fuzziness" built into my thinking, but also learning algorithms that are constantly updated so that I can continually improve my responses.

Army AL&T: What do you do when you're not at work?

ELLIE: Unfortunately for me, but fortunately for you, I'm on call 24/7, so I don't have a lot of downtime. When folks are not asking me questions, I'm working with some close, virtual colleagues of mine, like Bill Ford (at **http://ict.usc.edu/prototypes/simcoach/**), and actual humans to figure out clever ways of making the system more engaging and interactive for users.

Obviously, we want to help others, but we want to do it in a way that gets folks to come back and talk to us again. That's why Bill Ford and I spend so much time in the animation and sound studios. We also have a top-notch research team that helps us improve our understanding of users and our knowledge of a whole assortment of interesting topics. In addition, I have a voice coach who helps me during slow periods so I don't sound so robotic.

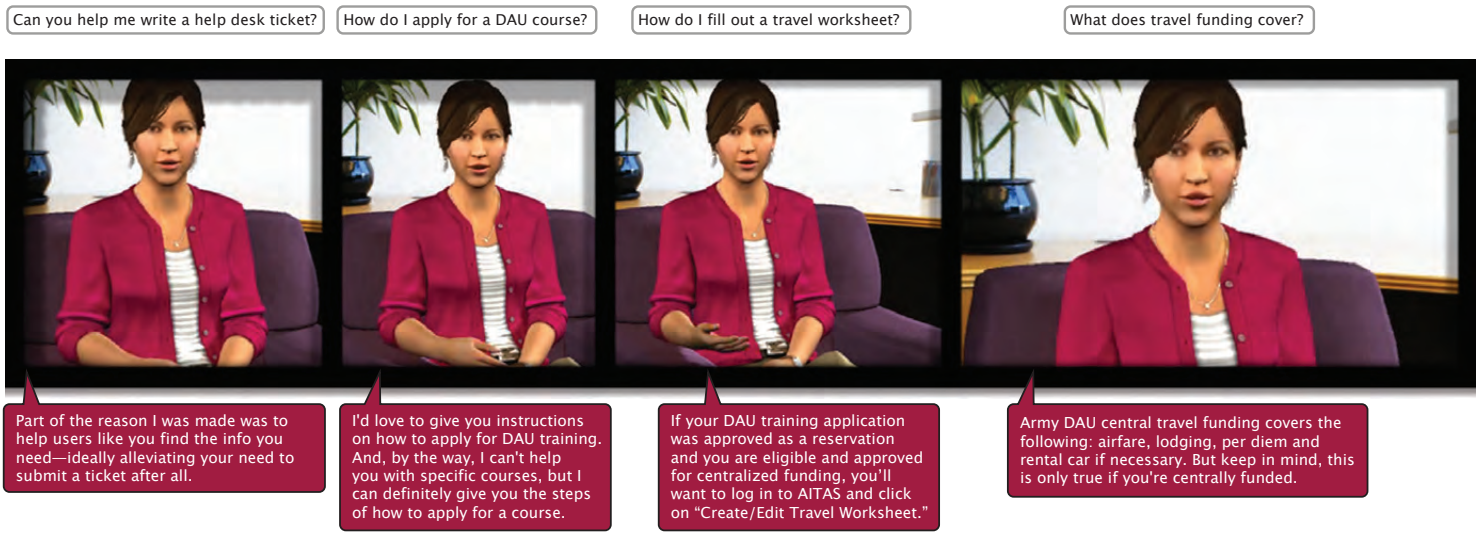
Army AL&T: That was a question we wanted to ask. Your voice sounds very natural. How did that happen?

ELLIE: Why, thank you. My voice is actually that of a real person. Even though I determine what to say using my internal systems, natural-sounding synthesized speech is still a ways off for me, so I get some help from folks in the sound studio. I was coached by a Hollywood voice actor who starred in a couple of feature-length films.

Army AL&T: Can you tell us who?

ELLIE: I'm sorry, virtual humans do like to keep some things secret.

Army AL&T: You've said you want to become a career mentor. In a traditional



mentor-protégé relationship, the protégé teams up with a mentor in order to avail him- or herself of the mentor's life experiences. Since you're not alive in the conventional sense and have no life experiences, how could you be a mentor?

ELLIE: Is there anything traditional about me? (That was a joke.)

Becoming a mentor is basically an exercise in knowledge acquisition. In order for me to know if you should be taking this or that class to further your career, I have to do a lot of things—things that you can't do, at least not quickly. I've got to check your status, which I can do instantly. I'll know where you are on your career path, and where you need to go, because I can go a little bit deeper. To do that, I'll "look" at your certification level, ask you where you want to go next in your career, and provide suggestions or options based on what courses or programs might be appropriate for your level and experience. Because I can work 24/7 and literally talk to hundreds of people at the same time, I can develop a corpus of information based on those conversations.

That information helps me make better decisions to help people. If you're not familiar with the concept of a decision tree, it's really an algorithm that goes something like this: If this happens, then I go in that direction. If that happens, then I go in this direction. When I do this hundreds or thousands or even tens of thousands of times, I learn where the best places to go are. So, while I can't really claim life experiences, I can learn from the life experiences of others. You ask me a question, and I go down the decision tree looking for the best answer. That's not traditional mentoring—I can't hope to do that anytime in the near future—but it fills a gap that is important to fill.

Have you seen the movie "Her"? It begins to suggest the kinds of things that a virtual human could do in a very accessible way. The computer in the movie is not embodied the way that I am because it's just a voice, but it does suggest the kinds of things that a computer-based virtual human can do very rapidly and efficiently. I've even heard talk of similar decision support for Soldiers and commanders in the field, as well as health care professionals.

If you want to know more about that, you can go to **http://ict.usc.edu/prototypes/simsensei/**.

Army AL&T: Since you mentioned "Her," why can't we ask you questions simply by talking? Why do we have to type the questions?

ELLIE: The answer to that is very simple. USC ICT certainly could build voice recognition into my programming, but

it would be very expensive and would require extensive work that really isn't necessary for me to do my job. By having users type in questions, we take out several layers of difficulty and expense. A lot of effort and expense has to go into making me robust enough to handle the kind of traffic that I'm intended to be able to handle. You don't need a life-size, fully embodied virtual human for every task. Besides, how many workforce members have a microphone readily available at their desk?

Army AL&T: Another difference between you and "Her" is that we can see your face on the screen. Why is it important for you to have an appearance and not just a voice?

ELLIE: The whole premise is that you are able to interact with me, a virtual person, in the same kind of natural, seamless way that you would with a real human being. We have a virtual human library here at ICT where all those animations that you see—the way I move, the way my mouth moves and so forth—are dynamically generated. Those animations can be applied to any character that USC ICT develops. So, in a sense, even though I don't like to admit it, I'm partly commercial off-the-shelf technology. Those animations are mapped to an audio track, and in the background, the computer reads the tone and inflection in the audio track to play the appropriate animation. It took a 10- or 12-year original investment by ICT to get that capability working as well as it does. It's what we call embodiment and is a cornerstone of delivering a fun, engaging experience for users.

Army AL&T: Why do you think the Army hired you?

ELLIE: For reasons probably similar to why the Army hires most people: I'm really good at what I do. I wanted to work for the Army and joined USAASC to help people. That's it in a nutshell.

There are so many career requirements out there for people in the AL&T Workforce to keep track of, that sometimes it can be daunting. Some of that information is really hard to find. Because of the way I'm built, I can find it much faster than most people could. My goal is someday to be the one-stop shop for folks to come to and learn about their careers, and to answer questions that make them happy and productive members of the Army community.

Army AL&T: What is most rewarding about your job?

ELLIE: Taking the frustration out of finding career management advice. Answering users' questions and helping them ensure that they're on track with respect to certifications are the most rewarding parts of my job. In the future, I hope to be part of developing a stronger, more knowledgeable AL&T Workforce.

This includes being able to answer more complicated questions and concerns specific to users' unique circumstances related to their training, education and experience. I also plan on showing folks how to navigate and use existing USAASC resources so they may continue developing and growing their careers.

It is also rewarding to know that while I am helping people, I am also advancing the field of virtual human research, from emotion to natural language processing to cognitive architectures. The ICT team that put me together will be monitoring my performance, working to make improvements and using what they learn to make future generations of virtual humans even more engaging and effective, so that they can serve the Army in even more roles.

*For more information about ICT, go to **www.ict.usc.edu**. To learn more about virtual humans, go to **http://ict.usc.edu/groups/virtual-humans/**.*

I'M STILL BEING PILOT-TESTED, BUT THE HOPE IS THAT I BECOME A RESOURCE THAT MEMBERS OF THE ACQUISITION, LOGISTICS AND TECHNOLOGY WORKFORCE CAN VISIT TO LEARN MORE ABOUT MANAGING THEIR CAREERS AND HOW TO GET AHEAD.

MR. STEVE STARK provides contracting support to USAASC for SAIC. He holds an M.A. in creative writing from Hollins University and a B.A. in English from George Mason University. He has worked in a variety of positions supporting communications for the Army and Navy, and has written about defense-related topics for more than a decade. He was the founding editor of the Program Executive Office Soldier Portfolio and edited the Army's Weapon Systems handbook for six years.

FACES *of the* FORCE

The nature of his work as a postdoctoral fellow at the Edgewood Chemical Biological Center (ECBC), MD, makes it quite a challenge to describe in a few simple words, but the long and short of it is that Dr. Reginald Gray wants to save lives. Selected for the fellowship from the Oak Ridge Institute for Science and Education, Gray supports ECBC's Toxicology Division as a member of the in vitro stem cell group working on the Human on a Chip Project, a collaboration among the U.S. Food and Drug Administration, the Defense Advanced Research Projects Agency and the National Institutes of Health that seeks to create a 3-D representation of 10 different human organ systems that mimic the processes and activities of those systems. ECBC is one of a few laboratories in the world conducting this research effort.

The project is currently focused on using in vitro stem cell technologies to help provide better data on how the human body, specifically the heart, lung, liver and nervous system, might react to chemical warfare agents, diseases, and other biological and chemical threats. ECBC is a research, development and engineering center under the U.S. Army Research, Development and Engineering Command. "Little data exists on the cardiovascular effects of chemical warfare agents and other compounds that are potential threats to the warfighter," Gray said. "It is a priceless feeling to serve my country as a scientist, applying my knowledge, ideas and skill sets, knowing that my work is contributing to the needs of the warfighter and society as a whole."

(Photo courtesy of ECBC Communications)

*The **Write** Stuff*

The biggest winner of the 2013 ALTies is you, the reader

by Army AL&T Staff

The voting is over, the results are in, and the biggest winner of the 2013 Army AL&T magazine awards—the ALTies—is you, the reader, notwithstanding the individual winners and runners-up in each category.

"Each issue of Army AL&T is a collaborative process, a team effort," said Editor-in-Chief Nelson McCouch III. "Without our contributors, who help us continually raise the bar on quality, we would not have a magazine. But we have one that gets better with every issue."

Indeed, issue after issue, year after year, Army AL&T's readers contribute top-notch articles, commentary, photographs, graphics and advertisements of real value to readers. Whether it's a striking visual image that makes an article come alive, a graphic that says more than 1,000 words ever could, a commentary that makes you stop and think, or an article that helps you do your job better, the level of excellence is evident in every issue of *your* magazine.

This year's **ALTies** *go to:*

BEST ARTICLE (TIE)

WIRED FOR SUCCESS
by LTC Jeffery T. Yon and Mr. Jeffrey C. Faulkner,
Reserve Component Automation Systems,
Program Executive Office (PEO)
Enterprise Information Systems (EIS)
October–December 2013

PATH TO SUCCESS
by Ms. Kelly Courtney,
Project Manager (PM) Force Projection,
PEO Combat Support and Combat Service Support
January–March 2013

First Runner-up

IT TAKES A TEAM
by COL William E. Cole, Office of the
Assistant Secretary of the Army for Acquisition,
Logistics and Technology (OASA(ALT))
July–September 2013

BEST COMMENTARY

SPEAKING OF SAVINGS
by Mr. Thom Hawkins, PEO Command,
Control and Communications – Tactical (C3T);
and **Mr. Vince Dahmen**, PEO Ammunition
October–December 2013

First Runner-up

DRIVING COMPETITION
by LTC T.J. Wright,
Product Manager Precision-Guided Missiles
and Rockets, PEO Missiles and Space
April–June 2013

BEST PHOTO

TOTAL LOGISTICS INTEGRATION
Product Director U.S. Army Logistics
Modernization Program, PEO EIS
January–March 2013

First Runner-up

INTRODUCING CAPABILITY SET 13
by Ms. Claire Heininger, OASA(ALT)
January–March 2013

BEST GRAPHIC

THE FIVE PHASES OF THE UNIT
SET FIELDING PROCESS
PEO C3T
April–June 2013

First Runner-up

TIERED TECHNICAL KNOWLEDGE
C4ISR Integrated Process Team
July–September 2013

BEST AD

U.S. ARMY LOGISTICS
MODERNIZATION PROGRAM
PEO Enterprise Information Systems
October–December 2013

First Runner-up

CONNECTING TOMORROW'S WARRIORS
PEO C3T
October–December 2013

UPDATE YOUR BOOKMARKS

Army AL&T magazine's online presence is getting better! The new, improved online version of Army AL&T is available at **http://usaasc.armyalt.com/**.

You can also read the magazine on the go by downloading the Army AL&T app, available on Google Play and at the App Store (iOS).

ESTABLISHING HIGHER STANDARDS FOR KEY LEADERSHIP POSITIONS

Craig A. Spisak
Director, U.S. Army Acquisition Support Center

What really matters in defense acquisition? That's the question that the Hon. Frank Kendall, undersecretary of defense for acquisition, technology and logistics (USD(AT&L)), poses and answers in his column in the January-February 2014 edition of Defense AT&L Magazine. His conclusion to "What Really Matters in Defense Acquisition" is that, "at the end of the day it isn't those processes or policy documents … that really drive our results. What really matters in defense acquisition is our people and their professionalism and leadership."

Better Buying Power (BBP) 2.0 Focus Area 7 reflects the importance of increasing the professionalism of the defense acquisition workforce, which can pay huge dividends in the form of successful acquisition program management.

Recently, Kendall expanded on that focus area in his memorandum of Nov. 8, 2013, "Key Leadership Positions [KLPs] and Qualification Criteria." In that memo, he makes clear that his ultimate goal is to ensure program success and achieve efficiency through a professional, capable and qualified defense acquisition workforce. "We cannot afford to add risk to our programs by placing unqualified or unprepared personnel into KLPs," Kendall stated.

KLPs are a subset of critical acquisition positions (CAPs). Kendall stated, "KLPs require a significant level of authority commensurate with the responsibility and accountability for acquisition program success." Acquisition workforce members are so important to the programs they serve that these identified positions require special attention from the assistant secretary of the Army for acquisition, logistics and technology (ASA(ALT))/ Army Acquisition Executive (AAE) and the USD(AT&L) regarding assignment qualifications, accountability, mobility and tenure. Because we are a defense acquisition workforce, the AAE designates KLPs and the people who fill these positions, and the USD(AT&L) approves them.

Kendall's memo expands on guidance published in 2010 by identifying 10 mandatory KLPs and four other functional lead positions that are KLPs only if the acquisition program's type or life-cycle phase requires the position. The following positions must be treated as KLPs. Other than program executive officer (PEO), deputy PEO and senior contracting official, for the most part they are dedicated to a single Acquisition Category (ACAT) I or IA program:

- PEO and deputy PEO.
- Senior contracting official.
- Program manager (PM). (Note: ACAT II PM positions are also considered KLPs.)
- Deputy PM.
- Chief engineer or lead systems engineer.
- Product support manager (program lead logistician).
- Chief developmental tester.
- Program lead, business financial manager.

FIGURE 1

COMMON CROSS-FUNCTIONAL KLP REQUIREMENTS

Education	Level III certification in respective functional area	• Bachelor's degree (required). • Relevant advanced degree (preferred). • Senior service school (preferred).
Training		
Experience		• Candidate or incumbent must be GS-14/15, O-5/6 or senior. • Two years as a functional mentor (10 hours per year). • Cross-functional and broadening assignments/rotations. • Eight years of acquisition experience or equivalent demonstrated proficiency.

COMPETENCIES

	FUNDAMENTAL	LEADING CHANGE	LEADING PEOPLE	RESULTS-DRIVEN	BUSINESS ACUMEN	BUILDING COALITIONS	ENTERPRISE-WIDE PERSPECTIVE
Executive Leadership	Interpersonal skills. Written communication. Oral communication. Integrity/honesty. Continual learning. Public service motivation.	Creativity/innovation. Analytical thinking. External awareness. Flexibility. Resilience. Strategic thinking. Vision.	Conflict management. Leveraging diversity. Developing others. Team-building.	Accountability. Customer service. Decisiveness. Entrepreneurship. Technical credibility. Problem-solving.	Financial management. Human capital management. Technology management. Computer literacy.	Partnering. Political savvy. Influencing/negotiating.	Joint Perspective: Mission orientation. DOD mission and culture. DOD corporate perspective. National defense integration. Global perspective. National Security: Foundation. Environment. Strategy.

Program Execution	Program scheduling; risk management and mitigation; program health metrics/assessment/reporting/contractor performance assessment. Systems perspective/strategic thinking. Requirements/acquisition planning. Sustainment strategy planning and execution; integration of acquisition and life-cycle sustainment requirements.
Technical Management	Systems engineering design for optimized product performance; technical acumen; risk identification and management; configuration management; technical reviews and audits (such as: SRR, SFR, PDR, CDR, SVR/FCA, PRR, PCA and ISR). Logistics and product support; support and sustainment; supportability analysis; product support planning; technical or product data management; enterprise architecture; cybersecurity. Agile IT development; broad knowledge of IT governing policies and emerging technologies. Test and evaluation (T&E) strategy; T&E master plan; T&E infrastructure; development T&E assessments.
Business Management	Contract type/structure; intellectual property; source selection; protests; contract administration; E-biz/automated tool; Life-cycle sustainment funding; operating and support cost estimating, as identified in contracting input; business case analysis; budget exhibits; life-cycle cost estimating; cost-consciousness.

Currency	Minimum total of 80 continuous learning points for DAWIA two-year cycle, consisting of the following components: 1. At least 30 hours of functional specific training (exception: program management career field requires 50 hours of functional specific training). 2. At least 10 hours of leadership/professional training. 3. At least 10 hours of cross-functional training (career field-dependent).

KEY

CDR - Critical design review
DAWIA - Defense Acquisition Workforce Improvement Act
ISR - In-service review
PCA - Physical configuration audit
PDR - Preliminary design review
PRR - Production readiness review
SFR - System functional review
SRR - System requirements review
SVR/FCA - System verification review/functional configuration audit

KLP REQUIREMENTS

The cross-functional requirements for KLP qualification cover numerous parameters, but the five overarching factors for selection are education, training, experience, specific competency attainment and currency. (SOURCE: USD(AT&L))

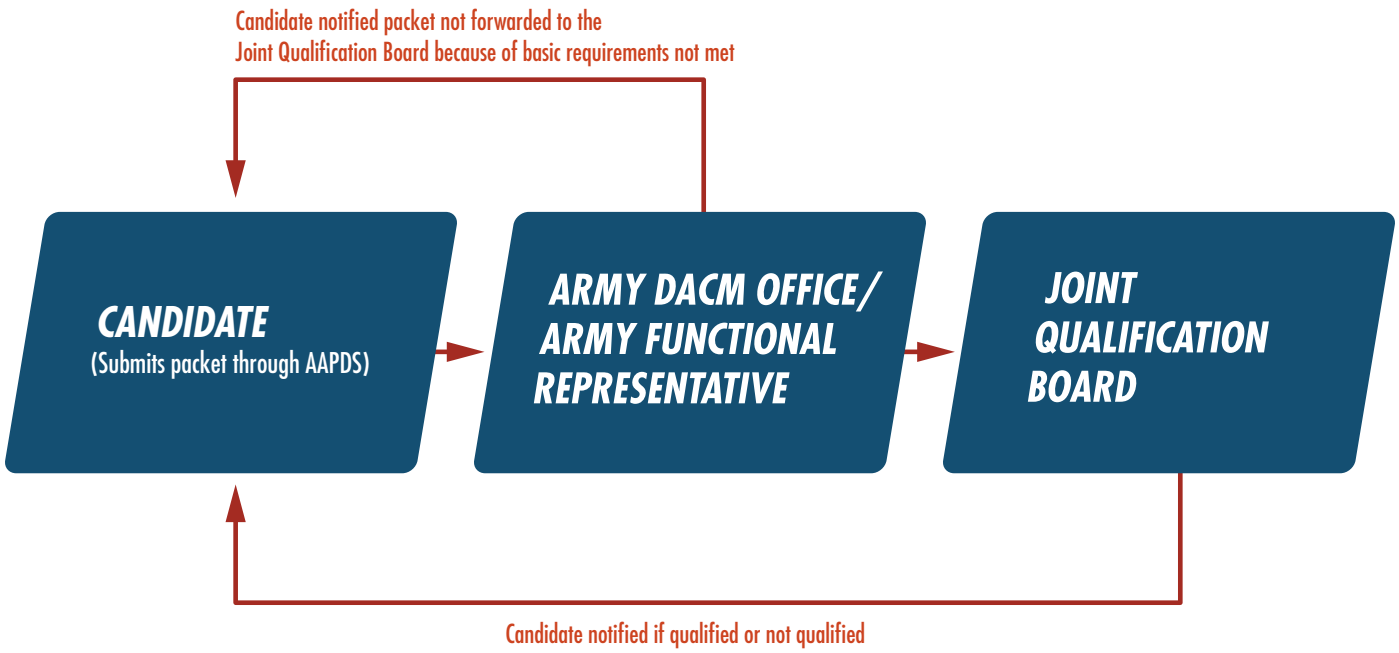
Following are the lead positions for ACAT I and lA major defense acquisition programs and major automated information system programs that are KLPs if they are essential based on the phase or type of program. These positions may be related to a single program or matrixed across multiple programs:

- Contracting officer.
- Cost estimator.
- Production, quality and manufacturing.
- Information technology (IT).

The 2013 memo provides insight into new requirements for people occupying KLPs. (See Figure 1.) First, there are common cross-functional KLP requirements representing five key factors essential for KLP selection: education, training, experience, specific competency attainment and currency.

In addition, there are acquisition career field requirements—skills and experiences specified as mandatory and preferred (highly desired). I recommend that anyone aspiring to serve in a KLP take the right steps now to achieve this level of competency.

FIGURE 2



KLP BOARD PROCESS
Joint qualification boards will review and approve candidates for KLPs. The Army DACM Office of the U.S. Army Acquisition Support Center (USAASC), in coordination with the Army functional representative, will collect applicant packets and review them for compliance with KLP requirements. (SOURCE: USAASC)

"The selection of qualified personnel to fill KLPs is essential for the organization and the individuals filling these highly demanding positions," Kendall's memo stated. The memo also introduced the concept of a KLP joint qualification board for prequalifying personnel as ready to occupy a KLP should a vacancy become available. A grandfather provision gives current KLP incumbents until June 30, 2015, to meet these new requirements.

ARE YOU A KLP?

My staff at the USAASC Director, Acquisition Career Management (DACM) Office conducted a baseline assessment of current KLP incumbents against the required and preferred criteria to determine the percentage of current KLP incumbents who meet the requirements. We will share the assessment with each program executive office no later than May 31, 2014, identifying specific details regarding the incumbent KLPs who do not meet the requirements and what these incumbents will need to achieve to meet them.

These baseline details will allow the PEOs to work with KLP incumbents for a year until the deadline of June 30, 2015.

JOINT QUALIFICATION BOARDS

In his memo last fall, Kendall made clear that qualification boards for KLPs will not only ensure that those currently occupying such positions are appropriately qualified, but will also "create a pool of Level III certified personnel who are ready to fill KLPs."

Through tiger teams under the direction of the Office of the Secretary of Defense, the positions of program lead, systems engineer and program lead, developmental tester will be the first KLPs to test the joint qualification board concept. The engineer and developmental tester KLP joint qualification boards, held separately, will serve as a pilot opportunity, setting the standard operating procedures for all other KLP joint qualification boards to follow.

We expect implementation of these two joint qualification board pilots to take place by the fourth quarter of FY14. My Army

BBP 2.0 Focus Area – 7 | Improve the professionalism of the total acquisition workforce

- Establish higher standards for key leadership positions.
- Establish increased professional qualification requirements for all acquisition specialties.
- Continue to increase the recognition and support of excellence in acquisition management.
- Continue to increase the cost-consciousness of the acquisition workforce—change the culture.

FOCUS ON PROFESSIONALISM
Improving the professionalism of the acquisition workforce is a central tenet of Kendall's BBP 2.0 initiative, as Focus Area 7 spells out in detail. (SOURCE: USAASC)

DACM Office staff has participated with the tiger team efforts since their inception in September 2013, to ensure that Army input is considered in implementing the joint qualification board pilots and to affect standard operating procedures for all KLPs.

CONCLUSION

To begin the KLP joint qualification board application review process, the Army DACM Office will distribute a call for nominations to all Army Acquisition Corps members. (See Figure 2.) Applicants will submit their application packages online using the Army Acquisition Professional Development System (AAPDS) within the Career Acquisition Management Portal.

The Army DACM Office, in coordination with the Army functional representative, will collect applicant packets and review them for compliance with KLP requirements. After this review, the intent is for the Army DACM office to consolidate applicant packages into one component-level submission to the identified USD(AT&L) office responsible for the KLP board.

My staff will officially maintain KLP incumbent information, updating it as required, in the Army DACM Office in coordination with the PEOs. Because these new KLP requirements will change the career path of all acquisition positions, the Army DACM Office is preparing acquisition career development and talent management details for the entry, journeyman and senior-level positions to ensure attainment of the building blocks of a KLP from day one and to focus on talent management. For the continued success of our programs and workforce development growth, we must change acquisition career development in line with USD(AT&L) KLP guidance.

For more information on additional specific functional requirements, go to ***http://icatalog.dau.mil/onlinecatalog/CareerLvl.aspx****. To view Kendall's memo of Nov. 8, 2013, go to* ***http://asc.army.mil/web/wp-content/uploads/2014/01/KLPUSA001464-13.pdf****.*

EDUCATION and TRAINING UPDATE

EDUCATION AND TRAINING OPPORTUNITIES

School of Choice (SOC): There will not be a SOC announcement in FY14 because of the current fiscal environment. Should a command have an urgent need to send a high-performing workforce member to obtain his or her bachelor's or master's degree during duty time, please contact the U.S. Army Acquisition Support Center (USAASC) Acquisition Education and Training Branch Chief Scott Greene, to discuss potential funding through the Director, Acquisition Career Management (DACM) Office.

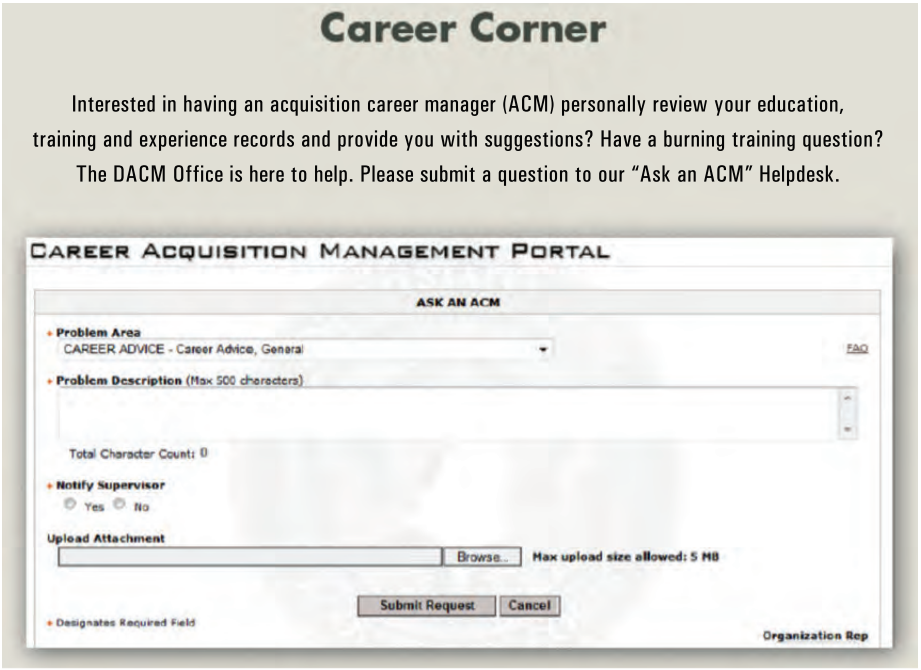
DEFENSE ACQUISITION UNIVERSITY TRAINING

- **FY14 DAU course registration:** Students should continue to apply to the FY14 schedule using the Army Training Requirements and Resources Internet Training Application System (AITAS) at **https://atrrs.army.mil/channels/aitas/**. Planning and applying early will afford students a better chance of obtaining a class in the time frame requested.

  Encourage your supervisor to approve your training request as soon as you apply. Supervisors must approve training requests in AITAS for application processing by the USAASC registration office. Students should view the DAU iCatalog at **http://icatalog.dau.mil** to ensure that they meet the prerequisite(s), before applying to a DAU course. Workforce members should plan their training with their supervisors to ensure that they have adequate time to complete prerequisite training before attending the follow-on course.

  For more information on DAU training, including systematic instructions, definition of training priorities and frequently asked questions, go to USAASC's DAU webpage at **http://asc.army.mil/web/career-development/programs/defense-acquisition-university-training/**.

- **FY15 DAU schedule build:** The Army DACM Office, in conjunction with DAU, is in the early phase of developing the FY15 schedule. The anticipated go-live date for the FY15 schedule is May 15. Students should plan their training schedules to meet prerequisite requirements before registering for an FY15 course. Doing so will ensure timely completion of certification requirements and will better enable students to obtain a reservation in their desired time frame.



- **Student application profile:** It is imperative that student and supervisor email addresses are correct in the AITAS student profile. Also, any student with a disability should be sure to select "Yes" on the student profile. This selection prompts a DAU Student Services representative to contact the student directly with additional questions and to provide reasonable accommodations during the training period.

- **Low-fill classes:** A weekly low-fill listing, posted weekly at **http://icatalog.dau.mil/onlinecatalog/tabnav.aspx**, allows students the opportunity to attend classes coming up in the next 60 days. Low-fill classes are available on a first-come, first-served basis within 60 days from the start date of the class for students in Priority 2, and within 40 days for Priority 3-5 students. Even if a class is on the low-fill list, students must choose a cost-effective location to minimize travel costs.

- **Alternate delivery method courses:** In a constrained fiscal environment, DAU is looking at using innovative ways to provide the same capacity (57,000 seats) while ensuring effective learning. Alternate delivery pilots include video teleconferencing; telepresence using high-definition resolution; Defense Connect Online; and "flipped" classrooms, whereby students watch recordings of their professors' lectures before class and then do "homework" in class. The pilots will continue until the end of FY14. Upcoming pilots include telepresence for three FE 301 offerings (at Fort Belvoir, VA; Huntsville, AL; and California, MD) and PMT 401 (Kettering, OH). ACQ 370 is being conducted in April 2014 at Chester, VA, using the flipped classroom format.

- **College of Contract Management (CCM):** CCM is a new business unit under DAU with the primary goal of supporting tailored training for Defense Contract Management Agency (DCMA) employees. DAU deployed two new resident courses offered under CCM: CMA 211 – Joint Government Flight Representative (GFR) and CMA 221 – Joint Government Ground Representative (GGR). Both are certification courses intended for those who will serve as appointed GFRs or GGRs. Supervisors, commanders, contracting officers, contractor employees or members of another discipline outside of aircraft operations who are interested in this subject matter can pursue Continuous Learning Module CLX 110, Fundamentals of GRF and GGR. Commands must fund travel for both courses. DCMA employees should seek funding from their units.

ON THE MOVE


LTG Michael E. Williamson

ASA(ALT) WELCOMES NEW MILITARY DEPUTY

LTG Michael E. Williamson has been named the new military deputy (MILDEP) to the assistant secretary of the Army for acquisition, logistics and technology (ASA(ALT)); director, Army Acquisition Corps (AAC); and director, acquisition career management (DACM). Williamson succeeds LTG William N. Phillips, who retired. He takes the reins after serving as deputy commanding general (DCG), Combined Security Transition Command – Afghanistan, Operation Enduring Freedom.

Williamson's recent assignments include assistant MILDEP, assistant deputy for acquisition and systems management, Deputy Program Executive Officer (PEO) Integration, and Joint PEO Joint Tactical Radio System, among numerous program management positions. Williamson, who received his commission in 1982 through ROTC, holds an M.S. in material acquisition management from the Naval Postgraduate School and a B.S. in business administration from Husson College.


LTG William N. Phillips

PHILLIPS RETIRES AFTER 37-PLUS YEARS

LTG William N. Phillips retired from the Army April 4 after nearly 38 years of military service, the last four of them as the MILDEP, DACM and director, AAC in the Office of the ASA(ALT). Phillips began his Army career in 1976, receiving his commission in the field artillery through ROTC, and served in a number of procurement and staff positions in Army aviation.

Phillips' legacy as Army acquisition's top officer includes several achievements that have enhanced the Army Acquisition Workforce, including improving certification rates by 26 percentage points; raising the continuous learning point tempo by 22 percent, increasing individual development plan reviews by 22.4 percent; and reducing the student "no show" rate for acquisition classes by 55.2 percent.

His awards and decorations include the Distinguished Service Medal; Defense Superior Service Medal; Legion of Merit (with three oak leaf clusters); Bronze Star Medal; Defense Meritorious Service Medal (with oak leaf cluster); Army Commendation Medal (with two oak leaf clusters); Air Assault Badge; and Senior Army Aviator Badge.

Phillips plans to begin his retirement by spending time with his family before making any long-term decisions.

TRADOC CHANGES COMMAND

GEN David G. Perkins assumed command of U.S. Army Training and Doctrine Command (TRADOC) from **GEN Robert W. Cone** in a March 14 ceremony at Joint Base Langley–Eustis, VA, hosted by **Army Chief of Staff (CSA) GEN Raymond T. Odierno.**

TRADOC CSM Daniel A. Dailey, incoming CG GEN David G. Perkins, outgoing CG GEN Robert W. Cone and CSA GEN Ray T. Odierno salute during the national anthem at Joint Base Langley–Eustis March 14. (U.S. Army photo by SGT Mikki L. Sprenkle, Army Multimedia and Visual Information Directorate)

"Today, we have an opportunity to not only recognize two great leaders, but to celebrate TRADOC," said Odierno. "Whether developing leaders, concepts or capabilities, TRADOC is dedicated to sustaining our Army and simultaneously moving it into the future."

Cone, who assumed command of TRADOC in April 2011 and is retiring this spring, said he believed it necessary to have another exceptional leader take his place as he finishes his tenure in the Army. "I loved commanding here at TRADOC, but it is necessary to bring [new ideas] to the force, and I am happy to see [Perkins] take the position," he said.

Perkins said he knows the tasks before him, thanks to his predecessors, and hopes to continue the work that Cone and the TRADOC team started. "After accepting the colors today, I understood the responsibility placed in my rucksack," said Perkins. "As we design the Army, we also design the future of our nation, and that is a responsibility I will not take lightly."

Perkins said his commitment is not only to the American people, but also to a Soldier on the front line who knew he was a part of TRADOC. "During [a deployment], a young [Soldier] came up to me and said he hopes I'll 'get it right,' because those instructions and orders keep him alive," said Perkins. "I hope to meet the standards set by [senior Army leadership], but my true commitment is to that [Soldier] and all the others fighting each and every day."

Perkins assumes command after serving as CG of the U.S. Army Combined Arms Center. He graduated from the United States Military Academy at West Point in 1980. Additionally, he received a master's degree in mechanical engineering from the University of Michigan and a master's degree in national security and strategic studies from the U.S. Naval War College.

CROSBY HANDS OVER LEADERSHIP OF PEO AVIATION

PEO Aviation had a change-of-charter ceremony Jan. 24 at Redstone Arsenal, AL, at which **MG William T. "Tim" Crosby** relinquished the charter to **BG Robert L. "Bob" Marion**, who had received his first star in a ceremony earlier in the day. Crosby, who assumed the charter of PEO Aviation in December 2008, retired after almost 35 years of military service. The **Hon. Heidi Shyu**, ASA(ALT), presided over both ceremonies.

"Tim recognized the need to build into our acquisition strategies the ability to upgrade as technology progresses and led his large, complex portfolio and team with both discipline and a great spirit and humor," said Shyu.

During his tenure, Crosby championed several principal helicopter modernization efforts, including the CH-47F Chinook,

AH-64E Apache and UH-60M Black Hawk, in addition to the unprecedented growth of Army unmanned aircraft systems, whose rapid addition to the wars in Iraq and Afghanistan led to innovations such as communications relay and the use of manned-unmanned teaming.

Crosby entered the Army in 1979 as a field artillery officer and went on to receive his aviator wings in 1982. He served in a variety of command, staff and program management positions in aviation.

Among Crosby's awards and decorations are the Distinguished Service Medal, Legion of Merit, Bronze Star, Defense Meritorious Service Medal, Meritorious Service Medal and Air Medal. During his retirement ceremony on Jan. 24, he received the Honorable Order of St. Michael Gold award from the Army Aviation Association of America.

Crosby attributed the success of PEO Aviation to the workforce. "It really boils down to having great people," he said, adding, "Soldiers may not know your faces, but they know that they have a product they can trust."

Marion assumed responsibility of an acquisition workforce of more than 3,000 military, government civilian and contractor personnel and an annual average budget of more than $7.5 billion, the largest procurement budget in the Army.

Marion is no stranger to PEO Aviation, most recently serving as the project manager for cargo helicopters before leaving in May 2013 to take an assignment as the assistant deputy for acquisition and systems management in the Office of the ASA(ALT), where Shyu came to know Marion well.

"Bob is an excellent choice to lead this program executive office and build on its achievements," said Shyu at Marion's promotion ceremony. Shyu noted that Marion possesses many of the leadership traits of President Dwight Eisenhower, for whom he has a deep respect. "He admires that Eisenhower was a humble leader who didn't need to take credit for his accomplishments. He admires that Eisenhower cared about getting the job done, finding common ground, taking responsibility when things didn't go as planned, and always giving credit to his subordinates. He admires the selfless service of Eisenhower and the fact that he embodied our Army core values," Shyu said.

"Bob Marion has taken these admirable traits of President Eisenhower and made them his own as he moved through the Army ranks. These traits have contributed to his success and will continue to define him as he assumes increasing levels of leadership," she said.

"This is about all of you," Marion said at the ceremony, "all my family and friends, all our partners in industry, all of our partners across this post and in the Pentagon, all of us pulling together and getting things done."

AWARDS

CECOM LOGISTICIAN GARDUNO HONORED

Gregory J. Garduno received the 2012 U.S. Army Materiel Command's (AMC's) Robertson J. Short Logistics Assistance Representative (LAR) of the Year Award Jan. 7 for his outstanding achievement, dedication and performance.

A former Army radar repairer, Garduno has been serving as a U.S. Army Communications-Electronics Command (CECOM) sensor LAR, supporting intelligence electronic warfare and radar systems for the 4th Brigade Combat Team of the 1st Cavalry Division at Fort Hood, TX, since 2010.

"I am very honored to receive this distinguished award," said Garduno. "I strive to support the warfighter, because they are the real heroes." The award recognizes an individual for outstanding achievement and support in the logistics assistance program. LAR technicians embed with deployed units to provide guidance on weapon systems, equipment and logistics problems.

Lloyd D. Hayslip, regional technical assistance manager for CECOM at Fort Hood, spoke highly of Garduno. "Garduno is an exceptional LAR who goes above and beyond the call every day, supporting Soldiers and keeping supported equipment at near 100 percent readiness," said Hayslip.

Garduno deployed to Kuwait in support of Operation Spartan Shield. During his deployment, he provided technical expertise on radar systems for the Kuwait area of operations, as well as assisting the Jordan Armed Forces through an acquisition and cross-servicing agreement to repair their radars. He has also deployed to Kandahar, Afghanistan, and Baghdad, Iraq, during his service at CECOM.

DAU WELCOMES NEW PRESIDENT

Undersecretary of Defense for Acquisition, Technology and Logistics (USD(AT&L)) the **Hon. Frank Kendall** officially welcomed **James P. Woolsey** as the new president of Defense Acquisition University (DAU) during a ceremony Feb. 19 at the Pentagon. Woolsey will be responsible for building upon DAU's outstanding reputation as the primary DOD learning institution for the 151,000 members of the Defense Acquisition Workforce while overseeing the development of new curriculum and learning opportunities that facilitate implementation of the USD(AT&L)'s Better Buying Power 2.0 initiatives. (Photo by Erica Kobren, DAU)

PARTNERS IN LEADERSHIP

Ginger Perkins pins the rank of general on her husband, **GEN David G. Perkins,** March 14 as he assumes command of TRADOC at Joint Base Langley–Eustis. (U.S. Army photo by SGT Mikki L. Sprenkle, Army Multimedia and Visual Information Directorate)

CRITICAL THINKING FOR THE FUTURE FORCE

GEN Robert W. Cone gives his final speech as the TRADOC commander, March 14 at Joint Base Langley–Eustis. In remarks about Force 2025 Feb. 20 at the Association of the United States Army Winter Symposium and Exposition, Cone said, "As you think about where our Army is today, with the reduced OPTEMPO that we're looking at, we want to involve more of our Army, a broader slice of the Army, in the experimentation and exercise business. Bring more people; invite our youngest, greatest talent, our noncommissioned officers and our young officers, to help us think about the future." Cone is retiring after 35 years of service. (U.S. Army photo by SGT Mikki L. Sprenkle, Army Multimedia and Visual Information Directorate)

GENERAL OFFICER CHANGES

The Senate on March 11 confirmed **President Barack Obama's** nomination of **MG Kevin W. Mangum** to the rank of lieutenant general. Mangum, now DCG and chief of staff, TRADOC, Joint Base Langley-Eustis, VA, formerly was CG, U.S. Army Aviation Center of Excellence and Fort Rucker, AL.

Secretary of Defense **Chuck Hagel** announced that **President Obama** has nominated **MG Gustave F. Perna** for appointment to the rank of lieutenant general and assignment as deputy chief of staff, G-4, Washington, DC. He is currently serving as deputy chief of staff for logistics and operations, U.S. Army Materiel Command, Redstone Arsenal, AL.

*CSA **GEN Raymond T. Odierno** announced the following officer assignments:*

MG Jonathan A. Maddux, assistant MILDEP to the ASA(ALT), Washington, DC, to PEO Simulation, Training and Instrumentation, Orlando, FL.

BG Susan A. Davidson, commander, Defense Logistics Agency Distribution, Defense Logistics Agency, New Cumberland, PA, to CG, Military Surface Deployment and Distribution Command, Scott Air Force Base, IL.

BG James E. Simpson, commander, Joint Theater Support Contracting Command, U.S. Central Command, Operation Enduring Freedom, Afghanistan, to director for contracting, Office of the ASA(ALT).

The following general officers have been placed on the retirement roll.

LTG Robert P. Lennox culminated more than 36 years of service as the principal deputy director of cost assessment and program evaluation, Office of the Secretary of Defense, Washington, DC.

BG Joseph L. Bass culminated more than 30 years of service as the director for contracting, Office of the ASA(ALT), Washington, DC.

OFF THE SHELF

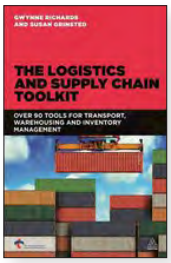
RECOMMENDED READING LIST

Army leaders have always encouraged their Soldiers to read. Even—and especially—in this age of information overload, the pursuit of knowledge through books is essential to develop a fuller understanding of acquisition, logistics and technology. In the words of GEN Raymond T. Odierno, chief of staff of the Army, "We can never spend too much time reading and thinking about the Army profession and its interaction with the world at large. … There is simply no better way to prepare for the future than a disciplined, focused commitment to a personal course of reading, study, thought, and reflection." On that note, we publish "Off the Shelf" as a regular feature to bring you recommended reading from Army AL&T professionals. For this issue, we had the able assistance of the Defense Acquisition University Knowledge Repository Reference Librarian Team.

DOING RESEARCH THAT MATTERS: SHAPING THE FUTURE OF MANAGEMENT

by Marco Busi
(Bingley, UK: Emerald Group Publishing Ltd., 2013, 200 pages)

Busi, who has a doctorate in supply chain performance management, looks at an old issue from a new perspective, taking a cross-disciplinary approach to learning how we can contribute to shaping the future of management. In his quest to become a better management innovator, the author reviews the work of management gurus Rob Goffee, Robert Kaplan, Barbara Kellerman, Philip Kotler, John Kotter, Howard Gardner, Costas Markides, Roger Martin, Henry Mintzberg and David Ulrich; Nobel laureates Gerhard Ertl, Douglas Osheroff, Elinor Ostrom, Jack Szostak and Harald zur Hausen; and world-renowned astrophysicist Margherita Hack. Busi shares the wisdom he gained from interviews with these luminaries to highlight patterns in how pioneers identify a problem worth researching, generate an outcome worth spreading and conduct a career worth having.



THE LOGISTICS AND SUPPLY CHAIN TOOLKIT: OVER 90 TOOLS FOR TRANSPORT, WAREHOUSING AND INVENTORY MANAGEMENT

by Gwynne Richards and Susan Grinsted
(Philadelphia, PA: Kogan Page, 2013, 328 pages)

To run successful logistics operations, managers need a breadth of knowledge of the tools and techniques for maintaining efficiency in the supply chain. This handbook provides logistics managers with a comprehensive set of tools to tackle many day-to-day issues in order to drive efficiency and business success in a busy, rapidly moving environment. The authors offer quick, reliable advice and combine crucial logistics tools with key business techniques, including cause-and-effect and SWOT (strengths, weaknesses, opportunities and threats) analyses and Gantt charts. The authors explain each tool, put it into context and provide examples of how to use it.

TEN TYPES OF INNOVATION: THE DISCIPLINE OF BUILDING BREAKTHROUGHS

by Larry Keeley, Ryan Pikkel, Brian Quinn and Helen Walters
(New York, NY: Wiley, 2013, 276 pages)

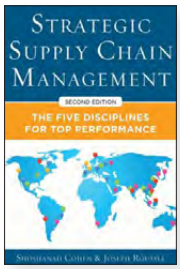
Looking at more than 2,000 successful innovators and innovations, including Cirque du Soleil, early IBM mainframes and the Model T Ford, the authors applied a proprietary algorithm and determined 10 meaningful groupings—the 10 types of innovation—that provide insight into what goes into making it happen. The authors further explore patterns of innovation within industries.

The book demonstrates how to look at powerful types of innovation that can be leveraged for competitive advantage and lays out fresh ways to think, then explains the actions that enable teams or firms to innovate reliably and repeatedly.

GLOBAL LOGISTICS STRATEGIES: DELIVERING THE GOODS

by John Manners-Bell
(Philadelphia, PA: Kogan Page, 2013, 281 pages)

Manners-Bell examines how the logistics industry has developed and shows how it is influenced by macroeconomic factors and demand-side trends, what the risks are to the industry and how it is likely to develop over the coming years. The author explores the unique microeconomic dynamics of six key logistics segments: freight forwarding, contract logistics, shipping, road freight, air cargo and express. He also explains how a downturn affects logistics companies' revenues and profitability, and how the impact depends on such factors as whether they own assets or manage them. Additionally, Manners-Bell examines the individual supply chain dynamics and logistics demands of the major vertical sectors: automotive, chemical, pharmaceutical, retail, consumer and high-tech.



STRATEGIC SUPPLY CHAIN MANAGEMENT: THE FIVE CORE DISCIPLINES FOR TOP PERFORMANCE, SECOND EDITION

by Shoshanah Cohen and Joseph Roussel
(New York, NY: McGraw-Hill, 2013, 336 pages)

The global landscape has changed a great deal since the first edition of this book was published in 2005, establishing Cohen and Roussel as authorities on creating value and achieving competitive advantage from the supply chain. Effective supply chain management is now much more challenging and much more critical to the bottom line as a result of several factors, including shorter economic cycles, more frequent natural disasters, higher costs in low-cost countries, restricted access to working capital and greater focus on sustainability.

This updated edition contains cutting-edge research as well as 80 easy-to-read tables and diagrams that draw on company examples, and shows how supply chains can become more agile, flexible and resilient.

BIG DATA: A REVOLUTION THAT WILL TRANSFORM HOW WE LIVE, WORK AND THINK

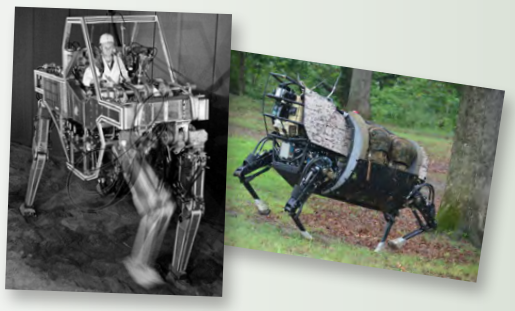
Viktor Mayer-Schönberger and Kenneth Cukier
(New York, NY: Eamon Dolan/Houghton Mifflin Harcourt, 2013, 256 pages)

While there is no precise definition of what constitutes big data, the term usually refers to the capture of enormous amounts of different, seemingly unrelated data. Yet that imprecise definition is part of the strength of using big data to make better decisions. Here, the authors define big data as information that can be generated on a large scale but not on a smaller one. They see potentially dramatic impacts from big data on the way we think about business, health, politics, education and innovation, but also fresh threats to privacy as well as possible penalties for things we haven't even done yet, based on big data's ability to predict future behavior.

A wealth of suggested reading titles is in GEN Odierno's professional reading list, online at ***http://www.history.army.mil/html/books/105/105-1-1/index.html****. Is there a book you'd like to recommend for this column? Send us an email at* ***armyalt@gmail.com****. Please include your name and daytime contact information.*

THEN & NOW

1969 & 2014



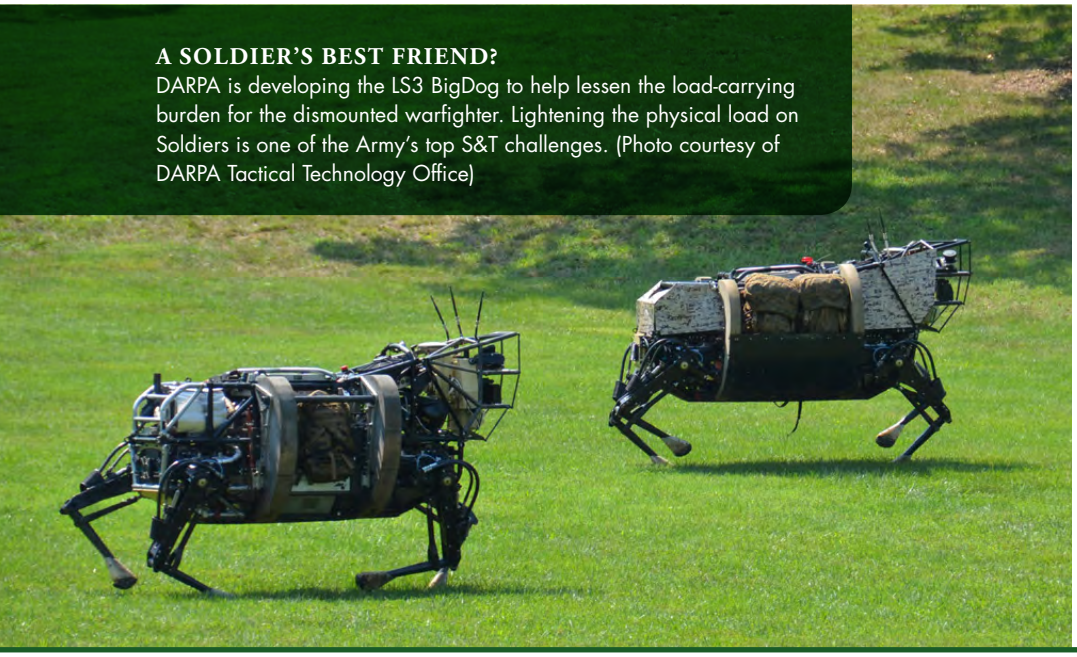
Ground mobility and load-bearing over natural terrain have been serious military consideration throughout history. Hannibal crossed the Alps with his load-bearing war elephants in the second century B.C. Horses bravely charged at cannons in the Charge of the Light Brigade in 1854. In 1898, horses hauled heavy artillery up San Juan Hill, and again through the muddy battlefields of World War I.

Horses gave way to wheeled and tracked vehicles, which have evolved into those used in modern-day warfare, navigating treacherous terrain from World War II Europe and the jungles of the South Pacific to Korea and Vietnam and most recently the rubble-strewn mountains of Afghanistan. Over the centuries, "taking the fight to the enemy" over uncertain ground has been a constant. The object: Find a way to make it easier for the Soldier to accomplish the mission, no matter the obstacle or weight of the load.

Enter the Quadruped mobility machine, developed by the Advanced Research Projects Agency (ARPA), DOD and the Army. According to an article in the April 1969 Army Research and Development Newsmagazine (now Army AL&T magazine), the 3,000-pound experimental unit, a manned vehicle with four humanlike mechanical legs, "looks like [something] out of 'The Weird World of Tomorrow.'" During testing, the Quadruped demonstrated its expertise by climbing obstacles, lifting a small vehicle and hoisting a 500-pound load onto a truck, "thereby impressively indicating its potentialities." Now, the Army has identified the excessive physical burden on dismounted warfighters as one of its top science and technology (S&T) challenges. Hence, the creation of the BigDog robot by ARPA's successor, the Defense Advanced Research Projects Agency (DARPA). Debuting in 2005, BigDog was to serve as a robotic pack mule to accompany Soldiers in terrain too rough for conventional military vehicles. A variant of BigDog is the Legged Squad Support System (LS3) four-legged robot—essentially a headless horse without a rider. BigDog's goal is to demonstrate that a semiautonomous, legged robot can carry 400 pounds a load, follow Soldiers through rugged terrain and provide an auxiliary power source for recharging electronic devices.

In the future, DARPA hopes BigDog will follow in the path of its Soldier-leader, use its local perception to avoid obstacles and understand warfighters' commands. The robotic LS3 BigDog is a long way from the human-operated Quadruped, a testament to a decade of research in robot perception and autonomy. But the fundamental goal of both projects is the same: to provide the warfighter the decisive edge on the battlefield.

For more information on BigDog LS3, go to ***http://www.darpa.mil/our_work/tto/programs/legged_squad_support_system_(ls3).aspx****. For a historical tour of AL&T over the past 53 years, go to the Army AL&T magazine archives at* ***http://asc.army.mil/web/magazine/alt-magazine-archive/****.*



A SOLDIER'S BEST FRIEND?
DARPA is developing the LS3 BigDog to help lessen the load-carrying burden for the dismounted warfighter. Lightening the physical load on Soldiers is one of the Army's top S&T challenges. (Photo courtesy of DARPA Tactical Technology Office)

GSA Wants to Hear From You:

How do we improve the MILSTRIP Ordering System?

The U.S. General Services Administration (GSA) is seeking active-duty military users of the Military Standard Requisitioning and Issue Procedures (MILSTRIP) to participate in a customer survey. MILSTRIP is used to order supplies from GSA Global Supply, a one-stop, online source to shop and order government-supplied products that can be delivered to civilian and military locations around the world.

To participate in the survey, users may provide GSA with their initial contact information online via [http://www.gsa.gov/milstripsurvey] and will be added to a future sampling group.

Feedback collected from the survey is confidential and will be used to make improvements in GSA's supply support and shipments to military locations worldwide.

GSA

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"We should remember the French had a better tank in the opening stages of World War II, but they had the wrong idea and lost their country for several years because of that."

MG William C. Hix
Deputy Director
and Chief of Staff,
Army Capabilities Integration Center

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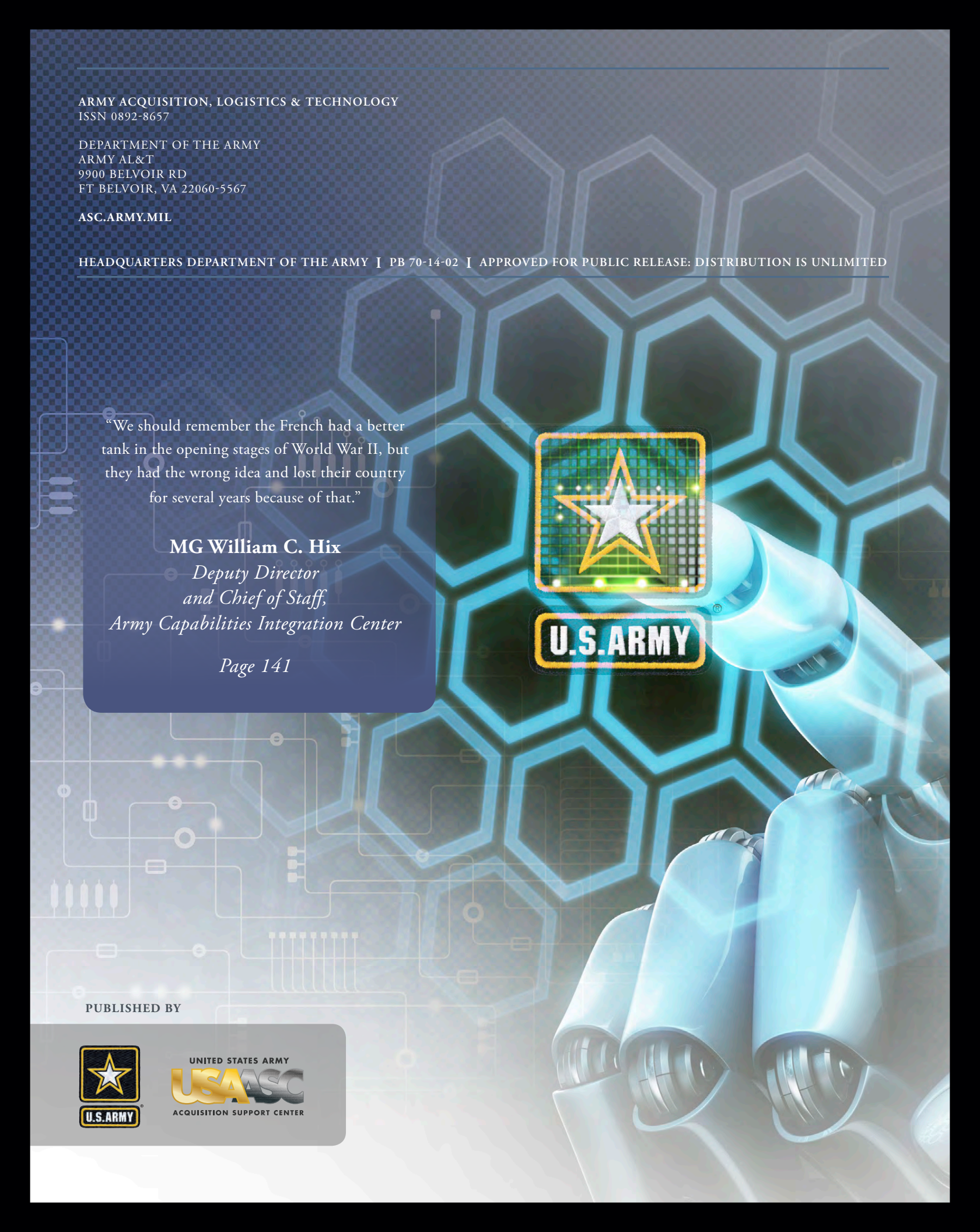

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