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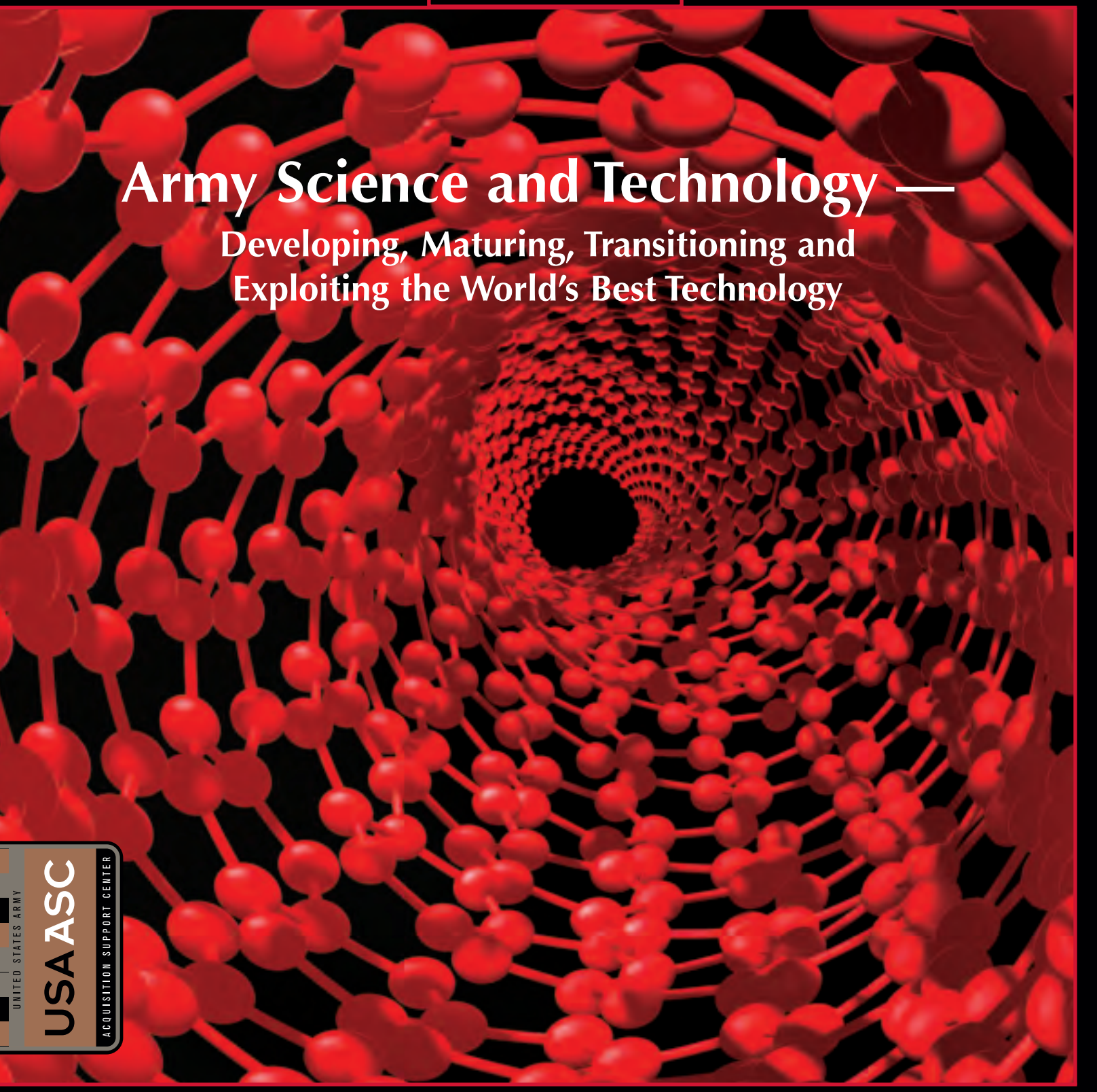
October - December 2007



Army Science and Technology —
Developing, Maturing, Transitioning and Exploiting the World's Best Technology

USA ASC
UNITED STATES ARMY
ACQUISITION SUPPORT CENTER

From the Army Acquisition Executive

Army Science and Technology

Supporting an Army at war is critical, both tactically and strategically. From a tactical standpoint, we are working with our sister services and industry partners to provide the weapon systems and equipment our Soldiers need to accomplish their mission decisively and return home safely. Strategically, as we meet ongoing requirements, we are working to collapse the timeline that it takes to get weapon systems and equipment to our Soldiers. Our goal is to compress the concept-to-combat cycle to meet the immediate and future needs of our warfighters.

The science and technology (S&T) community has a pivotal role in pursuing technologies to maintain and enhance the Army's already advanced capabilities. Our dynamic and responsive S&T portfolio is focused to enable specific new capabilities in the Future Force while remaining agile to satisfy the Current Force's operational needs. Capabilities from Army S&T ultimately provide our Soldiers with unmatched warfighting capabilities.

Army S&T has made numerous contributions to winning the global war on terrorism, and technological superiority continues to be a cornerstone of our military strategy as well as a deterrent against our adversaries. Let me highlight a few significant examples of the successful application of technology:

- First, Soldiers benefit today from technologies that emerged from past investments. Since the mid-1980s, the U.S. Army Natick Soldier Research, Development and Engineering Center has pursued advanced fiber technologies, in partnership with industry, to create lighter weight ballistic protection. This research produced the technologies to develop the lifesaving outer tactical vest and components for the protective plate inserts that Soldiers deployed worldwide use today.
- Second, we exploit transition opportunities by accelerating mature technologies from ongoing S&T efforts. The Army S&T program has transitioned the Mid-Range Munition (MRM) to system design and development for the Future Combat Systems (FCS)-Mounted Combat System. MRM is the first 120mm smart munition, and will provide FCS with a heavy armor defeat capability from line-of-sight to beyond-line-of-sight range.
- Third, we leveraged the expertise of our scientists and engineers to develop solutions to unforeseen problems encountered during current operations. Engineers at the U.S. Army Research Laboratory and the U.S. Tank Automotive Research, Development and Engineering Center have extensive experience in designing armor for the Army's combat vehicles. This team rapidly responded to a critical need by designing and demonstrating add-on armor survivability kits for High-Mobility Multipurpose Wheeled Vehicles for enhanced survivability. As new technology became available, the S&T community quickly recognized its operational potential. The new Mine Resistant Ambush Protected vehicles, designed to meet emerging threats in theater, are being manufactured and fielded now. The vehicles also increase mobility and enhance mission success. The S&T community continues to use its expertise to provide survivability upgrades, as needed, for this and all platforms in theater.

Army scientists and engineers execute their work in world-class Army facilities and also in cooperation with industry, universities, and other government scientists and engineers. The U.S. Army Research, Development and Engineering Command's International Technology Centers (ITCs) search the world for innovative technologies, state-of-the-art equipment and cooperative opportunities with allied and friendly nations. Their mission is to find and bring new technology developments to the field quickly, while keeping abreast of new research and development (R&D) trends leading to the S&T breakthroughs of tomorrow. Through direct engagement with foreign scientists and engineers, the ITCs have brokered a number of technology "finds" that have transitioned or are in the process of transitioning to our Soldiers including, non-lethal weapon ballistics protection shields from Slovenia (purchased by the Rapid Equipping Force), and Viral Inactivated Freeze-Dried Human Plasma from Germany (advanced development program at the U.S. Army Medical Research and Materiel Command).

In addition, the Army currently maintains four University Affiliated Research Centers, highlighted in this edition, that partner with industry and Army laboratories to transition new knowledge and novel technology concepts for further development. The Institute for Advanced Technology, established with the University of Texas-Austin, conducts long-term, theoretical and applied R&D in electrodynamics and hypervelocity physics that is focused on electromagnetic gun application. The Institute for Creative Technologies (ICT), established with the University of Southern California, performs research in advanced simulation and immersive environments. ICT leverages the resources and talents of the entertainment and game development industries to work collaboratively with Army experts in graphics, to improve the realism and usefulness of simulation for Soldier training and mission rehearsal. The Institute for Soldier Nanotechnology, established with the Massachusetts Institute of Technology (MIT), performs research in nanotechnologies for Soldier protection and survivability applications. Finally, the Institute for Collaborative Biotechnologies, established by the University of California-Santa Barbara, in partnership with MIT and the California Institute of Technology, researches bio-inspired materials with potential application to a broad spectrum of Army needs.

American Soldiers serve with distinction in Iraq and Afghanistan, in the Balkans, in Kuwait, in the Sinai, in Korea and in many other countries throughout the world. They face threats that change — quite literally — overnight, and their skill in meeting these challenges is unparalleled. Our Soldiers display unrelenting tenacity, steadfast purpose, quiet confidence and selfless heroism. We must never let them down.

Claude M. Bolton Jr.
Army Acquisition Executive

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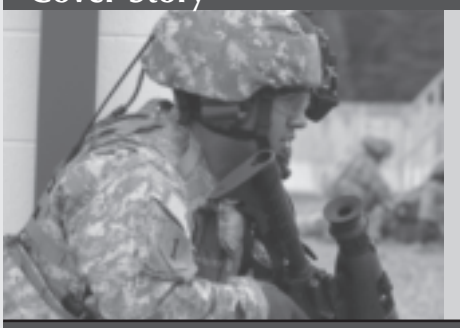

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On The Cover

Original cover art designed by Jeff Wright, Senior Graphic Designer, BRTRC Technology Marketing Group. This artist's rendering depicts highly magnified nanoscale materials being used as tiny, lightweight building blocks to form conduits as components of larger systems. The S&T community is building on its nanotechnology foundation to harness innovative science and engineering that addresses Soldier battlefield requirements today and for the future.

2007 Senior Leaders' Training Forum (SLTF) Recap

More than 80 general officers and Senior Executive Service acquisition workforce leaders attended the annual SLTF that was held Aug. 27-30, 2007, at the U.S. Army War College, Carlisle, PA.

Army AL&T Magazine's Meg Williams provides highlights of this year's forum in her article on Page 93.

Army AL&T Magazine (ISSN 0892-8657) is published quarterly by the ASAALT. Articles reflect views of the authors and not necessarily official opinion of the Department of the Army. The purpose is to instruct members of the Army acquisition workforce relative to AL&T processes, procedures, techniques and management philosophy and to disseminate other information pertinent to their professional development. Private subscriptions and rates are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 or (202) 512-1800. Periodicals official postage paid at Fort Belvoir, VA, and additional post offices. POSTMASTER: Send address changes to DEPARTMENT OF THE ARMY, ARMY AL&T, 9900 BELVOIR RD, SUITE 101, FORT BELVOIR, VA 22060-5567. Articles may be reprinted if credit is given to *Army AL&T* Magazine and the author.

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For more news, information and articles, please visit the USAASC Web site at **http://asc.army.mil**. Click on the *Army AL&T* Magazine tab located on the bottom of the flash banner in the center of the page.

This medium is approved for official dissemination of material designed to keep individuals within the Army knowledgeable of current and emerging developments within their areas of expertise for the purpose of enhancing their professional development.

By order of the Secretary of the Army

GEORGE W. CASEY JR.
General
United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the Secretary of the Army
0725305

The Army's Science and Technology (S&T) Strategy

We are excited to bring you an issue loaded with news from the forefront of Army S&T about the latest technological developments, academic partnerships and research initiatives. Dr. Thomas H. Killion, Deputy Assistant Secretary for Research and Technology, Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology (AL&T), and his entire S&T community bring their curiosity, ingenuity and technical expertise to bear on research that keeps our Army the greatest fighting force in the world.

In Killion's words, "Our science and engineering professionals and essential support personnel are our most important resources to achieve progress in S&T and deliver results for our Soldiers." We couldn't agree more and urge you to read about the Army's S&T strategy in our lead article, *An Overview of the Army Science and Technology (S&T) Program*, by Killion and Carolyn Nash.

Paschal A. Aquino and Mary J. Miller examine the factors that determine whether a technology transitions from the laboratory to Soldiers in their article, *Actively Managing the Technology Transition to Acquisition Process*.

Country singer Blake Shelton sings "Ol Red," a song about a hound with "a nose that can smell a 2-day trail." It's the Army's new Fido®/PackBot® robot, however, that has Dr. John A. Parmentola and Irena D. Szkrybalo singing the praises of "BigDog," a prototype that can sniff out hidden explosives in *Technology Transition — Lessons Learned From Fido®/PackBot®*.

Learn about the Army's basic, applied and technology demonstration research being conducted at five of the Army's University Affiliated Research Centers (UARCs) and University Centers in Dr. Reed Skagg's article, *Exploiting Technical Opportunities to Capture Advanced Capabilities for Our Soldiers*.

Fundamental research is being conducted by the University of Texas-Austin UARC on electromagnetic energy and the physics of what happens when a projectile is electromagnetically launched through the parallel rails of a rail gun. Dr. Ed Schmidt and Dr. Harry Fair explain this research in *The Institute for Advanced Technology — Advancing the State-of-the-Art in Electromagnetic and Hypervelocity Research*.

Training scenarios based on real events is the basis for Dr. Jeff G. Wilkinson's article, *Virtual Training — Keeping It Real*, which tells how Soldiers are trained in culturally appropriate behavior, bi-lateral engagement and tactical questioning with the right mix of artificial intelligence, graphics, sound and well-crafted stories and characters.

The Institute for Soldier Nanotechnologies — Developing Revolutionary Survivability Technologies for Soldiers, by Dr. Douglas Kiserow and Dr. John Joannopoulos, explores the research being conducted to create new materials, devices, processes and systems that provide enhanced capabilities for Soldiers.

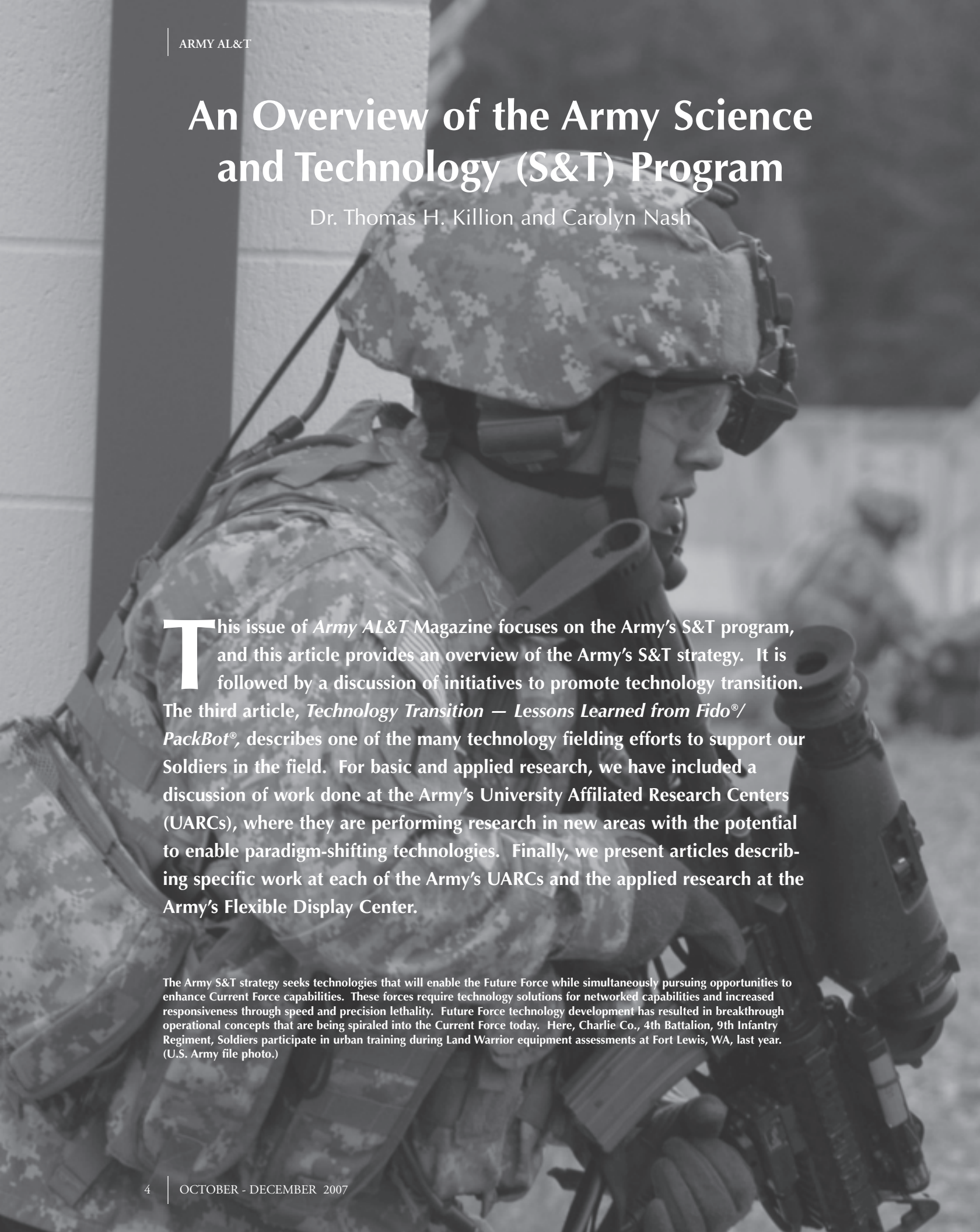
There are several other S&T articles that highlight biotechnology developments, hybrid electric technology and flexible display panels. Ben Ennis discusses the fastest moving program in DOD — the Mine Resistant Ambush Protected Vehicle, which is being tested at Aberdeen Test Center, MD. Finally, our own Meg Williams brings you highlights from this year's Senior Leaders' Training Forum on Page 93.

I hope you find this issue interesting and thought provoking. The S&T community is doing its fair share to ensure the AL&T Workforce lives up to its charter — "Design-Develop-Deliver-Dominate — We Make Soldiers Strong."

Michael I. Roddin
Editor-in-Chief

An Overview of the Army Science and Technology (S&T) Program

Dr. Thomas H. Killion and Carolyn Nash



This issue of *Army AL&T* Magazine focuses on the Army's S&T program, and this article provides an overview of the Army's S&T strategy. It is followed by a discussion of initiatives to promote technology transition. The third article, *Technology Transition — Lessons Learned from Fido®/ PackBot®,* describes one of the many technology fielding efforts to support our Soldiers in the field. For basic and applied research, we have included a discussion of work done at the Army's University Affiliated Research Centers (UARCs), where they are performing research in new areas with the potential to enable paradigm-shifting technologies. Finally, we present articles describing specific work at each of the Army's UARCs and the applied research at the Army's Flexible Display Center.

The Army S&T strategy seeks technologies that will enable the Future Force while simultaneously pursuing opportunities to enhance Current Force capabilities. These forces require technology solutions for networked capabilities and increased responsiveness through speed and precision lethality. Future Force technology development has resulted in breakthrough operational concepts that are being spiraled into the Current Force today. Here, Charlie Co., 4th Battalion, 9th Infantry Regiment, Soldiers participate in urban training during Land Warrior equipment assessments at Fort Lewis, WA, last year. (U.S. Army file photo.)

The Army S&T strategy seeks to develop and mature technology that will enable transformational capabilities in the Future Force while pursuing opportunities to accelerate technology maturity for transition into Current Force systems. This strategy is achieved through sustained investments in a balanced S&T portfolio that simultaneously funds innovative basic research, applied research and advanced technology development.

Our science and engineering (S&E) professionals and essential support personnel are our most important resources to achieve progress in S&T and deliver results for our Soldiers. To execute state-of-the-art S&T programs, we must invest in and maintain state-of-the-art laboratory facilities. Stakeholders, partners, customers and senior decision makers validate S&T program relevance by providing feedback to improve results and business processes.

Key elements of Army S&T strategy include:

- Ensuring investments are aligned with Army missions and capability needs.
- Maintaining balanced and responsive portfolios across:
  - Elements of investment (Budget Activities: 6.1/6.2/6.3).
  - Disciplines and technology areas.
  - Performers (intramural/extramural).
  - Capability pull and technology push.
- Recruiting and retaining highly competent people; protecting facilities to preserve future capabilities.
- Communicating S&T vision and approach to senior decision makers, key stakeholders, partners and customers.
- Establishing and refining processes and metrics to incentivize innovation, efficiency and effectiveness, and facilitate transition.

Aligning the S&T Portfolio to User Needs

S&T investments are aligned with Army missions and capability needs. The U.S. Army Training and Doctrine Command (TRADOC) represents Soldiers in the S&T process. TRADOC combat developers inform the S&T community of needs in terms of capability gaps and technology shortfalls identified through three Army Capabilities Integration Center processes: current gap analysis, capability needs assessments and technology shortfall analysis. TRADOC endorses and validates that the S&T program is pursuing technologies that are relevant to satisfying capabilities needed in the Current and Future Forces as depicted in Figure 1.

HQDA provides guidance to the S&T materiel development community and the TRADOC combat development community on priorities and needs for annual adjustments to the Army S&T portfolio, including proposals for new Army Technology Objective (ATO) programs. The ATOs are the highest priority S&T efforts designated by HQDA. This guidance is signed jointly by the Deputy Assistant Secretary of the Army for Research and Technology (DASA (R&T)); the Assistant Deputy Chiefs of Staff, G-3/5/7; and the Deputy Chief of Staff, G-8, Director for Force Development; and supports objectives in the *Army Modernization Plan* as well as the Defense Research and Engineering Director's strategy.

A Balanced Portfolio

We seek to maintain a balanced and responsive portfolio across a variety of perspectives that incorporate both the development and demonstration of near-term technologies. For example, maintaining investment balance requires simultaneous and sustained funding across all three primary S&T budget components:

- Advanced technology development (6.3) efforts demonstrate technical feasibility at system and subsystem levels and provide a deliberate path for technology spirals to acquisition programs in the near term. This program also enables rapid insertion of new technology into fielded systems as well as limited numbers of technology prototypes. Our technology demonstrations prove the concept, inform the combat developments process and provide the acquisition community

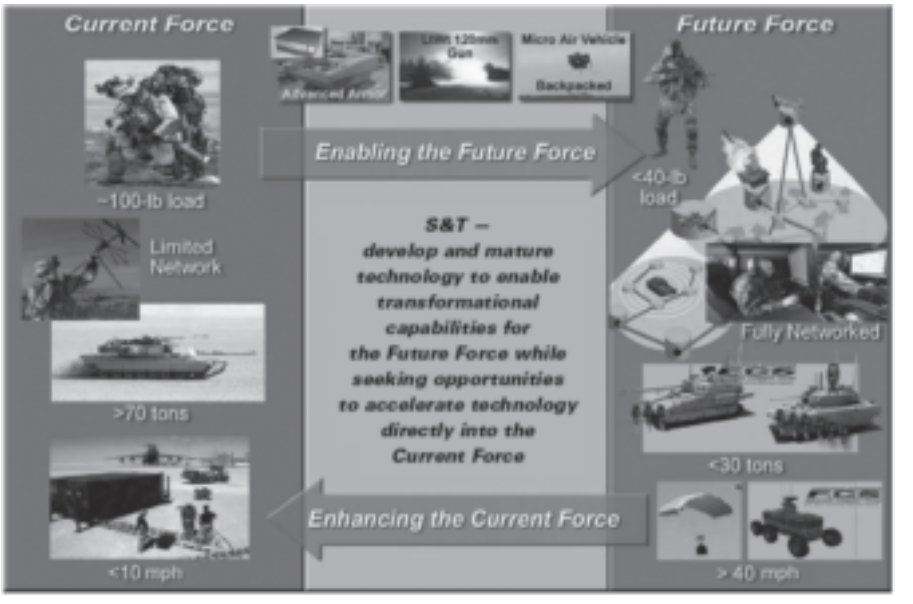


Figure 1. Enhance the Current Force/Enable the Future Force

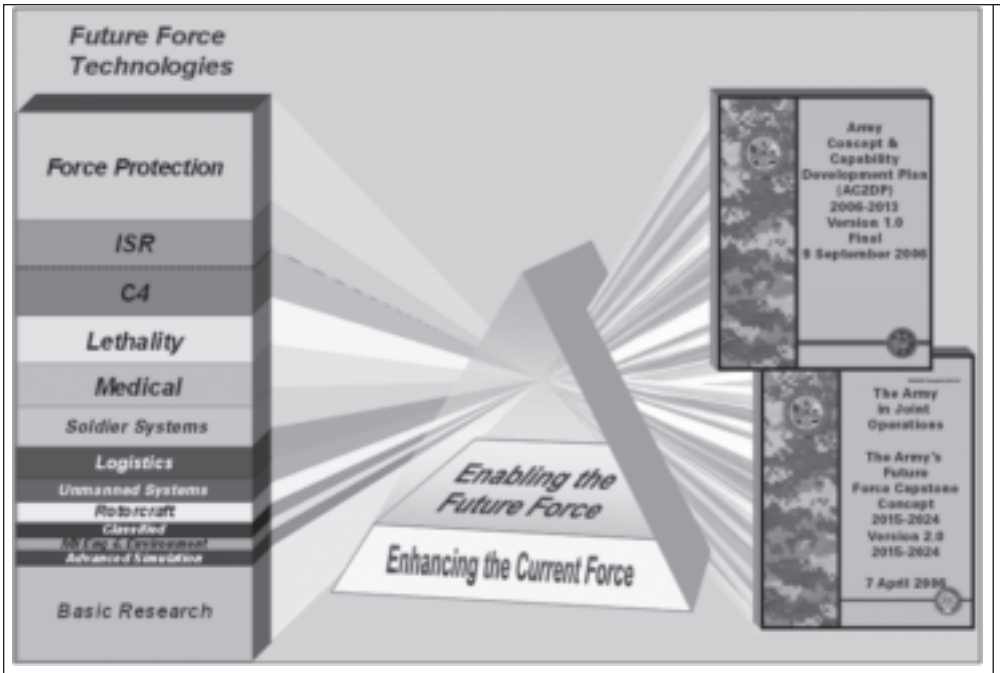


Figure 2. Proportion of Financial Investment Devoted to Future Force Technology Areas

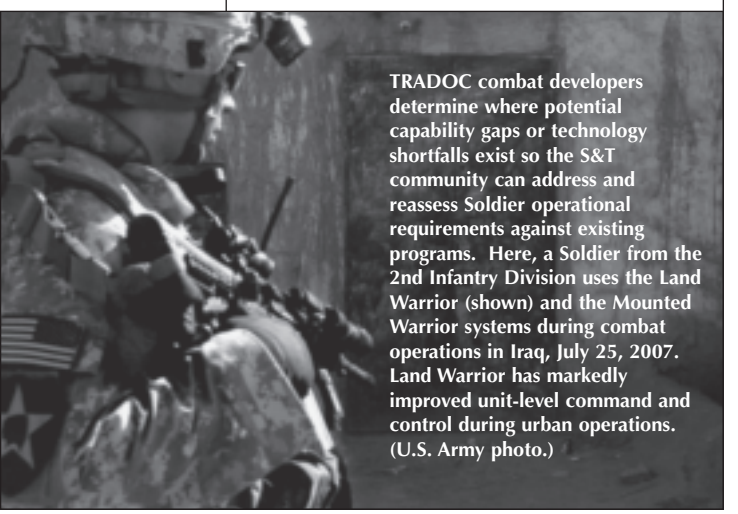
with evidence of technology's readiness to satisfy system requirements.

- Applied research (6.2) for technology applications at component and subsystem levels as well as advanced models for new technology concepts for the midterm.
- Basic research (6.1) provides new knowledge and understanding to solve Army-unique problems as well as novel approaches to solve problems with broad and, at times, unforeseen applications by investing in the basic sciences (e.g., biology, chemistry, physics) for the long term.

An additional component, the Manufacturing Technology program, is a major supporting investment to the advanced technology development programs. Manufacturing technology development seeks to provide solutions in two broad areas: to enable economic producibility for new technology; and to apply new manufacturing techniques that will improve durability and/or cost of operating currently fielded systems.

From another perspective, we describe the diversity and balance in the S&T program in terms of 13 Future Force Technology Areas that are defined herein and graphically depicted in Figure 2 in proportion to their funding totals within the $1.7 billion requested in the President's budget for FY08. The Future Force technology area color bands shown on the left side of the figure are approximately proportional to the financial investment within the Army's requested FY08 S&T budget and *Future Years Defense Plan*. The specific technologies funded in these investment areas are aligned to achieve the Future Operational Concepts (FOCs) defined by TRADOC. The documents depicted on the right describe the FOCs and Joint operations concepts.

- *Force Protection* technologies enable Soldiers and platforms to avoid detection, acquisition, hit, penetration and kill.
- *Intelligence, Surveillance and Reconnaissance (ISR)* technologies enable persistent and integrated situational awareness and understanding to provide actionable intelligence that is specific to Soldier needs across the full range of military operations.
- *Command, Control, Communications and Computers (C4)* technologies provide capabilities for superior decision making, including intelligent network decision agents and antennas to link Soldiers and leaders into a seamless battlefield network.
- *Lethality* technologies enhance Soldiers' ability and platforms to provide overmatch against threat capabilities and include nonlethal technologies enabling tailorable lethality options.
- *Medical* technologies protect and treat Soldiers to sustain combat strength, reduce casualties and save lives.
- *Unmanned Systems* technologies enhance the effectiveness of unmanned air and ground systems through improved perception, cooperative behaviors and increased autonomy.
- *Soldier Systems* technologies provide materiel solutions that protect, network, sustain and equip Soldiers, and non-materiel solutions that enhance human performance.
- *Logistics* technologies enhance strategic response and reduce logistics demand.
- *Military Engineering and Environment* technologies enhance deployability and sustainability.



TRADOC combat developers determine where potential capability gaps or technology shortfalls exist so the S&T community can address and reassess Soldier operational requirements against existing programs. Here, a Soldier from the 2nd Infantry Division uses the Land Warrior (shown) and the Mounted Warrior systems during combat operations in Iraq, July 25, 2007. Land Warrior has markedly improved unit-level command and control during urban operations. (U.S. Army photo.)

- *Advanced Simulation* technologies provide increasingly realistic training and mission rehearsal environments to support battlefield operations, system acquisition and requirements development.
- *Rotorcraft* technologies enhance the performance and effectiveness of current and future rotorcraft while seeking to reduce operational and sustainment costs.
- *Basic Research* investments seek to develop new understanding to enable evolutionary advances or paradigm shifts in future operational capabilities.

Critical Infrastructure — People and Facilities

The pursuit of Future Force technologies will be achieved through the Army's strong in-house research and technology development capability and its partnerships with industry and academia. The Army has world-class research, development and experimental facilities across the United States. These facilities have modern research tools and are staffed with highly dedicated engineers, scientists and support people who perform research and technology development as well as facility sustainment. This infrastructure has been shaped to meet the Army's full spectrum of technology needs. The Army has four major commands and an element of Human Resources Command (HRC) responsible for technical leadership, scientific advancement and support for the acquisition process. The four commands are the Research, Development and Engineering Command; U.S. Army Corps of Engineers; Medical Research and Material Command; and the Space and Missile Defense Command. The Army Research Institute for the Behavioral and Social Sciences is part of HRC under operational control of the Deputy Chief of Staff for Personnel.

Incentivize Innovation, Efficiency and Effectiveness — Facilitate Transition

The Army S&T program is executed within Army facilities by contracts to industry and grants to universities, or through cooperative efforts with other DOD organizations, national laboratories, industry, universities and international partners. The Army laboratories' and research, development and engineering centers' (RDECs') leaders work continually to improve the S&T enterprise effectiveness, apply Lean Six Sigma principles to establish and refine processes, identify metrics to incentivize innovation and efficiency, while also promoting technology transition. These initiatives are described in a separate article in this issue.

Communicating the S&T Vision

We rely on a broad range of strategic communications initiatives to convey the S&T vision and priorities to senior decision makers, key stakeholders (such as Congress), partners and customers. The Army S&T program is also coordinated with the programs of other services and defense agencies through the DOD Reliance 21 processes, including Office of the Secretary of Defense strategic reviews and program briefings.

The Army's S&E professionals are innovation change agents committed to developing the technologies that will provide America's Soldiers with capabilities superior to any adversary, allowing our troops to achieve decisive results and return home safely. Our balanced S&T investment portfolio — developed in collaboration with our stakeholders, customers and private sector partners — is executed through a vital infrastructure that serves as a relevant and responsive component of the DOD-wide research and technology enterprise.

SGT Philip Morici models the improved Land Warrior individual Soldier combat system during an equipment demonstration at the Rayburn House Office Building in Washington, DC, June 6, 2007. (U.S. Army photo by Gerry J. Gilmore.)

DR. THOMAS H. KILLION is the DASA(R&T) and Army Chief Scientist. He earned B.A. degrees in psychology and English from St. Mary's College and a Ph.D. in experimental psychology from the University of Oregon. Killion oversees the Army's R&T program, which encompasses all Army laboratories and RDECs.

CAROLYN NASH is the Deputy Director for Science and Technology Integration, Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology. She holds a B.A. in physics from the University of California-Berkeley and an M.S. in physics from Wright State University.

Actively Managing the Technology Transition to Acquisition Process

Paschal A. Aquino and Mary J. Miller

Technology transition requires collaboration, commitment and perseverance. Success is the responsibility of everyone in the development and life-cycle management of a system from concept to fielding, and fundamentally requires sustained leadership commitment to the acquisition program. The science and technology (S&T) community focuses on rapidly maturing technology with the relevant performance to satisfy user-defined needs and the receiving acquisition program's requirements. This mandates close and continuous dialogue across the acquisition and combat development communities.

Congress has directed that "the technology in the program has been demonstrated in a relevant environment." Thus, Milestone B decisions involving technology transitions must demonstrate at a TRL 6 or higher level. To this end, Army S&Es provide expert technical advice and engineering support to quickly develop and test interim solutions to urgent needs to achieve required TRL standards. (*Army AL&T* Magazine file photo image.)

Many factors determine whether or not a technology transitions from the laboratory to the ultimate customer — the Soldier. These factors include technology maturity, performance, affordability (of the technology and/or the system), manufacturability, available funding, schedule, continued need and/or support from program managers (PMs) and, perhaps most importantly, sustained priority for the technology/system in the Army's eyes.

Changing priorities and budget process instability have profoundly affected technology transition throughout this decade. We are a Nation at war. With the Army's focus on support to current operations, the Army S&T strategy has expanded to include the pursuit of opportunities that provide enhanced capabilities for the Current Force while continuing to develop and mature enabling transformational capabilities for the Future Force.

This strategy's dual objectives require flexibility and cooperation throughout the acquisition domain, including the processes by which we transition technologies from the laboratories and engineering centers into the acquisition programs providing products and/or services to the warfighter. In addition, we are also striking a balance between efforts that include:

- Capability pull — addressing an identified materiel shortfall within an acquisition program.
- Technology push — the discovery of new capabilities that can change the way the Army operates.

Given the Army's challenge to modernize the force while at war, the S&T community has been challenged to address technology affordability and manufacturability earlier in the development cycle.

Capability Pull Process

For long-term development and fielding of future capabilities, the Integrated Defense Acquisition, Technology and Logistics Life Cycle Management Framework (LCMF) establishes a deliberate *capability pull* process. This framework's normal timeline allows planning for development and transition of technologies to meet known performance requirements and production schedule needs. Technologies are matured and applications are refined in synchronization with operational and system concepts development. In this framework, technology development strategies are crafted to mature technologies for a specific application, reduce the technology risk and transition that mature technology to PMs in time for that acquisition program's System Development and Demonstration (SDD) phase. The Army Technical Objective (ATO) process fits well in this framework.

Demonstration ATOs (ATO-Ds) are often designed to meet a known specific need for a planned acquisition program in a specific time frame or a planned capability improvement to an existing system. Given the Army's challenge to modernize the force while at war, the S&T community has been challenged to address technology affordability and manufacturability earlier in the development cycle. When developing ATO-Ds, we look for opportunities to pair a developing technology effort with a supporting manufacturing technology initiative. These two efforts, done concurrently, seek to produce more affordable systems/subsystems to reduce technology risk for transition into an acquisition program.

The Technology Transition Agreement (TTA) is a management tool used to improve our success in transitioning ATO-D technology solutions to the warfighter. TTAs ensure that users, technology developers and acquisition PMs fully understand what is being developed and the final "product(s)" that will be provided from the S&T program. This agreement formalizes and documents the acquisition

Technology is transferred from the laboratory to the Soldier as quickly as practical. Limiting factors that impact tech transfer often include the maturity level of the technology, the technology's affordability or the affordability of the system it's designed to support, and manufacturability, just to name a few. Here, CPL Pavlo Colon drives his High-Mobility Multipurpose Wheeled Vehicle onto an Afghan National Police compound in Laghman Province, Afghanistan, July 26, 2007. (U.S. Navy photo by MC2 Joshua Karsten.)

program's needs for the key technologies being developed and validated against the receiving program's schedule and resources. Key TTA elements are:

- An accurate description of the technology product(s) to be transferred, including the Technology Readiness Level (TRL).
- The performance metrics that the technology product(s) must demonstrate at delivery and the relevant conditions of that demonstration.
- The required delivery schedule for the technology product(s).

The current requirement for ATO-Ds is to have a TTA in place as soon as feasible, but not later than 1 year prior to ATO completion. Meeting this requirement is necessary to retain ATO status and maintain funding through ATO completion. The TTA must:

- Define the technology transition path.
- Provide cost, schedule and performance parameters for the technology developer.
- Enable more defined requirements development and acquisition program planning.

Having a clear transition path also helps acquisition domain leaders to evaluate their own strategic performance in meeting warfighter-identified gaps, to establish priorities of effort and to use limited resources efficiently.

Technology Push Process

The process for *technology push* efforts is very similar but it requires an even closer working relationship with the requirements development community. "Tech push" is intuitively more difficult as it is seeking to apply an unfamiliar solution to an existing capability shortfall. These efforts tend to require much more robust testing and demonstration efforts to convince the acquisition and requirements communities of their added benefit to our Soldiers.

There are many checks and balances on the technology transition from S&T. One that is integrated into the LCMF is the Technology Readiness Assessment (TRA). TRAs are required for all acquisition programs undergoing a Milestone B or Milestone C decision review. The TRA's purpose is to assess whether or not the technologies to be used in an acquisition program are sufficiently mature for the milestone being considered. This assessment validates that the technology can be transitioned from the laboratory to the acquisition program with low risk. TRL is the metric used to assess technology maturity. The TRL approach was originally established by NASA and adopted by DOD to measure technology maturity against its intended application.

DOD policy requires that all technologies in a program must have been demonstrated in a relevant environment and achieved a TRL 6 prior to Milestone B. Exceptions, however, were frequent if the PM had an acceptable technology maturation plan and the resources to execute it. Since 1999, the Government Accountability Office (GAO) has published several reports criticizing DOD for allowing programs to begin acquisition with "immature" technologies. The GAO views the use of immature technologies as a major factor in causing cost and schedule overruns in major acquisition programs.

Congress, likewise, is concerned about cost overruns in DOD programs.

As U.S. forces wage the global war on terrorism (GWOT), the Army's S&T strategy has expanded to transition emerging technology into the Current Force while continuing to develop and then mature transformational capabilities for the Future Force. Here, SGM Kerry Tooley conducts a safety briefing prior to his Soldiers boarding a CH-47 Chinook helicopter at Bagram Airfield, Afghanistan, July 10, 2007, for a mission deployment. (U.S. Army photo by SPC Rodney Carreiro.)

The S&T community strives to maintain a healthy balance between capability pull — identifying/ addressing materiel shortfalls — and technology push — discovering new capabilities that can change Army operations. Here, paratroopers from Bravo Battery, 4th Battalion, 319th Airborne Field Artillery Regiment, fire their 155mm howitzer from Forward Operating Base Blessing in eastern Afghanistan during an operational mission on June 28, 2007. (U.S. Army photo by SPC Jon H. Arguello.)

Section 2366a of *Title 10, United States Code*, as enacted by Section 801 of the *National Defense Authorization Act for FY06 (Public Law No. 109-163)*, requires the Milestone Decision Authority for Major Defense Acquisition Programs (MDAPs) to certify to Congress that "the technology in the program has been demonstrated in a relevant environment." This means that the TRA prepared to support a Milestone B decision must conclude that the transitioning technologies have been demonstrated at a TRL 6 or higher level. While Section 2366a still allows a waiver, it must be reported to Congress before Milestone B approval and the basis can be only to achieve critical national defense objectives. As a result, TRAs for MDAPs are receiving increased scrutiny by the Director of Defense Research and Engineering before he recommends that the Defense Acquisition Executive "certify" the technology maturity to Congress.

The second S&T strategy element is to seek opportunities to mature, provide and facilitate transfer of enhanced capabilities for the Current Force in the GWOT. In implementing this strategy, the S&T community fully leverages knowledge gained from past investments. Working closely with warfighters and acquisition PMs, Army scientists and engineers (S&Es) provide technical advice and engineering support gained from years of experience to quickly develop and test interim solutions to satisfy urgent needs in response to adaptive, ever-changing threats.

The S&T community encourages the use of initiatives such as the Quick Reaction Fund, Technology Transition Initiatives, Agile Integration, Development and Experimentation effort at the U.S. Army Research, Development and Engineering Command, and Joint Capability Technology Demonstrations that are designed to accelerate the transition from S&T to useful military products. Working with organizations such as the Rapid Equipping Force and the Joint Improvised Explosive Device (IED) Defeat Organization, the S&T community has contributed to shrinking of the development, experiment and assess cycle that quickly adapts commercial-off-the-shelf items or maturing technology products in development to solve an urgent warfighting requirement.

The Army Field Assistance in S&T Program provides a liaison for the component commander staff to transmit their near-term requirements to the Army laboratories and research, development and engineering centers, where efforts are focused on providing near-term warfighter solutions. Responding to urgent need requests from actively engaged warfighters, Army S&Es have been instrumental in rapidly fielding capability for IED detection and defeat, counter-mortar systems, individual Soldier and tactical vehicle protection, precision airdrop, robotic sensors and improved surveillance.

The teamwork that is being exercised in this rapid response environment is increasing awareness throughout the acquisition community that all of the parts are needed for successful technology transfer. While we continue to work on reducing the impact of factors such as the budget process, the relationships that are being engendered in the current warfighter support efforts are fostering the teamwork that will contribute to improved overall long-term success of Army technology transition processes and programs.

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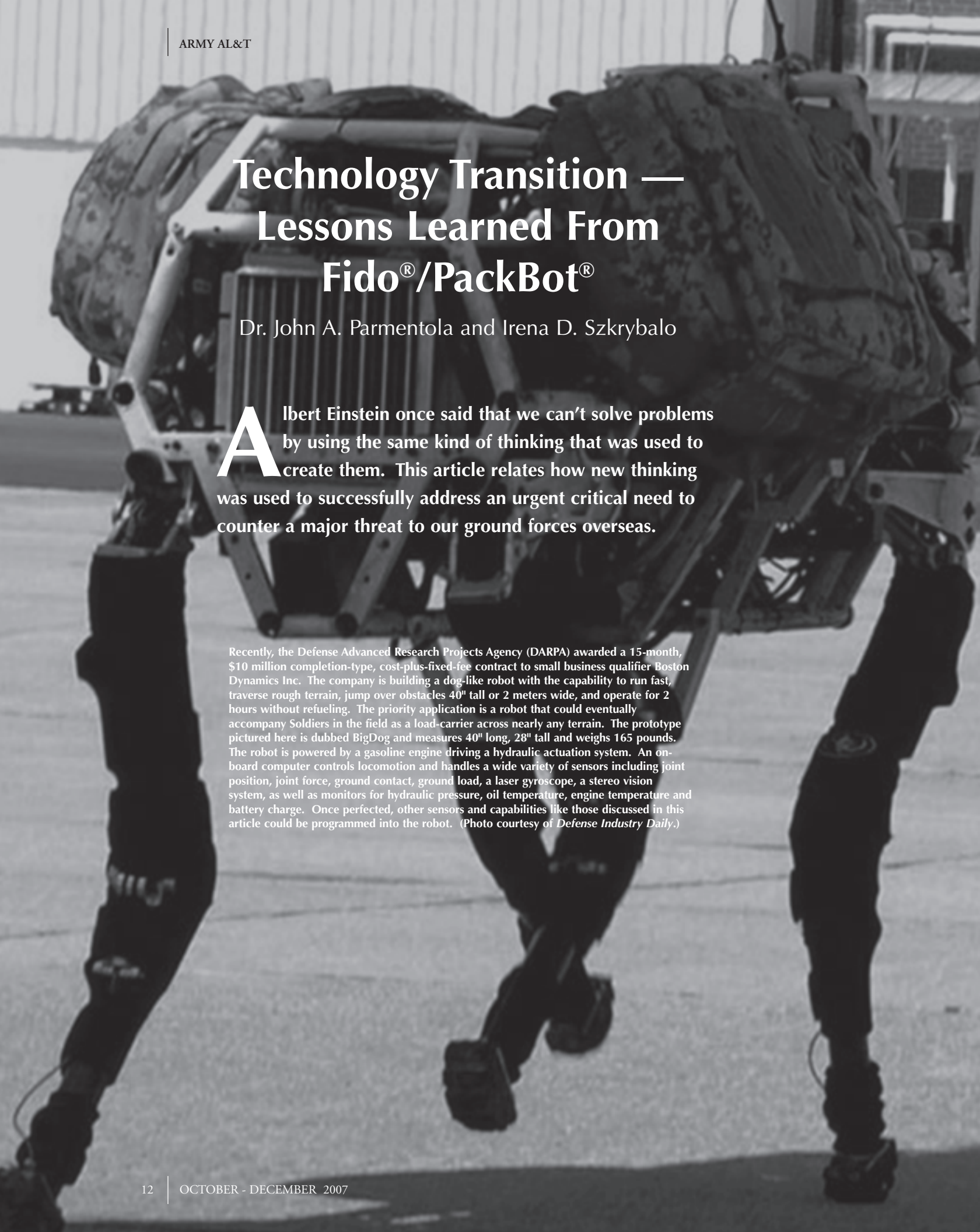
Technology Transition — Lessons Learned From Fido®/PackBot®

Dr. John A. Parmentola and Irena D. Szkrybalo

Albert Einstein once said that we can't solve problems by using the same kind of thinking that was used to create them. This article relates how new thinking was used to successfully address an urgent critical need to counter a major threat to our ground forces overseas.



Recently, the Defense Advanced Research Projects Agency (DARPA) awarded a 15-month, $10 million completion-type, cost-plus-fixed-fee contract to small business qualifier Boston Dynamics Inc. The company is building a dog-like robot with the capability to run fast, traverse rough terrain, jump over obstacles 40" tall or 2 meters wide, and operate for 2 hours without refueling. The priority application is a robot that could eventually accompany Soldiers in the field as a load-carrier across nearly any terrain. The prototype pictured here is dubbed BigDog and measures 40" long, 28" tall and weighs 165 pounds. The robot is powered by a gasoline engine driving a hydraulic actuation system. An on-board computer controls locomotion and handles a wide variety of sensors including joint position, joint force, ground contact, ground load, a laser gyroscope, a stereo vision system, as well as monitors for hydraulic pressure, oil temperature, engine temperature and battery charge. Once perfected, other sensors and capabilities like those discussed in this article could be programmed into the robot. (Photo courtesy of *Defense Industry Daily*.)

Yuma Proving Ground (YPG), AZ, was still hot and dusty the last week of October and first week of November 2005 — hovering around 100 degrees during the day. The Fido/PackBot team of Active Army Soldiers and Marines, government contractor scientists and engineers (S&Es), and a group of Reservists called in from the Arizona National Guard put a robotic dog through its paces during a rigorous test to see if it could find explosives in and under vehicles hidden there by YPG explosives experts. With its wide-view camera and unique explosives sensor located on its highly maneuverable and extendable arm, the robotic dog looked and sniffed under truck carriages, in car trunks and inside vehicles. When the faint whiff of an explosive was sensed, an unmistakable signal was sent to Soldiers in a van at a safe distance away who were operating Fido/PackBot through its Operator Control Unit, making note of detections and keeping score. After 2 long weeks of testing, the tired and dusty team and their robotic dog declared victory and concluded their experimentation and tests.

It was less than a year earlier that the Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASAALT) Research and Laboratory Management Directorate conceived the idea of integrating Fido on a robotic platform. Fido's sniffer is based on an amplifying fluorescent polymer (AFP) whose high sensitivity to explosives was created by eminent scientist Dr. Tim Swager, affiliated with the Army's Institute for Soldier Nanotechnology (ISN) at the Massachusetts Institute of Technology (MIT). The detection technology associated with AFP was developed over several years at the ISN and by a small startup company, Nomadics Inc., through a congressional add-in collaboration with the Night Vision Laboratory (NVL) and commercialized as a hand-held explosives detector.

The U.S. Marine Corps (USMC) and NVL had also experimented earlier with putting Fido on a robotic system. So putting the detector on a robotic platform that could also see for remote detection of improvised explosive devices (IEDs) for operational use in theater looked like a no-brainer for the staffers who approached the Military Police (MP) at Fort Leonard Wood (FLW), MO, with the concept. As it turned out, this new capability was responsive (it actually provided much more capability) to an Operational Needs Statement (ONS) promulgated by the Maneuver Support Center at FLW for vehicle inspection at checkpoints. The MP user representative at FLW became an integral Fido/PackBot team member.

The detection technology associated with AFP was developed over several years at the ISN and by a small startup company, Nomadics Inc., through a congressional add-in collaboration with the NVL and commercialized as a hand-held explosives detector.

The newly formed Joint IED Defeat Task Force (JIEDDTF) in the Office of the Secretary of Defense was briefed on the concept at the Detect Sub-Integrated Process Team level, and funding was requested to conduct a concept demonstration. They liked the idea, especially the proposed 90-day delivery schedule of producing 10 integrated systems in theater, including testing at YPG with training manuals and videos as well as a safety release for each system. Potential robotic platforms were assessed in a single half-day session involving a group comprised of customer, user and stakeholder representatives from diverse organizations. iRobot's® PackBot was selected for its ruggedness, versatility, reliability, availability and requirements fulfillment as expressed in the ONS. Along with contractors Nomadics Inc. and iRobot, the platform decision also brought new team members from the acquisition community — the Robotic Systems Joint Project Office (RSJPO) in Huntsville, AL; a representative from DOD's Joint Robotics Office; and the U.S. Army Research, Development and Engineering Command NVL. The 90-day clock would start ticking the day the Army received JIEDDTF funding, which arrived in early July 2005.

The Fido XT provides a wide-view camera and an explosives sensor on its highly maneuverable and extendable arm. It is ideal for "sniffing" out explosives from under vehicle chassis, car trunks and inside vehicles. Soldiers can operate the device from a safe distance. (U.S. Army photo.)

The Prototype Integration Facility (PIF) at Redstone Arsenal, AL, was selected by the Deputy Assistant Secretary for Research and Technology to manage the program. The PIF, through careful analysis based upon extensive experience with comparable efforts, developed the rationale and delineated the key assumptions associated with the ambitious 90-day schedule. An Executive Steering Board (ESB) was formed with the ASAALT

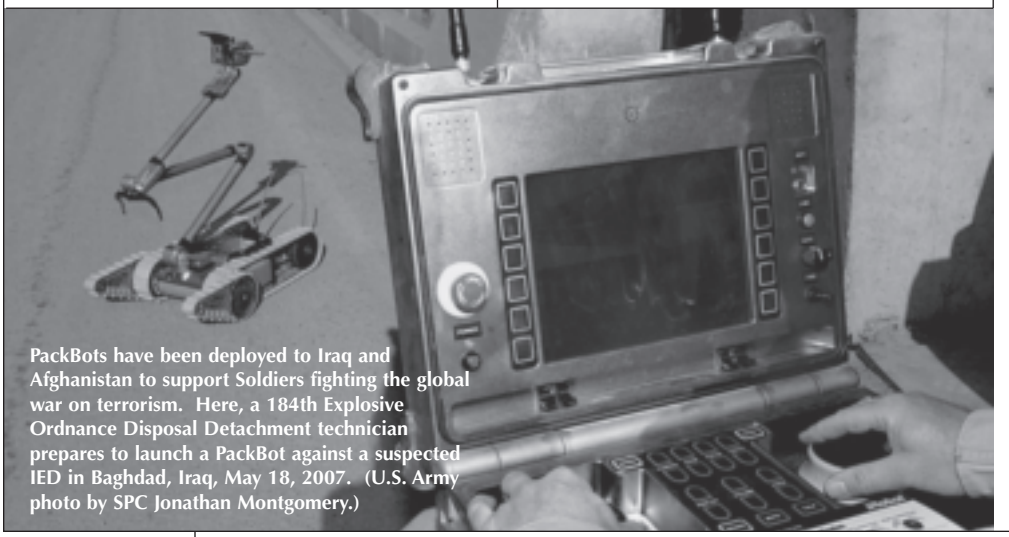
Research and Laboratory Management Director as Chair and lead spokesperson for the effort. The ESB was comprised of team members and included stakeholders from other organizations such as JIEDDTF, Rapid Equipping Force, U.S. Army Test and Evaluation Command (ATEC), Navy Explosive Ordnance Disposal, Army Research Laboratory and the Technical Support Working Group.

A Fido/PackBot proposal for a concept demonstration, reviewed by the full ESB, was briefed up the JIEDDTF chain, approved and funded. Per JIEDDTF direction, ATEC conducted a survey with troops in theater after the initial prototype systems were deployed and operated in theater for several months. A team of government explosives experts and Army S&Es collaborated with ATEC in preparing the original YPG test program and the theater survey to assess its operational effectiveness. Based upon these experiences, it is clear that much mutual benefit can be derived from more direct collaborations between ATEC and Army S&Es.

But the idea of a robotic dog remotely sensing IEDs turned out to be a much greater challenge than the originally expected no-brainer. Staying within both the 90-day schedule and cost became a formidable challenge. The cost estimate turned out to be off by a factor of two, so only half of the original 10 prototype units were eventually produced, tested and fielded. Completed prototypes sent to theater were inadvertently misdirected by the commercial shipper, traveling a circuitous route from the U.S. to South America and Europe before finally arriving in the Middle East.

Once in theater, several unexpected operational issues with the integrated system emerged that had not been experienced in prior successful testing at YPG and subsequent demonstrations at FLW. Contractor engineers were eventually sent in theater to support the Joint Robotics Repair Facility by identifying and solving Fido/PackBot technical issues amidst an escalating war and many other robots waiting for repair. At the same time, a red team of S&Es from various Army laboratories was quickly formed in the U.S. to augment and interact with the engineers in theater working to solve the operational Fido/PackBot issues. Costs increased because of these technical problems and underestimates of actual YPG testing costs, thus reducing the number of prototype systems procured for theater from 10 to 5.

Within a few weeks, however, all Fido/PackBot technical solutions were identified and repairs made. Throughout this period, the ESB continued to meet regularly, providing the team with guidance and support. Regular briefings to JIEDDTF also provided useful suggestions in advancing the effort's goals and objectives as well as troubleshooting. Positive feedback regarding the robotic dog's capability was received from theater through anecdotal e-mails and the official ATEC operational survey, which included urgent requests for additional systems. All of this created a ground swell of support for the system and the approach taken in managing this complex fast-moving effort.



PackBots have been deployed to Iraq and Afghanistan to support Soldiers fighting the global war on terrorism. Here, a 184th Explosive Ordnance Disposal Detachment technician prepares to launch a PackBot against a suspected IED in Baghdad, Iraq, May 18, 2007. (U.S. Army photo by SPC Jonathan Montgomery.)

Joint IED Defeat Organization (JIEDDO)

In the meantime, the JIEDDTF was reestablished by the Deputy Secretary of Defense (DEPSECDEF) as the JIEDDO and governed by an entirely new set of people who had never heard of Fido/PackBot. To proceed to a larger procurement required going back up the JIEDDO chain starting at the bottom and, because this second funding request exceeded $25 million, required final DEPSECDEF approval.

Within 2 months, approval for the additional buy was received and FY07 funding provided to procure systems for the MP and USMC in theater and for training centers in the U.S. and abroad. After satisfying the requirements for the initial planned fielding of Fido/PackBot to units in theater, the RSJPO returned 25 percent of the money that was provided by JIEDDO for this project. This was a result of creative negotiation by RSJPO with the suppliers for spare parts for the units ordered. Delivery to theater of all the units procured was made by the end of July and are being deployed incrementally. Execution of this phase of the Fido/PackBot program has transitioned from the PIF to the RSJPO with ASAALT and ESB leadership and management remaining the same. The PIF remains an integral Fido/PackBot team member and a key technical advisor.

Historical Example

An interesting pertinent historical example of technology transition is the introduction of interchangeable parts in manufacturing by Thomas Jefferson, a capability that today we take for granted. In 1785, while Ambassador to France, Jefferson met Honore Blanc, a French mechanic who was building muskets using handcrafted parts of such precision that they could be interchanged. Unable to persuade Blanc to move to America to demonstrate his techniques, Jefferson influenced inventors and musket producers such as Eli Whitney and Roswell Lee to incorporate the innovation. Both tried but failed because of cost and schedule overruns.

Approximately 25 years later, in 1826, John Hall — who headed the Harper's Ferry Armory — built the first rifles from interchangeable parts. Eight years later a private contractor was able to use the methods, tools and technologies developed by Hall to produce parts in his factory that could also be used interchangeably with those manufactured by Hall. Now, parts from multiple sources could be used to assemble rifles and for field repair of any rifle manufactured at any location. For a more complete discussion, go to: **http://www.virtualschool.edu/cox/pub/PSIR/PSIRResponse.html**.

The challenges Jefferson faced have counterparts in the Fido/PackBot fielding experience. The major lessons learned for successful transition that parallel Jefferson's interchangeable parts transition experience are:

- Effort supported by a very high-level executive for introduction of the innovation despite lack of measurable results on which to base judgment on operational effectiveness.
- Promoted by respected, well-connected technologists even though the idea had not been successfully demonstrated operationally yet.
- Determined and highly motivated "change agents" work together over a considerable time period, falling short of the goal of adoption.
- Major effort is undertaken to promote the innovation, combining all circumstances to achieve success.
- Replication of the success by someone else demonstrates to all concerned that the innovation is not a fluke.
- A "champion" pushes for adoption once success has been established.

A PackBot remote-controlled robot from the U.S. Navy (USN) Explosive Ordnance Mobile Unit 2 is put through its paces during an IED drill aboard the Wasp Class Amphibious Assault Ship USS Bataan (LHD 5). (USN photo by MC2 Elizabeth R. Allen.)

Additionally, there were some lessons learned such as:

- A user agrees to the technology insertion to meet a yet-to-be-defined requirement.
- In early stages of transition, technologists are in the lead with the fielding organization in a subordinate role and customers/users as integral team members.
- The fielding organization takes lead role (still with same team) after innovation has been successfully tested, demonstrated in operation and acquisition funds for a major buy identified.
- Technologists continue to assist to ensure that any technical issues are resolved expeditiously.
- Technical requirements must remain stable throughout; otherwise additional costs and risks are incurred.
- Getting the problem properly formulated and exercising informed judgment to understand uncertainties is very important.
- Imagination is needed to deal with the unpredictable, which the transition process is often fraught with.

The outstanding success of Fido/PackBot fielding earned the project one of the U.S. Army Awards for the Top 10 Inventions of 2006 as well as a 2007 Army Research and Development Award. These accomplishments should be attributed to the people involved in the program. They are an extraordinarily talented group of experts who believed in the concept from the beginning, even in the presence of possible failure, and were determined to make it work in an expeditious manner. There was no preplanned process outlined on how to do it, no regulation to follow. But together, as an enthusiastic and highly dedicated team, they accomplished an extraordinary transition from concept to fielding in very short time. Transition of technology, therefore, is really all about strong dynamic leadership, people, passion, conviction, tenacity, knowledge, informed judgment and imagination.

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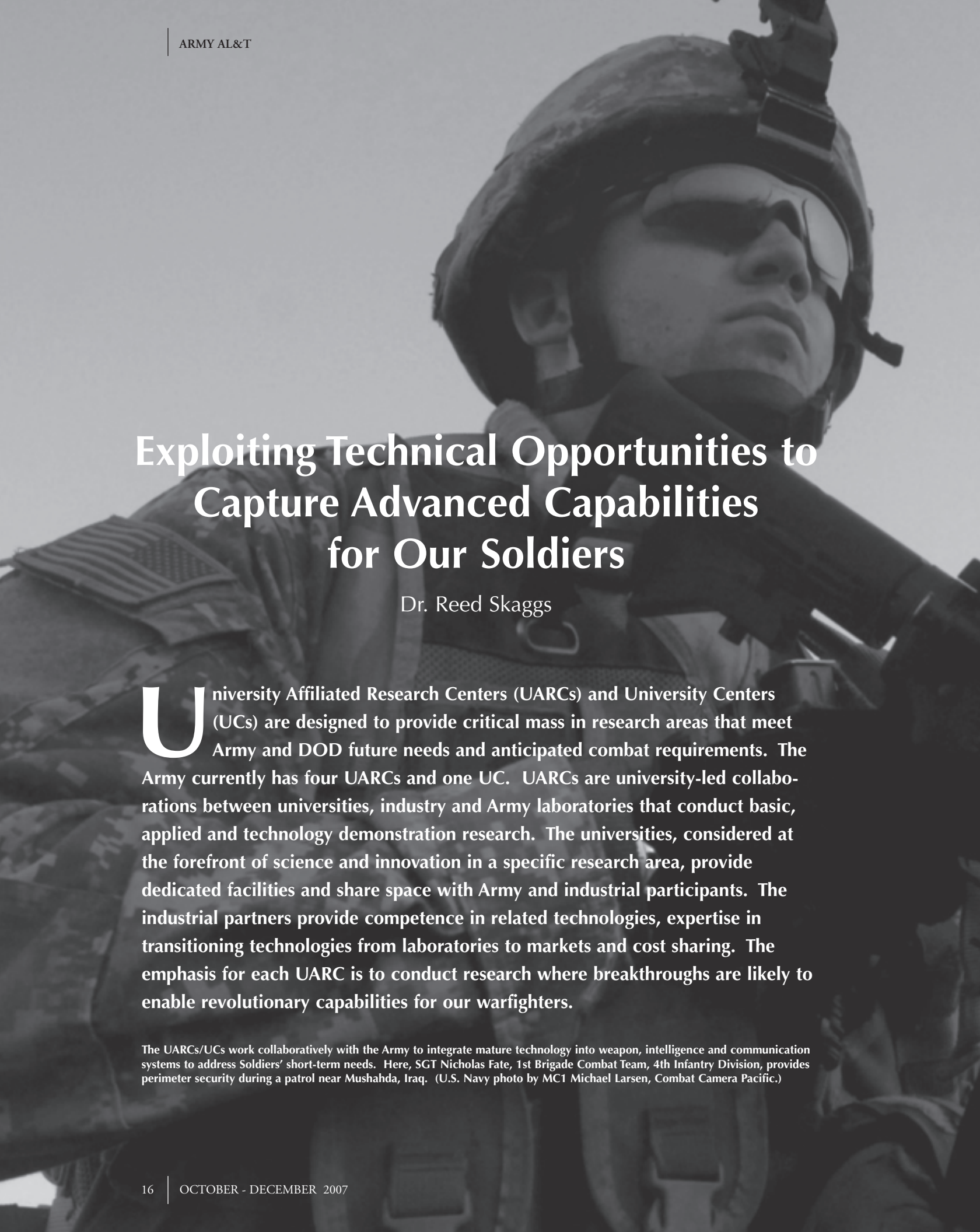

Exploiting Technical Opportunities to Capture Advanced Capabilities for Our Soldiers

Dr. Reed Skaggs

University Affiliated Research Centers (UARCs) and University Centers (UCs) are designed to provide critical mass in research areas that meet Army and DOD future needs and anticipated combat requirements. The Army currently has four UARCs and one UC. UARCs are university-led collaborations between universities, industry and Army laboratories that conduct basic, applied and technology demonstration research. The universities, considered at the forefront of science and innovation in a specific research area, provide dedicated facilities and share space with Army and industrial participants. The industrial partners provide competence in related technologies, expertise in transitioning technologies from laboratories to markets and cost sharing. The emphasis for each UARC is to conduct research where breakthroughs are likely to enable revolutionary capabilities for our warfighters.

The UARCs/UCs work collaboratively with the Army to integrate mature technology into weapon, intelligence and communication systems to address Soldiers' short-term needs. Here, SGT Nicholas Fate, 1st Brigade Combat Team, 4th Infantry Division, provides perimeter security during a patrol near Mushahda, Iraq. (U.S. Navy photo by MC1 Michael Larsen, Combat Camera Pacific.)

UCs are very similar to UARCs with the exception that they are funded by a cooperative agreement between the Army and the university to work collaboratively in a rapidly changing, mature technology area that is aligned with the short-term needs and timelines of major Army weapon, intelligence and communication systems. Industry partners join the center through cooperative agreements, when a synergism between the center's technology and the production abilities of industry can be achieved.

UCs are funded by a cooperative agreement between the Army and the university to work collaboratively in a rapidly changing, mature technology area that is aligned with the short-term needs and timelines of major Army weapon, intelligence and communication systems.

The roles of UARCs and UCs include:

- Conducting research on assigned Army problems.
- Developing selected research prototype hardware, software and models.
- Conducting independent technical evaluations at the Army's request.
- Providing technical leadership in identifying and resolving Army problems within their areas of competency.
- Organizing collaborative activities and promoting other linkages between Army/DOD, academia and industry.
- Assisting in technology transfer to industry.
- Fostering education in engineering and scientific disciplines that are especially relevant to Army/DOD needs.

Management and oversight of each UARC is coordinated by an Army Executive Agent (EA). The EA provides oversight organization of each UARC with coordination of individual Technical Advisory Boards (TABs) that assess the UARC's technical progress and achievements annually. The UARC TABs report to an Executive Steering Board that addresses issues of Army policy with respect to all UARCs. Brief overviews of the four Army UARCs and the Flexible Display UC follow.

The University of Texas-Austin Institute for Advanced Technology (IAT)

The IAT conducts basic research to advance the state-of-the-art in electrodynamics and hypervelocity physics as they relate to electromagnetic weapons. A detailed article on Page 20 of this edition by Army Program Manager Dr. Ed Schmidt and IAT Founding Director Dr. Harry Fair describes IAT's awesome capabilities and some of the technical challenges and breakthroughs their research team has encountered developing electromagnetic weapons.

The University of Southern California (USC) Institute for Creative Technologies (ICT)

The ICT conducts basic and applied research in immersive technologies to advance and maintain the state-of-the-art for human synthetic training experiences so compelling that participants will react as if they are real. The article on Page 24 details the impact that ICT training products have on today's and tomorrow's warfighters. Army Program Manager Dr. Jeff G. Wilkinson shares his insight about program direction and how immersive technologies are helping Soldiers learn, train and prepare for operational environments.

The Massachusetts Institute of Technology (MIT) Institute for Soldier Nanotechnologies (ISN)

The ISN's mission is to conduct basic research to advance the state-of-the-art in nanotechnologies as they relate to Soldier protection needs and requirements. The ISN's goal is to carry out fundamental research that is relevant to the Soldier and to transition it into more applied efforts. The article on Page 28 by Army Program Manager Dr. Douglas Kiserow and ISN Director Dr. John Joannopoulos details the five strategic research areas where the ISN is actively implementing nanotechnology to affect revolutionary changes for warfighter survivability on the battlefield.

The University of California-Santa Barbara Institute for Collaborative Biotechnologies (ICB)

The ICB provides national leadership in frontier research at the interface between biotechnology and engineering to harness complex

Research being developed at USC's ICT will lead to immersive technologies that will advance human synthetic experiences from compelling training events so that Soldiers entering a new theater of operations will already feel like they know the culture, terrain and political/sociological nuances. Here, Soldiers from Alpha Co., 1st Battalion, 149th Infantry Regiment, patrol the Al Furat section of Baghdad, Iraq, on Aug. 20, 2007. (U.S. Army photo by SGT Jon Soucy.)

MIT's ISN is advancing the state-of-the-art in nanotechnology research and development related to Soldier protection needs and requirements. Here, Soldiers from Delta Co., 2nd Battalion, 3rd Brigade Combat Team, 25th Infantry Division, monitor vehicular and pedestrian traffic in and out of Riyadh, Iraq, last April. (U.S. Air Force photo by TSGT Maria J. Bare, 1st Combat Camera Squadron.)

biological mechanisms for the development of revolutionary approaches to advanced sensors — electronic, optical and magnetic materials — information processing and network control systems to enhance Army operational effectiveness. The ICB mission, organization and promising transitions are described in an article by ICB Army Program Manager Dr. Robert J. Kokoska and ICB Director Dr. Daniel E. Morse on Page 32.

The Arizona State University Flexible Display Center (FDC)

Flexible Display Center at Arizona State University

The FDC facilitates the advancement of full-color flexible display technology while catalyzing the rapidly growing vibrant flexible display industry by contributing to and accelerating development of human capital, tools, facilities and intellectual property. The FDC's principal technical goal is to develop material and manufacturing technology for high-performance, conformal and flexible displays that are ultra-rugged, lightweight, of reduced volume, low power and low cost. FDC Army Program Manager Dr. David Morton and FDC Director Dr. Gregory B. Raupp provide a detailed synopsis of the FDC's recent accomplishments in their article on Page 44.

Technical opportunities arise to advance major new capabilities through sustained, long-term multidisciplinary research efforts. To exploit these opportunities, the Army has created UARCs and a UC in the areas of hypervelocity lethality, simulation and training, Soldier protection, biologically inspired technologies and flexible displays. Each center brings together a collection of specific basic research disciplines to focus on significant technical challenges involving a sustained effort over time. Collectively, the centers partner with industry and Army laboratories to transition new knowledge and novel technology concepts for further development. The centers also take advantage of knowledge and expertise that uniquely reside at Army laboratories and industry to further advance their research work. Graduate students led by senior scientists and engineers at these centers play a critical role in advancing new knowledge to support the Army mission.

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The Institute for Advanced Technology — Advancing the State-of-the-Art in Electromagnetic and Hypervelocity Research

Dr. Ed Schmidt and Dr. Harry Fair

The use of electromagnetic energy to propel objects to extremely high speeds has broad and important consequences for many elements of our society, including transportation, communications, energy, national defense and space. Both the U.S. Army and the U.S. Navy (USN) have interest in electromagnetic launch to provide enhanced lethality at greatly extended ranges. The U.S. Air Force is examining the possibility of electromagnetically inserting satellites into low Earth orbit. These applications all require a base of fundamental research. The Institute for Advanced Technology (IAT) at the University of Texas-Austin (UTA) is providing these scientific underpinnings. IAT was founded in 1990 and in 1993 became the very first Army University Affiliated Research Center (UARC). The IAT is chartered to perform basic research in electromagnetic launch, pulsed power, hypervelocity physics and education.

The UTA IAT is at the forefront of hypervelocity projectile/ballistics research. Besides the Army, other federal agencies interested in the IAT's technological breakthroughs are the Department of Energy and NASA. Here, the "energy flash" is created by a projectile launched at extreme velocity during a ballistics test. (Photo courtesy of NASA.)

Electromagnetic launch research is primarily directed at the physics of rail guns. A rail gun consists of a pair of parallel rails between which a conducting projectile (armature) travels. The electrical current passing through the rails generates a magnetic field that acts on the conducting armature to produce the Lorentz force to accelerate the projectile. Rail guns have achieved velocities up to 6 kilometers per second (km/s). Present Army interest is in the range of 1.5-2.5 km/s. Given the high currents and magnetic fields associated with these launchers, the thermal, structural and electrodynamic behavior of the hypervelocity projectile and launcher cannot be defined with either conventional modeling or experimentation. IAT is developing the techniques necessary to attack these problems.

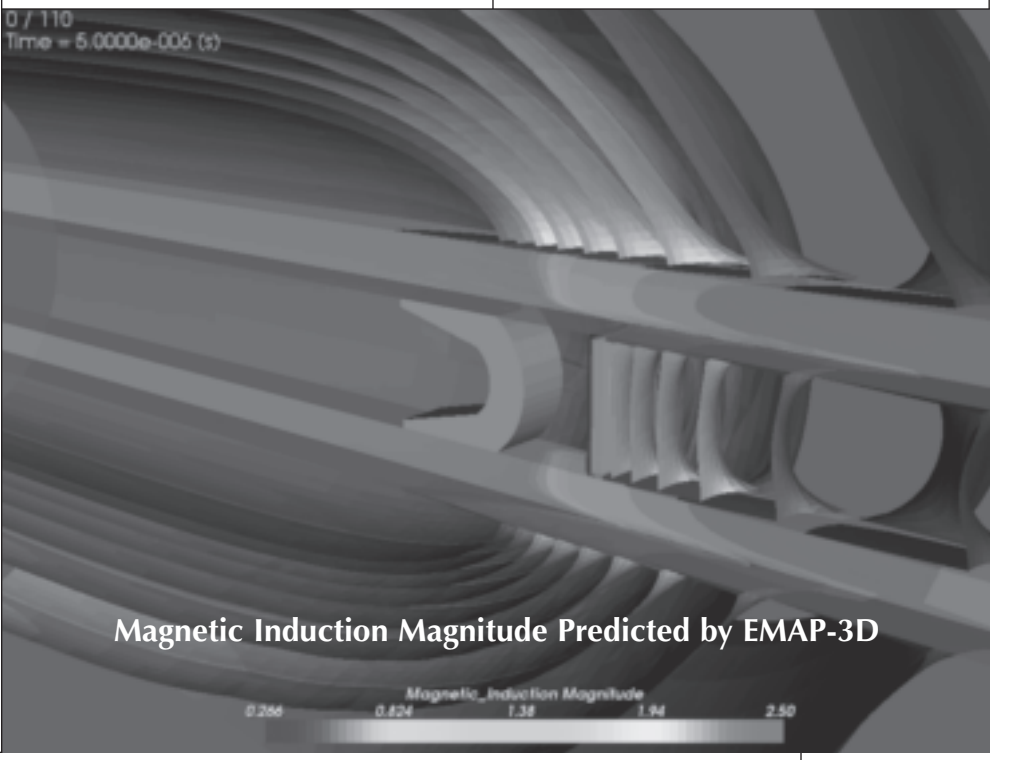
The Electromechanical Analysis Program in Three Dimensions, better known as EMAP-3D, code under development at IAT provides the best model of the environment during launch, as illustrated in the adjacent figure. This shows the magnitude of the magnetic field induced around the projectile and rails. The code couples electromagnetic, thermal and structural dynamics. The electromagnetic environment must be accurately described to predict the loads to which the projectile and launcher are exposed. Since the currents passing through rail guns can reach 5 million amperes or more, the thermal loadings associated with ohmic heating critically influence the survival of both the projectile and launcher. Typically, projectiles lose part of their mass as the armature ablates away.

In addition, a phenomenon called contact transition takes place when the rail/armature contact changes from a solid to a plasma contact. Damage to both the projectile and launcher may take place during and after transition. IAT is developing the theory to describe these high-velocity interface dynamics so that future Army electromagnetic launch systems can be effective. Important input to the model is detailed material properties. The UARC has developed a unique experimental capability to measure these properties under conditions of impulsive thermal, mechanical and electrodynamic loads. The data has proven that significant differences exist when compared to static or nearly static databases.

The UARC has developed a unique experimental capability to measure these properties under conditions of impulsive thermal, mechanical and electrodynamic loads.

To provide validation of theory and to test advanced concepts, the IAT operates a premier electromagnetic rail gun research laboratory that contains multiple rail guns, extensive diagnostic instrumentation and is powered by a flexible capacitor-based pulse-forming network.

Experiments conducted in the Electromagnetic Research Facility have led to theoretical treatments for the control of hypervelocity gouging. This phenomenon occurs when two surfaces slide over each other at high speeds and is characterized by the production of gouges or divots in the softer surface. This theory is being applied by both the Army and USN in developing electromagnetic launchers and projectiles. This facility has provided the best fundamental description of contact transition and how it progresses across the armature during the launch process. It is presently being used to analyze the physical processes that lead to rail and insulator wear and erosion. If the rail gun is to be practical, it must be comparable to conventional propellant guns and survive thousands of shots. Typically, laboratory rail guns only operate for a few shots and then they are re-cored. IAT technology has provided insight to the



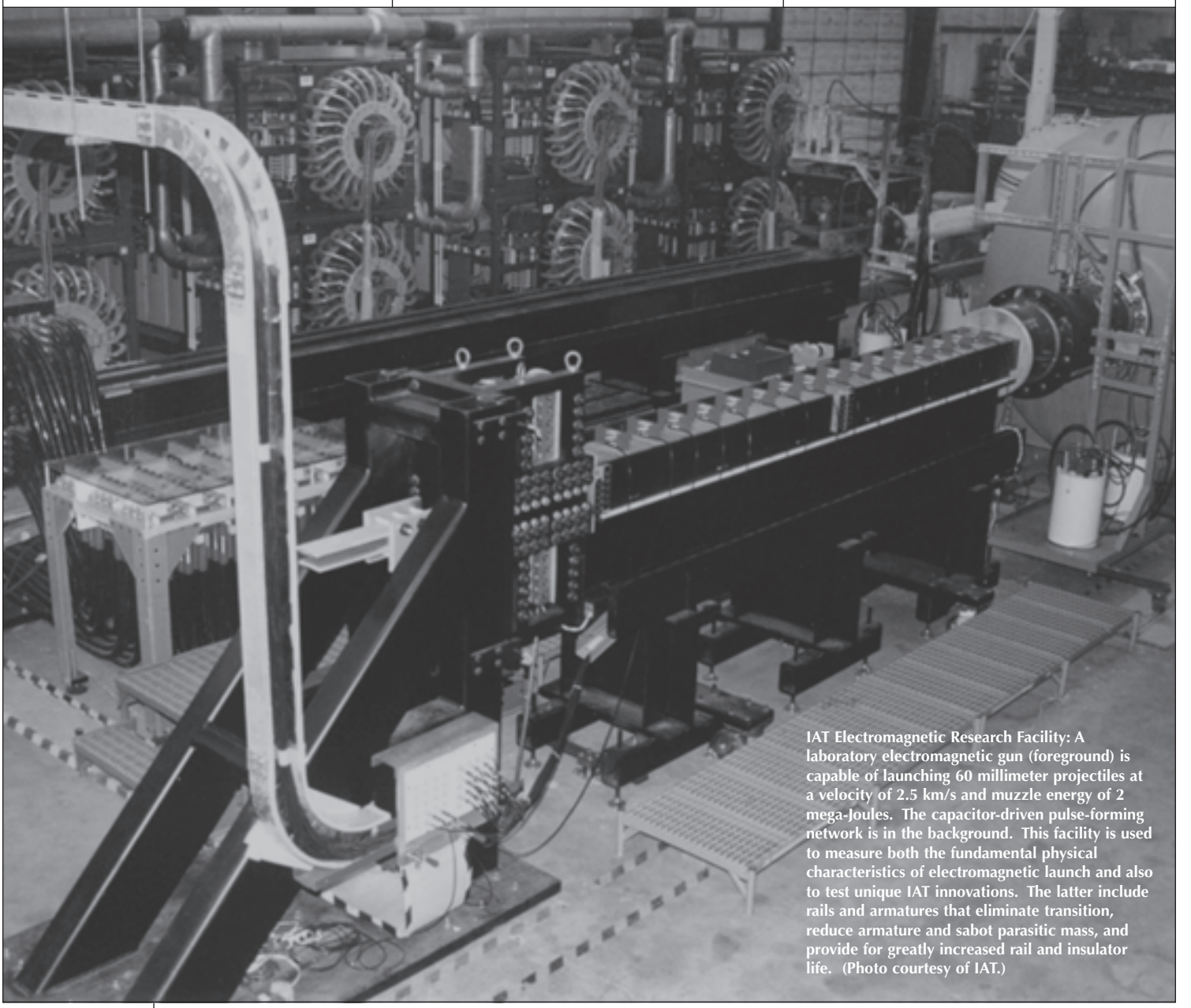
Magnetic Induction Magnitude Predicted by EMAP-3D

life problem and has demonstrated up to 100 shots. This work is continuing to prove that rail guns have even greater useful lives.

The most critical problem faced by the Army's electromagnetic program is to develop pulsed power that is compact, lightweight and efficient. These characteristics are requirements for mounting an electromagnetic system on a mobile ground-fighting platform. IAT research is making important, long-term contributions to solving this problem. Both analytic and numerical models are being developed to describe the physical and electromechanical characteristics of pulsed power. The primary Army electrical power system is the rotating machine or pulsed alternator. IAT has developed a model to describe machine performance and its interaction with the electromagnetic gun and projectile. IAT is also looking into longer-term solutions using alternative approaches that just might prove to be more effective. A wide range of techniques have been examined ranging from explosive flux compressors to advanced, high-energy density capacitors.

The most critical problem faced by the Army's electromagnetic program is to develop pulsed power that is compact, lightweight and efficient.

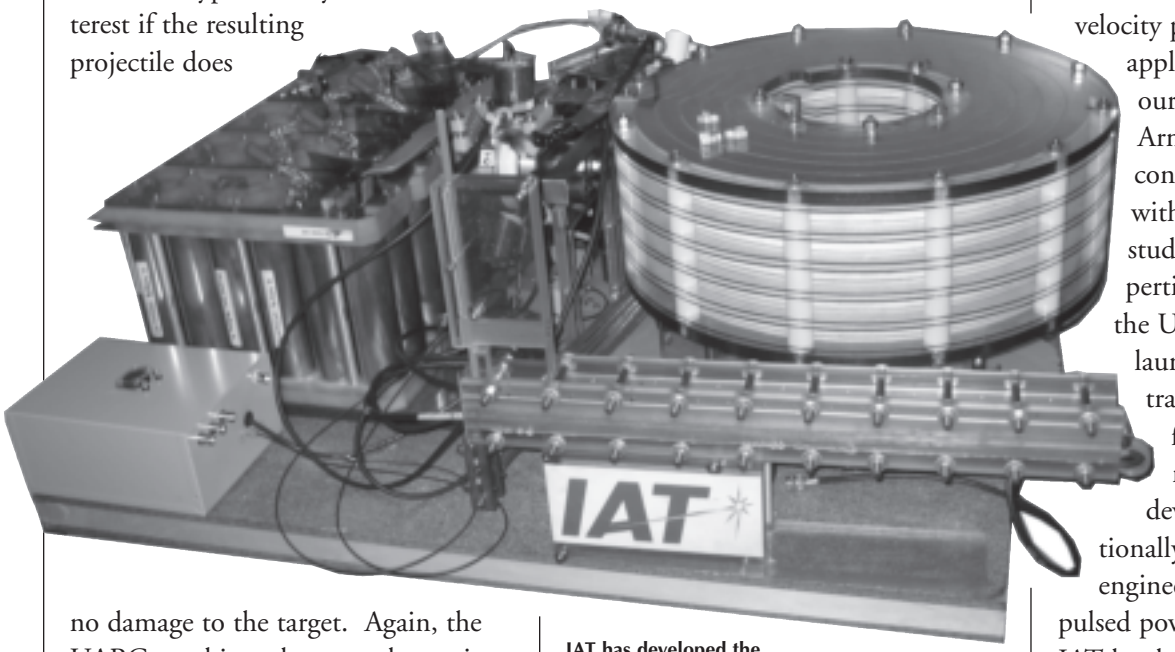
One approach that is receiving particular attention is the battery-inductor. This device uses lithium-ion batteries discharging through an inductor coil to fire a small caliber rail gun. The system has demonstrated the ability to rapidly recharge and has fired



IAT Electromagnetic Research Facility: A laboratory electromagnetic gun (foreground) is capable of launching 60 millimeter projectiles at a velocity of 2.5 km/s and muzzle energy of 2 mega-Joules. The capacitor-driven pulse-forming network is in the background. This facility is used to measure both the fundamental physical characteristics of electromagnetic launch and also to test unique IAT innovations. The latter include rails and armatures that eliminate transition, reduce armature and sabot parasitic mass, and provide for greatly increased rail and insulator life. (Photo courtesy of IAT.)

multiple-shot bursts. The technology is being scaled up to a size more compatible with actual Army needs.

Of course, having the capability to launch at hypervelocity is of little interest if the resulting projectile does no damage to the target. Again, the UARC combines theory and experiment to describe the processes associated with hypervelocity impact. It has long been known that monolithic rods achieve their greatest penetration (per unit impact energy) at a velocity of around 2.2 km/s. IAT has demonstrated that this process can be greatly enhanced through the use of novel kinetic energy penetrators having unique geometries to optimize their effectiveness. IAT uses and improves upon the latest state-of-the-art models developed by the Department of Energy. It has successfully modified the codes to treat novel kinetic energy penetrators. The process of performance optimization requires validation of the code predictions. IAT operates an impact physics laboratory containing the largest and most highly diagnosed hypervelocity light gas gun of any university worldwide. The facility is capable of detailed measurements of penetration into the complete range of targets of Army interest.



IAT has developed the battery-inductor driven rail gun, which has demonstrated that it can fire multiple-shot bursts. (Photo courtesy of IAT.)

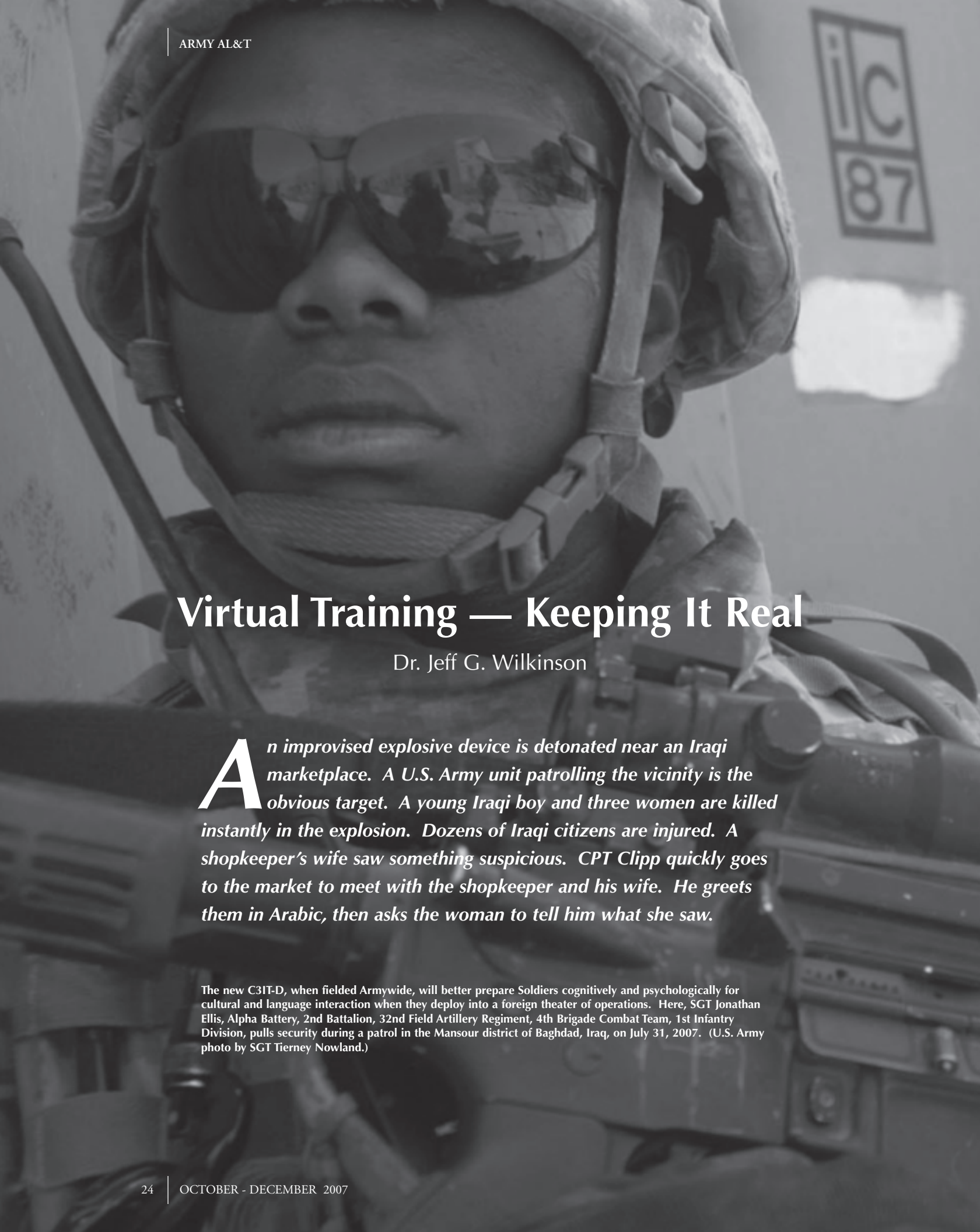
The IAT also serves as a center for education in the disciplines associated with electromagnetic launch. It sponsors guest researchers who pursue advanced degrees at UTA. It has a strong outreach program to attract high school students and undergraduates, including cadets and midshipmen, to study science and engineering. IAT is also the lead biannual Electromagnetic Launch Symposium sponsor, bringing together people from around the world working in this technology. IAT conducts frequent short courses in support of Army and national needs. As a separate activity, it hosts the Army Senior Service Fellows. This group of field grade officers is pursuing War College-equivalent studies at UTA.

> The IAT remains committed to providing pioneering research and development for the implementation of advanced electric weapons systems for the Future Force.

The IAT continues to support the Army by executing world-class research in electrodynamics and hypervelocity physics pointing the way to applications with high payoff for our armed forces. As the Army's first UARC, the IAT continues to assist the Army with data generation, analytic studies and subject matter expertise. Recent commitment by the USN in electromagnetic launch for ships is being fast-tracked through lessons learned from Army-sponsored IAT research. By recruiting and developing the leading internationally recognized scientists and engineers in hypervelocity physics, pulsed power and electrodynamics, IAT has built a research team to conduct world-class, tightly coupled theoretical, computational and experimental research. Many science and technology challenges considered to be insurmountable have yielded to this focused research team. The IAT remains committed to providing pioneering research and development for the implementation of advanced electric weapons systems for the Future Force.

DR. ED SCHMIDT is the Army Program Manager for IAT. He holds a Ph.D. in astronautics from the Polytechnic Institute of Brooklyn and is a Senior Scientist at the Army Research Laboratory.

DR. HARRY FAIR is the IAT Founding Director at UTA. He holds a Ph.D. in solid state physics from the University of Delaware.



Virtual Training — Keeping It Real

Dr. Jeff G. Wilkinson

An improvised explosive device is detonated near an Iraqi marketplace. A U.S. Army unit patrolling the vicinity is the obvious target. A young Iraqi boy and three women are killed instantly in the explosion. Dozens of Iraqi citizens are injured. A shopkeeper's wife saw something suspicious. CPT Clipp quickly goes to the market to meet with the shopkeeper and his wife. He greets them in Arabic, then asks the woman to tell him what she saw.

The new C3IT-D, when fielded Armywide, will better prepare Soldiers cognitively and psychologically for cultural and language interaction when they deploy into a foreign theater of operations. Here, SGT Jonathan Ellis, Alpha Battery, 2nd Battalion, 32nd Field Artillery Regiment, 4th Brigade Combat Team, 1st Infantry Division, pulls security during a patrol in the Mansour district of Baghdad, Iraq, on July 31, 2007. (U.S. Army photo by SGT Tierney Nowland.)

The shopkeeper is outraged. "You speak to me, not to her!" he shouts. Clipp quickly apologizes, rethinks his approach and then carefully works with the shopkeeper to get the information he needs from the man's wife. A short time later, a suspect is detained. After many questions about the man's activities that morning, Clipp asks the man, "Did you have a push cart at the market this morning?" The man replies, "I did not have a pottery cart." Clipp did not mention a pottery cart. The detainee just made a big mistake and Clipp knows that he has his man.

What you just witnessed is not a real event, but rather a training scenario based on a real event. Soldiers need training in culturally appropriate behavior, bilateral engagement and in the art/science of tactical questioning. Enter human-oriented training. Currently, live Iraqi role players provide realism for home station and combat training center human-oriented training.

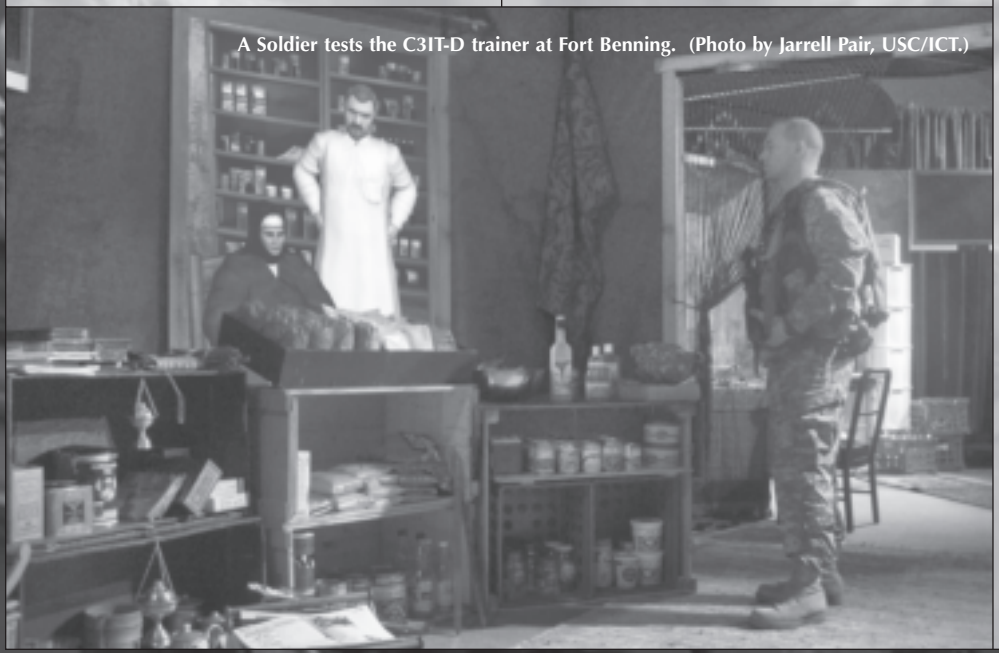
This vignette, however, is not part of a live scenario. It comes from the Cultural & Cognitive Combat Immersive Trainer-Demonstration (C3IT-D) prototype tested at Fort Benning, GA. Clipp is a real Soldier but all of the other participants are life-sized computer-generated virtual humans created by the University of Southern California's (USC's) Institute for Creative Technologies (ICT). The realistic environment, complex characters and technologies integrated to create this prototype were the result of collaboration by the ICT; the U.S. Army Research, Development and Engineering Command (RDECOM) Simulation and Training Technology Center (STTC); and U.S. Army Infantry Center.

In 1997, the National Research Council Report *Modeling and Simulation [M&S]: Linking Entertainment and Defense* identified opportunities for leveraging DOD and entertainment research. In 1999, the ICT was chartered as a University Affiliated Research Center (UARC) to conduct research in M&S technologies by leveraging the entertainment industry's, DOD's and academia's research and innovation. RDECOM STTC serves as the Executive Agent for this UARC and manages the research contract for the Army.

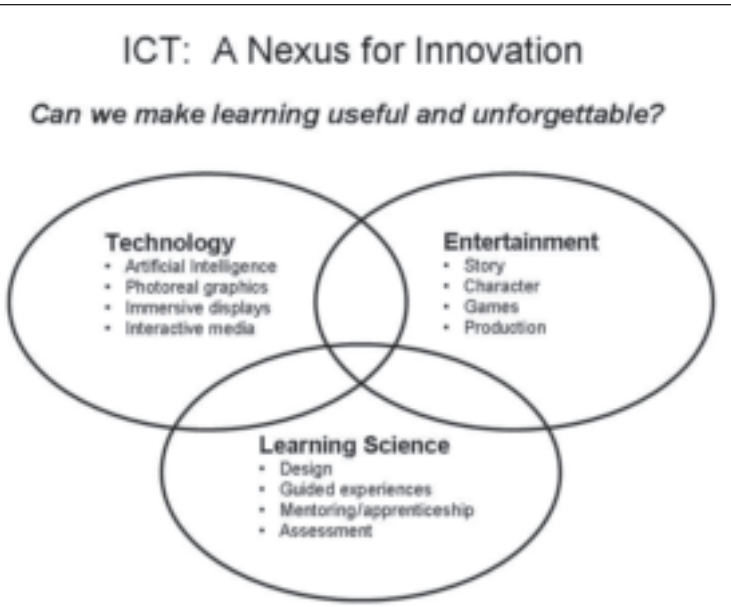
ICT's mission is to "build a partnership among the entertainment industry, the Army and academia, with the goal of creating synthetic experiences so compelling that participants react as if they are real. The result is engaging, new immersive technologies for learning, training and operational environments."

The ICT has evolved since it opened in 1999. Opportunities to leverage ICT research have expanded beyond immersive training technologies into operational capabilities. Research in the areas of artificial intelligence (AI), realistic graphics and immersive audio have significant potential to enhance multimodal display systems, decision support systems and user interfaces in next generation command and control systems. They also enable virtual reality immersion therapy to treat Post-Traumatic Stress Disorder. With this in mind, ICT's mission is to "build a partnership among the entertainment industry, the Army and academia, with the goal of creating synthetic experiences so compelling that participants react as if they are real. The result is engaging, new immersive technologies for learning, training and operational environments."

Research in AI, graphics and sound alone is not sufficient to create compelling and memorable experiences. Another key element to immersion is provided by well-crafted stories and characters, which draw the viewer into the scenario, setting the conditions for memorable experiences. Through its collaboration with Hollywood and the game industry, ICT is conducting research to extend state-of-the-art story development, immersive games for training, rapid scenario generation and system production. Realistic environments and well-crafted scenarios are necessary



A Soldier tests the C3IT-D trainer at Fort Benning. (Photo by Jarrell Pair, USC/ICT.)



to create truly useful experiences but alone are insufficient. Whether one is focused on training a task or learning a concept, it is crucial to present the right set of developmental experiences. This is where the learning sciences make a contribution to this nexus of innovation — through design, guidance, mentoring and assessment. ICT's multidisciplinary approach to research in immersive learning technologies is depicted in the figure above. The end goal is effective learning that is useful and unforgettable.

The ICT research portfolio spans these areas through an interdisciplinary research program that includes the following major thrusts.

Virtual Humans

Most military simulations focus on high-fidelity models and simulators of vehicles, aircraft and units. But mission success also requires human interaction, whether it is within a team, engagement with locals or working with nongovernmental organizations. To train these human-oriented tasks, the objective is to create interactive simulations of people — virtual humans. A significant portion of ICT's research in AI is focused on solving the challenges to developing virtual humans that:

- Fully perceive their environment (including real humans).
- Interact using the full repertoire of human interaction:
  - Robust verbal language.
  - Nonverbal communication (gestures, facial expressions, etc.).
- Manipulate and interact with the environment.
- Model emotions and their effect on behavior.
- Can introspect and model other's beliefs, desires and intentions.
- Learn.

While the C3IT-D prototype described above is a glimpse into how a fully capable virtual human can be used in a training system, individual technologies are already being transitioned to Army programs. For instance, RDECOM STTC and ICT are currently working with Program Manager (PM) Constructive Simulation to integrate natural language and emotion models into the Intelligence and Electronic Warfare Tactical Proficiency Trainer. This successful technology transition resulted in a $34 million program cost avoidance.

Realistic Graphics

A typical animated film or game requires expensive and time-consuming artistic effort. The ICT graphics lab is performing research that will enable simulations that are photorealistic, rapidly reconfigurable and available in real-time.

A challenge to providing photorealistic animated images is the need for realistic lighting within a simulation. The graphics lab has created techniques to rapidly capture and manipulate image data, which includes the reflectance properties of an object or person. These techniques enable rendering, in a computer-generated environment, of photo-real images of objects or people that react appropriately to the lighting conditions in the simulation (streetlights, explosions, etc.). These photo-real images can be calculated automatically and produce consistent and realistic appearance. The results of this research have been exploited in movies such as *Spider Man II*, *Superman Returns* and *King Kong*. A new challenge being addressed by ICT is to create highly realistic real-time animations of virtual humans. This capability will enable mission-rehearsal-level training of human-oriented tasks.

Social and Cultural Representation

Simulations need to account for the operational environment's social, cultural and political complexities. This goes beyond developing the hard-coded methods that occur each time a new area of operations is introduced. The ICT is researching methods to represent cultural knowledge in simulated characters as swappable culture modules. Critical to this effort are the answers to some very basic questions: What does such a culture module contain? How does the system use it? Can culture modules be authored? The idea of a swappable culture module that modifies the behavior of simulated characters cannot be fully

exploited without also addressing the need for representing these characteristics within the environment. Key to the development of rapid scenario generation tools is developing a fundamental understanding of how to represent the social, cultural and political context of the terrain, and do it in a modular and easy-to-author manner. Advances in this research will enable simulation-based training in geo-specific terrain that has been augmented with social, cultural and political information.

> Whether one is focused on training a task or learning a concept, it is crucial to present the right set of developmental experiences. This is where the learning sciences make a contribution to this nexus of innovation — through design, guidance, mentoring and assessment.

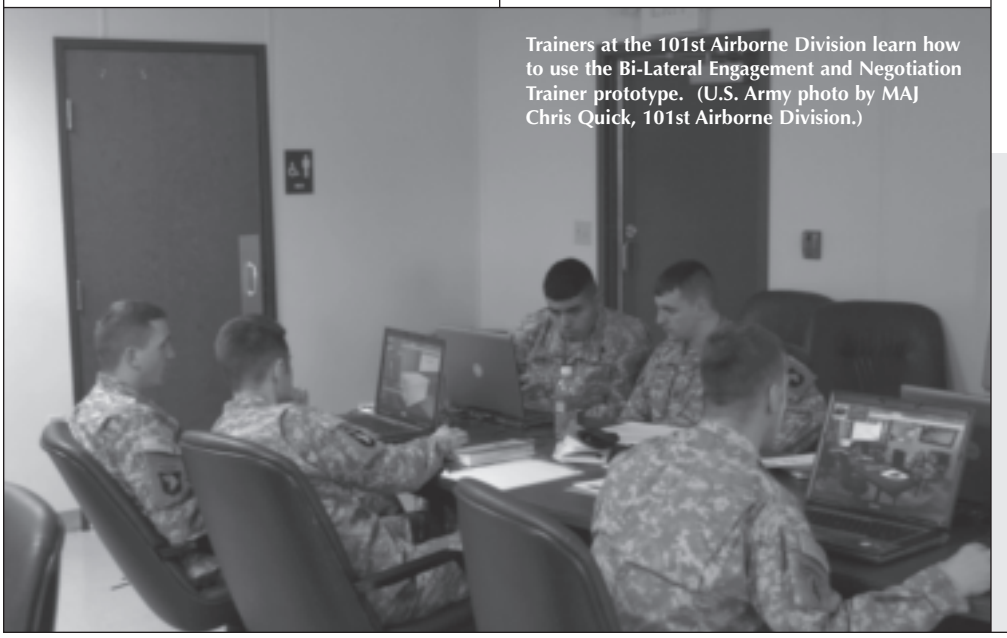
Intelligent Tutoring Systems

The ICT is exploring the integration of Intelligent Tutoring System technology into human-oriented training systems. This research is set within the Guided Experiential Learning (GEL) model of training design. Created by Dr. Richard Clark, Professor of Educational Psychology and Technology at the USC Rossier School of Education, GEL has been adopted as a supplement to Soldier training by the U.S. Army Training and Doctrine Command (TRADOC). It emphasizes deliberate practice and the critical role of feedback and guidance. The ultimate goal is to build automated tutors and coaches that maximize the learning effectiveness of computer simulations used for training.

This team seeks to answer fundamental questions that face all serious games and training simulations:

- The timing of feedback — how often should a coach intervene?
- Content — is goal-based feedback superior to explanation-based?
- Reflection — what is the appropriate structure for an after-action review?

The results of this learning science research are critical to ensure that the investment in the simulation's realism and the complex scenarios are coupled with the guidance and feedback necessary to enable effective learning.



Trainers at the 101st Airborne Division learn how to use the Bi-Lateral Engagement and Negotiation Trainer prototype. (U.S. Army photo by MAJ Chris Quick, 101st Airborne Division.)

The ICT has developed active partnerships with government laboratories, other universities, Army schools, PMs and industry to align its research with the greater community's needs. A current example of a collaborative effort is the Learning With Adaptive Simulation and Training Army Technology Objective (ATO), which is a team effort among the ICT, RDECOM STTC, Army Research Institute, Army Research Laboratory and TRADOC. An early spin-out from this ATO is the Bi-Lateral Engagement and Negotiation Training System. This PC-based prototype incorporates many of the research technologies discussed into a GEL system. The prototype is being tested by units from the 101st Airborne Division, 10th Mountain Division, 1st Infantry Division and the School for Command Preparation.

ICT's early vision — to bring together academia, the entertainment industry and the Army to create engaging, new immersive technologies for human-oriented learning and training — has proven to be even more important today than it was in 1999. ICT Executive Director Dr. Randy Hill welcomes the opportunity to partner with organizations to transition ICT research, or collaborate to create innovative multidisciplinary solutions to tough immersive learning technology challenges.

DR. JEFF G. WILKINSON is an RDECOM STTC member. He is the government's PM for the ICT at USC. Prior to retiring from the Army, he was the Chief, Simulations Division, Armor Center, and served as the Deputy TRADOC System Manager for the Combined Arms Tactical Trainer. He holds an M.S. and Ph.D. in economics/operations research from The Colorado School of Mines.

The Institute for Soldier Nanotechnologies — Developing Revolutionary Survivability Technologies for Soldiers

Dr. Douglas Kiserow and Dr. John Joannopoulos

In March 2002, the Army selected the Massachusetts Institute of Technology (MIT) to host the Institute for Soldier Nanotechnologies (ISN) as a University Affiliated Research Center (UARC). By definition, UARCs maintain a strategic relationship with DOD and provide or maintain DOD-essential engineering, research and/or development capabilities. ISN's mission is to dramatically enhance Soldier survivability through basic research and technology transitioning. ISN is a team that includes academia, industry and the Army, all working together to explore fundamental science and engineering and applied research to create new materials, devices, processes and systems to provide new and enhanced capabilities for Soldiers.

Through collaborative agreements, scientists and engineers are exploring emerging technological developments in the field of nanotechnology that will convert promising research results into practical Soldier products. This artist's rendering depicts a carbon nanotube membrane being developed to desalinate or demineralize water molecules. This previously unobserved phenomenon opens potentially unlimited possibilities or applications to enhance Soldier battlefield survivability and quality of life. (Image courtesy of Lawrence Livermore National Laboratory.)

The Army plays a critical role by providing guidance on Soldier survivability needs and the relevancy of new ISN research concepts. In addition, Army and industry personnel provide valuable expertise on how to convert promising results into practical products that work in harmony with other Soldier technologies. ISN innovations are beneficial for Soldiers, but also have broad applicability for DOD and the private sector, including first responders, law enforcement officers and U.S. Customs officials. As a UARC, the ISN provides the Army with a large, multidisciplinary academic and industrial team that can meet diverse scientific and engineering challenges in developing revolutionary survivability technologies for Soldiers.

The Challenge

Today's Soldier may carry more than 140 pounds of clothing and related equipment while facing a broad array of lethal threats, including ballistic, blast waves and shrapnel from improvised explosive devices (IEDs); lasers, chemical and biological weapons; and other hazardous materials. Moreover, Soldiers are expected to function effectively in climates, terrain and environments that can present significant risk of injury and medical problems. The ISN's challenge is to discover and transition technologies that can provide new and enhanced protective capabilities integrated into durable, comfortable, lightweight uniforms and equipment as depicted in the figure at right. By grounding its research portfolio in nanotechnology, the ISN is harnessing innovative science and engineering that is well-matched to Soldier requirements' challenges.

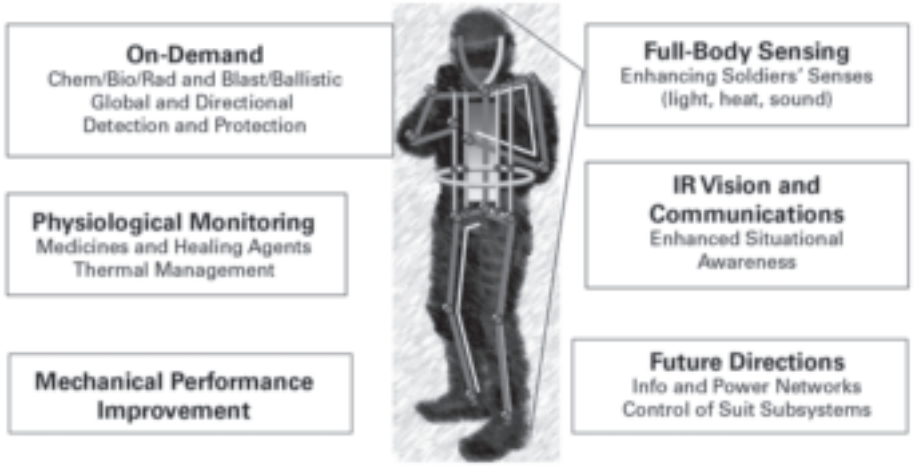
Nanotechnology research is focused on understanding and harnessing the size-dependence of the properties of matter at "tiny" length scales to generate fundamentally different and useful physical, chemical and biological properties. These tiny length scales range from less than 1,000 nanometers (nm) down to just a few nm. These sizes are truly minute — the diameter of a single human hair is roughly 80,000 nm. This size-dependent behavior opens up potentially paradigm-shifting opportunities to create materials and devices with unique electrical, optical, magnetic, thermal and chemical properties that may be exploited for Soldier survivability. Nanoscale materials and devices, either directly or as components of larger systems, have the potential to bring multiple capabilities in the form of tiny, lightweight building blocks. Building on its nanotechnology foundations, ISN research also addresses larger dimension materials and systems that are essential to developing new Soldier safety and protection capabilities.

> ISN's mission is to dramatically enhance Soldier survivability through basic research and technology transitioning.

Strategic Research Areas (SRAs)

The ISN basic research program has five SRAs focused on Soldier survivability as follows:

- *SRA-1, Lightweight, Multifunctional Nanostructured Fibers and Materials:* focuses on creating and enhancing survivability capabilities, e.g., sensing, imaging, decontamination and communications, using fibers, fabrics, particles, coatings, membranes and other "building block" materials. A key focus area is creating nanoparticle materials known as quantum dots (QD) for enhanced infrared (IR) vision/communications. Engineering the size of QDs allows for tailored emission or detection of IR light. Research on QDs is being carried out to develop low-cost, uncooled night vision goggles by an ISN-Raytheon-Army team that includes the Army Research Laboratory Sensors and Electron Devices Directorate (ARL-SEDD) and Communications-Electronics Command Research, Development and Engineering Center (RDEC) Night Vision Electronic Sensors Directorate.
- *SRA-2, Battle Suit Medicine:* is exploring autonomous medical diagnosis and intervention through materials and devices for physiological monitoring and controlled delivery of medicines. Research includes



Areas of Soldier protection and capabilities the ISN is exploring.

NSRDEC and ISN successfully demonstrated the IR laser-to-helmet combat identification and communications capabilities for the ICOM-H prototype. Nanoenabled materials and devices and optoelectronic fibers are enhancing potential Soldier battlefield survivability and communication capabilities. (U.S. Army photo by SSG Michael J. Carden.)

exploring tiny devices for autonomous medical care, e.g., to automatically monitor a Soldier's medical condition and, when needed, administer care, which could include arresting bleeding and preventing the onset of hemorrhagic shock.

- *SRA-3, Blast and Ballistic Protection:* focuses on understanding how blast waves and ballistic threats interact with and damage human tissues; and on creating a new generation of lighter weight yet stronger polymeric, metallic, ceramic and hybrid materials to protect the Soldier. One area of interest is creating nano- and micro-scale architectures, analogous to truss structures used for buildings, bridges and towers, to provide high strength-to-weight capability. Picatinny Arsenal, NJ, is collaborating with the ISN to investigate the use of ceramic composite structures to further strengthen these materials.
- *SRA-4, Chemical and Biological Materials Science:* is developing a new foundational understanding to enable sensing and identification of harmful substances in the Soldier's environment, as well as materials and coatings to protect Soldiers from a range of toxic materials. A particularly promising technology being explored is "gentle" chemical vapor deposition, which is effective for coating individual fibers in materials, such as cloth and fabrics, and for coating other surfaces, such as vehicles. This technique generates ultra-thin polymeric coatings that provide multiple protective capabilities without damaging the material being coated. Potential Soldier applications include lightweight, conducting polymer coatings to protect fabrics from hazardous substances, while also detecting and decontaminating toxic materials. In addition, ISN researchers are collaborating with ARL-SEDD to improve the performance of field effect transistors and with the Natick Soldier RDEC (NSRDEC) to facilitate biorecognition using nanofiber structures.
- *SRA-5, Nanosystems Integration Research:* is creating and bringing together nanoscale and nanoenabled materials and devices to provide new and enhanced systems for communications and other applications. A most promising technology being explored and developed is optoelectronic fibers that can be engineered to detect light or heat at any point along the fiber. In collaboration with NSRDEC, IR laser-to-helmet combat identification and communications capabilities were successfully demonstrated using the Identification and Communication-Helmet (ICOM-H) prototype by U.S. Army Special Operations Command (USASOC) Soldiers at Fort Devens, MA. This collaboration is ongoing and is refining and extending the communications and situational awareness capabilities of these devices. Potential Soldier applications include full-body sensing of light, heat, sound and non-radio frequency (RF) local area networking.

Technology Transitions

The most significant technology transition to date has put a new, highly accurate and sensitive explosives detector in the hands of Soldiers on the battlefield. ISN basic research exploring amplifying fluorescent polymer sensors, with roots in the Defense Advanced Research Projects Agency (DARPA) "Dog's Nose Program," has been transitioned by ISN industrial partner ICX/Nomadics into the Fido XT explosives detector, which won 2005 and 2006 Army's Greatest Invention Awards (See related articles in the August 2007 edition of *Army AL&T Online Monthly*) and is in use by Soldiers and Marines in Iraq and Afghanistan, USASOC and by U.S. Customs officials at U.S. ports of entry.

The use of these sensors is being explored for other applications, including an applied research project at NSRDEC on detecting food-borne pathogens. In another critical area, fabric modeling codes — based upon ISN research accomplishments in analytical modeling and numerical simulation of blast and ballistic impacts on structures and humans — have been transitioned to ParaSym Inc., which won an Armament Research, Development and Engineering Center Phase II Small Business Innovation Research (SBIR) award. The benefit to the Soldier is a tool that can more reliably analyze and predict the behavior of blast protective gear and to guide the design of stronger, yet lighter materials for blast and ballistic protection.

Basic research on antimicrobial coatings is being transitioned to industry via SBIR. Recently, small-business qualifier ICEO Inc. began transitioning and commercializing ISN basic research. They have licensed five ISN technology patents from MIT and are developing a microfluidic mixer that has no moving parts for biological sampling and portable medical diagnostics. The list of businesses licensing and transitioning ISN research include

DuPont®, Dow Corning, Raytheon, Triton®, ICx™/Nomadics, Parasym, GVD Corp., MicroCHIPS™ and QD Vision. Research areas include sensors for explosives, blast mitigation, medical treatment, displays and conformal electronics.

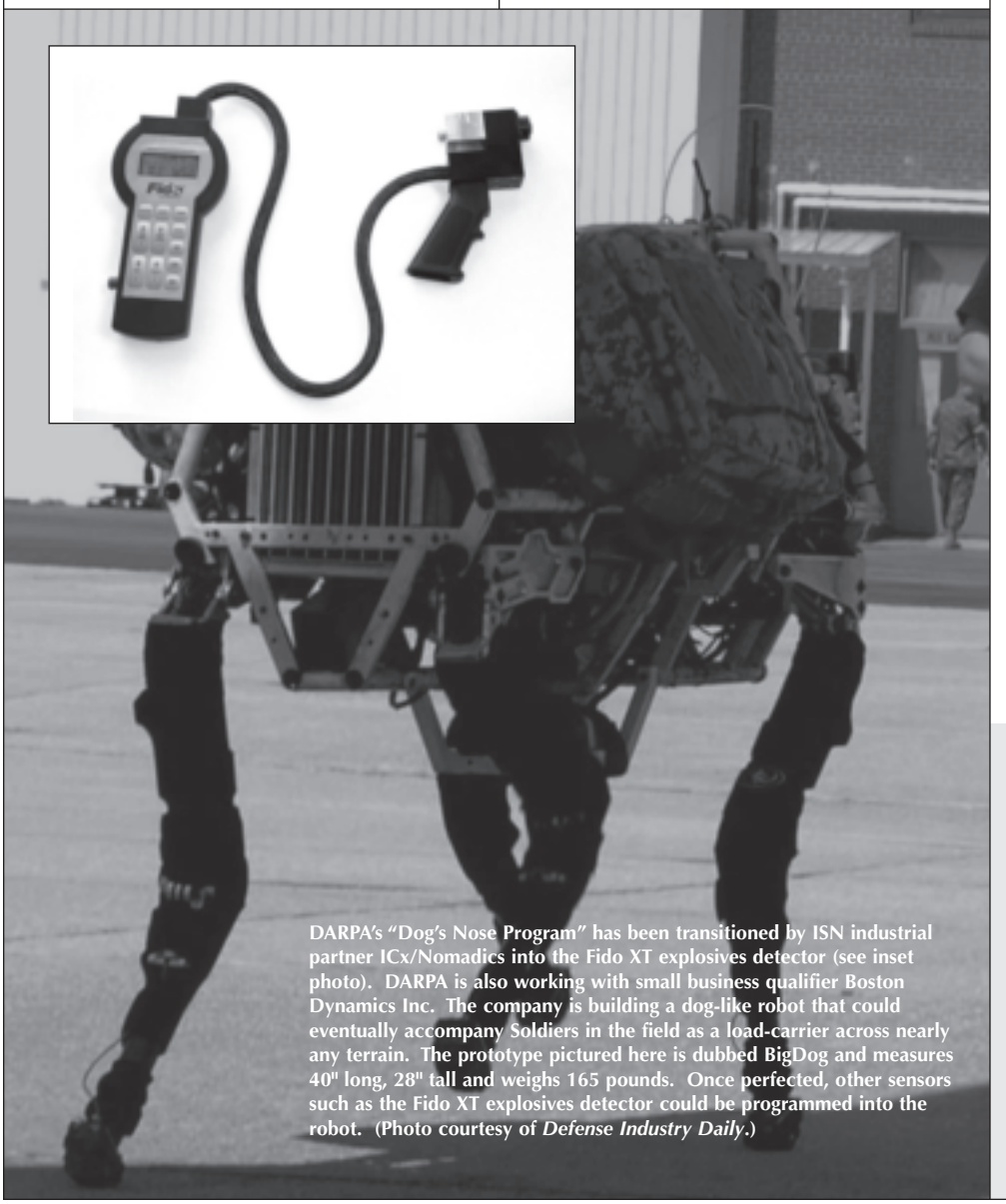
Established in 2003, the Soldier Design Competition (SDC) provides MIT students and U.S. Military Academy cadets with opportunities to perform research in the design and prototyping of technology solutions for real-world challenges faced by Soldiers. Teams compete for $20,000 in prize money donated by industrial sponsors that include Boeing, Foster-Miller, L3 Communications and Lockheed Martin. Winning prototypes are selected by a panel of experts from the Army, U.S. Marine Corps, industry and MIT. This highly successful initiative has engaged more than 125 students from the two campuses and spawned 11 startup companies. Transitions from the SDC include a battery scavenger technology and a "gesture engineering" system now funded in the Army Phase II SBIR program.

Looking to the Future

In the near term (2-5 years), ISN will continue creating and transitioning novel materials, devices and systems to provide Soldiers with new survivability capabilities. Examples include, but are not limited to:

- "Designer" polymer molecules that can detect trace quantities of a variety of explosives and toxic chemicals.
- Multifunctional optoelectronic fiber devices that sense heat, light and sound along the entire fiber length.
- Devices that monitor the Soldier's surroundings and provide non-RF bandwidth for communications.
- Ultra-thin coatings to impart diverse threat detection and protective capabilities.
- Wireless transmission of electricity over room-size distances.
- Potential Soldier applications include powering electronics within vehicles while reducing clutter and eliminating the weight of wires and cables, automatic recharging of Soldier electronic devices and supplying power to robots.

Additional academic expertise will strengthen the ISN in 2008 under a new program to engage faculty and students from Historically Black Colleges and Universities and Minority Institutions (HBCU-MIs) in ISN research. This effort will seek to develop research collaborations between the ISN and HBCU-MIs to enhance ongoing ISN programs and provide a wealth of previously untapped scientists and engineers.



DARPA's "Dog's Nose Program" has been transitioned by ISN industrial partner ICx/Nomadics into the Fido XT explosives detector (see inset photo). DARPA is also working with small business qualifier Boston Dynamics Inc. The company is building a dog-like robot that could eventually accompany Soldiers in the field as a load-carrier across nearly any terrain. The prototype pictured here is dubbed BigDog and measures 40" long, 28" tall and weighs 165 pounds. Once perfected, other sensors such as the Fido XT explosives detector could be programmed into the robot. (Photo courtesy of *Defense Industry Daily*.)

DR. DOUGLAS KISEROW is the Army Program Manager for ISN at MIT. He holds a Ph.D. in physical chemistry from the University of Texas-Austin and works for the ARL Army Research Office.

DR. JOHN JOANNOPOULOS is the MIT ISN Director. He holds a Ph.D. in physics and is the Francis Wright Davis Professor of Physics at MIT.

Pioneering Research for the Army at the Institute for Collaborative Biotechnologies (ICB)

Dr. Robert J. Kokoska and Dr. Daniel E. Morse

The worlds of biology and biotechnology have found their way into the development of vital technologies that will have a positive impact on Soldier performance. This is being accomplished through the basic and applied research efforts of investigators within the Army's ICB.

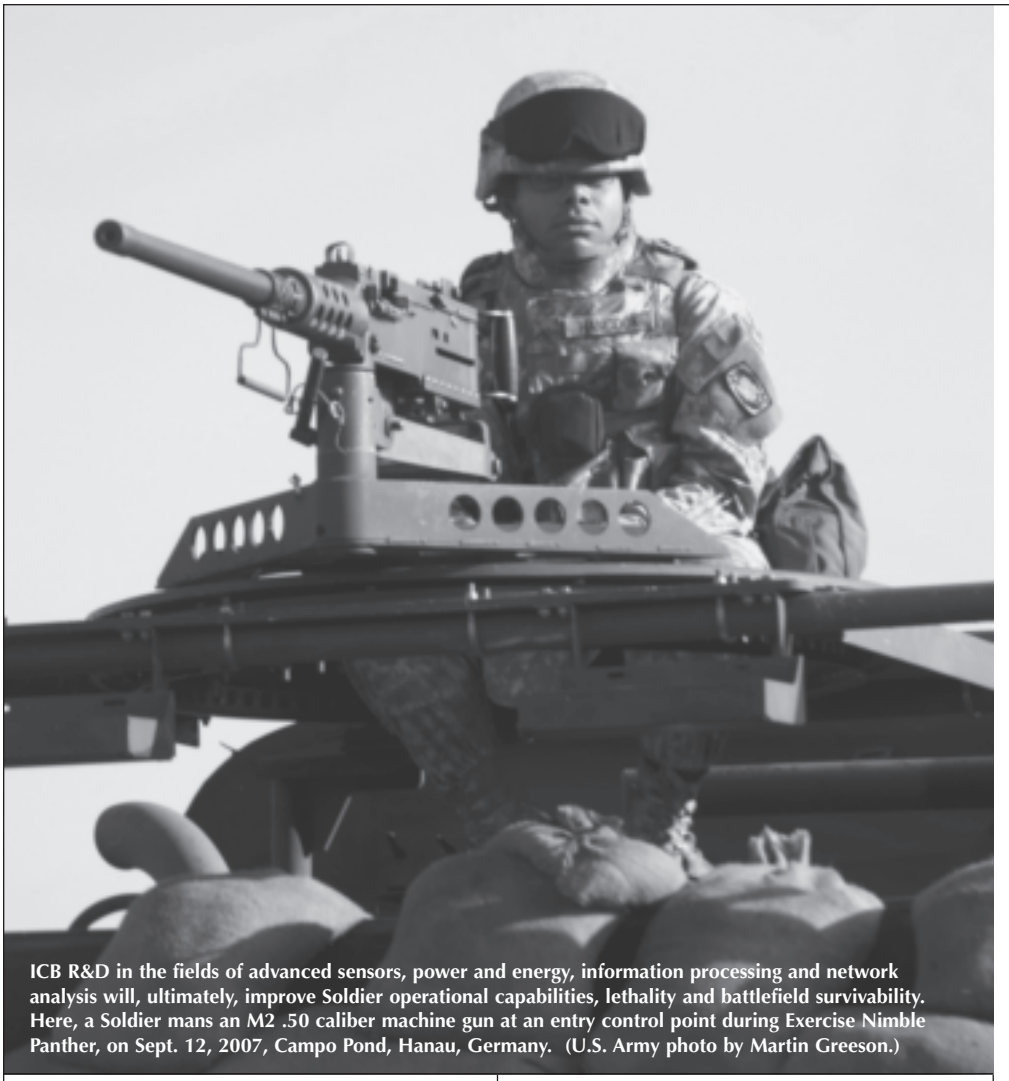
Through the collaborative efforts of MIT and UCSB, the ICB is researching biologically based batteries and materials synthesis to develop semiconductive materials and alternate power sources to reduce Soldier operational loads. Here, SFC Robert Abram (left) radios in his position while PFC Matthew Murphy observes the progress of his fellow Soldiers from Alpha Battery, 2nd Battalion, 4th Stryker Brigade Combat Team, 2nd Infantry Division, during a cordon and search mission in Khan Bani Sa'ad, Iraq, on July 18, 2007. (U.S. Navy photo by MC2 Scott Taylor, Fleet Combat Camera-Pacific.)

The ICB was established in 2003 and operated on behalf of the Army at the University of California at Santa Barbara (UCSB) in partnership with the Massachusetts Institute of Technology (MIT), the California Institute of Technology (Caltech) and partners in industry. The ICB is one of only a few Congressionally chartered University Affiliated Research Centers designed to facilitate and accelerate the transition from discovery to development and implementation. Through its own research and its strategic collaborations and alliances with Army laboratories; research, development and engineering centers (RDECs); and industrial partners, the ICB provides the Army with a single conduit for developing, assessing and adapting new products and biotechnologies in direct support of Army missions. The Army needs addressed by the ICB include research and development (R&D) improvements in the fields of advanced sensors, materials synthesis, power and energy, information processing, network analysis and neuroscience.

Why has the field of biology been invoked to develop important engineering systems for the Army? The answer lies in the observation that biological systems are essentially nature's own high-performance systems that display exquisitely high levels of control, function, structure and organization. This high performance is observed at a number of different levels: from the organization and control of biomolecular and genetic systems; to how the performance and function of individual cells and organs help to ensure the survival and health of an organism and provide unique functions to different organisms; to how entire ecosystems are shaped, maintained and controlled.

The ICB's mission is to use the tools of modern biotechnology to discover the mechanisms responsible for the remarkably high performance of complex biological systems and translate these into revolutionary advances in engineering for the support of Army operations.

"The ICB's mission is to use the tools of modern biotechnology to discover the mechanisms responsible for the remarkably high performance of complex biological systems (such as sensors, the brain and energy-harvesting systems) and translate these into revolutionary advances in engineering for the support of Army operations," explains ICB Director Dr. Daniel E. Morse. The idea, then, behind ICB research is to draw upon the basic principles underlying these finely tuned biological



ICB R&D in the fields of advanced sensors, power and energy, information processing and network analysis will, ultimately, improve Soldier operational capabilities, lethality and battlefield survivability. Here, a Soldier mans an M2 .50 caliber machine gun at an entry control point during Exercise Nimble Panther, on Sept. 12, 2007, Campo Pond, Hanau, Germany. (U.S. Army photo by Martin Greeson.)

systems to make us better engineers. The development of these technologies at the intersection of biology and engineering requires a multidisciplinary approach involving the talents and expertise of scientists in the fields of biology, chemistry, physics, mathematics, computer science and materials science, as well as engineers in the disciplines of mechanical, chemical and electrical engineering. More than 40 basic research projects are ongoing within the ICB. Highlighted here are some of these unique and creative ICB success stories that are making an impact on advancing Soldier capabilities within the Army.

Advanced Biosensors for Force Protection

The development of detectors for lethal chemical and biological agents is a high priority for protecting our Soldiers in the field. These detectors must have high sensitivity, reliability, ruggedness and compactness and are often based on biological systems. Nobel Laureate Dr. Alan Heeger and Dr. Kevin Plaxco of UCSB have developed a system in which specific DNA molecules bound to an electrical surface are used to sensitively detect DNA from biological pathogens. If a pathogen is recognized, an electrical signal is generated. Plaxco and Heeger have demonstrated that detection is effective even when the target DNA is contained within soil, blood serum or saliva.

This method has shown great potential for environmental sensing and for testing Soldiers for exposure. In addition, this system has been shown to be operationally stable for weeks. This sensing system was developed in collaboration with the Army Research Laboratory, Sensors and Electron Devices Directorate (ARL-SEDD). Since its initial testing, the technology has further transitioned toward a handheld device in collaboration with Nanex LLC under the ICB's 6.2 Applied Research program.

Lightweight Power and Energy and New Methods for Materials Synthesis

Batteries are heavy and an important part of a Soldier's primary logistical load. To reduce this load, MIT MacArthur Scholar Dr. Angela Belcher is developing lightweight, flexible rechargeable batteries. Belcher has engineered nontoxic virus particles that bind metallic electrode materials in highly ordered structures that can self-assemble on flexible transparent films to produce high-performance battery materials. The half-cell specific capacity of this biologically based battery is over double the capacity of currently used lithium ion rechargeable batteries. Belcher is trying to integrate this battery material into textiles. Because the materials are synthesized in a liquid solution, it should also be possible to pour a battery into a mold of desired shape or to spray a battery electrode onto any suitable surface.

In the field of materials synthesis, UCSB's Dr. Daniel E. Morse has studied how marine sponges nanosynthesize silica. He is using his findings to develop a new low-temperature method to fabricate a host of conductive and semiconductive materials with superior structural characteristics. Morse's improvement in materials synthesis holds the promise for the development of more efficient lightweight 3-D batteries and solar cells and this method has been extended to other

metallic materials that may be useful in uncooled infrared (IR) detection. Morse has partnered with ARL's Infrared Materials & Devices Branch and the Aerospace Corp. to develop cheap uncooled IR sensors with low-power requirements for applications such as driver vision enhancement, rifle sights, physical security and target acquisition.

The Gecko — Nature's Reversible Adhesive

The gecko's feet can reversibly adhere to and release from surfaces many times. This remarkably unique feature enables the gecko to climb walls and run across ceilings upside down. UCSB's Dr. Kim Turner has studied the mechanics that allow the gecko to perform these unusual feats and has developed metallic nanoscale structures that mimic the adhesion properties of the gecko's toe. When actuated by a magnetic field, these structures adhere to surfaces with a strength that is now beginning to approach the strength that the gecko uses for attachment. An ongoing collaboration with ARL-SEDD is focused on improvements in the adhesion of this system and the application of this technology for micro-autonomous robotic systems. This bio-inspired adhesive will greatly enhance the capabilities of walking robots to move over all-terrain horizontal and vertical surfaces and to support their own weight.

Translating Biological Networks to Effective Communications Networks

The development of Future Combat Systems will require components that are smaller, lighter and safer, yet more lethal than current systems. These new systems will rely more on speed, agility and situational awareness than on heavy armor, and will require coordination of a multitude of networked sensors. To meet this challenge, ICB has created a program in Bio-Inspired Network Science. Led by UCSB's Drs. Frank Doyle and Joao Hespanha, and Dr. Richard Murray of Caltech, this group investigates the basic principles and mechanisms of biological networks and seeks to apply this knowledge to design high-performance, robust communications networks.

One basic research component is directed toward the mathematical modeling of a number of complex biological networks including the genetic networks responsible for determining sleep patterns and the signaling patterns that control the life cycles of aquatic corals (both as individuals and as a community). Also, theoretical studies seek a clearer understanding of the organizational principles that guide the operation and control of biological networks.

The models developed will be tested with a number of case studies, including a project in cognitive neuroscience led by UCSB's Dr. Michael Gazzaniga. In the neuroscience project, brain imaging data will be used to determine the neurological differences among individuals: how they are hard-wired to learn and perform certain tasks. Finally, the dynamics of large-scale networks such as swarms, flocking patterns and insect colony formation are studied to provide clearer guidelines to the design of complex, adaptable network structures.

The ICB — Sustaining the Army's Future

The ICB's working mission is highly collaborative and focused on Army needs. The Institute reaches out beyond basic research to productive collaborations with Army laboratories and actively works toward effective transitioning to the Army. "We're collaborating with the ARL, the RDECs and more than 25 private companies [ranging from major defense contractors to small, technology-based startups] to accelerate the transition from basic discoveries in the university laboratories to manufacturing and acquisition by the Army," Morse explained. Every year an ICB-Army-Industry Conference is held at UCSB. This conference brings together ICB investigators with Army scientists and current and future industrial partners to focus interactions and shape efforts toward effective technology transitioning. Plans are underway for the 2008 ICB Army-Industry Collaboration Conference to be held at the Corwin Pavilion, UCSB campus, Feb. 12-13, 2008. Dr. Thomas H. Killion, Deputy Assistant Secretary of the Army for Research and Technology and Army Chief Scientist, will deliver the keynote address. Through working R&D collaborations during the year, regular reviews and major conferences, the ICB is building and maintaining a vital strategic relationship with the Army.

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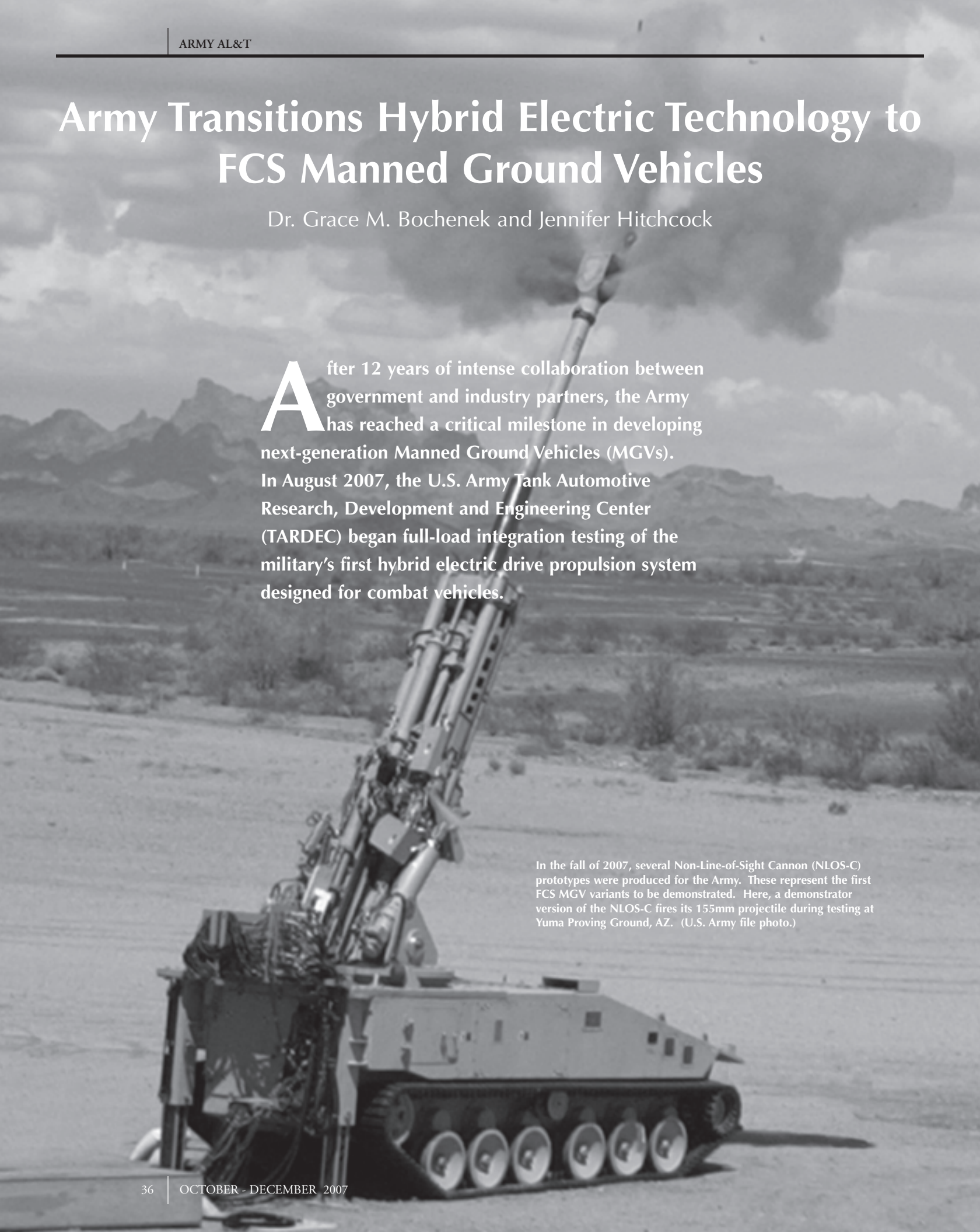
DR. DANIEL E. MORSE is the ICB Director, Professor of Biochemistry and Molecular Genetics, and founder and past Chair of the Interdisciplinary Program in Biomolecular Science and Engineering at UCSB. He received his B.A. in biochemistry from Harvard University and his Ph.D. in molecular biology from Albert Einstein College of Medicine. He conducted postdoctoral studies in molecular genetics at Stanford University, and was appointed the Silas Arnold Houghton Associate Professor of Microbiology and Molecular Genetics at Harvard Medical School before joining the UCSB faculty.

Army Transitions Hybrid Electric Technology to FCS Manned Ground Vehicles

Dr. Grace M. Bochenek and Jennifer Hitchcock

After 12 years of intense collaboration between government and industry partners, the Army has reached a critical milestone in developing next-generation Manned Ground Vehicles (MGVs). In August 2007, the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC) began full-load integration testing of the military's first hybrid electric drive propulsion system designed for combat vehicles.



In the fall of 2007, several Non-Line-of-Sight Cannon (NLOS-C) prototypes were produced for the Army. These represent the first FCS MGV variants to be demonstrated. Here, a demonstrator version of the NLOS-C fires its 155mm projectile during testing at Yuma Proving Ground, AZ. (U.S. Army file photo.)

This new propulsion system will drive and provide electrical power to all eight Army Future Combat Systems (FCS) MGV variants. As explained by MG Charles Cartwright, Program Manager FCS Brigade Combat Team (BCT), "Combat vehicles need significantly more power than commercial platforms. To meet those requirements, the Army and a robust set of industry partners have pioneered the development of advanced hybrid propulsion systems."

This work directly impacts the Army's ability to enhance force protection and more rapidly execute battlefield maneuver.

The Army's Research, Development and Engineering Driver Behind Hybrid Drive

TARDEC has been the Army's chief architect throughout the research, development and testing of this new powerpack, guiding it from concept to actual hardware. The FCS MGV hybrid electric drive system consists of an engine, generator, generator dissipater controller, traction drive system, energy storage system and cooling system.

The system is built around a 5.5-liter, 5-cylinder, 440-kilowatt (kW) diesel engine that can operate at speeds of up to 4,250 revolutions per minute (rpm), compared with maximums of 2,600 to 3,000 rpm typical of today's diesel engines. At about the same gross horsepower (hp), the engine is almost 50 percent smaller in volume and weight, and produces more than a 60 percent increase in engine speed than the diesel engine that currently powers the Bradley Fighting Vehicle (BFV).

The new engine itself, however, will not directly drive the Army's future MGVs. Its job is to provide power via the generator to all the vehicle's electrical systems. In these vehicles, the hybrid drive system will propel the vehicle via traction motors, which is a completely new way of maneuvering on the battlefield. The system's advanced energy storage, power generation, regenerative braking and power management technologies will also provide the power necessary to support each vehicle's nonprimary power requirements.

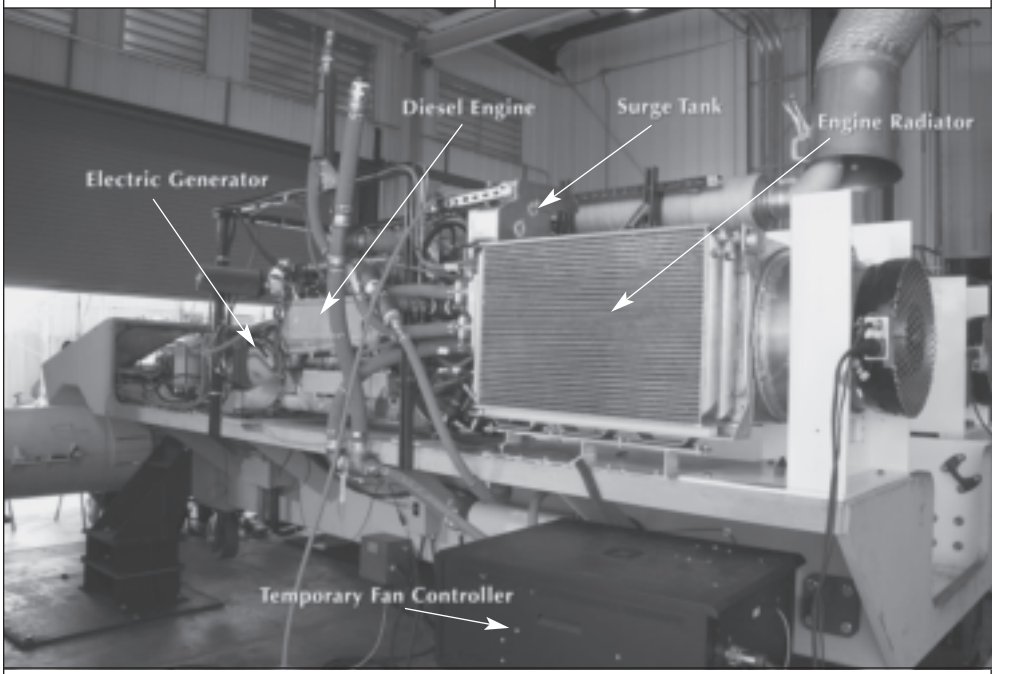
The system will allow the vehicles to operate in silent watch and silent run modes, and will improve vehicle dash capability while enhancing low-speed maneuverability. Finally, by decoupling the engine from the drive train architecture, the system has been designed so that its components are positioned throughout the vehicle platform in a way that maximizes interior space availability. This will provide Soldiers with more room to move and perform mission-critical tasks.

Power On

Headquartered just outside Detroit, MI, the automotive capital of the world, TARDEC has led the development of propulsion technologies for Army ground vehicles for more than 50 years. Propulsion technologies are the engines, transmissions, generators, air cleaners, cooling systems and energy storage technologies that put the "mobility" in ground vehicle platforms. Increasingly, these same technologies are also on the hook to answer increasing nonprimary power requirements (requirements not specifically dedicated to propulsion), such as those that power a vehicle's lethality, survivability and communications systems.

As each of these requirements has evolved and escalated over time, so has the Army's need for more advanced primary and nonprimary power systems. Anticipating these propulsion system requirements before the Army's transformation process began, TARDEC had already amassed the expertise and tools to respond.

By the late 1980s, it was clear that hybrid electric technologies — a marriage of combustion and electrical components to generate vehicle power — were going to be key in powering the next generation of military ground



This side view of the fully integrated FCS propulsion system undergoing tests on the "Hot Buck" at TARDEC's P&E SIL shows some of the key components TARDEC has engineered. The Hot Buck is a one-of-a-kind virtual FCS test bed platform for full-load testing. (Photo courtesy of TARDEC.)

The new 5.5-liter, 5-cylinder, 440-kW diesel engine designed to power the FCS MGV platforms is almost 50 percent smaller in volume and weight, but will increase engine speed by more than 60 percent when compared with the venerable diesel engine that currently drives the BFV pictured above. (U.S. Air Force photo by SSGT Shane A. Cuomo, 1st Combat Camera Squadron.)

vehicles. Those technologies are where they are today in large part because TARDEC scientists, engineers and administrators — either directly or through funding of innovative industry and academic programs — have led the way in maturing engine, electric motor, electronic architecture and energy storage systems to meet anticipated military vehicle power demands.

The Engine Block as Building Block

As a principal member of the FCS "One Team" partnership, which included FCS (BCT), the Army Research Laboratory (ARL), Boeing, BAE Systems, General Dynamics Land Systems and Science Applications International Corp., TARDEC initially brought its expertise and leadership to bear in supporting the FCS Engine Technology Science and Technology Objective (STO).

The Engine Technology STO's goal was to develop a high power density (net power per total system volume) engine with reduced engine size, weight, heat rejection and high coolant temperatures. When improved, each of these factors provides the critical parameters needed to advance overall propulsion system power density. For example, higher coolant temperatures and lower heat rejections allow for a much smaller cooling system and less cooling fan power losses. This translates to greater power density and, therefore, to more power to the tracks or wheels for greater mobility.

The outcome of the Engine Technology STO, which concluded in 2005, was a 4.4-liter, in-line 4-cylinder diesel engine that met several critical performance goals.

- It provided six net hp/cubic foot, compared with currently fielded military systems that provide three net hp/cubic foot. This metric — net hp/cubic foot — represents the entire propulsion system's output.
- It met an unprecedented displacement goal (the engine's output to volume ratio) of 2 hp/cubic foot, which was more than 40 percent less displacement than any commercial or military engine that had come before.
- It was able to generate 410 kW of prime power.

However, the Army's biggest challenge was in meeting the program's high-speed combustion goals and high operational coolant temperature (267 F) requirements. The high engine speeds of the FCS hybrid electric powerpack provided the solution. Those higher speeds would also allow for a lighter, smaller generator, which would keep the propulsion system volume goals on target.

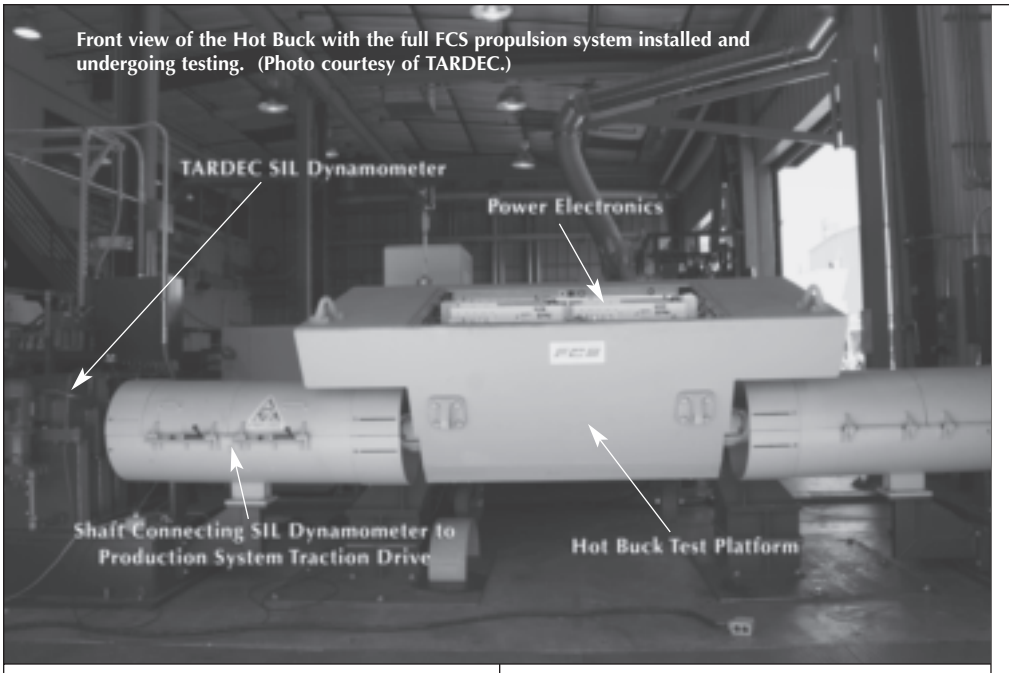
Eventually, the technology from the Engine Technology STO was transitioned to develop a 5.5-liter, 5-cylinder engine that would produce up to 440 kW of prime power with a 10-percent growth margin, to ensure coverage of evolving FCS ground vehicle platforms and operational concepts. In less than a year, the new design went from blueprint to hardware.

Bringing It All Together

As important as the engine was to the program's success, it was still only one of many components that would eventually comprise the FCS propulsion system. In 2004, under the Hybrid Electric for FCS Army Technology Objective, the Army expanded the FCS propulsion program to improve cooling reliability and efficiency and to increase the power and energy density of the system's other components. TARDEC was again prepared for the tasks at hand, having heavily invested over many years in electric motor, air cleaner, cooling system and advanced battery technologies.

To enable silent watch and silent maneuver operations, and to provide additional

The engine for the Abrams main battle tank platform took nearly 15 years to design, develop and field. Although the Abrams has performed admirably throughout *Operations Enduring* and *Iraqi Freedom*, the unforgiving terrain and desert environment has been rough on engines, drive trains, filtration and cooling systems. The evolutionary FCS MGV hybrid electric drive system has been designed with urban and desert environments in mind. (U.S. Army photo by SSG D. Myles Cullen.)



Front view of the Hot Buck with the full FCS propulsion system installed and undergoing testing. (Photo courtesy of TARDEC.)

boost power, TARDEC accelerated its already advanced energy storage research and development work to further develop lithium ion battery technologies. In collaboration with ARL, TARDEC segregated 880 individual program tasks into 5 categories, including mixing, coating and winding; electrolyte filling; circuit breaker bussing and closing; electrical formation; and battery assembly. Since 2004, the team has made tremendous strides toward increasing power density to 3 kW per kilogram (kg); increasing energy density to 150 watt-hours/kg; reducing production costs; and improving overall battery performance, safety and reliability.

Most importantly, as the Army's systems integrator for ground vehicle platforms, TARDEC played a key role in evolving each of these parts of the system from component to subsystem and, finally, to full system capability. TARDEC began the process at the component and subsystem levels at its Engine Generator Test Lab in Michigan. In August 2007, the process migrated to TARDEC's state-of-the-art Power and Energy System Integration Laboratory (P&E SIL) in Santa Clara, CA. This represents the first time that real FCS hardware has been integrated into a full hybrid electric power system in a vehicle platform (see *Army Invests in Testing Facilities to Support Current and Future Technologies*, Page 40).

True Technology Transfer

While anticipating each new technology requirement, TARDEC has also been evolving its operational and business processes to engage in the vehicle development life cycle at a much earlier stage and to transition technologies to program executive officers and product managers much more rapidly. Nowhere is that more evident than in TARDEC's transition of hybrid electric technologies to the FCS program.

While the engines in the Bradley and Abrams vehicle platforms took upwards of 15 years to design, develop and field, the FCS package has reached this critical point in its development process in only 5 years. This fall, a limited number of systems will be produced for the NLOS-C prototype, the first of the FCS MGV variants to be demonstrated.

TARDEC has been at work for many years to fund and cultivate the expertise, facilities and processes necessary to make this possible. The forethought that went into these investments has resulted in the delivery of the FCS MGV propulsion system in record-breaking time, enabling the rigorous testing, refinement and reengineering processes that are necessary to mature the system as each FCS MGV variant becomes a reality.

Indeed, the process continues. In partnership with ARL, for example, TARDEC continues to pursue such advanced technologies as silicon carbide (SiC) power electronics. These SiC devices will allow component operation at even higher temperatures, thus reducing future cooling system size, weight and power requirements. All of this goes to refining the system that is going to propel and provide auxiliary power to all future MGVs in the Army's fleet.

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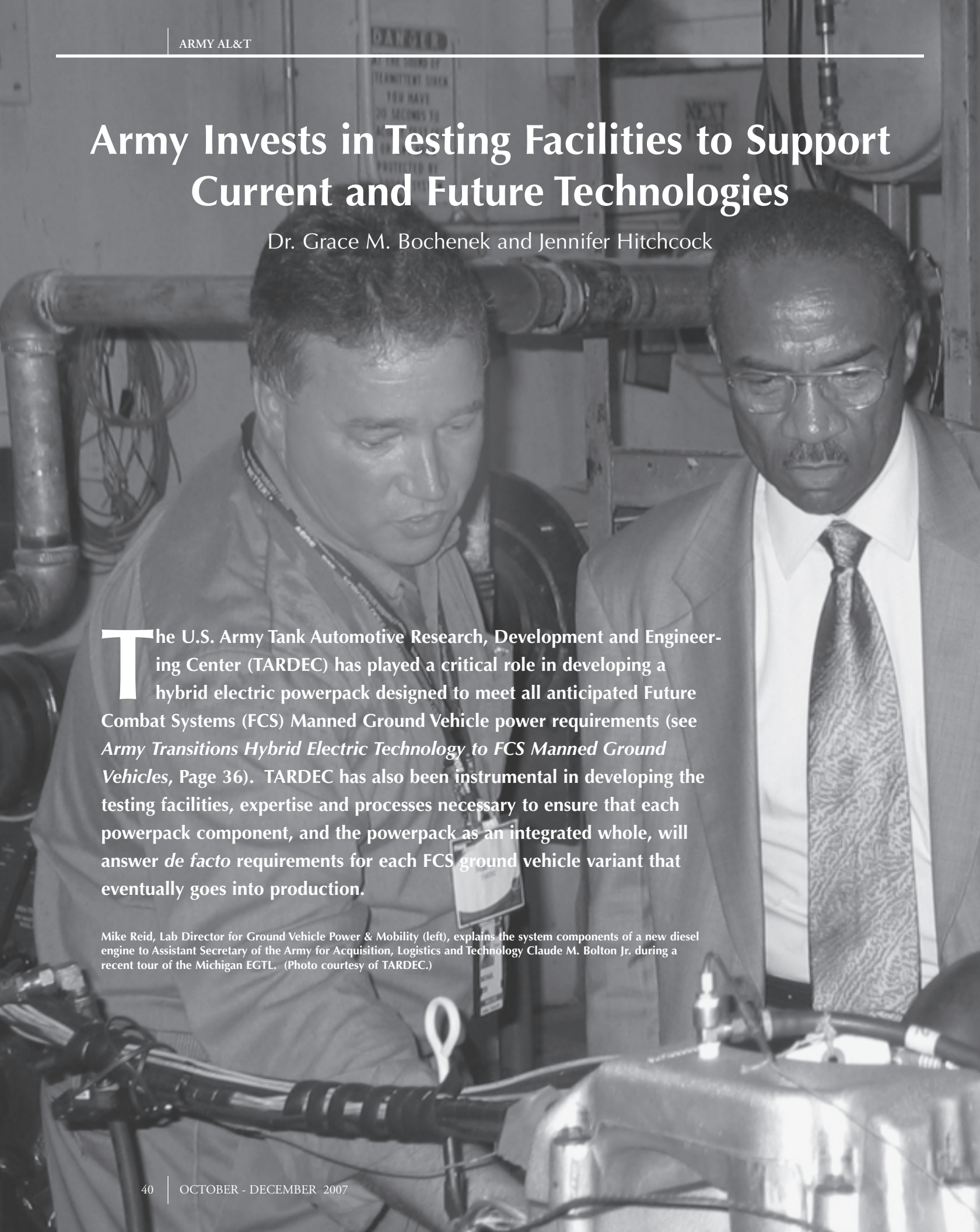
JENNIFER HITCHCOCK is the Associate Director for Ground Vehicle Power and Mobility Technology at TARDEC. She holds a B.S. in mechanical engineering from Lawrence Technological University and an M.S. in engineering from Oakland University. Hitchcock has more than 18 years of technical and managerial experience in mobility and power and energy technologies, system engineering, acquisition and program management.

Army Invests in Testing Facilities to Support Current and Future Technologies

Dr. Grace M. Bochenek and Jennifer Hitchcock



The U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC) has played a critical role in developing a hybrid electric powerpack designed to meet all anticipated Future Combat Systems (FCS) Manned Ground Vehicle power requirements (see *Army Transitions Hybrid Electric Technology to FCS Manned Ground Vehicles*, Page 36). TARDEC has also been instrumental in developing the testing facilities, expertise and processes necessary to ensure that each powerpack component, and the powerpack as an integrated whole, will answer *de facto* requirements for each FCS ground vehicle variant that eventually goes into production.

Mike Reid, Lab Director for Ground Vehicle Power & Mobility (left), explains the system components of a new diesel engine to Assistant Secretary of the Army for Acquisition, Logistics and Technology Claude M. Bolton Jr. during a recent tour of the Michigan EGTL. (Photo courtesy of TARDEC.)

Army propulsion systems are inherently expensive and time-consuming to change or upgrade once a vehicle has entered production. Successful Army transformation demands that the best possible propulsion technologies get into the vehicle development life cycle at the earliest possible juncture. Early life-cycle collaboration between Army science and technology (S&T), acquisition and industry partners makes this possible.

To successfully transition and integrate these technologies into a vehicle platform that is itself under development, it is necessary to adopt evolutionary acquisition practices and constantly test, refine and reengineer the propulsion system as the vehicle platform matures. That requires still greater collaboration between all program partners, and demands the very latest in testing instrumentation, facilities and methodologies from the S&T community.

In short, it is not enough for the S&T community to deliver a state-of-the-art product at a certain point in time. It must also be prepared to partner with program managers and chief engineers to monitor field data and to fully test and refine that product throughout the host platform's development life cycle.

Successful Army transformation demands that the best possible propulsion technologies get into the vehicle development life cycle at the earliest possible juncture.

TARDEC has worked for the last decade to ensure that it can deliver on both of these requirements. The process typically begins with propulsion system component testing at government and contractor facilities to verify performance capabilities and specifications. Components are then tested at the subsystem and, finally, the entire propulsion system level. Individual components often behave much differently than intended when integrated into a system, and additional engineering work is required to resolve installed systems-level performance conflicts.

TARDEC Engine Generator Test Laboratory (EGTL)

TARDEC has been conducting component-level and subsystem testing of FCS engine/generator elements for

the past year at its Michigan EGTL. This testing includes verification of engine/generator performance and cooling loads, validation of power system transient response for vehicle performance and mapping of fuel consumption for the power system.

TARDEC's EGTL was configured from the onset specifically for FCS engine/generator testing. The cell has a custom-built load bank capable of 600 kilowatt (kW) power absorption. It has a custom inverter system consisting of 4 Emerson industrial inverters with a power absorption capability of 500 kW and a current rating of 880 amperes. The cell has a customized high-pressure fuel system capable of delivering fuel at 11 bar and 3 cooling system loops to meet FCS propulsion system requirements.

Two high-speed data acquisition systems acquire the data (300 low-speed and 120 high-speed channels capable of sampling the data at 1,000 hertz). The high-speed data acquisition can perform engine combustion analysis up to 2 million samples per second. These advanced facilities provide FCS vehicle integrators with very high fidelity data to validate performance, incorporate the data into FCS modeling and simulation efforts, and refine the propulsion system architecture development.

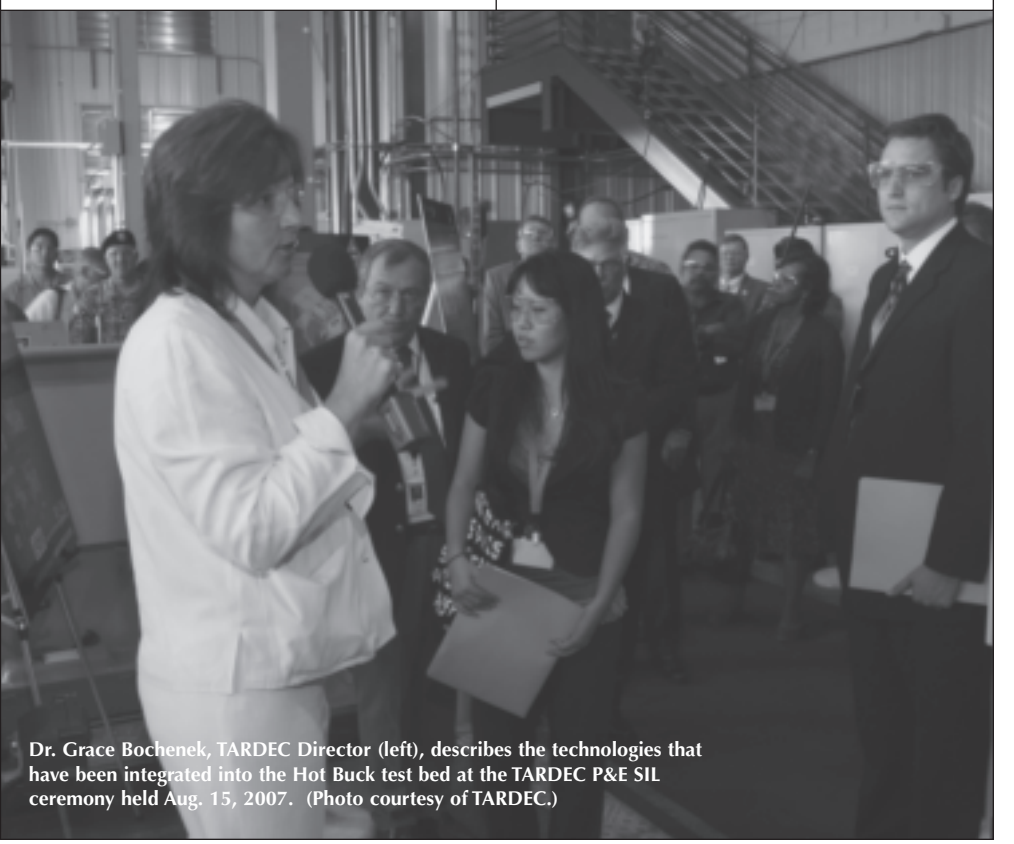
TARDEC Power and Energy System Integration Laboratory (P&E SIL)

The P&E SIL is another proactive TARDEC investment that the FCS program has leveraged for state-of-the-art testing of combat vehicle hybrid power propulsion systems at the whole system level. Located in the heart of Silicon Valley, the P&E SIL is a companion lab to TARDEC's Michigan facilities, which are strategically at the heart of the world's automotive capital. The SIL maximizes the Army's ability to tap into the technical expertise that both locations offer.

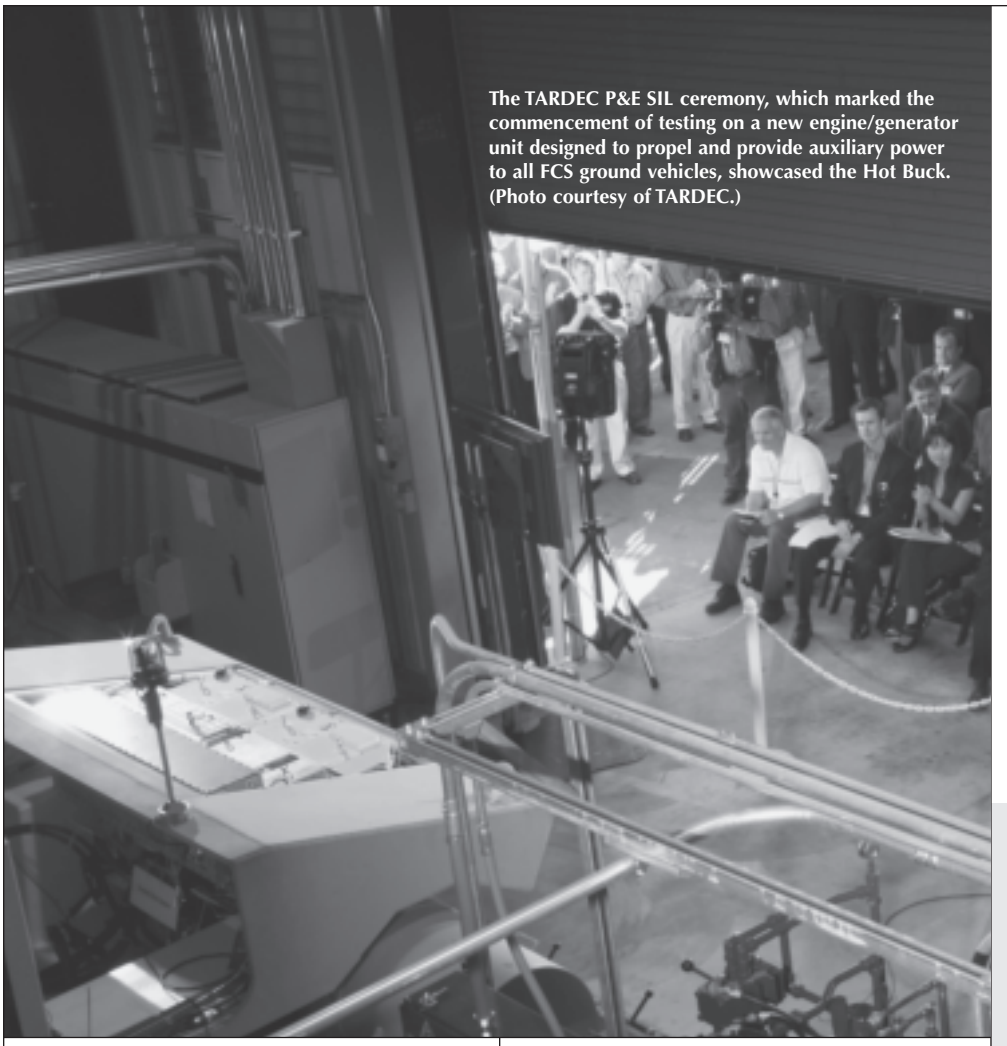
The P&E SIL is another proactive TARDEC investment that the FCS program has leveraged for state-of-the-art testing of combat vehicle hybrid power propulsion systems at the whole system level.

The SIL was built in 1995 to support the Defense Advanced Research Projects Agency's (DARPA's) Combat Hybrid Power System program. In 2000, DARPA transitioned the facility to the Army, and specifically to TARDEC. Initially, the lab focused on hybrid electric system component-level research, development and testing of electric motors, power electronics and high-power/high-energy batteries. Since then, TARDEC and its "One Team" partners — including the FCS Brigade Combat Team, Boeing, BAE Systems, General Dynamics Land Systems and Science Applications International Corp. — have matured the SIL to allow for subsystem, and now for full system, hybrid electric research and development.

All along, TARDEC has been transitioning the SIL's data and results to the FCS program, while constantly refining and maturing the base technologies. In August, a fully integrated engine/generator system was installed in the SIL's "Hot Buck," a one-of-a-kind virtual FCS test bed platform, for full load testing. This represents the first time that real FCS hardware is integrated into a full hybrid electric power system in a vehicle platform, and is an example of true technology transfer. The engine and generator data produced by TARDEC's EGTL is being fed into the SIL's 440 kW hybrid drive system. In turn, TARDEC test equipment connected to the Hot Buck is providing critical data on FCS hardware operational capabilities before that hardware is installed in the first FCS vehicle.



Dr. Grace Bochenek, TARDEC Director (left), describes the technologies that have been integrated into the Hot Buck test bed at the TARDEC P&E SIL ceremony held Aug. 15, 2007. (Photo courtesy of TARDEC.)



The TARDEC P&E SIL ceremony, which marked the commencement of testing on a new engine/generator unit designed to propel and provide auxiliary power to all FCS ground vehicles, showcased the Hot Buck. (Photo courtesy of TARDEC.)

Another important SIL benefit is its ability to develop system models to evaluate performance, and to define and develop the software required to operate this very complex propulsion system. Today, the SIL is operating the FCS Hot Buck platform to help work through system integration issues, as well as to iterate and optimize the FCS propulsion system design. This FCS platform is used for testing, evaluating and collecting valuable data on FCS hardware operational capability before it is integrated into the first FCS vehicle.

Investing in the Future

The EGTL and P&E SIL are redefining how the Army develops and tests future propulsion systems. In the past, the only testing option was to simply run a propulsion system or component test and collect basic power data at different temperatures and speeds. Today, as the technologies are advancing, so is TARDEC's investment in testing equipment and processes.

The Army must have systems that can deliver fuel at high pressures and absorb electrical power at 750 volts direct current, and must be able to measure and control large power generation, energy storage and energy recovery. Army Test Operating Procedures (TOPs) must also be reviewed for applicability to new technology. For example, the Army is currently changing its fuel economy TOP to be suitable to test fuel economy of hybrid electric vehicles. Reliability and safety testing have begun on the lithium ion batteries needed for FCS and other current platforms.

These investments in advanced facilities and reengineering of current testing methods and procedures are laying the groundwork for future technology transitions to the warfighter. Technology improvements such as high-temperature silicon carbide power electronics and other advanced technologies will lead the way to achieving a propulsion system power density goal of 8-10 net horsepower/cubic feet for the future. This combination of technology improvements, facility advancements, updated testing methods, and Army and industry cooperation and collaboration — early in the S&T development process — are critical to transitioning the latest technologies to the battlefield as quickly and efficiently as possible.

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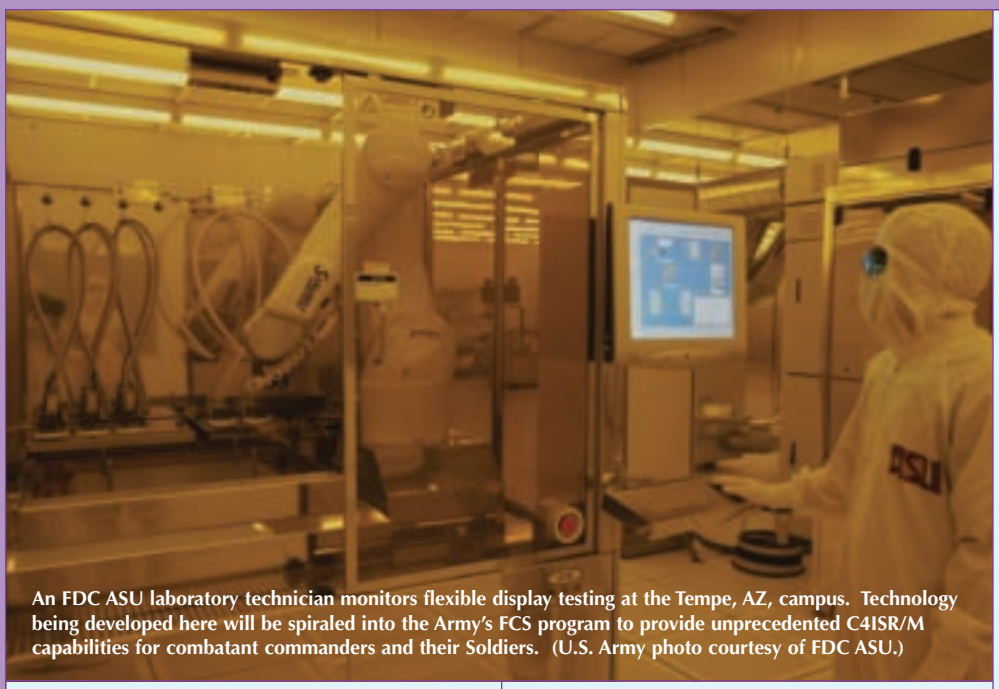
The Army's Flexible Display Center (FDC) at Arizona State University (ASU)

Dr. David Morton and Dr. Gregory B. Raupp

The first commercial flat panel displays appeared less than 20 years ago with the advent of the now ubiquitous laptop computer. Since then, these important electronic devices have become an indispensable component of the infrastructure of our increasingly networked world. Consumer electronics such as laptop computers, personal digital assistants (PDAs), cellular telephones and an increasing variety of portable information and entertainment devices all depend on flat panel displays to provide critical user interfaces. The Army has long recognized the capability that flat panel displays provide and has developed and adapted this technology to improve mission capability for its Soldiers.

The Army's FDC at ASU is developing flexible display technologies that will significantly improve Soldiers' operational field capabilities by providing them with lightweight, large-format displays that can be folded or rolled up for easy storage and transport. (U.S. Army photo courtesy of FDC ASU.)



An FDC ASU laboratory technician monitors flexible display testing at the Tempe, AZ, campus. Technology being developed here will be spiraled into the Army's FCS program to provide unprecedented C4ISR/M capabilities for combatant commanders and their Soldiers. (U.S. Army photo courtesy of FDC ASU.)

As Army transformation unfolds through the Future Combat Systems (FCS) program, the ability to perform essential command, control, communications, computers, intelligence, surveillance, reconnaissance/mobility (C4ISR/M) functions for combat vehicles and dismounted warfighters is vital. These applications will require some kind of compact, thin-profile display. Unfortunately, key flat panel display features being produced for today's commercial electronics market make them unsuitable for emerging military applications. Conventional displays tend to consume too much power and are usually made out of glass. This feature means that they require expensive and bulky "ruggedization" before they can be incorporated into military systems, adding significant size and weight to the actual component. For the dismounted Soldier, the high-power requirements of current displays compel the Soldier to bear the additional weight of batteries during operations.

Since the late 1990s, the Defense Advanced Research Projects Agency and the Army have been investigating a number of innovative new flat panel display technologies that can be made on unbreakable substrates such as thin metal foils or even sheets of plastic. These "flexible display" technologies would significantly improve many of the size, weight and power characteristics of today's commercial displays. Looking forward, they also promise lightweight, large-format displays that could be folded or rolled up for storage or transportation.

By the early part of this decade, primitive prototypes of a number of flexible display technologies developed under DOD programs had been demonstrated. However, the efforts to develop these prototypes revealed a number of challenges that must be met in order to perfect the technology to the point that it can be reliably manufactured. The principally offshore flat panel display industry has proven reluctant to make the investments needed to address these challenges, since the breakability and excessive power requirements of existing displays have not limited their widespread adoption in consumer electronics.

As Army transformation unfolds through the FCS program, the ability to perform essential C4ISR/M functions for combat vehicles and dismounted warfighters is vital.

FDC

In 2004, to accelerate the development of commercial flexible displays to meet military needs, the Army established the FDC at ASU in partnership with the state of Arizona. The FDC is the first research and development (R&D) facility in the world to be exclusively dedicated to work on flexible displays. The FDC was formed through a Cooperative Agreement with the Army Research Laboratory (ARL), Sensor and Electron Devices Directorate, managed in conjunction with the Army Natick Soldier Research, Development and Engineering Center (RDEC). The Cooperative Agreement allows ASU, the Army and industrial partners to work together to achieve a common goal. The initial 5-year phase of this 10-year program represents a $44 million investment by the Army and a comparable matching commitment by ASU. It also includes significant participation by a growing list of industrial partners who pay an annual membership fee and make internal investments in support of development projects at the FDC. The industrial participation is governed by a unique Partnership Agreement that spells out the intellectual property rights for participating organizations. The FDC also collaborates with eight universities through a variety of research focus projects.

The FDC's cornerstone is a state-of-the-art pilot manufacturing facility housed in a dedicated building within a university-owned industrial park about

Assistant Secretary of the Army for Acquisition, Logistics and Technology Claude M. Bolton Jr. examines a small flexible display prototype during a visit to the FDC ASU research facility in February 2005. (Photo by Tim Trumble and Jessica Slater, FDC ASU.)

five miles south of the main ASU campus. Operated by a staff of professional engineers and technicians, the facility includes 17,500 square feet of class-10 cleanroom that houses both a development-scale production line and a Generation II pilot display manufacturing line which produces displays on rectangular substrates 370mm by 470mm. The FDC also contains the research laboratories of a number of ASU faculty and their graduate students, who conduct affiliated longer-range research projects supported by a variety of traditional outside research funding sources.

> The demonstration of innovative flexible display technology is how the FDC shows that it is achieving its central mission to develop reliable fabrication techniques that are sufficiently mature to stimulate their adoption by the existing display manufacturing infrastructure.

Partnering With Academia and Industry

FDC activities focus on the issues associated with the fabrication of an array of thin-film transistors on flexible substrates, such as thin stainless steel or a transparent specialty polyester. This challenging piece of large-area microelectronics is the critical subsystem that is required to control an array of electro-optical devices to create a digital display. To complete the display, one of three electro-optic technologies being developed by FDC members is integrated with these thin film transistor panels. Ultra-low-power reflective displays can be made using electrophoretic ink from a Massachusetts Institute of Technology spin-out company, E Ink, or cholesteric liquid crystal films provided by a Kent State University spin-out, Kent Displays of Ohio. Alternatively, vibrant full-color and full-motion video organic electroluminescent displays can be built using materials developed by a Princeton University spin-out, Universal Display Corp. These technologies were chosen because of their compatibility with flexible substrates, power advantages and maturity.

Because the flexible display characteristics being developed are unlike those of any technology currently available to system designers, the FDC works closely with system integrators to develop technology demonstration devices to showcase the new capabilities. Member companies General Dynamics, Honeywell International, L3 Communications and Raytheon have all contributed to the identification of demonstrator projects whose success will help meet the technical requirements of their road maps for future system offerings. The display requirements for these demonstrator projects help define the detailed FDC development program's objectives.

This past summer the FDC successfully demonstrated a fully functional concept device incorporating a flexible display at the Army Future Force Warrior C4ISR On the Move exercise at Fort Dix, NJ. With customer funding and management support coordinated by teams at the Natick Soldier RDEC, a rugged and compact networked PDA was developed for use by individual infantry rifleman squad members.

This Soldier Flex PDA is the first demonstrator candidate for transition to Program Executive Office Soldier from the FDC. It features a rugged low-power reflective display and weighs only 13 ounces. By contrast, ruggedized

Soldiers evaluate Future Force Warrior program equipment during a training exercise. Flexible displays will be another component added to the Soldier's arsenal of lightweight communications and sensory equipment thanks to the world-class research being conducted at FDC ASU. (Photo by Sarah Underhill, Natick Soldier Systems Center.)

The ASU Research Park is home to the first R&D facility in the world exclusively dedicated to flexible display development. The FDC's principal focus is to fabricate an array of thin-film transistors on flexible substrates. FDC's R&D initiatives led to the testing of the Soldier Flex PDA during the Future Force Warrior C4ISR On the Move exercise at Fort Dix this past summer. (Photo courtesy of ASU.)

PDAs featuring conventional glass liquid crystal displays typically weigh as much as 20 pounds. The reflective display technology in the Soldier Flex PDA can be viewed using night vision goggles using only ambient illumination, reducing the Soldier's night vision signature. Programs are underway with the ARL Human Research and Engineering Directorate and Natick human factors engineers to investigate more effective uses of this new capability. The demonstration of technology capabilities to Army users is a key element in the Army's insertion plan.

The demonstration of innovative flexible display technology is how the FDC shows that it is achieving its central mission to develop reliable fabrication techniques that are sufficiently mature to stimulate their adoption by the existing display manufacturing infrastructure. Because this approach necessarily involves the use of new materials and the adoption of unconventional manufacturing processes, it is crucial to engage industrial partners from these parts of the supply chain as early as possible. For such companies, the FDC provides a unique integrated development environment in which they can create and test new products for the emerging field of flexible displays and microelectronics.

FDC member DuPont-Teijin Films is developing a novel high-temperature polyester film that they hope will become the substrate of choice for flexible or printed electronics. Similarly, in the critical area of manufacturing equipment, FDC member EV Group (EVG) has developed a unique tool for the coating of ultra-high uniformity micrometer-thick films of unconventional materials onto large area substrates. The FDC served as the beta-test site for this tool and, as a direct result, EVG recently received an order for a number of these new machines. Finally, a modification to an Azores stepper sponsored by the U.S. Display Consortium (USDC) that enables compensation for the distortion in plastic substrates caused by transistor array fabrication processes has stimulated commercial interest in the modification of tools in existing display fabrication facilities.

FDC member DuPont-Teijin Films is developing a novel high-temperature polyester film that they hope will become the substrate of choice for flexible or printed electronics.

The Army's FDC at ASU represents a pioneering approach to developing technologies to meet warfighter-specific needs in a world in which the American industrial base has become more knowledge-intensive and less manufacturing-intensive. To achieve this objective, a network of world-class partnerships and a dedicated physical infrastructure have been established to create a unique venue for the developing advanced technology and associated manufacturing processes. The FDC has shown worldwide leadership in the development of large-area, low-temperature amorphous silicon microelectronics, and has begun to receive recognition for this at international meetings and in the trade press. After less than 4 years of operation, integrated systems incorporating innovative displays developed by the FDC have already been demonstrated, and the Center is on track to achieve initial technology insertion by decade's end.

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DR. GREGORY B. RAUPP is Professor of Chemical Engineering (Ch.E.) at ASU and FDC Director at ASU. He received his B.S.Ch.E. with Distinction from Purdue University, M.S.Ch.E. from Purdue University and Ph.D. from the University of Wisconsin-Madison. Prior to becoming the FDC Director in 2004, Raupp was ASU's Associate Vice President for Research; and from 1999-2002, he was the Associate Dean for Research in the Fulton School of Engineering. He has published more than 115 technical papers and is the holder of three U.S. patents.

Aberdeen Test Center (ATC) Commander Discusses the Mine Resistant Ambush Protected (MRAP) Vehicle Program

Ben Ennis

MRAP vehicles are the fastest moving program in DOD, and the program is not being handled in a business-as-usual fashion, remarked John Young, Director, Defense Research and Engineering and Task Force Chairman in a recent DOD News briefing. "We are not delaying manufacture of these vehicles for documentation, extended testing or test reports," Young added. "Key to this testing is the exceptional and dedicated work done by COL John Rooney and his team at the Army's Aberdeen Proving Ground. This team has worked almost constantly for the last 6 months to test and evaluate MRAP vehicles."

ATC conducts about 80 percent of all DOD automotive testing for tracked and wheeled vehicles, both manned and unmanned. This capability is one of the key reasons the MRAP was sent to ATC for testing. Here, an MRAP undergoes testing on one of ATC's automotive test tracks. (Photo courtesy of ATC.)

Army AL&T Magazine met with COL John P. Rooney, ATC Commander, to discuss the center's mission and involvement with the testing of DOD's number one equipment fielding priority — MRAP vehicles.

AL&T: Tell us about ATC's mission and the MRAP program testing being conducted at ATC.

Rooney: ATC's mission is to conduct developmental testing across a wide range of commodity areas, basically in support of the overall test and evaluation of DOD systems. Even though we are an Army test range, we are a DOD asset because we do testing across all services. We are involved in the other services' work to include the Navy, Marine Corps and some Air Force. We are testing MRAP vehicles here, but MRAP is led by the Joint Program Office [JPO]. Most of ATC's work comes from two commodity areas — automotive and survivability — which is largely why MRAP came here for testing.

Number one is automotive work. We do about 80 percent of all DOD automotive work. Tracks and wheels, manned or unmanned, generally come here. Our automotive work complements Yuma Proving Ground's [YPG's] automotive testing. YPG generally does environmental testing in desert, jungle and cold region environments on the same kinds of systems that we conduct early performance and endurance testing on.

The second area is survivability and lethality testing. If a system or piece of equipment has a capability to protect Soldiers, Sailors, Marines and Airmen, then it is a requirement and is generally congressionally mandated to undergo survivability testing. So whether it is a helmet, body armor, vehicle armor or even armor on a ship, we generally are involved in the testing.

In addition, we test to confirm lethality of a system or piece of equipment. This means that we confirm whether or not systems or equipment that are supposed to have a certain lethality capability — for example a tank, or a gun round — can indeed penetrate or defeat the threat as it is intended.

ATC's mission is to conduct developmental testing across a wide range of commodity areas, basically in support of the overall test and evaluation of DOD systems. Even though we are an Army test range, we are a DOD asset because we do testing across all services.

We also do direct fire testing from small arms pistols to individual weapons, and crew-served weapons all the way up to large caliber weapons that include artillery pieces and tank guns. For example, we are currently testing experimental gun tubes for the Future Combat Systems program and the currently fielded mobile gun system for Stryker.

Finally, we do Soldier system testing. We test everything from boots to uniforms to Land Warrior to Body Armor systems. In other words, we test all those Soldier systems placed on the individual. We do much more than what I just discussed, but these are the major areas that account for most of ATC's workload.

AL&T: In a recent DOD news briefing, John Young, Director, Defense Research and Engineering and MRAP Task Force Chairman, praised the work being done at ATC to support the MRAP program. What role has ATC played in MRAP testing?

Rooney: The request to test MRAP came to ATC shortly after Thanksgiving last year when JPO representatives indicated they needed ATC to help with testing for the new MRAP program. MRAP had a very high priority and needed to be tested as quickly as

Rooney (left) briefs JROC members on MRAP vehicle capabilities. VCJCS ADM Edmund P. Giambastiani (right) has been a staunch advocate of improved protection and survivability for all troop carriers and support vehicles. (USAF photo by TSGT Adam M. Stump.)

JROC members observed MRAP explosive testing during a demonstration May 17, 2007, at ATC. Survivability and ballistics testing is an important capability that the Maryland-based test center provides. (Photo courtesy of ATC.)

possible, so we started our planning processes immediately. Our objective was to gain information about the capabilities and limitations of MRAP systems so that JPO could get this new capability to theater as soon as possible. Our role to date has been phase one testing.

From February through April 2007, we received test articles from various vendors to conduct automotive and ballistic survivability testing to determine their capabilities against threshold requirements in the first phase of testing. We focused on testing the threshold requirements that would enable JPO and DOD to determine whether these systems had a significant capability increase over what was in theater. Once we answered that question, they could make decisions on which systems should go into theater. We have completed that phase and a number of decisions have been made by JPO and DOD that have enabled them to put approximately 4,000 systems on contract. A number of those systems have already gone to theater.

Today [July 26], we are beginning phase two. We have the first 11 vehicles for testing and we are testing against more significant requirements. We know how MRAP does in threshold environments, so we must now test for more significant threats and overall vehicle endurance. We will better understand how MRAP does in a much more difficult environment. From the phase two testing, we will understand MRAP's future potential. We are testing to higher limits that will help support future acquisition decisions. In addition, this testing will support the safety release that will enable the systems to be used.

In phase one, we were the sole tester for DOD. During phase two, YPG — in concert with what we are doing — will conduct some of the desert testing on the systems. In fact, the initial operational test will be conducted at YPG this fall. To do phase one testing, 250 ATC workforce members specifically focused on MRAP. We worked 3 shifts, 24 hours a day, 6 days a week and a 12-hour shift on Sunday. We are continuing along that path as we enter phase two. I have hired additional employees for the MRAP testing due to specific workload requirements.

AL&T: Secretary of the Army Pete Geren recently told the Senate Armed Services Committee that the Army is buying MRAP vehicles to counter the threat of roadside bombs and that the Army is committed to rushing MRAPs to Iraq and Afghanistan as quickly as possible. "MRAPs can help Soldiers in conflicts beyond Iraq," Geren explained. In your view, how will MRAP fielding enhance Soldier survivability in Iraq?

Rooney: Even though we have only done threshold requirements, I am well aware of MRAP's capabilities. I have been to Iraq three times since being the lead tester for armor systems. I was there to understand exactly what is going on with the vehicle and to gain information on the threats as they evolve.

I brought information in terms of capabilities and limitations of the platforms so that leaders can employ systems knowing what they can and cannot do. The last two times I visited Iraq, I spoke at commanders' conferences to provide that information, and I went to numerous forward operating bases to have discussions about what we know and what the commanders have seen in theater.

There is no question that fielding MRAP will enhance Soldier survivability. Fielding MRAPs to the theater will provide improved protection and there is no doubt that the vehicles will save lives. We will continue to test against difficult threats to fully understand MRAP's performance capabilities within that arena. Army Test and Evaluation Command's Forward Operational Assessment Teams have been in Iraq for at least 3 years to monitor exactly what is happening with the threat. I have an ATC member on that team to ensure our tests replicate reality being experienced within theater.

AL&T: An article written by TSGT Adam M. Stump, U.S. Air Force (USAF) — *Oversight Council Checks Out Mine-Resistant Vehicles* — highlighted senior military and civilian leaders from the Joint Requirements Oversight Council (JROC) visit to ATC earlier this year to view initial MRAP testing. U.S. Navy ADM Edmund P. Giambastiani, Vice Chairman of the Joint Chiefs of Staff (VCJCS), chairs the JROC. He has previously stated that MRAP's design and armor provides greater protection and increases crew survivability. However, Giambastiani added that while the vehicles may increase troop protection, they are not an end-all solution. "Testing is a critical part of providing the best possible solution for troops," he remarked. What did JROC members have to say about the testing they saw during their visit to ATC?

Rooney: JROC, senior leaders and a number of congressional staffers visited ATC to understand the testing and make sure we had what we needed to test as rapidly and as well as possible. JROC received emerging results when they came for their visit to ATC. We actually did some survivability tests when they were here. From that, JROC gained a greater understanding of the vehicle's capabilities. DOD enabled me to increase my capability and capacity to handle this program, which of course will help increase my ability to handle other programs in the future. JROC saw some of the testing issues and was better able to address requirement changes.

AL&T: Is there other key equipment being deployed to Iraq that ATC is involved in testing?

Rooney: From an ATC perspective, a couple of years ago I stood up an office to address rapid initiatives for theater. We have been handling rapid initiatives from a number of program offices for quite some time. The armor testing program alone has had more than 500 solutions that have been brought forward from all corners of the world for testing. We have averaged between 20 and 30 rapid initiative programs a week that are ongoing. They represent a wide range of system components, from mine rollers to improvised explosive device [IED] protection to vehicle and Soldier system enhancements. I stood up an expedient armor task force. It has not been business as usual for quite a while as we have been working multiple shifts off and on for the last 4 years. Testing to support an Army at war has really changed. We feel the operational tempo [OPTEMPO] on our range here. Last year we set OPTEMPO records in miles driven, rounds fired and tests conducted. This year we are on pace to break most of those records.

Dr. Delores Etter, Assistant Secretary of the Navy for Research, Development and Acquisition, exits the rear of an MRAP used as a static display following a vehicle test and demonstration event at ATC, May 17, 2007. Etter, JROC members and other senior officer and civilian leaders from the four services observed how an MRAP performed during explosive testing. (USAF photo by TSGT Adam M. Stump.)

AL&T: Why is developmental testing needed in the fielding of Soldier equipment?

Rooney: Evaluation determines the capabilities and limitations of a system and Soldiers need to understand the capabilities and limitations of their equipment. Developmental testing is where much of that information is gained. In developmental testing, we provide a Test Incident Report [TIR] to the material developer. In a TIR, we provide information back to the material developer on changes or fixes that need to happen. The TIR captures things that do not work as they should — or should work differently — and recommends solutions. Last year, we captured almost 60,000 TIRs during developmental testing and those TIRs equated to fixes and changes that make equipment better. There are many examples of systems within theater that were made better because of developmental testing. We provide the facts of what a system can or cannot do so senior leaders can better understand the system's components and capabilities and make informed decisions for the system's forward progress.

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HEAT — Army Innovation in Action

MAJ Vernon Myers

Imagine being in a combat environment taking enemy fire when, suddenly, your vehicle flips over violently from the force of an improvised explosive device (IED), caved road or impact from another vehicle. Your vehicle is now upside down and water is rapidly filling the inside of the cab. How do you survive? Could you effectively respond to a similar situation and live to talk about it? Could you unfasten your seat belt, recover from being hit by radios, ammunition cans and other equipment flying around in the vehicle, while remaining calm so you can reorient yourself and egress from the vehicle?

The 4th Squadron, 73rd Cavalry Regiment, 4th Brigade Combat Team, 82nd Airborne Division, patrols in Ghazni Province, Afghanistan, July 17, 2007. Driving in the rough terrain depicted here is one of the reasons Soldiers developed the HEAT. This innovation has saved countless Soldiers' lives since being deployed overseas to the theater of operations and at training centers around the Army. (U.S. Army photo by SPC Matthew Leary.)

Teaching Soldiers how to react in rollover situations had been impractical until a group of Soldiers collaborated in creating the High-Mobility Multipurpose Vehicle (HMMWV) Egress Assistance Trainer (HEAT).

Why HEAT?

Before HEAT, Soldiers were not trained how to properly exit a vehicle that had turned over on its side or top because of a rollover incident. During these exit attempts, Soldiers were experiencing various problems including:

- *Disorientation*. The violence and speed of a rollover caused Soldiers to become disoriented, thus losing precious reaction time that may have meant the difference between life and death.
- *Loose equipment*. Equipment not properly secured inside the vehicle became dangerous projectiles in a rollover, causing injury to Soldiers.
- *Unlocking seat belts*. Soldiers found it difficult to unlock seat belts, which prevented rapid egress.
- *Unlocking doors*. Soldiers were having difficulty opening the single-action combat locks that are standard on HMMWVs in theater. Since unlocking combat locks in a rollover situation could not be simulated prior to the HEAT, Soldiers could not practice opening the combat locks.

The Army needed a solution to properly prepare Soldiers to survive a vehicle rollover. The solution to this problem was found in current technology used to train pilots — the dunker trainer. Army Soldiers created the HEAT by adapting and applying the idea of the pilot dunker trainer to the HMMWV. They combined key ideas to create a lifesaving device that increases the likelihood of survival for Soldiers involved in rollovers.

HEAT History

In response to numerous casualties resulting from HMMWV rollovers, the U.S. Army Forces Command (FORSCOM) developed the first HEAT in 2005. Combined Forces Land Component Command-Kuwait (CFLCC-K) built 31 first-generation HEATs for use in Iraq and Afghanistan and, to date, has trained thousands of Soldiers. CFLCC-K built the first-generation systems using government labor and parts from battle-damaged HMMWVs, resulting in tremendous cost savings for the government.

The Army decided that a standard HEAT design was needed for U.S.-based units so that Soldiers could receive egress training prior to deployment. The common design's key component would be its increased safety features and its ability to be mass-produced quickly.

As the standardized design effort's sponsor, Program Executive Office (PEO) Combat Support and Combat Service Support's Program Manager (PM) Tactical Vehicles, selected PEO Simulation, Training and Instrumentation's (STRI's) PM Ground Combat Tactical Trainers (GCTT) to serve as the HEAT standard design effort's materiel developer in August 2006. This critical decision led to the stand-up of an integrated product team (IPT) to define the HEAT standard design requirements.

Getting HEAT Off the Ground

The HEAT startup process posed its fair share of challenges. PM GCTT and the U.S. Army Transportation School co-chaired bimonthly meetings to determine the requirements. The meetings' purpose was to define the system requirements by creating a Technical System Requirements Document and to gain buy-in from the user community and institutional training organizations. This document served as the foundation of what HEAT's capabilities would be. The IPT used Operational Needs Statements from CFLCC-K and FORSCOM to establish an initial baseline. The intent was to develop a trainer that matched the M1114 HMMWV's form, fit and function.

Who Would Design and Manufacture the HEAT?

With the assistance of PEO STRI leadership, the IPT made two key

The HEAT Army Standard was displayed during the prototype unveiling, operational test and safety certification at TARDEC, Warren, MI, on Jan. 24, 2007. (U.S. Army photo courtesy of Jim Revello, TARDEC.)

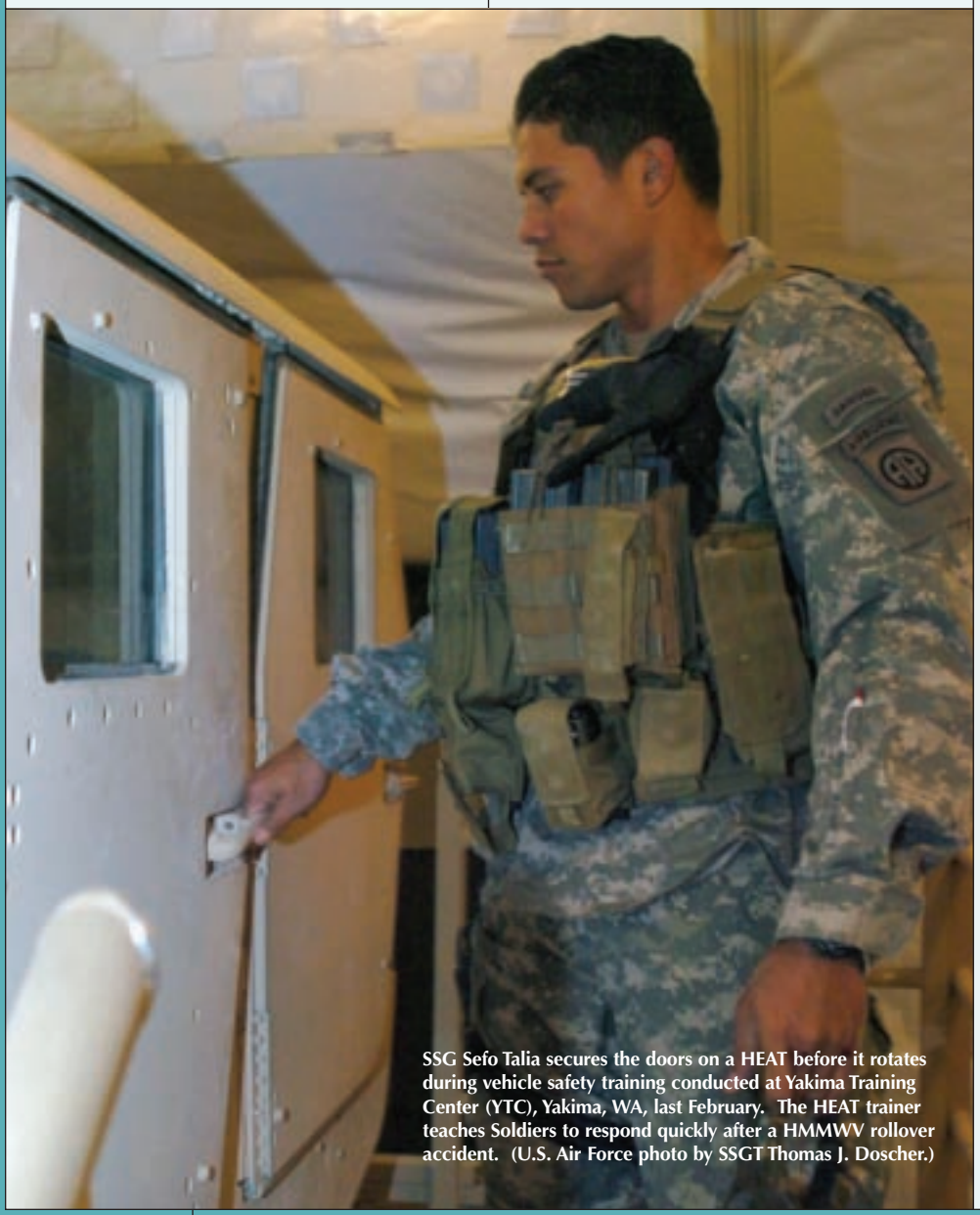
decisions that had a huge impact on the program's overall success:

- Selecting the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC) to design and build the HEAT prototype.
- Selecting Red River Army Depot (RRAD) to produce and manufacture the HEAT production systems.

TARDEC provided engineering design expertise that resulted in an initial design being completed in 1 month and prototype production within 4 months. RRAD provides lean manufacturing and production capability that resulted in tremendous cost savings to the government. In addition, RRAD provided 23 battle-damaged cabs for the HEAT's initial production run.

Funding HEAT

One of the biggest challenges was to secure funding to build 53 HEATs. After the Army validated the HEAT requirement, PM Tactical Vehicles provided initial startup capital to produce the first 23 systems. Remaining funding was provided from the main supplemental in June 2007 based upon the Army Requirements and Review Board identifying the HEAT as a valid requirement.



SSG Sefo Talia secures the doors on a HEAT before it rotates during vehicle safety training conducted at Yakima Training Center (YTC), Yakima, WA, last February. The HEAT trainer teaches Soldiers to respond quickly after a HMMWV rollover accident. (U.S. Air Force photo by SSGT Thomas J. Doscher.)

The Materiel Developer IPT

As the requirements IPT continued to define system requirements, PM GCTT established a materiel developer IPT that allowed us to effectively integrate the requirements into a safe and producible materiel solution. The materiel developer IPT's primary purpose was to develop, safety certify and test the HEAT prototype.

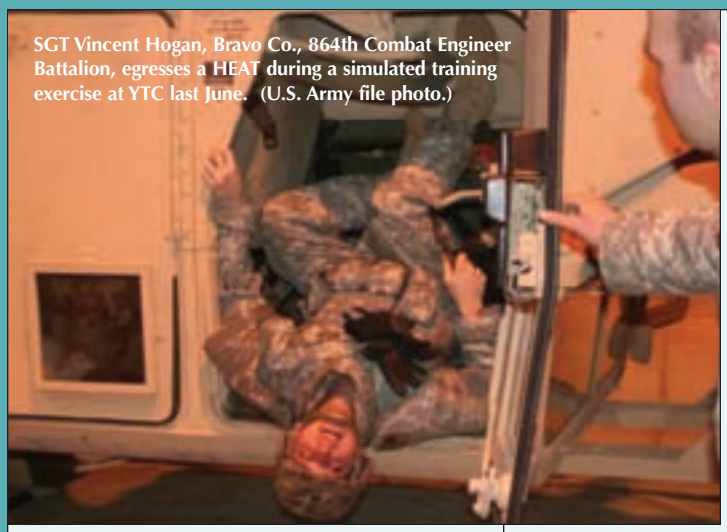
The materiel developer IPT allowed us to successfully integrate TARDEC into the planning process by translating requirement IPT decisions into materiel solutions. This process allowed the IPT to fine-tune requirements and resulted in excellent cross-talk and communication between both the requirements and materiel IPTs.

A key process component was to define the costs to build the prototype, as well as the costs to produce, field and sustain 53 trainers worldwide. The other key materiel developer IPT piece was that TARDEC and RRAD were able to coordinate design and manufacturing issues in real-time. The IPT overcame an early challenge by securing 33 additional cabs from CFLCC-K to RRAD to support HEAT production.

Training Soldiers how to set up, operate and maintain the HEAT was another challenge tackled by the materiel developer IPT. With Combined Arms Support Command assistance, we identified and selected a contractor to develop the HEAT operator manuals and to develop and conduct regional new equipment training (NET) train-the-trainer courses.

Prototype Design

TARDEC designed the HEAT using first-generation systems as the baseline and used the best in design technology to produce the HEAT prototype.



SGT Vincent Hogan, Bravo Co., 864th Combat Engineer Battalion, egresses a HEAT during a simulated training exercise at YTC last June. (U.S. Army file photo.)

Some key innovations included:

- Design focused on parts that can be readily procured by any Army organization.
- Electrical and drive motor assembly used the same motor that drives car assembly lines, thus providing high reliability with low maintenance.
- Upper and lower support frames allowed the cab to be replaced at the installation level.
- Simulated components including ammunition cans, weapons, water bottles and radios were made of foam material.
- Plexiglass was used for windows and windshields instead of ballistic glass.
- Durable cage over gunner's hatch allowed gunner training and provided added safety.
- Sliding rail platforms on either side of the vehicle provided a compact shipping configuration and added safety.
- Video and audio capability was included for after action review purposes.
- External training door locks allowed the instructor-operator to simulate a door being jammed while training Soldiers.

Unveiling and Producing HEAT

The HEAT prototype was officially unveiled at TARDEC on Jan. 24, 2007. The Army Test and Evaluation Command conducted the HEAT prototype safety certification and assessed the system as an overall low risk.

After unveiling the HEAT prototype, the program moved into the production phase. Our focus shifted to the following:

- Producing the HEATs.
- Developing NET train-the-trainer courses.
- Fielding the HEATs.

This training will help Soldiers overcome the natural fear and panic associated with rollover incidents.

RRAD leadership engineered program success by allocating the necessary funds and resources to set up the production line, even before program funds arrived to pay for labor and parts acquisition.

The transformation of a battle-damaged cab into a HEAT is an amazing process. RRAD starts with an M1114 cab that must be rebuilt from the ground up because of the extensive damage it received from IEDs, mines or rockets in theater. The process included removing the engine, removing the cab's front and rear portions, repairing any damage to the cab body, sandblasting the cab to remove all rust and paint, repainting the cab, installing wiring and electrical systems, building the frame, joining the frame to the cab and conducting a final system test.

RRAD set up its production facility and started 24-hour operation on Jan. 5, 2007. By implementing lean manufacturing processes, RRAD expects to produce the HEATs faster and more efficiently as it produces more systems. Each major component is inspected by a quality assurance team followed by a final quality control check of the entire system after assembly, assuring that all components work as required. The first two systems were produced and shipped to installations starting in April 2007.

Fielding the HEAT

PEO STRI personnel will conduct on-site acceptance tests on each system prior to it being turned over for use by the receiving installation. Personnel from each installation will learn how to set up, operate and maintain the HEAT when they attend the HEAT NET train-the-trainer course to be conducted at various installations across CONUS and OCONUS.

HEAT Army Standard is an outstanding example of innovation in action exemplifying the best in collaborative acquisition excellence. This trainer represents a great idea — for Soldiers, by Soldiers — that allows individual Soldiers and crews to rehearse and physically execute the necessary steps required to survive a vehicle rollover. This training will help Soldiers overcome the natural fear and panic associated with rollover incidents.

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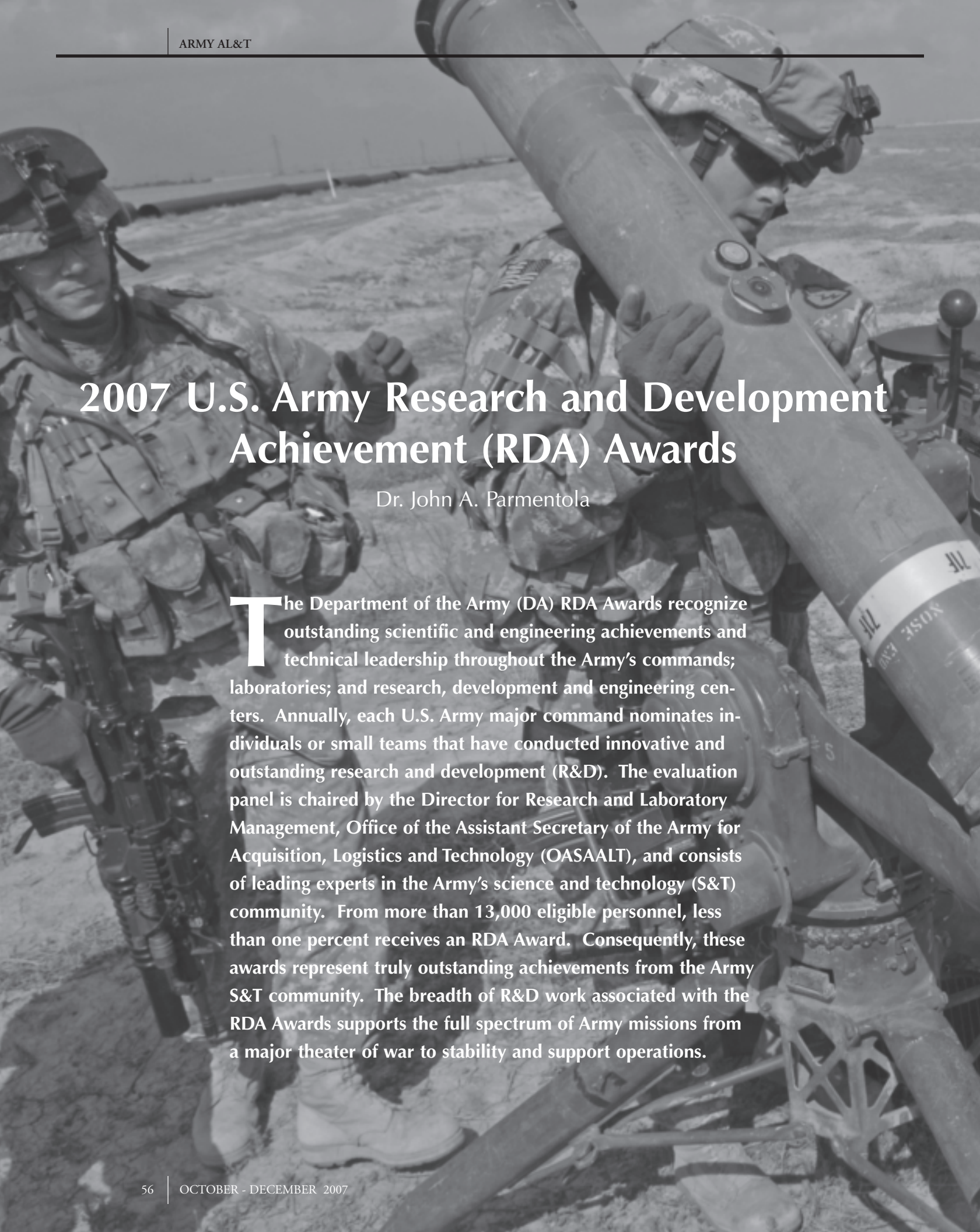


2007 U.S. Army Research and Development Achievement (RDA) Awards

Dr. John A. Parmentola

The Department of the Army (DA) RDA Awards recognize outstanding scientific and engineering achievements and technical leadership throughout the Army's commands; laboratories; and research, development and engineering centers. Annually, each U.S. Army major command nominates individuals or small teams that have conducted innovative and outstanding research and development (R&D). The evaluation panel is chaired by the Director for Research and Laboratory Management, Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology (OASAALT), and consists of leading experts in the Army's science and technology (S&T) community. From more than 13,000 eligible personnel, less than one percent receives an RDA Award. Consequently, these awards represent truly outstanding achievements from the Army S&T community. The breadth of R&D work associated with the RDA Awards supports the full spectrum of Army missions from a major theater of war to stability and support operations.

RDA Awards

The 2007 RDA Awards recognized 95 DA scientists and engineers for their outstanding scientific, technical and leadership accomplishments during calendar year 2006. Award recipients distinguished themselves through their proven scientific and technical excellence. Their individual outstanding contributions will advance the Army's capabilities and enhance U.S. national defense and welfare. Their pioneering work and dedication in 12 areas of basic research and 12 technology development areas — ranging from behavioral and social sciences to armor, aviation and missiles — bring great credit to themselves, their organizations and the Army. Further, these awards reflect the great diversity of talent and expertise within the Army laboratory system to support the future capabilities of our Soldiers.

The following list recognizes the 2007 RDA Award winners and the organizations they represent:

Office of the Secretary of Defense, Robotic Systems Joint Project Office
COL Edward M. Ward, U.S. Marine Corps

OASAALT
Dr. John A. Parmentola

Throughout the year, the Army's S&T community conducts cutting edge R&D to support the full range of Army operations. Their scientific and technical research results in innovative technologies that are spiraled into Current Force weapon and communication systems. Here, Soldiers from Delta Co., 2nd Battalion (Bn), 3rd Brigade Combat Team (BCT), 25th Infantry Division, assemble an Improved Target Acquisition System Tow Missile launcher near Riyadh, Iraq, last April. (U.S. Air Force photo by TSGT Maria J. Bare, 1st Combat Camera Squadron.)

The Army S&T community conducts pioneering R&D in a variety of developmental areas ranging from the behavioral and social sciences to armor, aviation and tactical missile systems. Here, Bravo Co. Soldiers from the 1st Squadron, 4th Cavalry Regiment, 1st Infantry Division, patrol in their M1A1 Abrams tank during *Operation Iraqi Freedom*. (U.S. Army photo by PV2 Brandi Marshall.)

Army Vice Chief of Staff, Maneuver Support Battle Lab
MAJ Scott Werkmeister

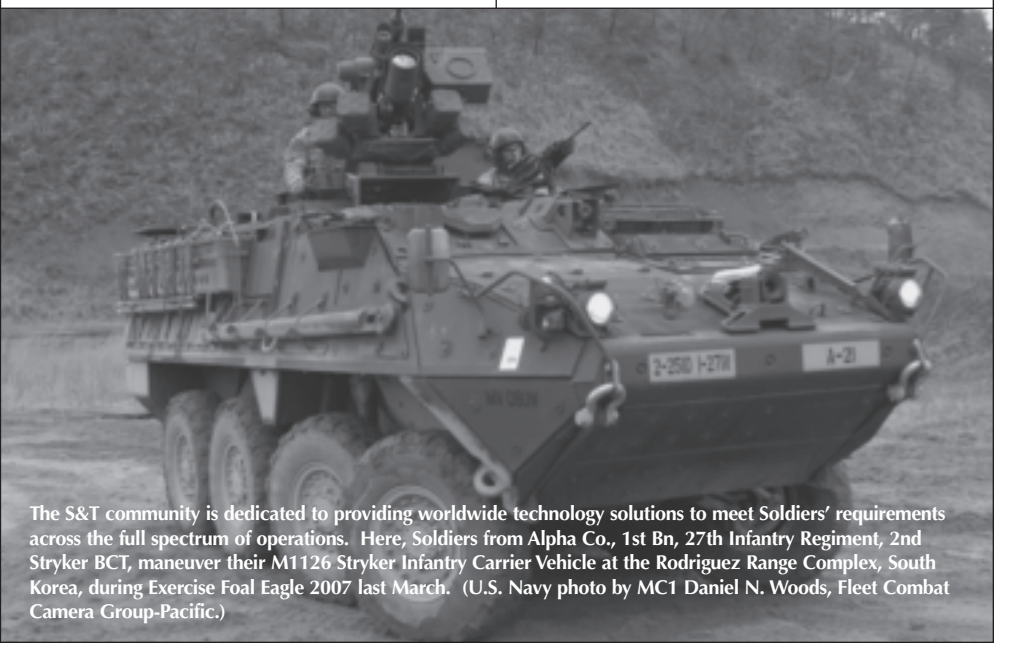
Deputy Chief of Staff, G-1, Army Research Institute for the Behavioral and Social Sciences
Dr. James W. Lussier
Dr. Scott B. Shadrick

U.S. Army Research, Development and Engineering Command, Aviation and Missile Research, Development and Engineering Center
LaShanda Felton
Robert C. Glover
Ralph H. Halladay
Sean P. Hawkins
W. Scott Howard
Gary T. Jimmerson
Dr. Henry E. Jones
Donald E. Lovelace
Nathan P. Mathis
R. Scott Michaels
Kevin W. Noonan
Patrick E. Renfroe
William T. Schultz
Dr. Mark B. Tischler
Mike H. Turner
Zhu S. Wang
Dr. Oliver D. Wong

Army Materiel Systems Analysis Activity
Dean Muscietta
Dr. Dwayne Nuzman

Armament Research, Development and Engineering Center
Christopher J. Aiello
Patricia Alameda
Nausheen Al-Shehab
Dr. Ernest L. Baker
Wayland P. Barber, C.P.L.
Daniel L. Cler
Robert L. Cooley
Thomas Coradeschi
Dr. Reddy Damavarapu
Stanley DeFisher
Edward W. Holmes
Robert Pinto
Gregory Schneck
Sanjeev Singh
Christopher M. Smith
David C. Smith, P.E.
Dr. Rao Surapaneni
Stephen M. VanDyke-Restifo

Army Research Laboratory
Dr. William R. Anderson
Stephen A. Aubert
Victor K. Champagne
Dr. Melanie W. Cole
Dr. J. Derek Demaree
Bruce Geil
Clifford Hubbard
Nicholas Jankowski
Dr. Anthony J. Kotlar
Dr. Keith Krapels
Dr. Kaleb McDowell
Dr. Michael J. McQuaid
Eric Ngo
Dr. William Nothwang
Dr. Michael J. Nusca



The S&T community is dedicated to providing worldwide technology solutions to meet Soldiers' requirements across the full spectrum of operations. Here, Soldiers from Alpha Co., 1st Bn, 27th Infantry Regiment, 2nd Stryker BCT, maneuver their M1126 Stryker Infantry Carrier Vehicle at the Rodriguez Range Complex, South Korea, during Exercise Foal Eagle 2007 last March. (U.S. Navy photo by MC1 Daniel N. Woods, Fleet Combat Camera Group-Pacific.)

These awards truly recognize the outstanding R&D achievements and contributions made by S&T community members and the technology teams they lead. Technological breakthroughs have led to numerous innovations being incorporated into the new CH-47F Improved Cargo helicopter. (U.S. Army file photo.)

Dr. Chuck H. Perala
Dr. Brian D. Roos
Dr. Sidra I. Silton
Dr. Bruce S. Sterling
Dr. Mikhail A. Vorontsov
Christopher Waits
Dr. Paul Weinacht
Dr. Shiqiong Susan Young

Communications-Electronics Research, Development and Engineering Center
Henry Croley
Mark Cumo
Dr. Ronald G. Driggers (Leadership Award and Achievement)
Aaron La Pointe
Dr. Roy T. Littleton
Pat Maloney
John M. Petek
Jason Ruck
Eric C. Slominski
David T. Wiatt
Dr. Jason G. Zeibel

Edgewood Chemical Biological Center
Daniel J. Weber

Natick Soldier Center
Robert Auer
Dr. Christopher Doona
Florence Feeherry
Dr. Dale Malabarba

Tank Automotive Research, Development and Engineering Center
Patrick Nunez
John J. Schmitz (Leadership Award)

U.S. Army Corps of Engineers, Engineer Research and Development Center
Dr. Jeffrey L. Davis
Michael A. Tischler
Roy Wade

U.S. Army Medical Research and Materiel Command (MRMC), Army Aeromedical Research Laboratory
Dr. Adrianus J.M. Houtsma (Leadership Award)

MRMC, Medical Research Institute of Infectious Diseases
Catherine V. Badger
Dr. Jay W. Hooper
Dr. Connie S. Schmaljohn
Dr. Melanie P. Ulrich

Walter Reed Army Institute of Research
Dr. Nageswararao Chilukuri
Kalpana Parikh

U.S. Army Training and Doctrine Command, U.S. Army Test and Evaluation Command
MAJ Jeffrey Redecker

U.S. Army Maneuver Support Center, U.S. Army Military Police School
George T. Anderson Jr.

DR. JOHN A. PARMENTOLA is the Director for Research and Laboratory Management, OASAALT. He has a B.S. in physics from the Polytechnic Institute of Brooklyn and a Ph.D. in physics from the Massachusetts Institute of Technology.

NSRDEC Employee Appointed Army Senior Scientist

Dr. Armand Cardello, NSRDEC, was recently appointed to the position of Senior Research Scientist for Behavior and Performance for the U.S. Army. He is also a renowned psychophysicist and subject matter expert on consumer expectations of product performance. (Photo courtesy of U.S. Army Soldier Systems Center-Natick.)

U.S. Army senior scientists divide their time between conducting research in their own disciplinary areas and serving DOD as scientific reviewers, program advisors and mentors of young scientists and engineers. Earlier this year, the U.S. Army Natick Soldier Research, Development and Engineering Center (NSRDEC) was notified by the Army Civilian Leader Management Office at Headquarters, Department of the Army, that Dr. Armand Cardello had been appointed to the prestigious position of Senior Research Scientist for Behavior and Performance.

Cardello said that he is looking forward to the challenges and opportunities this new position will bring because it will allow him more focused time for his independent research, while enabling him to be a more effective advocate within NSRDEC and the Army for both his own area of research — sensory and consumer behavior — and for the more general area of human behavior and performance.

"These are extremely important areas of research," Cardello remarked. "Our Soldiers are the primary consumers of rations, clothing and equipment developed by NSRDEC and the Army. Research into consumer behavior and performance can ensure that we are getting the best and most effective products into the field."

Cardello noted that even if you have a good product, if Soldiers are not willing to use it, or they don't have the ability to use it, then missions could be compromised or lives endangered. "Understanding the sensory, cognitive and situational factors that influence effective utilization of military products and equipment is essential. This is an area that DOD needs to pursue more heavily," he added.

Cardello has been working at the Natick installation for more than 30 years. During this time, his research has focused on two main areas in which he has made significant scientific breakthroughs. The first area, pschophysics, is the study of the relationships between physical stimuli in the environment and how humans perceive them. For many years, Cardello has worked on establishing new methods for measuring human perceptual responses. Recently, he developed conceptually new methods for assessing the magnitude of sensory and emotional experiences, such as likes, dislikes, comfort and satiety (feelings of fullness). Such methods enable better quantification of Soldier-consumer responses to rations, new products and equipment.

Cardello's second research field concerns consumer expectations of product performance and how these expectations influence behavior toward the products. In this area, he has worked to develop models to predict the acceptability of consumer goods based on the user's expectations about them. "This area is especially important to the military," he explained. "There are many negative stereotypes about military rations and other products. Research into how people's beliefs and expectations influence how they actually perceive the world is essential for counteracting negative beliefs and ensuring that beneficial foods and advanced technologies and equipment are used effectively to ensure the safety and well-being of both our Soldiers and the consuming public."

Cardello holds a B.A. in psychology from Dartmouth College and both an M.S. and a Ph.D. in psychology (biopsychology) from the University of Massachusetts. He is author or co-author of more than 150 scientific journal articles and book chapters. Cardello is on the editorial boards of two scientific journals; has been a scientific columnist and book reviewer; has been a member of the National Science Foundation, National Institutes of Health, U.S. Department of Agriculture and DOD ad hoc research and grant review panels. His scientific innovations have resulted in numerous military and federal scientific awards.

U.S. Army Soldier Systems Center-Natick press release.

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PS Form **3526**, October 1999 (Reverse)

Aberdeen Chemical Agent Disposal Facility (ABCDF) Develops Tool to Expedite Electronic Records Archiving

Wayne N. Bushell and Diane L. Graham

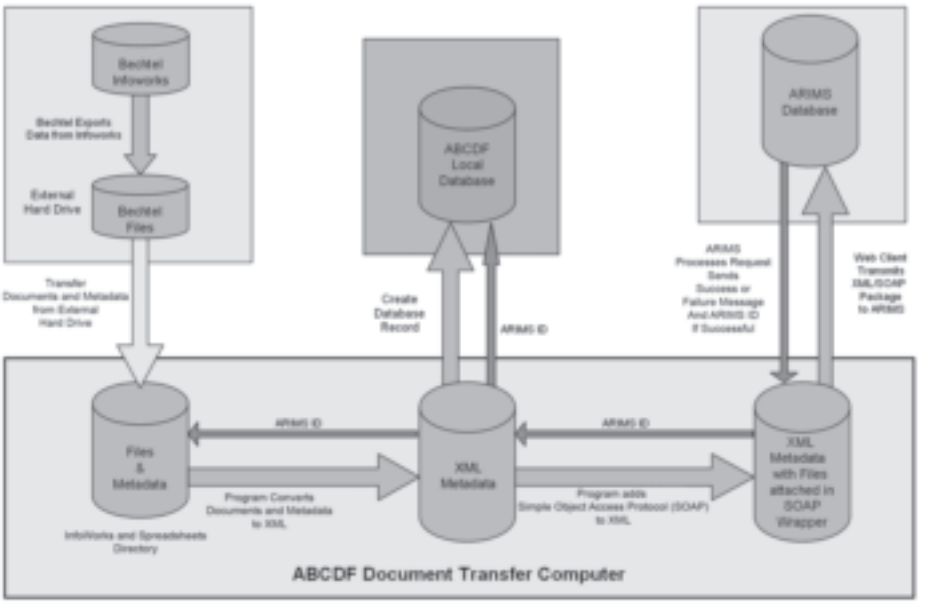
It seemed that for every ton of chemical warfare mustard agent destroyed at the U.S. Army's ABCDF, nearly another ton of records documenting the decisions and technology employed in conducting those operations was created. When workers at the ABCDF, located on the Edgewood Area of Aberdeen Proving Ground, MD, safely eliminated the last of the Maryland mustard agent stockpile in February 2006, the Army wasted no time planning for the expedient archiving of almost 10 years of indispensable records created over the project's life. The ABCDF had successfully constructed and operated a pilot facility that destroyed mustard agent by mixing it vigorously with hot water and sodium hydroxide, and made history by being the first chemical demilitarization facility in CONUS to successfully destroy its chemical weapons stockpile. No stranger to out-of-the-box thinking, the site developed a unique method to ensure its files would be available to the Nation's remaining seven chemical weapons disposal sites, as well as to the defense community at large.

ABCDF officials inspect Process Neutralization Building reactors prior to project startup in 2003. (Photo courtesy of the U.S. Army Chemical Materials Agency (CMA).)

ABCDF site personnel began working with the U.S. Army Records Management and Declassification Agency (RMDA) to determine the feasibility of archiving more than 100,000 electronic records into the Army Electronic Archive (AEA) as quickly and efficiently as possible, and then being able to retrieve a copy of these records if needed at a future time. In addition to the guidance provided in *Army Regulation 25-400-2, Army Records Information Management System (ARIMS)*, RMDA provided its Army Automated Information Systems to ARIMS Interface Control Document, which provided the key to electronically archiving batches of records via the ARIMS Web Services.

RMDA's ARIMS provides three interfaces for the electronic records archiving:

- The Electronic Capture and Store application, which is a Microsoft® Outlook tool that permits users to archive e-mails and attachments one record at a time, but use of the application is limited. Because many secure e-mail systems limit the size of file attachments, archiving large files often is difficult or impossible.
- The Records Input Processing System (RIPS), which is a Web-based application that permits users to attach and send one file at a time into ARIMS. The one-file-at-a-time limitation combined with minimal ability to submit metadata also made RIPS an unlikely candidate.
- The ARIMS Web Services.



Scanned/electronic records are sent to ARIMS AEA via the Web with little human intervention. Record retrieval is completed in seconds rather than days. (U.S. Army photo courtesy of ABCDF.)

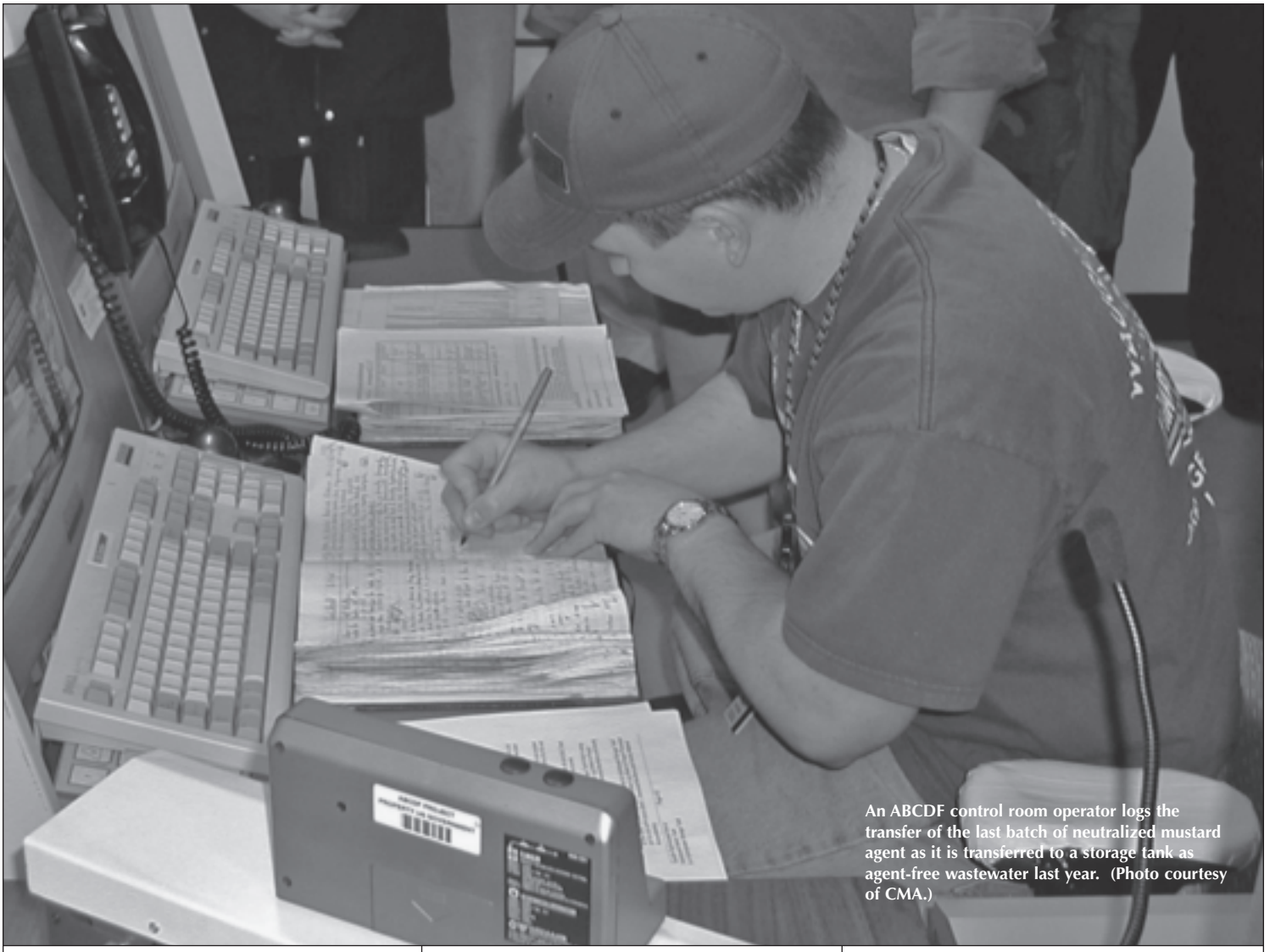
The ABCDF made history by being the first chemical demilitarization facility in CONUS to successfully destroy its chemical weapons stockpile.

ARIMS Web Services Client (WSC)

Given the short suspense the ABCDF team had to archive its voluminous quantity of records, they began investigating the ARIMS Web Services interface, the third option for electronic records archiving. ARIMS Web Services is a relatively new technology that favors simplicity, best design practices and cross-platform use over raw communication speed. To use the ARIMS Web Services, a team of information technology (IT) specialists from Science Applications International Corp. (SAIC), the ABCDF government team, Bechtel and RMDA personnel created a software interface connecting the ABCDF network with the ARIMS Web Services. This software interface became known as the WSC. It should be noted that the WSC is a tool for archiving records and is not a records management program. Prior to using the tool, agencies must first register in the ARIMS Web site and establish their office records lists (ORLs).

Acting as middleware between the ABCDF and the ARIMS AEA component, WSC allows users to automatically archive electronic records from a local site to ARIMS over a fast, secure network. WSC automatically translates existing metadata into the required ARIMS format to archive the

Archiving hard-copy records is labor intensive and costly. Records retrieval is a time-consuming process, usually requiring days for receipt of requested records. ARIMS WSC is streamlining that arduous process and creating a full record search capability. (U.S. Army photo courtesy of ABCDF.)



An ABCDF control room operator logs the transfer of the last batch of neutralized mustard agent as it is transferred to a storage tank as agent-free wastewater last year. (Photo courtesy of CMA.)

record. It then stores a record of each ARIMS transaction in a local Microsoft Structured Query Language (SQL) Server database. Metadata, along with the ARIMS identification number, can be used to retrieve the record from ARIMS AEA anytime.

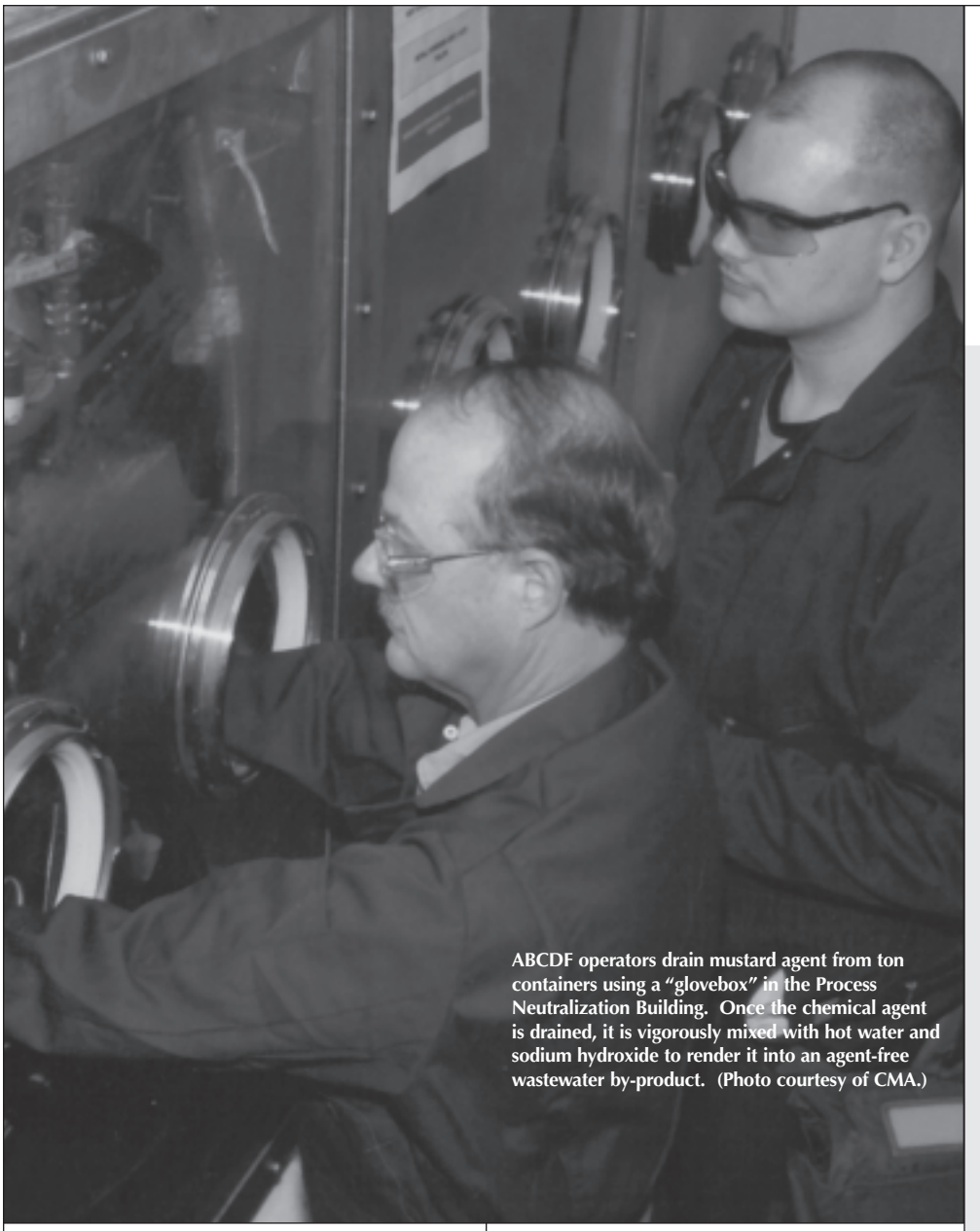
When accessing the WSC system, users must first customize their records submission by completing a specialized input form. This form associates the submitted records to the correct Unit Identification Code and ORL previously established. They then click a "Start Processing" button and the system begins processing a zipped batch of records with an accompanying Microsoft Excel file containing the submission's corresponding metadata. The zipped file is copied into a WSC local storage folder. WSC automatically connects to ARIMS, authenticates the user's credentials (based on an Army Knowledge Online account) and begins archiving records with no additional user interaction required.

> ARIMS Web Services is a relatively new technology that favors simplicity, best design practices and cross-platform use over raw communication speed.

The ABCDF IT team designed the WSC interface to be user-friendly, robust and to check for record duplication. Further, should an error occur during record transmission, the WSC logs the error and notifies users immediately so that the mistake may be corrected.

In addition to the functionality mentioned above, the WSC's local Microsoft SQL Server database enables users to conduct full record searches using flexible search criteria such as title, keywords, dates, etc. Search results yield a record's ARIMS identification number, along with all metadata stored on the record. This information is used to retrieve a copy of the actual record.

"WSC has revolutionized how we think about records archiving,"



ABCDF operators drain mustard agent from ton containers using a "glovebox" in the Process Neutralization Building. Once the chemical agent is drained, it is vigorously mixed with hot water and sodium hydroxide to render it into an agent-free wastewater by-product. (Photo courtesy of CMA.)

explained Brian O'Donnell, ABCDF Site Project Manager. "Because the system is so easy to install and access, rather than waiting until the tail end of their mission, project personnel can archive vital records throughout all phases of operations."

Authorized personnel and future researchers and historians will have instant access to these important Army records for generations to come.

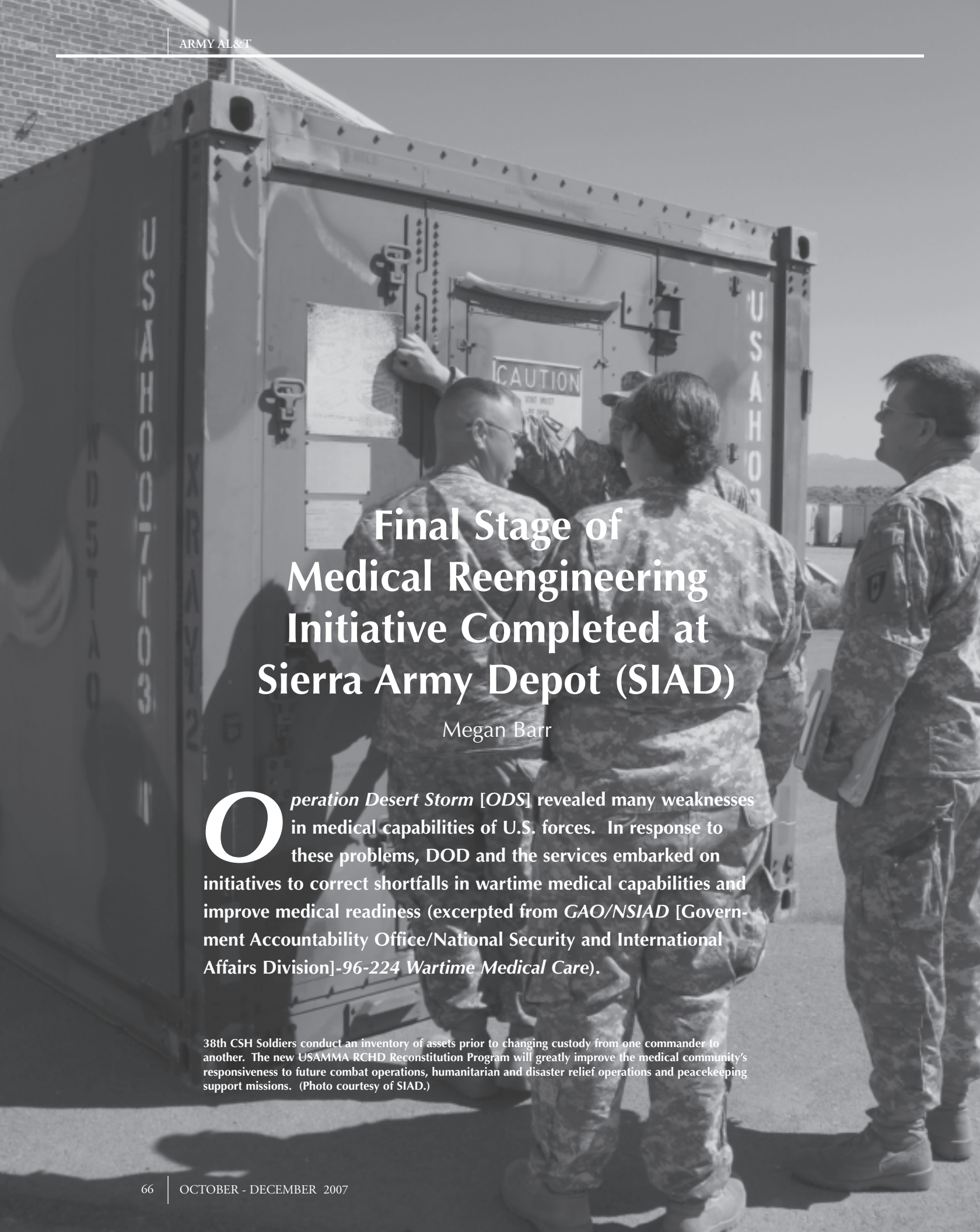
ABCDF's success in creating an automated, rapid method to archive and retrieve project documents within ARIMS is yet another example of how site personnel continue to leverage innovative thinking and technology in completing their missions. Site personnel are presently collaborating with the remaining chemical demilitarization sites to share their experiences with the system and facilitate the potential future adaptation of the system by other sites.

"We are pleased that the CMA chose to archive its long-term and permanent electronic records using the ARIMS WSC and that it was so successful," remarked Ken Hansen, Acting Chief, Records Management Division, RMDA. "Authorized personnel and future researchers and historians will have instant access to these important Army records for generations to come."

WAYNE N. BUSHELL is a Senior Software Applications Engineer for SAIC. He serves as an IT team leader in the Integrated Management Solutions Department with responsibility to design, develop and maintain information systems for multiple projects for CMA (formerly Program Manager for Chemical Demilitarization), U.S. Army Soldier and Biological Chemical Command and other agencies. Bushell has a B.S. in physics from the University of Maryland-Baltimore County, with additional coursework in organic chemistry, biology, biochemistry and computer programming completed after graduation.

DIANE L. GRAHAM is an Information Management Specialist and a Senior Records Manager employed with SAIC for more than 13 years, supporting the CMA Alternative Technologies and Approaches Product with her in-depth understanding of U.S. Army regulations and CMA policies. She holds a B.A. in foreign languages from the University of Maryland-Baltimore County, with specialties in both German and Russian.

CMA
U.S. ARMY CHEMICAL MATERIALS AGENCY



Final Stage of Medical Reengineering Initiative Completed at Sierra Army Depot (SIAD)

Megan Barr

O*peration Desert Storm* [*ODS*] revealed many weaknesses in medical capabilities of U.S. forces. In response to these problems, DOD and the services embarked on initiatives to correct shortfalls in wartime medical capabilities and improve medical readiness (excerpted from *GAO/NSIAD* [Government Accountability Office/National Security and International Affairs Division]-*96-224 Wartime Medical Care*).

38th CSH Soldiers conduct an inventory of assets prior to changing custody from one commander to another. The new USAMMA RCHD Reconstitution Program will greatly improve the medical community's responsiveness to future combat operations, humanitarian and disaster relief operations and peacekeeping support missions. (Photo courtesy of SIAD.)

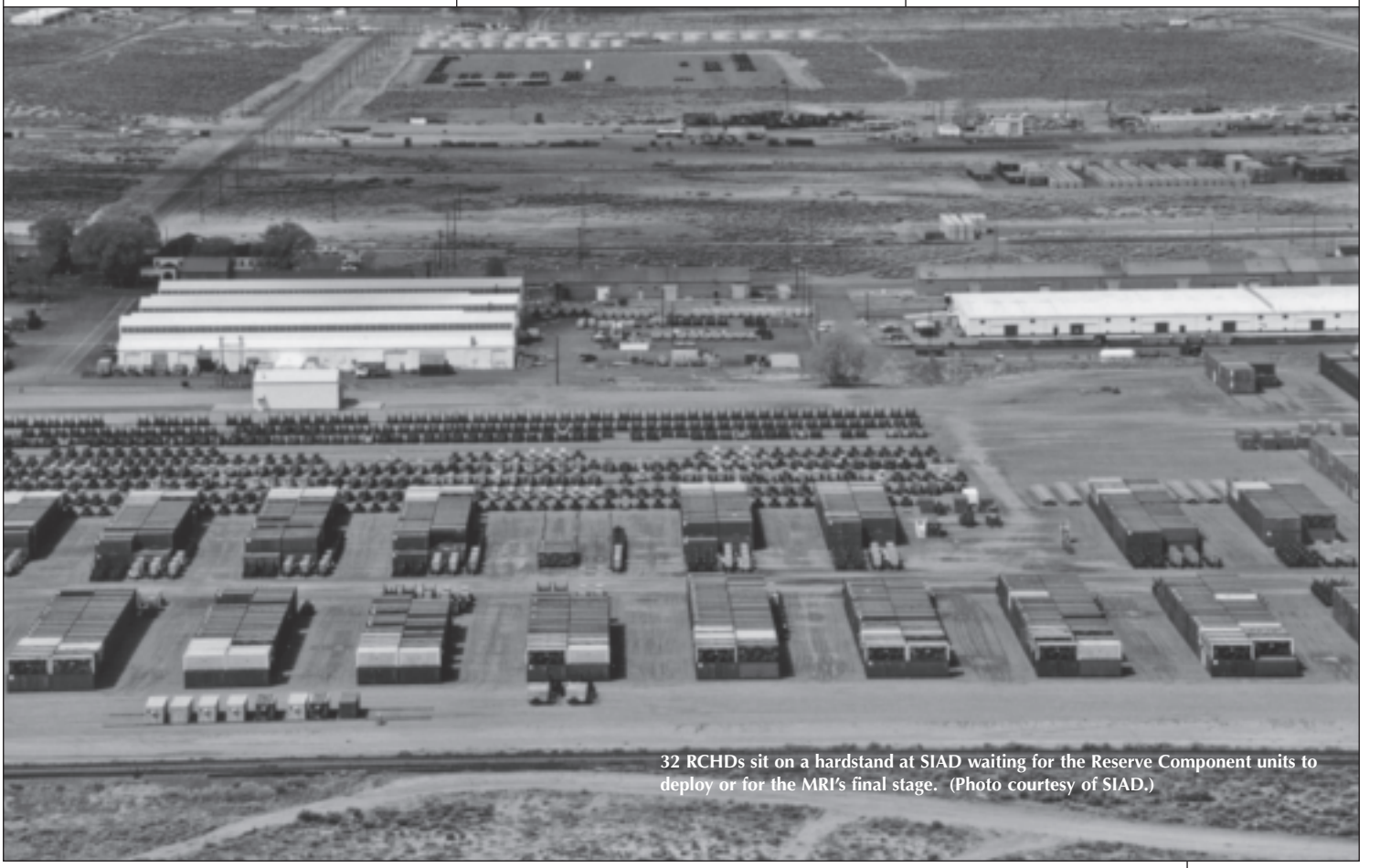
Shortly after *ODS*, the Army Medical Department (AMEDD) began its Medical Reengineering Initiative (MRI). This initiative addresses medical unit restructuring so that AMEDD can fulfill its mission to "conserve the fighting strength." One of MRI's final stages is taking place at SIAD where the U.S. Army Medical Materiel Agency (USAMMA) is overseeing Reserve Component Hospital Decrements (RCHD) downsizing. With a combined effort between SIAD and USAMMA, the 32 RCHDs under SIAD's care will be condensed down to 21. SIAD's mission is to "provide worldwide expeditionary logistics support for the defenders of our Nation through long-term storage, maintenance, care of supplies in storage, reset and container management." SIAD is demonstrating many of these key initiatives as it strives to fulfill a significant role in supporting USAMMA's RCHD Reconstitution Program.

MRI

AMEDD's MRI began in 1993 in an effort to streamline the Active and Reserve medical units with the purpose of increasing flexibility, deployability and mobility while reducing the medical footprint. As a result, the MRI transformed the obsolete Medical Force 2000 (MF2K) to a 248-bed Combat Support Hospital (CSH). The MF2K concept was designed to support the casualty streams from the worst possible scenarios imagined during the Cold War. The MF2K is comprised of three hospitals: the general hospital, the field hospital and the CSH. It is cumbersome and lacks the ability to enter a war, humanitarian relief operation or peacekeeping operation early.

SIAD's mission is to "provide worldwide expeditionary logistics support for the defenders of our Nation through long-term storage, maintenance, care of supplies in storage, reset and container management."

The MRI force structure is comprised of two hospitals: Company A and Company B. As outlined in *Field Manual [FM] 4-02.10, Theater Hospitalization*, Company A is an 84-bed hospital that can be split up into an "early entry" hospital element of 44 beds and an augmentation element of 40 beds. Company B is a 164-bed hospital that supplements Company A by adding two extra operating rooms, two Intensive Care Units, seven Intensive Care Wings and dental capabilities. The early entry hospital element (44 beds) can quickly deploy



32 RCHDs sit on a hardstand at SIAD waiting for the Reserve Component units to deploy or for the MRI's final stage. (Photo courtesy of SIAD.)

48th CSH Soldiers perform preventive maintenance on small generators prior to placing them back in storage for the next deployment. (Photo courtesy of SIAD.)

and operate as a self-contained unit for 72 hours without any other logistical support. If additional assistance is needed, the augmentation element (40 beds) and Company B (164 beds) can deploy. This structure provides a medical force that has early entry capabilities and a reduced footprint.

Reserve Component Hospital Decrement Reconstitution Pilot Program (RPP)

USAMMA manages the RCHDs as long-term storage assets. Currently, 32 RCHDs are being stored at SIAD and have not been upgraded since the mid-1990s. As a part of the MRI, the 32 RCHDs from the old MF2K concept are being downsized to 21 hospitals that follow the new MRI concept. The Scope of Work Pilot Program for the 352nd CSH mandates that USAMMA develop a plan to reconstitute the remaining RCHDs on a 5-year cycle. The plan will be similar to the 5-year long-term storage program, but with additional requirements.

The RPP took place at SIAD from April 1, 2007 to May 15, 2007. The 352nd RCHD was chosen for the pilot program because it was the next RCHD due in for its maintenance cycle. The program's purpose was to perform 100 percent inventory of all assets for the 352nd RCHD to determine:

- The accuracy of the Theater Enterprise Wide Logistics System information.
- How well plastic and metal items survive when placed in long-term storage.
- That all rolling stock and nonmedical Associated Support Items of Equipment (ASIOE) are present, serviceable and aligned properly.
- That at least one hospital can be easily readied for deployment.
- What future inventories, manpower and funds are needed.
- What would be more costly — purchasing a new hospital or modernizing the old ones?

> AMEDD's MRI began in 1993 in an effort to streamline the Active and Reserve medical units with the purpose of increasing flexibility, deployability and mobility while reducing the medical footprint.

According to the SIAD *Concept of Operations Plan*, the RPP's mission includes several directives. The plan outline states that once the Deployable Medical Systems containers, Military-owned Demountable Containers (MILVAN) and International Organization for Standardization shelters are downloaded, the following steps would be conducted:

- Complete 100 percent inventory on medical and nonmedical assets.
- Complete medical maintenance cycle on all medical maintenance items.
- Relocate the medical maintenance items to newly assigned MILVANs.
- Complete the Care of Supplies In Storage (COSIS) on all ASIOE.
- Complete an 84-bed and 164-bed hospital.
- Obtain 100 percent Container Safety Certification (CSC) on all containers.

- Repack all containers and seal using long-term storage procedures.
- Stencil all containers.
- Complete the time study on all aspects of the inventory.

Many workers were needed to execute the RPP's mission. Employees at SIAD provided the entire labor support. USAMMA provided RCHD Manager Robert Schaad and the Logistics Assistance Program's Chuck Davis, the pilot program's Quality Assurance Inspector. Medical maintenance support was provided by USAMMA Medical Maintenance Chief Rich Burlison. After successful pilot program completion, it remains to be determined if the RPP will become the future reality for the RCHD program. The number of hospitals that would be inducted into the RPP also remains to be determined. If implemented, the program would create an additional, year-round work effort at SIAD. When Schaad was asked why the RCHDs are being stored at SIAD, he stated, "Sierra Army Depot has an excellent environment for long-term storage."

SIAD will continue to play a significant role in the readiness of future combat support, humanitarian efforts and peacekeeping operations.

SIAD Operations and the RCHD Reconstitution Program

Maintenance, long-term storage, container management and COSIS are only a few of the operations that take place at SIAD, and these were the operations that provided primary support to USAMMA's RPP.

During the RPP, SIAD's employees unloaded the 352nd CSH's RCHDs and moved all medical items to their respective locations for inventory and inspection. All empty containers went through a CSC inspection performed by Davis. If containers did not pass inspection for maintenance reasons, they were taken to the Metal Working Shop for repair. The containers were then sent to the Paint Shop to have the end wall doors and side doors cleaned of old Chemical Agent Resistant Coating (CARC) paint and repainted with new CARC paint. All appropriate container information was then stenciled on both doors.

After the containers were repaired and painted, they were packed with the items that had been inventoried and passed material inspections. Once the containers were packed, they were prepared for long-term storage. All containers had their humidity indicators replaced, new desiccant was added for moisture control, and all door seals and container frames were sealed with caulk. The containers were then weighed and stenciled with the proper weight and returned to the SIAD staging area. The containers were arranged by the new 84-bed/164-bed hospital configuration with special attention given to container management by maintaining accurate inventories, preventing the recording of improper items and locations while keeping records of cycle times and repair information.

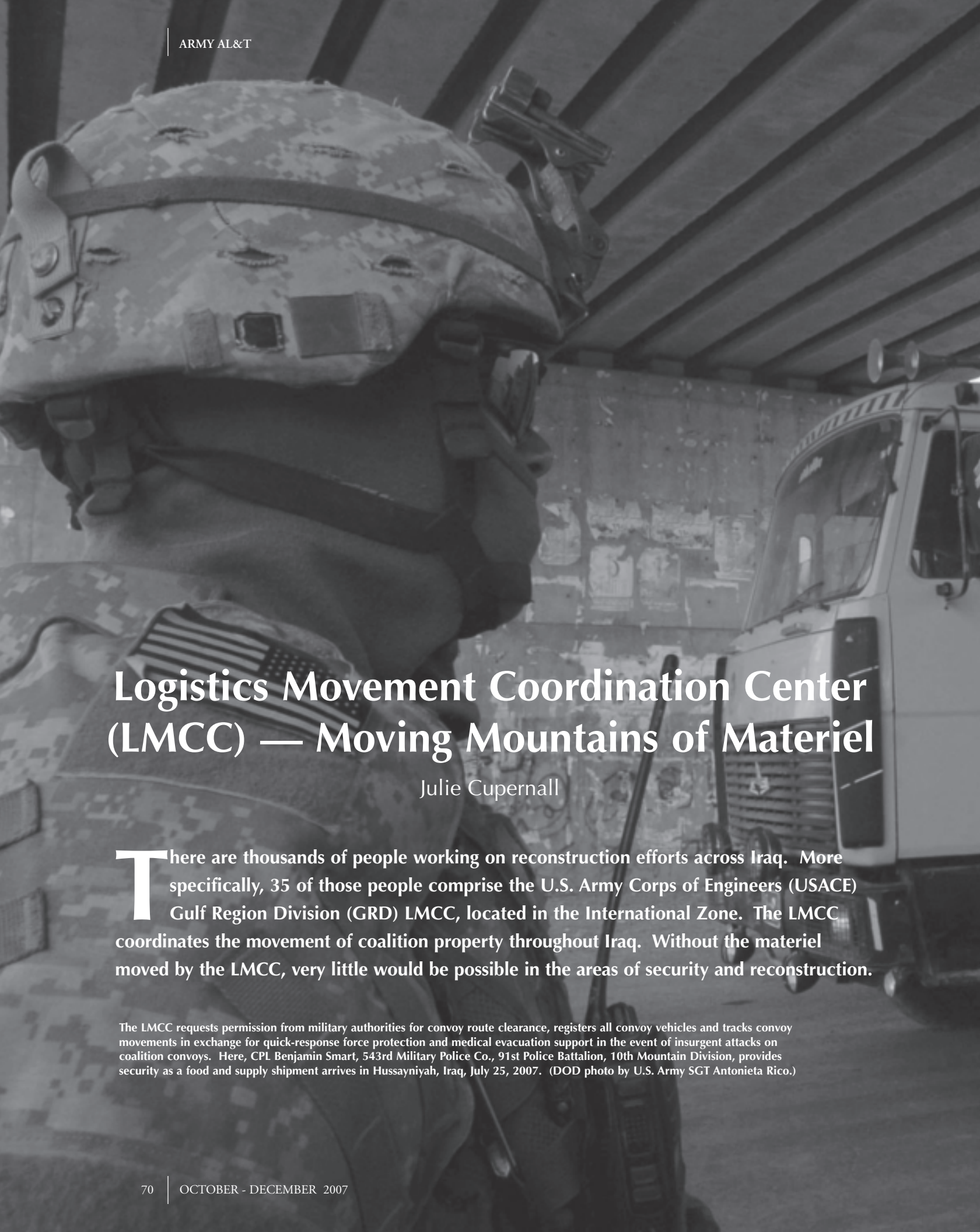
When all newly configured MRI units were finished and put into RCHD at SIAD, the COSIS process began. SIAD's COSIS process is done to keep all materials in storage maintained and ready to issue and consists of checking the humidity and temperature for all containers, inspecting the container for any damage, examining the caulking for defective sealing and supporting medical maintenance cycles.

Along with maintenance, long-term storage, container management and COSIS, SIAD also provides expeditionary logistics support, transportation management, reset and retail supply. The depot's infrastructure is ideal for performing multifunctional operations and providing Joint expeditionary logistics support to the warfighter.

ODS provided the experience that made AMEDD more aware of the direction it needed to pursue to keep up with the changing nature of combat. The lessons learned in that campaign highlighted the necessity to become more flexible, deployable and mobile while reducing the medical footprint. The old MF2K hospital that was used during *ODS* was large and hard to move. The MRI was able to learn from this experience and, as a result, transformed the aging hospital into a smaller and more innovative configuration. With SIAD's help, USAMMA will be able to fulfill its obligation and bring the RCHD Reconstitution Program to completion.

SIAD is working hard at being the primary location and providing the workforce support for USAMMA's RCHD Reconstitution Program, and will continue to play a significant role in programs such as this to ensure the readiness of future combat support, humanitarian efforts and peacekeeping operations.

MEGAN BARR is a Contract Specialist at SIAD. She holds a B.S. in supply chain management from the University of Nevada-Reno. She is Level I certified in life-cycle logistics and program management and is working on her Level I contracting certification.



Logistics Movement Coordination Center (LMCC) — Moving Mountains of Materiel

Julie Cupernall

There are thousands of people working on reconstruction efforts across Iraq. More specifically, 35 of those people comprise the U.S. Army Corps of Engineers (USACE) Gulf Region Division (GRD) LMCC, located in the International Zone. The LMCC coordinates the movement of coalition property throughout Iraq. Without the materiel moved by the LMCC, very little would be possible in the areas of security and reconstruction.

The LMCC requests permission from military authorities for convoy route clearance, registers all convoy vehicles and tracks convoy movements in exchange for quick-response force protection and medical evacuation support in the event of insurgent attacks on coalition convoys. Here, CPL Benjamin Smart, 543rd Military Police Co., 91st Police Battalion, 10th Mountain Division, provides security as a food and supply shipment arrives in Hussayniyah, Iraq, July 25, 2007. (DOD photo by U.S. Army SGT Antonieta Rico.)

"The LMCC is a collection of minds, banded together to solve the problem of movement and all its complexities," explained Jack Holly, GRD Logistics Director. "Everything you see in the LMCC are tools to assist in that decision-making process." After 2½ years, the LMCC is a well-oiled machine when it comes to materiel movement. It's been accomplished with more than a little bit of adjustment to the machine along the way.

From the beginning, the LMCC has been organized as a team that will one day be taken over by Iraqis. This envisioned end state created a couple of challenges from the onset. First, even though the convoy environment is extremely dangerous, the LMCC could not be a classified organization if it was to support Iraqi apprenticeship. Second, although the movement environment is military, the LMCC had to be composed mainly of contractors because the LMCC must be sustainable for reconstruction needs while coalition forces concentrate on security missions.

Holly, who has been directing the LMCC since its inception in 2003, tackled these challenges by creating a new business model: a team primarily run by contractors in a military environment with a desired end state of total takeover by the Iraqi government. The LMCC was accomplished through what members of Holly's team describe as the "three Cs:" coordination, communication and cooperation.

Coordination

The initial issue boiled down to responsibility. While it was the contractors' responsibility at the LMCC to coordinate movements of materiel around Iraq, it was not included in their contracts that those movements

GRD LMCC employees request permission for, register and monitor convoy movements throughout the operational environment in Iraq. (U.S. Army photo courtesy of USACE GRD.)

needed to be coordinated with the military elements controlling the areas the convoys were moving through. This lack of coordination did not sit well with the military.

On the other end of the spectrum, military quick-reaction forces, emergency response and medical evacuation teams were not explicitly responsible for covering the LMCC convoys. This lack of coordination was causing insurance premiums for the LMCC's contract companies to go through the roof.

Drawing upon his many years of experience as a former U.S. Marine Corps officer, Holly recognized this lack of coordination and set out to resolve it. In short, he convinced the contract companies at the LMCC to request permission for, register and track their movements with the military controlling the operational environment.

The tradeoff was a guarantee from the military for quick-response forces and medical evacuation support in the event of an attack upon LMCC convoys.

Coalition forces were getting their logistics needs fulfilled, while keeping a better view of their operating environment, and the contract companies working at the LMCC received a safer workspace, which dramatically lessened their insurance premiums.

During the LMCC's coordination phase, the need for effective communication between the contractors controlling and executing the movement and coalition forces on the ground was recognized as the deal maker or breaker.

Communication

During the LMCC's coordination phase, the need for effective communication between the contractors controlling and executing the movement and coalition forces on the ground was recognized as the deal maker or breaker. The first question: "How to talk about movements in an unclassified environment without tipping off the bad guys?" The answer was encryption of data, much the way banks do. The encryptions aren't foolproof, but are difficult enough that by the time the info is decrypted, the movements are usually complete.

"We had to be unclassified, but that does not mean stupid," related Holly. "It means we have to use commercial methods of encryption. You understand the security concerns of certain things you do, but you're not under the restrictive umbrella of a DOD security organization that makes working with other people, other countries and private industry very hard," Holly continued.

The ability to safely track the reconstruction resources needed to get $13 billion worth of reconstruction underway did not go unnoticed by the Commander, USACE GRD. "We can track our reconstruction resources directly from the border, and we can make sure we do that in a secure way," explained BG Michael Walsh. "It's a vitally important job. It's vital to what we do."

The second question: "How to track the materiel convoys in real time?" Real time is necessary for two reasons:

- So coalition forces know that the convoys are "friendlies" when they deploy.
- So when the convoys come under attack, help can be on the way within minutes.

The LMCC answered this need by using removable tracking devices on all its convoys. The tracking devices are monitored by employees at the LMCC and by coalition forces. The complex computer software that monitors the tracking devices on the convoys is constantly being updated and reconfigured to better meet the LMCC's needs. In fact, the contract company that designs the tracking software has an employee on the ground in Baghdad so needs can constantly be assessed and addressed.

Cooperation

The LMCC and its coalition partners are firmly within the cooperation phase now. In the past 2½ years, more than 11,300 convoys have been guided by the LMCC, including the delivery of more than 28,500 vehicles and 353 million rounds of ammunition. Sadly, even the best cooperation in a war zone doesn't eliminate danger completely. The LMCC's dedicated workers have paid a high price for moving the materiel that keeps the coalition moving forward. As of Feb. 14, 2007, there had been 977 attacks on LMCC guided convoys, resulting in 129 dead and 370 wounded. Many of the killed and wounded have been Iraqi associates.

Iraqi apprenticeship is integral to USACE's GRD logistics movement success long term. Here, an Iraqi worker performs warehousing operations in Abu Ghraib, Baghdad Province, Iraq. The ultimate goal is to have Iraqis assume management responsibility of their own materiel movement and security countrywide once coalition forces leave. (U.S. Army photo courtesy of USACE GRD.)

The Way Forward

GRD Logistics and the LMCC have always had one end state — total takeover of operations by the Iraqi people. With this goal constantly in mind, Iraqis are working and succeeding at the LMCC and on the convoys moving across their country. Iraqis also are working at the GRD Logistics warehouses in Baghdad and Um Qasr, learning the additional skills of inventory control along with materiel movement. "I'm very glad to be working for this company. I have learned many things and this allows me to serve my country and provide for my family's future," said one Iraqi GRD Logistics employee who preferred to remain anonymous because of security concerns.

There have also been lessons learned for the USACE and coalition forces. The LMCC is a new business model and it works. Military outsourcing to contractors who, in turn, outsource to Iraqis is getting the job done now, and is ensuring that the Iraqis will get the job done in the near future. According to Holly, perhaps the biggest lesson learned at the LMCC is how to operate effectively in a learning environment. "The battlefield is changing so dramatically every day and every week that it is a luxury of laziness to accept that what worked last week will work next week," Holly remarked. "It doesn't happen. Every week you have to analyze, relook, reevaluate and maybe come up with changes as to how you're doing things."

JULIE CUPERNALL is a Public Affairs Broadcaster for USACE GRD. For more information, call (540) 665-1229 or e-mail **cegrd.pao@tac01.usace.army.mil**. For more information about USACE's operations in Iraq, go to **www.grd.usace.army.mil**.

Physics of Failure (PoF) and the Rapidly Emplaced Bridge System (REBS) — How Teamwork and Modeling and Simulation Turned a Test Failure Into Program Success

Rick Mitchell, James R. Horchner and Rob Wahl

The REBS, a mobile bridge that can span gaps of up to 13 meters, is transported by the Common Bridge Transporter (CBT) and can be deployed and retrieved quickly to provide additional battlefield maneuverability to warfighters.

The REBS, depicted here in transportation configuration, is being carried by a CBT. Successful testing of the REBS at ATC led to a capability upgrade to MLC 40. (Photo courtesy of U.S. Army ATC.)

Initial REBS requirements envisioned a basic load-carrying capacity of Military Load Class (MLC) 30 (approximately 30 tons for a tracked vehicle). An acquisition based on the MLC 30 requirement was undertaken, and production qualification testing at Aberdeen Test Center (ATC), MD, was initiated. Historically, the cost and time associated with conducting large-scale bridge crossing tests precluded full testing of the requirement to levels of statistical confidence. To solve this problem, ATC developed the Bridge Crossing Simulator (BCS) device, which physically simulates the loads imposed by a crossing vehicle on a bridge under test, allowing durability testing to be conducted quickly and economically.

While the REBS was under test on the BCS, a problem developed. Specifically, the bridge center coupler connection failed before the bridge had reached its required durability life. Army Materiel Systems Analysis Activity (AMSAA) engineers used a physics-based computer modeling analysis technique — PoF — to identify the root causes of the REBS failure and to recommend a design improvement.

The recommendation suggested adding structural angle sections to connect the center couplings of the bridge to the vertical webs, which

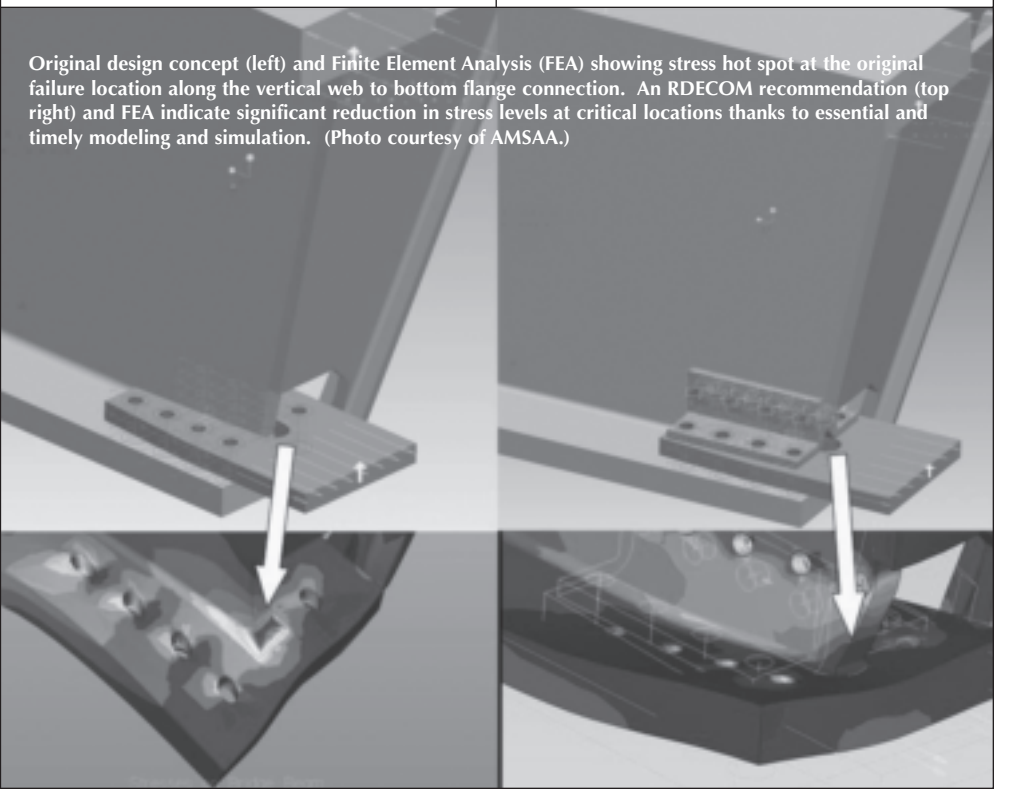
The REBS undergoes testing on the BCS device developed by ATC. (Photo courtesy of U.S. Army ATC.)

would create a much stronger double-shear connection. The new design proposal eliminated the hot spot in the weld between the bridge bottom flange and vertical web where the previous failure had originated.

U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC) engineers, along with the Product Manager (PM) Assured Mobility Systems, reviewed the results of an MLC 40 upgrade feasibility study performed by the REBS prime contractor to address increased requirements. They determined that the suggested design improvement might not only fix the immediate problem, but also provide the additional margin needed to upgrade the bridge's load capacity. The PM Bridging, located in the Program Management Office Force Projection, capitalized on the confluence of events and moved forward to upgrade the bridge. TARDEC and the REBS contractor worked to implement the AMSAA recommendation and to add other enhancements to ensure that REBS would meet the new, tougher requirements. A new plan was developed to test the bridge durability at the MLC 40 level.

There was high confidence as the test began. The PoF fatigue analysis predicted that the redesigned center coupler region — the previous failure location — would survive 100,000 MLC 40 crossings. The new test demanded that the bridge survive 19,000 MLC 40 crossings to prove its requirement to a high degree of statistical confidence. The question on everyone's mind was, "Would some 'new' weak link emerge as the test progressed?" The answer turned out to be both, "Yes" and "No."

After 16,584 simulated crossings, a crack was discovered at a new location on the bridge. The question was, "What to do now?" The crack initiated in a replaceable component, and so the failure of such a component by definition was not a durability failure.



Original design concept (left) and Finite Element Analysis (FEA) showing stress hot spot at the original failure location along the vertical web to bottom flange connection. An RDECOM recommendation (top right) and FEA indicate significant reduction in stress levels at critical locations thanks to essential and timely modeling and simulation. (Photo courtesy of AMSAA.)

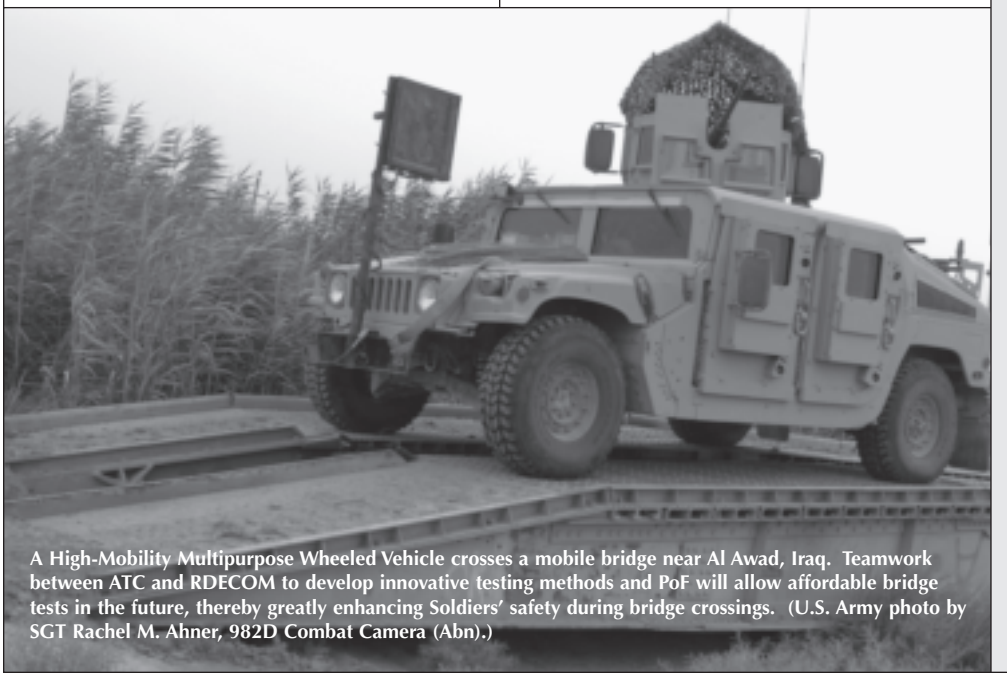
A U.S. Army Soldier drives a Bradley Fighting Vehicle over a mobile bridge near Al Awad, Iraq. A recently tested REBS mobile bridge, by ATC, that's capable of being deployed and retrieved quickly, will provide additional battlefield maneuverability to warfighters. (U.S. Army photo by SGT Rachel M. Ahner, 982D Combat Camera Airborne (Abn).)

If the part was replaced, the test could continue. REBS would have almost certainly continued on to pass its durability test. But, what if the crack developed during a mission? How fast would it grow? Could the REBS still carry its crossing load? Would Soldiers be able to complete their mission before failure? It was important to know this information for the future safety of our warfighters.

After considering the options, a decision to continue the test without repair was made. Amazingly, the REBS continued to carry its full load — 100, 200, 300 … crossings. The crack in the bridge grew, easily reaching sizes that would be spotted in routine preventive maintenance checks and service (PMCS) — 500, 600, 700. ... The test went on at maximum MLC 40 load. Finally, after an additional 748 crossings, a grand total of 17,322 crossings, the test was stopped. The REBS was durable, and when it failed, it did so with warning. The operators would have ample opportunity to discover the damage during the preventative maintenance checks and services and before a new mission. The REBS had proven "damage tolerance," a hallmark of a creditable bridge design.

The REBS is the most tested bridge in recent U.S. Army history. Prior to BCS introduction by ATC, large-scale durability testing was cost prohibitive and, as a result, past production decisions were made with incomplete information and at increased risk. Now, the U.S. Army can affordably test bridges to high levels of statistical confidence and verify the damage tolerance, thereby greatly enhancing Soldier safety.

The REBS program is a good example of Army organizations working together for success. ATC's innovative testing methods, the U.S. Army Research, Development and Engineering Command's (RDECOM's) PoF analysis and the PM's determination to provide warfighters with the best possible tools made this program a success.



A High-Mobility Multipurpose Wheeled Vehicle crosses a mobile bridge near Al Awad, Iraq. Teamwork between ATC and RDECOM to develop innovative testing methods and PoF will allow affordable bridge tests in the future, thereby greatly enhancing Soldiers' safety during bridge crossings. (U.S. Army photo by SGT Rachel M. Ahner, 982D Combat Camera (Abn).)

RICK MITCHELL is the REBS Acquisition Manager. He is certified Level III in program management and in life-cycle logistics.

JAMES R. HORCHNER is the PoF Mechanical Systems team leader at AMSAA. He received a B.S. in mechanical engineering from Pratt Institute and an M.S. in engineering from the University of Pennsylvania. Horchner is Level III certified in test and evaluation and is a U.S. Army Acquisition Corps member.

ROB WAHL is a Mechanical Engineering Contractor for SRS Technologies and works on the PoF Mechanical Systems team at AMSAA. He holds a B.S. in mechanical engineering from George Washington University and is pursuing a master's degree in mechanical engineering at Johns Hopkins University.

From the Acquisition Support Center Director

I would like to begin by welcoming and introducing our new U.S. Army Acquisition Support Center (USAASC) Deputy Director, COL Brian C. Winters. He joins us after serving as the Chief, Acquisition Management Branch (AMB), U.S. Army Human Resources Command, Alexandria, VA. His previous assignments include Product Manager (PM) Army Watercraft Systems; Project Manager Force Protection, Program Executive Office (PEO) Combat Support & Combat Service Support, Warren, MI; and Program Analyst for the Army Chief of Staff's Program Analysis and Evaluation Directorate at the Pentagon.

Traditionally, we have had an extremely close working relationship with AMB and, with COL Winters joining us, it will truly provide synergy to that partnership. We are very fortunate to have a superb officer like COL Winters on our team and our expectations for his success run high. He brings essential knowledge and expertise to the job and, together with the USAASC team, we will continue to provide optimal support as quickly as possible to our Soldiers as they gallantly fight the global war on terrorism (GWOT). COL Winters follows in the footsteps of COL Fred Mullins who is now PM Training Devices, PEO Simulation, Training and Instrumentation, Orlando, FL.

USAASC Regional Customer Support Offices (CSOs)

In accordance with the *Defense Acquisition Workforce Improvement Act (DAWIA)*, the USAASC Regional CSO missions are to develop, implement and execute acquisition workforce policy and procedures. CSOs are responsible for acquisition career development and management, ensuring that the Army Acquisition, Logistics and Technology (AL&T) Workforce receives consistent, accurate and timely information regarding acquisition programs, education, training and competitive opportunities generated by the Army Acquisition Corps (AAC) and Director, Acquisition Career Managment (DACM). CSOs ensure consistency between *DAWIA* and Army objective policies and programs pertaining to managing military and civilian AAC members and AL&T Workforce position requirements, while increasing awareness and participation of senior leaders in acquisition career management initiatives. The CSO vision is to provide superior career development and career management assistance in total support of our ultimate customer — the warfighter — through enhancing AL&T Workforce quality by attracting qualified new people and improving the training and motivation of current workforce members.

With GWOT and USAASC's response to *Program Budget Decision 753*, significant resource cuts, including manpower, had to be absorbed throughout the organization. To minimize the direct effect on existing staff, USAASC accommodated this Table of Distribution and Allowances reduction through existing and known impending vacancies. Once those reductions were realized, it became paramount to restructure USAASC resourcing to respond to existing and increasing mission/workload resulting from our recent designation as a Direct Reporting Unit to the Assistant Secretary of the Army for AL&T. The Regional CSO construct responded by consolidating all remaining and staffed CSOs into two regional hubs:

- Eastern Region Headquarters (HQ), Fort Belvoir, VA, with CSOs at Fort Belvoir and Aberdeen, MD.
- Western Region HQ, Redstone Arsenal, AL, with CSOs at Huntsville, AL; White Sands, NM; and Warren, MI.

Ensuring that our customer support mission did not diminish because of the restructuring, many business practices were revisited using Lean Six Sigma principles. This resulted in significant automation enhancement development and deployment in FY07:

- *DAWIA certification process. DAWIA* certificates are now available electronically through the careerist's Acquisition Career Record Brief (ACRB) module. The application, review, notification and documentation process is now completely virtual via the Certification Management System (CMS) enhancement to the Civilian Acquisition Personnel & Position Management (CAPPMIS) database. An automated certification process for more than 1,000 Level 1 achievements in program management and acquisition logistics was piloted, thus negating the need for a paper-intensive application process. CMS will go live in the first quarter of FY08.
- *DAWIA AAC process. DAWIA* AAC certificates are now available electronically through the careerist's ACRB module. In FY08, a virtual process to automate the AAC application, review, notification and documentation process through a CAPPMIS enhancement will be deployed.
- *Enhancements to the Individual Development Plan system in CAPPMIS*. The awarding of continuous learning points and completed status documentation of all Defense Acquisition University (DAU) coursework is now automated.

This has significantly reduced the administrative burden on AL&T Workforce members as well as their supervisors.

- *Automated response systems.* Several of our CSOs have automated phone response systems with 24/7 response capability to our careerists seeking guidance on ACRB edits, certification and AAC application processes, as well as procedures for DAU training applications. We are in the process of expanding this capability throughout the AL&T Workforce. We are taking the automated response systems one step further in FY08, by developing a Web-enabled response system entitled "Ask An ACM," which will also provide 24/7 response capability via the USAASC Web site.

Interactive Customer Evaluation (ICE) Program

In an effort to extend our outreach to the AL&T Workforce and pursue continuous improvement, we are implementing the Defense Information Systems Agency-sponsored ICE program. ICE allows AL&T Workforce members to submit online comment cards to rate USAASC services and provide suggestions for improvement. By clicking the link, **http://ice.disa.mil/index.cfm?fa=card&service_provider_id=106027&site_id=336&service_category_id=14**, which will be made available on the USAASC Web portal and on all e-mail correspondence from USAASC personnel, you are taken directly to a feedback sheet. The default submission is anonymous, but you can add contact information if you want a direct response. I see this as an opportunity to enhance responsiveness to the workforce's needs and to enable USAASC to better achieve its mission. We welcome any comments, criticisms and, of course, any accolades.

Senior Rater Potential Evaluation (SRPE) Revamped

The SRPE provides a means for civilians to better understand their leadership strengths and weaknesses for developmental purposes and allows them to demonstrate their leadership potential when competing on selection boards. Unfortunately, until recently, SRPEs did not receive the same level of management attention that is routinely placed on the Officer Evaluation Report senior rater section, resulting in an unfavorable outcome for our competing civilians in best-qualified (BQ) situations.

As the SRPE is not a mandatory business practice for the entire AL&T Workforce, the resulting SRPE profiles for our civilian BQ competitors are often not mature. To address this anomaly, it is anticipated that the Army's DACM will revisit mandating the annual completion of a SRPE for those at the GS-13 and above levels (to include broadband equivalents). Please note: the SRPE does remain a requirement for all BQ opportunities including Project/Product Manager Boards, Competitive Development Group (CDG)/Army Acquisition Fellows (AAF) and Acquisition, Education, Training and Experience Boards.

With the introduction and existence of so many different civilian pay systems, including the Total Army Personnel Evaluation System, Acquisition Demonstration Project, the National Security Personnel System and the Laboratory Demonstration Projects, USAASC found that the execution of SRPEs became increasingly difficult for our senior raters, and created even smaller profile ranges. In response, USAASC modified the SRPE policy and procedures in July 2007, and created more equitable and sizable profile ranges for the civilian AL&T Workforce by consolidating like pay scales into single profile ranges.

I cannot emphasize enough the importance and benefit of the completion of annual SRPEs for the entire AL&T Workforce at the GS-13 and above levels. This practice will enable a healthy and historical profile supporting our civilian AL&T Workforce BQ applicants and aligning them with their military peers.

SRPE policy and guideline changes can be found at **http://asc.army.mil/docs/policy /SPRE_policy.pdf**.

For more information about SRPE, Regional CSOs and automated customer support enhancements, contact Kelly Terry at **kelly.terry@us.army.mil** or (732) 532-1406/(DSN) 992-1406.

Competitive Board Announcements — Call for Nominations

- FY09 Army Acquisition Director, Key Billet Positions — Closes Oct. 12, 2007
  https://www.hrc.army.mil/site/protect/Active/opfam51/FY09_Army_Acquisition_Director_Key_Billet.htm
- CDG/AAF — Closes Nov. 2, 2007
  http://asc.army.mil/docs/programs/cdg/CDG_AAF_YG08_Announcement_updated.pdf
- Acquisition Tuition Assistance Program — Closes Nov. 15, 2007
  http://asc.army.mil/career/programs/atap/atap_announce.cfm

Craig A. Spisak
Director, U.S. Army
Acquisition Support Center

Contracting Community Highlights

I am extremely proud of all you do. Every day Army contracting community members perform a critical mission. Our workload is up as much as 300 percent and our annual obligations are nearly $100 billion. Our workforce is not increasing and the operations tempo is high, as are the complexities and demands for us to support our Soldiers and our Nation.

Serving in this community, some have been wounded and others have died in the line of duty. In our CONUS and OCONUS offices, from here to Iraq, you work long, hard hours. No matter the challenge, I have seen the innovation and commitment contracting brings to the mission. With this mission comes a responsibility to exercise sound judgment and maintain the highest levels of integrity and ethics that must always remain the cornerstone of all that we do. You are encouraged to question and challenge any act or failure to act that compromises or does not follow U.S. laws, regulations and policies.

Our community has the ability to work in a "can-do" spirit. We can do a great deal within the parameters of the laws and regulations. As we get the job done, always remember that we are obligated to protect the government's interests and act in a manner that is worthy of the public trust.

This month's feature article highlights the developing role of the Contingency Contracting Officer (CCO) in support of Army transformation. Written by two of the Army's CCOs who deployed with the modular Brigade Combat Teams (BCTs), the article discusses some of the most challenging and rewarding aspects of integrating the contracting function within the BCTs. We must never forget or underestimate the importance of our CCOs who serve as force multipliers to achieve our Nation's domestic and global objectives.

This month, I offer hearty congratulations to Harry P. Hallock, Director, U.S. Army TACOM Life Cycle Management Command Acquisition Center, who was recently promoted to the Senior Executive Service. With the support of his esteemed colleagues and workforce, some of whom are honored in this edition, Hallock will continue to serve our community and our Soldiers for many years.

Included in this issue are articles on the resurrection of Job Order Contracting at Letterkenny Army Depot to provide agile, flexible and responsive support for facilities repair and improvement programs. Additionally, innovative ways that the U.S. Army Research, Development and Engineering Command Acquisition Center, Natick Contracting Division, is recruiting new interns is featured. Articles containing important information for all contracting officials concerning prohibitions on using GovWorks, the Department of Interior National Business Center's Federal Acquisition Center and final revisions to *Federal Acquisition Regulation Part 45* on government property are also highlighted in this issue.

As always, we appreciate support from the field in providing a variety of material from across the contracting community.

Ms. Tina Ballard
Deputy Assistant Secretary of the Army
(Policy and Procurement)

Army Transformation and Contingency Contracting With the 101st Airborne (ABN) Air Assault Division (AAD)

LTC Greg Franks and LTC Thomas Lippert

In spring 2004, Army Acquisition Corps (AAC) officers (51C, 51S, 51T and 51A) and noncommissioned officers (NCOs) were notified that they would support Army transformation by being assigned to the 3rd Infantry Division (DIV), Fort Stewart, GA; the 101st ABN AAD, Fort Campbell, KY; or the 10th Mountain DIV, Fort Drum, NY. The Army focused heavily on its transformation plan, while the AAC fully supported the Army's plan for the new modular Brigade Combat Teams (BCTs). The contingency contracting officers (CCOs) and NCOs were assigned by modified table of organizational equipment (MTOE) to each of the new modular BCTs as well as to DIV staff sections. Without a clearly developed strategy by the new BCTs on how to best integrate these new assets, it was incumbent on these recently assigned CCOs and NCOs to break new ground to provide combat multiplier capabilities to the warfighter.

The CCOs and NCOs were assigned by MTOE to each of the new modular BCTs as well as to DIV staff sections. Here, RCC military and civilian staff members are pictured at Camp Victory, Baghdad, Iraq, in August 2006. (U.S. Army photo.)

Communication and Education Challenges

Upon arriving at Fort Campbell, several challenges confronted the new CCOs. The first challenge was determining how to provide the BCTs adequate contract support. The BCTs were not clear on how to best integrate the new 101st ABN AAD CCOs into mission planning and requirements generation. In fact, until summer 2004, they had not been assigned CCOs; the three designated to 101st ABN AAD were actually assigned to the DIV Support Command. The second challenge was the units wanting the CCOs to work in the S-4 shops doing logistics functions. The third challenge was that there were no formal contracting scenarios or contracting involvement in the DIV warfighters or other training exercises. As we started to address these concerns with our units, we quickly discovered that we needed to generate a formal education plan in numerous areas.

After weeks of internal document and presentation formulation, the CCO teams embarked on an intense education campaign with classes for BCT, Battalion (BN) S-4 and G-4 logistics personnel:

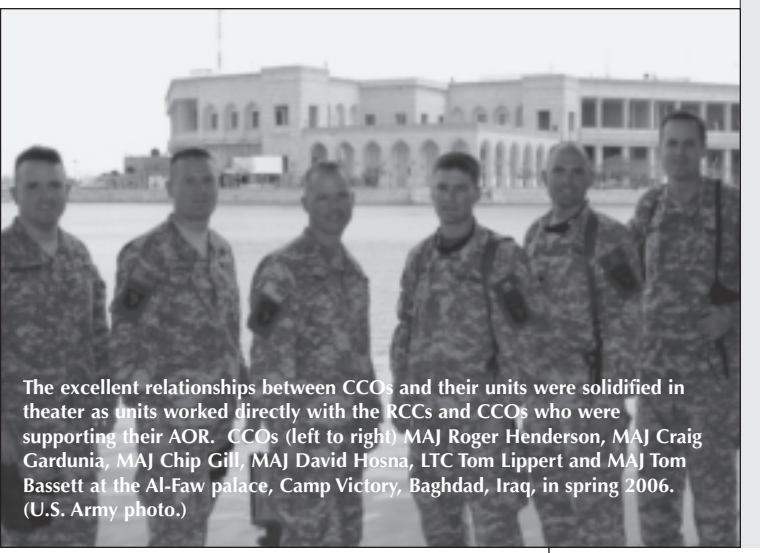
- Formulation of Purchase Request and Commitments and the comprehensive process of requirements generation.
- How to write a good Performance Work Statement or Statement of Work.
- Field Ordering Officer responsibilities and the associated capabilities and limitations.
- Appointment and rules regarding a contracting officer's representative.
- Receiving reports and unit responsibility for accurate and timely submission.
- Joint Acquisition Review Board process that units would see in theater.
- Commander's Emergency Response Program that would become a huge asset to commanders in theater, trained by CCOs, but executed by BCT and BN Soldiers.

Through class progression, a growing relationship between units and contracting officers slowly developed, but as contracting requirements increased, CCOs were able to demonstrate their value as enablers. CCOs focused mainly on the G-4 and the BCT S-4s to help identify requirements needing early contracting interaction. This meant CCOs inviting themselves to training and staff meetings. Briefings to senior leaders and recommending scenarios for upcoming warfighter exercises were common. It was imperative that CCOs establish relationships early to get the DIV to understand what CCOs bring to the logistical arena and that they would prove instrumental in the DIV's success during *Operation Iraqi Freedom*.

In early 2005, the brigades completed their transformation to the new modular BCTs. To validate their transformation process, the DIV conducted mission readiness exercises at the Joint Readiness Training Center (JRTC), Fort Polk, LA. With the JRTC on a condensed rotation schedule, the CCOs proved invaluable to the success of units training there by assisting the BCT S-4s in identifing life support requirements and finding solutions to logistical shortfalls created by the shortened timeline. After the JRTC rotation was completed, the DIV developed a better understanding and appreciation of the importance of involving CCOs early in the planning process, as well as a realistic understanding of the procurement process and timeline.

Deployment

Through U.S. Central Command order, all CCOs deployed with their units. Once in theater, the Joint Contracting Command-Iraq/Afghanistan exercised operational control



The excellent relationships between CCOs and their units were solidified in theater as units worked directly with the RCCs and CCOs who were supporting their AOR. CCOs (left to right) MAJ Roger Henderson, MAJ Craig Gardunia, MAJ Chip Gill, MAJ David Hosna, LTC Tom Lippert and MAJ Tom Bassett at the Al-Faw palace, Camp Victory, Baghdad, Iraq, in spring 2006. (U.S. Army photo.)

(OPCON) of the contracting function. Each CCO worked at one of 10 Regional Contracting Centers (RCCs). The excellent relationships between CCOs and their units were solidified in theater as units worked directly with the RCCs and CCOs who were supporting their area of responsibility (AOR). The units' S-4s now understand the acquisition process and where requirements begin. This understanding and communication allowed requirements to be clearly identified and fulfilled, often more quickly than units experienced at their home station. This relationship also made the warfighters realize how much of a combat multiplier the CCOs were for their operations.

Current Operational Contracting Support

After redeployment, the contracting support structure was further modified to support evolving Army transformation. This change ended the short-lived assignment with the DIV and maneuver brigades. The current concept calls for four Principal Assistants Responsible for Contracting and four contracting BNs stationed at various locations throughout the world, all subordinate commands of the U.S. Army Materiel Command and U.S. Army Sustainment Command. Assigned to these contracting BNs are 4-person contingency contracting teams that support units on a regional basis and can deploy on short notice. While in garrison, these teams are OPCON to the U.S. Army Contracting Agency and have the primary mission of supporting the units with which they are collocated and supporting the Directorate of Contracting on that installation.

The contingency contracting professional has seen tremendous change over the past 3 years, ever-evolving to support Army transformation objectives. No matter the structure, CCOs will continue to function as force multipliers, serving the warfighter both in garrison and downrange, enabling the commander to achieve the mission decisively.

No matter the structure, CCOs will continue to function as force multipliers, serving the warfighter both in garrison and downrange. Here, Iraqi contractors work on rebuilding the Baghdad infrastructure at Camp Liberty, Iraq, in 2006. (U.S. Army photo.)

LTC Greg Franks was the senior CCO in the 327th Infantry Regiment, 1st BCT, and served as the key trainer of his BCT and several of the new CCOs and NCOs. He can be contacted at ***gregory.franks@us.army.mil*** *or (703) 695-2181/(DSN) 225-2181.*

LTC Thomas Lippert was the G-4, 101st ABN CCO Team Chief.

TACOM LCMC Director Harry P. Hallock Promoted to Senior Executive Service (SES)

An enthusiastic, standing room only crowd filled the auditorium at the Detroit Arsenal, Warren, MI, to watch the SES promotion of Harry P. Hallock, Director TACOM Life Cycle Management Command (LCMC) Acquisition Center. MG William M. Lenaers, TACOM LCMC Commander, administered the SES oath of office and presented Hallock with the SES pin, flag and certificate. Lenaers said that while managers and supervisors must focus on "making sure we are doing things right," senior leaders such as Hallock must focus on "making sure we are doing the right things." He went on to describe Hallock's role as senior leader in the acquisition center as "the cement that holds the LCMC together." "Your business is all about Soldiers, your business is not about spending money, it is about taking care of Soldiers," Lenaers continued. "I can't think of anyone better to take over from Dan Mehney than Harry Hallock, a tremendous professional, a caring person respected throughout the LCMC, as evidenced by all the people here, and big enough to guard the money. Harry, I want to congratulate you, welcome you to senior leadership, and I know you'll do a great job."

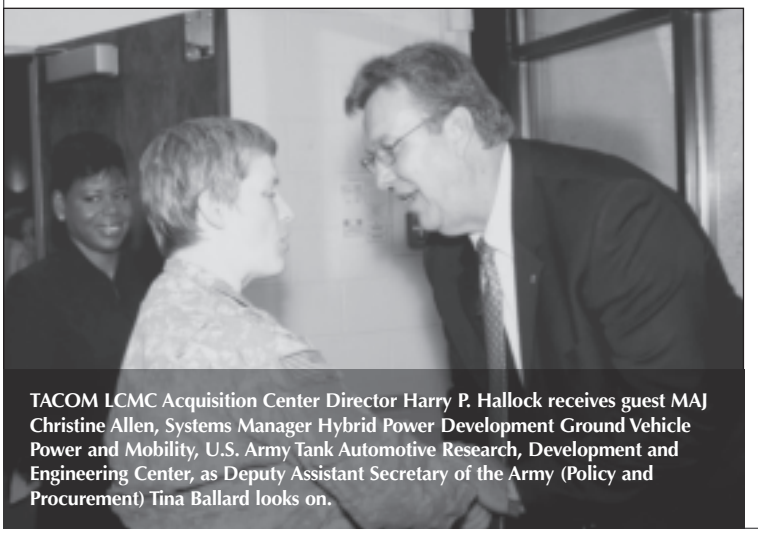
In his remarks, Mehney spoke about the history of SES, whose members are the key link between the president and their top-level political appointees and the career federal employees, and the prestige of being chosen as a senior executive. Mehney mentioned informational points about the SES:

- SES was established under the Carter Administration in 1979 and designed to reward competent, highly motivated, successful senior personnel and to offer them

TACOM LCMC Director Harry P. Hallock speaks to the audience at the Detroit Arsenal at his induction to the SES on July 9, 2007. (U.S. Army photos by Elizabeth Carnegie, TACOM LCMC Media Services.)

increased responsibility and the chance to improve the management of major government programs and initiatives.
- SES members are approved up the chain of command to the Secretary of the Army.
- SES members play a critical role in the democratic process, translating the mandate of the national electorate into the development and execution of government policies, programs and actions.

Hallock thanked the many people who have influenced and helped him along his path to SES. He recounted his own experience as a 22-year-old coming into the federal service and how he fell in love with contracting and working together as a team. Hallock emphasized the importance of teaming and pledged to continue this "culture" under his leadership at the acquisition center. He also gave his philosophy on leadership. "I believe that all members of the organization should be given the opportunity for success so that we may become a benchmark learning organization that provides its people the opportunity to learn and grow while collectively providing the best service possible to our customers." Hallock acknowledged Mehney's influence in heading the acquisition center down the right path preparing for changes to come in the future. "Here's to the best job in the world … supporting the best troops in the world … representing the best country in the world," he concluded.



TACOM LCMC Acquisition Center Director Harry P. Hallock receives guest MAJ Christine Allen, Systems Manager Hybrid Power Development Ground Vehicle Power and Mobility, U.S. Army Tank Automotive Research, Development and Engineering Center, as Deputy Assistant Secretary of the Army (Policy and Procurement) Tina Ballard looks on.

As an SES and TACOM LCMC Acquisition Center Director, Hallock manages and ensures warfighting readiness for the Soldier by purchasing ground combat tactical vehicles, supporting services and component parts, small arms, armaments, marine systems, munitions and Future Combat Systems. He oversees acquisition support and contracting for 70 percent of the Army's major systems, systems and equipment supporting other services, and foreign military sales customers. Hallock directs the TACOM contracting activities at six geographic sites: Anniston Army Depot, AL; Red River Army Depot, TX; TACOM Rock Island, IL; Sierra Army Depot, CA; Warren Arsenal, MI; and Watervliet Arsenal, NY. He is responsible for 677 acquisition associates and $20 billion in funding. Hallock also serves as the TACOM LCMC Principal Assistant Responsible for Contracting and is the recipient of the Department of the Army (DA) Commander's Award for Public Service (1997) and the DA Achievement Medal for Civilian Service (1991).

TACOM LCMC Commander MG William M. Lenaers administers the SES oath to Harry P. Hallock at the Detroit Arsenal on July 9, 2007.

For more information, contact Mary-Louise McCarroll at **marylouise.mccarroll@us.army.mil** or (586) 574-7628/ DSN 786-7628.

Editor's note: Portions of this article were taken from the TACOM LCMC Community Report.

Job Order Contracting (JOC) at Letterkenny Army Depot (LEAD)

James Coccagna

It takes little more than a quick glance at the current trend in television commercials for corporate America to realize that agility, flexibility and responsiveness are the most prominent words in the high-priced advertising campaigns for IBM®, UPS™ and many other giants in service industries. In that same vein, the focus on capabilities and meeting Soldiers' changing needs has prompted a similar emphasis on adaptability within the depots as they strive to ensure that their facilities and equipment provide the necessary means to accomplish new missions and to adjust as existing missions continue to evolve. After a prolonged hiatus from using JOC to accomplish much of its facilities' repair and improvement programs, LEAD is once again relying heavily on JOC to rapidly renovate, modify or maintain existing facilities to a condition that meets customer needs.

As funding and workload declined because of its Base Realignment and Closure 1995-mandated repositioning, the number and scope of repair and construction projects declined considerably and LEAD's once-vibrant JOC program was allowed to expire. The surge in both traditional and new missions that have accompanied *Operations Enduring* and *Iraqi Freedom* has produced a need to quickly modify existing buildings and interior utility systems. In most cases, the usual procurement lead times for traditional invitations for bids are prohibitive to rapidly accomplishing the required work. Therefore, JOC has been brought back to life.

Over the past several years, LEAD has been quite successful in using small and disadvantaged construction firms as a source of quality work and timely performance. Based on that history, one of those firms was selected as the prospective contractor.

After receiving Small Business Administration approval, a solicitation was issued subject to the restrictions associated with the 8(a) program: a 3-year maximum term with a maximum $3 million contract value. The response to that solicitation resulted in a contract award to Earth Savers Inc., a Pittsburgh, PA, area general contractor. Earth Savers has placed a project manager/superintendent and quality control manager at LEAD who work from an office trailer in the depot's industrial area.

The availability of the project manager onsite is a considerable benefit, as it facilitates the flow of documents, such as requests for proposals and contract submittals, and provides for quick response when scheduling site visits and resolving technical issues. The majority of Earth Saver's subcontractors are local to the Chambersburg, PA, area, which makes managing and coordinating subcontractors' activities much easier.

While the presence of a full-time staff undoubtedly slightly increases the contractor's overhead, the responsiveness is significantly better than it would be if dealing with a remote main office. Plans for a competitive JOC using the 8(a) program as a source of prospective contractors are already being made.

James Coccagna is the LEAD Construction Contract Contracting Officer's Representative, Directorate of Contracting, at Letterkenny. He can be reached at ***james.coccagna@us.army.mil*** *or (717) 267-5601/DSN 570-5601.*

Edward W. Walters III Appointed as the Army's Representative to the President's Committee

Martin Tillman

In July 2007, President George W. Bush appointed Deputy Assistant Secretary of the Army (DASA) (Strategy and Performance Planning) Edward W. Walters III as the Army's representative to the Committee for Purchase From People Who Are Blind or Severely Disabled. Walters is the Army's advocate and champion of the AbilityOne program (formerly Javits-Wagner-O'Day). This program provides the Army acquisition workforce with a unique opportunity to help reduce the 70 percent unemployment rate among Americans

with disabilities. Walters serves as a key member on the Business Development Subcommittee to aggressively review and formulate strategies to create and increase employment opportunities for people with severe disabilities.

On Oct. 23, 2007, the Pentagon will be holding an event to celebrate National Disability Employment Awareness (NDEA) Month. Walters encourages all Army military and civilian personnel in the National Capital Region to support the AbilityOne program by attending this event. NDEA Month recognizes the employment needs of Americans with disabilities and the workplace contributions made by them. As such, it is an ideal opportunity to recognize the individuals with disabilities who work under the AbilityOne program and the federal employees who support the program in the agencies where they work.

For more information about the products or distributors under the AbilityOne program, go to **www.abilityone.gov**.

*Martin Tillman works for the DASA (Policy and Procurement) and manages the Contracting Operations Review program. He can be contacted at **martin.tillman@hqda.army.mil**, (703) 696-5069/DSN 426-5069 or fax (703) 696-7581/DSN 426-7581.*

Anniston Army Depot (ANAD) Receives AMC Small Business Award

Kathy Harvey

ANAD Directorate of Contracting (DOC) has won the FY06 U.S. Army Materiel Command (AMC) Group Small Business Award. "This team demonstrated a sincere commitment to the small business program and has played an integral role in exceeding most of their assigned targets in spite of a 70 percent increase in their workload, without additional personnel," said GEN Benjamin S. Griffin, AMC Commanding General, in a memo announcing the awards. "The depot's awarding of over $100 million in service contracts through the use of the set-aside programs exemplifies their commitment to the success of America's small businesses."

One example of the team's work is their unique approach for a "turnkey" parts cleaning, painting and minor parts repair service that was a small business set-aside. This contract helped the depot meet its surge workload requirements and built flexibility for workload fluctuations. The team also conducts annual small business trade fairs in the surrounding communities and works closely with local universities and businesses to educate and open doors for companies to compete for government contracts.

Through their professionalism, total dedication to the Army's multifaceted missions and realizing the overall importance the small business community plays in mission accomplishment, 2006 was a phenomenal year for the Small Business Program, TACOM Life Cycle Management Command-Anniston, AMC and the U.S. Army.

*Kathy Harvey is ANAD's DOC. She can be reached at **kathy.harvey@us.army.mil** or (256) 235-6232/DSN 572-6232.*

ANAD DOC team members from left to right: Sara Young; Shirley Wooten; Ginger Homesley; Teresa Bonds; Theresa Woodard; Linda Wallace; Kaye Nunnelley; Rita Dingler; Shirley Towne; Linda Carlston; Heather Robinson; LTG David F. Melcher, Military Deputy for the Budget Office of the Assistant Secretary of the Army for Financial Management & Comptroller; GEN Benjamin S. Griffin; COL Alexander Raulerson; Ricky Little; Lacresha Brewster; Tyerronnica Leshore; Wanda Adams; Yvonne Land; Beth Howard; Valerie Jones; Dorothy Dutton; Cassandra Hughes; CPT Anthony Hughley; and Morey Gaddy. (ANAD photo by Mark Cleghorn.)

Team members not pictured are Kathy Harvey, Jacob Boneysteele, Jeremy Goldsmith, Jeffrey Hardin, Brenda Hudson, Christine Katterheinrich, Judy Marler, Janice Norton and Anthony Wofford.

JCC-I/A Contracting Team Wins SHINE Award

The Joint Contracting Command-Iraq/Afghanistan (JCC-I/A) Rusafa Law and Order Team was presented the Office of Federal Procurement Policy (OFPP) SHINE award by OFPP Director Paul Dennett at the SHINE awards luncheon during the Federal Acquisition and Conference Exposition in the Ronald Reagan Building, Washington, DC, on June 19, 2007.

The SHINE award is presented by the OFPP Chief Acquisition Council for innovation in contract management spotlighting acquisition excellence. Team members include MG Darryl A. Scott, U.S. Air Force (USAF); the late CDR Phillip A. Murphy-Sweet, U.S. Navy (USN), who was killed in action while working on this project; LTC Mario J. Troncoso, USAF; LTC Bradley T. Riddle, USAF; LTC Gregory S. Green, U.S. Army (USA); MAJ James M. Delong, USAF; MAJ Robert W. Hearon, USA; SSGT Gregory D. Lindsey, USAF; and Rodney D. Aytch, DOD support contractor. The Rusafa Law and Order project was featured in the July-Sep 2007 issue of *Army AL&T* Magazine (**http://asc.army. mil/docs/pubs/alt/2007/3_JulAugSept/dept/070_Dept_Contracting_Community_Highlights_200707.pdf**).

Accepting the SHINE Award from left to right: COL Casey Blake, USAF, Director, Defense Acquisition Regulations System, Defense Procurement and Acquisition Policy; RADM Kathleen Dussault, USN, Senior Procurement Executive; COL K.C. Jones, Military Deputy to the Deputy Assistant Secretary of the Army (Policy and Procurement); Shay Assad, Director, Defense Procurement and Acquisition Policy; and Paul Dennett, OFPP Director. (Photo courtesy of Strategic Resource Acquisition Corp.)

U.S. Army Sustainment Command (ASC) Selects LOGCAP IV Contractors

ASC, Rock Island, IL, has selected three companies to provide essential logistics support services to forces in the field. "Awarding it to three companies allows us to mitigate our risk by not having to rely on only one source, and at the same time, allows us further competition," said ASC Director Jim Loehrl. DynCorp International LLC, Fort Worth, TX; Fluor Intercontinental Inc., Greenville, SC; and Kellogg, Brown and Root (KBR) Services, Houston, TX; will serve as performance contractors under the Logistics Civil Augmentation Program (LOGCAP) IV contract. The firms were chosen based on their management, past performance, price and technical abilities.

Under LOGCAP, contractors from the private sector are used to provide a broad range of logistics and support services to U.S. and allied forces during combat, peacekeeping, humanitarian and training operations. The LOGCAP umbrella contract dates back to 1992, when a contract for support services was awarded by the U.S. Army Corps of Engineers.

DynCorp held the LOGCAP II contract from 1997 through 2001. In December 2001, the LOGCAP III contract was competitively awarded to KBR. Since that time, more than 50,000 contractor and subcontractor employees have delivered more than $20 billion in front-line logistics and support services to military units deployed to Iraq, Afghanistan and other locations.

LOGCAP IV

The transition from LOGCAP III to LOGCAP IV will be made in lieu of exercising government options to renew the present arrangement. Transition terms and the performance start date under LOGCAP IV will be announced later this year.

LOGCAP IV employs a new strategy developed by ASC, in consultation with its higher headquarters, the U.S. Army Materiel Command, and combatant commanders who represent LOGCAP's ultimate customers — Soldiers and other U.S. service members in the field. The new strategy calls for multiple contractors to deliver services under LOGCAP instead of using a single contractor for the entire contract. Under the strategy, planning support and performance functions have been split to more effectively manage the number and scope of LOGCAP actions required to fight the global war on terrorism.

LOGCAP IV services include field operations such as dining facilities (DINFACs). Here, 2LT Jeremy Reyes (left) chats over dinner with CPT Marc Motyleski and CPT Jason Lewis at Forward Operating Base Prosperity's DINFAC in Baghdad, Iraq, last January. (U.S. Army photo by CPL Robert Yde.)

The use of multiple LOGCAP contractors is designed to reduce risk to the government, which no longer needs to rely on a single company to execute the entire LOGCAP contract at a time of high demand for military logistical and support services. Under the new strategy, the three performance contractors may compete for individual LOGCAP task orders, creating a competitive environment meant to control costs and enhance quality.

Contract Awards

Solicitations for the planning support and performance contracts were issued in August 2006 and proposals were accepted in October 2006. A total of two proposals were received for the planning support contract, while six proposals were received for the performance contract. All proposals were evaluated based on a "best-value" approach, which examines a company's ability to deliver the best possible service to the government.

In February 2007, the LOGCAP IV planning support contract was awarded to Serco Inc., Vienna, VA, the North American affiliate of parent company, Serco Group PLC, based in the United Kingdom. The contract was awarded for 1 base year with 4 option years, with a maximum value of up to $45 million per year. Serco Inc. supports the LOGCAP contract by providing a broad range of logistics planning and program support functions.

Like the LOGCAP III contract, the LOGCAP IV performance contracts are being awarded as indefinite quantity, indefinite delivery contracts with 1 base year and 9 option years. Each of the three contracts has a maximum value of up to $5 billion per year, for a total annual maximum value of $15 billion and a lifetime maximum value of $150 billion.

The services that will be delivered under the LOGCAP IV include supply operations, such as the delivery of food, water, fuel, spare parts and other items; field operations, such as dining and laundry facilities, housing, sanitation, waste management, postal services and morale, welfare and recreation services; and other operations, including engineering and construction, support to communication networks, transportation and cargo services; and facilities maintenance and repair.

For more information about this contract award, LOGCAP or ASC, contact the ASC Public Affairs Office at (309) 782-5421/DSN 793-5421, fax (309) 782-5011/DSN 793-5011 or **rock-amsas-pa@conus.army.mil**.

Natick Contracting Division (NCD) New Recruitment Efforts Reap Dividends

Maria Dunton and Mark Marchioli

In an attempt to find new, innovative ways to recruit entry-level positions, the U.S. Army Research, Development and Engineering Command (RDECOM) NCD has begun to seek interested candidates at local colleges and universities through the use of the Federal Career Intern Program (FCIP) hiring authority. This was accomplished through postings on college career Web sites and live presentations to college students, who were seniors and business students. The endeavor was designed to encourage a broad base of individuals to consider a career in federal government contracting through the Army Civilian Training, Education and Development System (ACTEDS) and NCD's local intern programs.

On April 11, 2007, Maria Dunton, Procurement Analyst and Intern Team Leader, and Mark Marchioli, Contract Specialist and ACTEDS Intern, traveled to Framingham State College (FSC), Framingham, MA, to give a presentation to a marketing management class of graduating seniors. The successful presentation contained information on the benefits of working for the Army and on positions available

at NCD. Dunton covered the intensive training program employed at NCD, which includes rotational assignments lasting 3 to 6 months, monthly intern meetings and in-depth mentoring. She also clarified the application procedure for the students. Marchioli explained the benefits including health care, sick and annual leave, and the Thrift Savings Plan. He described the types of major programs procured through NCD, including the Modular Lightweight Load-carrying Equipment rucksack and the Army combat uniform. He also illustrated a typical day in a contracting office. Samples of NCD's procured items, including Meals, Ready-to-Eat; HOOAH bars; and the Army combat helmet, were displayed to put a real-life spin on what contracting entails.

In addition to the presentation at FSC, Dunton placed job postings on college Web sites. This effort netted the biggest pool of qualified and interested candidates to date. These postings were made available to soon-to-be graduates as well as alumni. Individuals were required to submit a résumé and transcript, which were then forwarded to the servicing Civilian Personnel Operations Center (CPOC) for qualification. From there, NCD worked with its CPOC and Civilian Personnel Advisory Center representatives to follow the FCIP hiring and merit principle practices.

The presentation and posting of flyers yielded excellent results. Many qualified FSC seniors applied for intern positions at NCD. One of our newest ACTEDS interns, Nathan Jordan, was one of those qualified candidates. Additionally, NCD recruited three additional well-qualified local interns as a result of the postings: Renee Couturier, Paul Hannah and Huy Le. All have been a welcome addition to the office and representative of the recruiting initiative's success.

One goal of the increased recruitment effort is to find the best possible applicants for the organization to assist in meeting customers' needs. Additionally, NCD hopes to make individuals more cognizant of the opportunities and benefits that exist with federal employment. The final and most important goal of the program is to fill the ever-widening gap forming from contracting professionals retiring from federal service. In the next 10 years, NCD faces a situation whereby over half, currently 65 percent, of its employees will be eligible for retirement. Work must be done now to ensure that sustainment of the mission continues uninterrupted and remains at a high level of performance. The FCIP is an excellent means to accomplish this goal.

NCD plans to incorporate and expand these presentations to fill future openings and looks forward to further successes in recruiting highly skilled and qualified contracting individuals.

Maria Dunton is a Procurement Analyst and the Intern Team Leader for the RDECOM NCD. She can be reached at (508) 233-4169/DSN 256-4169 or ***maria.dunton@us.army.mil****.*

Mark Marchioli is a second year ACTEDS intern working as an RDECOM NCD Contracting Specialist. He can be reached at (508) 233-4336/DSN 256-4336 or ***mark.marchioli@natick.army.mil****.*

DOD Limits Contracting Through GovWorks

Kimberly Carroll

On June 14, 2007, the Under Secretary of Defense for Acquisition, Technology and Logistics (USD(ATL)) and the USD Comptroller issued a joint memorandum directing that DOD agencies, including the Department of the Army, no longer use GovWorks, the Federal Acquisition Center of the Department of Interior's (DOI) National Business Center, for contracting actions greater than $100,000. As a result, the Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASAALT) and the ASA for Financial Management and Comptroller have issued a memorandum reiterating this prohibition and providing a sample "best-interest" determination that is to be used by agencies requesting a waiver to contracts through GovWorks. U.S. Army activities are directed not to enter into any interagency agreements for requirements in excess of $100,000 with GovWorks unless a best-interest determination has been rendered by USD(ATL). This restriction was put in place because of the DOD Inspector General's findings that GovWorks had not improved its funding and contracting practices. There are no exceptions, such as incremental funding or exercise of options, to the requirement to obtain USD(ATL) approval. The restriction does not apply to the DOI's Southwest Branch of the National Business Center because they have made appropriate improvements.

The sample best-interest determination can be found at **https: //webportal.saalt.army.mil/saal-zp/procurement/index.htm**. Requests for approvals should be sent via e-mail to USD(ATL) through the Director, Defense Procurement

and Acquisition Policy at **michael.canales@osd.mil** with a copy provided to **PSStaff@hqda.army.mil**.

It is mandatory that all U.S. Army agencies comply with this restriction and also with the Army policy regarding the proper use of non-DOD contracts, which can be found in the November-December 2005 issue of *Army AL&T* Magazine at **http://asc.army.mil/docs/pubs/alt/2005/6_NovDec/full/00_ALT_magazine_Full_Issue_200506.pdf**. The complete policy document can be found at **https://webportal.saalt.army. mil/saalzp/procurement/index.htm#non_dod**.

The ASAALT point of contact is Kathy Love at **kathy.love@hqda.army.mil** or (703) 604-7102/DSN 664-7102.

Kimberly Carroll is a Procurement Analyst working in the Office of the Deputy Assistant Secretary of the Army (Policy and Procurement).

Federal Acquisition Regulation (FAR) Revision on Government Property

Barbara Binney

The final rule for *FAR Case 2004-025*, which amends *FAR Part 45, Government Property*, and its associated clauses, was published May 15, 2007. The rule, effective June 14, 2007, simplified procedures, clarified language and eliminated obsolete requirements related to the management and disposition of government property in the contractor's possession. The final rule specifically impacts contracting officers, property administrators and contractors responsible for managing government property. *Part 45* was amended to implement a policy to improve the management of government property while fostering efficiency, flexibility, innovation and creativity by adopting property practices typically used in the commercial arena while continuing to protect the government's interest. Additionally, the rule simplified requirements on contractors by reducing the number of *FAR* clauses from 19 to 3 overarching clauses:

- Basic clause — *52.245-1, Government Property*, is used in all cost reimbursement; time and material; labor-hour-type solicitations and contracts; all fixed-price solicitations and contracts when the government will provide the property; and all contracts or modifications awarded under *FAR Part 12* procedures when government property exceeds the simplified acquisition threshold. There are two alternates: *Alternate 1* is used in contracts with adequate price competition, such as fixed price; and *Alternate 2* is used in contracts involving basic or applied research at nonprofit institutions of higher education or nonprofit organizations involved in scientific research.
- *52.245-2, Government Property (Installations Operation Services)*, clause is used in service contracts to be performed on a government installation when government-furnished property will be provided. This clause provides for the initial provisioning of property where the government is not responsible for repair or replacement.
- *52.245-9, Use and Charges*, clause is included in the contract when *52.245-1* applies.

Highlights of the changes are as follows:

- Eliminated more than 80 percent of current *FAR* (property) language, including 15 clauses.
- Eliminated obsolete, unnecessary language including records of special tooling and special test equipment.
- Restructured language as performance outcomes based on property life cycle, i.e., acquisition through disposal/contract closeout.
- One basic government property clause for all contractor requirements.
- *Part 45* is now strictly limited to requirements placed upon the government.
- Contractor managed self-assessment programs.
- No more property control system approvals.
- Does not apply to intellectual property or software or progress/advanced payments.
- Greater justification for furnishing government property.

The following 15 clauses were eliminated:

52.245-3 — Identification of Government-Furnished Property
52.245-4 — Government-Furnished Property (Short Form)
52.245-6 — Liability for Government Property (Demolition Services)
52.245-7 — Government Property (Consolidated Facilities)
52.245-8 — Liability for the Facilities
52.245-10 — Government Property (Facilities Acquisition)
52.245-11 — Government Property (Facilities Use)
52.245-12 — Contract Purpose (Nonprofit Educational Institutions)
52.245-13 — Accountable Facilities (Nonprofit Educational)
52.245-14 — Use of Government Facilities
52.245-15 — Transfer of Title to the Facilities
52.245-16 — Facilities Equipment Modernization

52.245-17 — Special Tooling
52.245-18 — Special Test Equipment
52.245-19 — Government Property Furnished (As Is)

To receive a 45-minute presentation on the *FAR Case 2004-025* final rule, contact Tom Ruckdaschel, Property and Equipment Policy Office, Office of the Under Secretary of Defense (Acquisition, Technology and Logistics), Acquisition Resources and Analysis, at **tom.ruckdaschel@osd.mil** or (703) 604-6350 ext. 138/DSN 664-6350 ext. 138.

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The Acquisition, Logistics and Technology Integration Office (ALT-IO) — The Catalyst for Integrating the Army's Warfighting Requirements

COL Harry W. McClellan Jr. and Gordon L. Campbell

The ALT-Futures Office (FO) was provisionally established in November 2005 to serve as the combat developer integrating acquisition, technology and logistics issues across the Army. ALT-FO's mission is to integrate doctrine across the Army AL&T community; Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASAALT); U.S. Army Materiel Command (AMC); and U.S. Army Training and Doctrine Command (TRADOC), and has a significant role in developing Joint AL&T doctrine as well. The ALT-FO is collocated with the U.S. Army Combined Arms Support Command (CASCOM) at Fort Lee, VA.

ALT-IO's mission is to develop and integrate doctrine, concepts, organizations and selected materiel solutions into and throughout applicable Army and Joint combat development actions. Here, Soldiers from the 6th Battalion (Bn), 9th Armored Reconnaissance Squadron, 3rd Brigade Combat Team, 1st Calvary Division, prepare for a mission at Forward Operating Base Normandy, Iraq, last April. (U.S. Air Force photo by SSGT Stacy L. Pearsall.)

ALT-FO's initial objective was to translate the concepts regarding the future presence of AL&T in support of deployed operations into Table of Organization and Equipment (TOE) or Table of Distribution and Allowances (TDA) doctrinally supported organizations as appropriate. The establishment of Army field support brigades (FSBs) and contracting support brigades (CSBs), along with the publication of *Field Manual Interim (FMI) 4-93.41, Army Field Support Brigade Tactics, Techniques and Procedures*, have made that "future" a reality.

The initial objective successfully accomplished, the ALT-FO will now concentrate on the development and integration of AL&T doctrine, concepts, organizations and selected materiel solutions into and throughout applicable Army and Joint combat development actions. Thus, the office shed its provisional status and officially stood up on Oct.1, 2007, as the ALT Integration Office (ALT-IO).

As the combat developer for AL&T — in concert with CASCOM, AMC and U.S. Army Acquisition Support Center (USAASC) — ALT-IO will oversee the development, coordination and integration of AL&T-specific doctrine, organization, training, materiel and leadership (DOTML) issues. AL&T Workforce personnel proponency will remain with USAASC, and AMC will continue to handle any AL&T facility needs. ALT-IO has primary responsibility for integrating AL&T capability into the Army's overall combat development requirements while AMC retains responsibilities concerning deliberate war planning, training and readiness. ALT-IO's location within CASCOM, along with the collocation of AMC's liaison office and Logistics Civil Augmentation Program planner positions, greatly facilitates our integration efforts. Given ongoing operations in Iraq and Afghanistan, ALT-IO is actively engaged in numerous doctrine, training and leader development initiatives. This article will profile several.

Doctrine

ALT-IO has contributed AL&T-specific content to updated versions of more than 15 Army field manuals (FMs) and 6 Joint Publications (JPs). Under development and soon to be released are program directives that create a specific FM for the CSB, convert the FSB *FMI* to an FM, create a *Commanders Guide to Contractors and Contracting Support* and

U.S. Army SGT Mijung Kim, Guam Army National Guard, 1st Bn, 249th Infantry Regiment, instructs U.S. Marine Corps SGT John Rheuby, 5th Provisional Security Co., how to properly site and fire an M24 rifle during a Joint training exercise last December in Arta, Djibouti, Africa. As weapon systems and ammunition cross traditional service boundaries, ALT-IO will become more heavily engaged in writing, coordinating and implementing Joint doctrine. (U.S. Navy photo by MCC Eric A. Clement, Naval Air Station Joint Reserve Base, Fort Worth, TX.)

create the U.S. Army Sustainment Command (ASC) *Organization & Operations FM*. Furthermore, ALT-IO is the lead developer for the new draft *JP 4-10, Contracting and Contractor Management in Joint Operations*, dated March 2, 2007, currently in staffing.

ALT-IO is also actively engaged in several working groups, both Army and Joint, related to Contractors Accompanying the Force (CAF) policy. Relative to its AL&T-specific materiel development mission, ALT-IO is a "Red Team" member in support of DOD-wide Synchronized Predeployment and Operational Tracker implementation issues.

Training

In coordination with AMC's ASC, the ALT-IO has drafted the CSB and FSB Core Capabilities Mission Essential Tasks that have been subsequently submitted to CASCOM in accordance with the new TRADOC Mission Essential Task List development policy. ALT-IO provided subject matter expertise to the Quartermaster Center and School for the development and then revision of a CAF training support plan (TSP) and is partnering with AMC and CASCOM's Training Directorate to create an updated CAF Interactive Media Instruction product based upon that TSP and the latest doctrinal and policy publications.

ALT-IO is also working with the Department of Logistics and Resource Operations to develop a 2-hour contracting and contractor management overview module that will be part of the base curriculum for Intermediate Level Education students. Specific to the CSB and its 51C career field members, ALT-IO is leading a team effort in developing combat arms training strategies to enable contingency contracting unit commanders to tailor mission training plans for specific support scenarios. Additionally, a Soldier manual/training guide is being developed for 51C noncommissioned officers and 51C officer foundation standards that will outline training guidance with critical tasks, conditions and standards. In the Joint arena, ALT-IO is an active participant in a working group now finalizing a new *Joint Contracting Handbook*.

Leader Development

ALT-IO is a constant presence in all the Logistics and Acquisition Pre-Command and Logistics Executive Development Courses relaying the latest information regarding Army and Joint contracting and contractor management information. ALT-IO also supports CASCOM in international staff talks providing AL&T-related briefings.

Organization

ALT-IO is a participant in the Total Army Analysis 10-15 working with AMC's G-5 and Command Contracting Directorate to develop action plans regarding TDA augmentation for the CSB and ASC Headquarters, as well as AL&T staffing for the combat training centers. ALT-IO is also coordinating a Joint Manning Document (JMD) TDA initiative with ASAALT and the HQDA G-3/5/7 Force Management Division to document contingency contracting positions assigned to the Joint Contracting Command-Iraq/Afghanistan (JCC-I/A) JMD on a carrier TDA. If enacted, it would enable replacement of the individual contingency contracting Soldiers on the contingency contracting Modified TOEs.

ALT-IO is seeking an exemption for contingency contracting units/personnel assigned to JCC-I/A from inclusion on the carrier TDA for Standard Requirements Code 90 due to the low density of assets available. ALT-IO is also advocating the push of units forward in accordance with Army operational doctrine and new contracting TOE structures and the filling of gaps with individual augmentees from the Reserve Components.

ALT-IO integrates AL&T capability into the Army's overall combat development requirements. Here, SPC Philipp Arthur, a small arms repairman assigned to 3rd Forward Support Bn, 1st Brigade, 3rd Infantry Division, assembles an AK-47 at Logistics Support Area Anaconda, Iraq. (U.S. Army photo by Joshua R. Ford.)

ALT-IO works closely with its AMC, TRADOC and CASCOM liaisons to determine the latest issues and Soldier field requirements confronting AL&T support for deployed operations. Here, SPC Michelle Higgins provides security aboard Army Logistics Support Vessel-06 Specialist Four James A. Loux near the Port of Djibouti in Africa. (U.S. Army photo by SSG Stephen Schester.)

As a new and growing organization, ALT-IO is presently just under 60 percent of its authorized strength. As the Army ALT DOTML developments office, ALT-IO relies on contacts from the field for the most up-to-date issues confronting AL&T support of deployed operations. Questions, comments and suggestions regarding AL&T DOTML issues can be sent to me or my key personnel using the contact information below.

- COL Harry W. McClellan Jr., Director, ALT-IO, (703) 806-9345 or **harry.mcclellan@us.army.mil**.
- Gordon L. Campbell, Deputy Director, (804) 734-0093 or **gordon.lee.campbell@us.army.mil**.
- Chuck Maurer, Chief, Doctrinal Developments, (804) 734-2726 or **charles.maurer@us.army.mil**.
- Andrew Eger, Chief, Force and Materiel Developments, (804) 734-0440 or **andrew.eger@us.army.mil**.
- LTC Mark Stone, Chief, Acquisition Policy Compliance and Training, (804) 734-1986 or **mark.wayne.stone@us.army.mil**.

COL Harry W. McClellan Jr. is the ALT-IO Director. He holds a B.S. in civil engineering, a Distinguished Military Graduate designation from the Virginia Military Institute, an M.S. in mechanical engineering from The Georgia Institute of Technology and an M.S. in national resource strategy from the Industrial College of the Armed Forces (ICAF). McClellan is certified Level III in program management and Level II in both test and evaluation and systems planning, research, development and engineering. He is an Army Acquisition Corps (AAC) member.

Gordon L. Campbell is the Deputy Director of ALT-IO. He holds a B.A. in political science and public administration from Augustana College, an M.A. in public administration from Texas A&M University and an M.S. in national resource strategy from the National Defense University's ICAF. Campbell is certified Level II in both contracting and program management and is an AAC member.

2007 Senior Leaders' Training Forum (SLTF) Strengthens Life Cycle Management Command (LCMC) Processes

Meg Williams

Army Acquisition Executive/Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASAALT) Claude M. Bolton Jr. and ASAALT Military Deputy (MILDEP) LTG N. Ross Thompson III briefed more than 80 general officers and Senior Executive Service acquisition workforce leaders at the annual SLTF held at the Army War College in Carlisle, PA, Aug. 27-30, 2007.

Bolton was very direct in his opening address. "When the shooting stops, we can anticipate having fewer resources. How do we maintain the #1 Army? How can we make LCMCs more responsive to warfighters and our country? Take this opportunity to look at Enterprise Value Stream Mapping and Analysis [EVSMA] to let us know where you need our help."

Improving processes was the training forum's theme and participants collaborated in teams working on life-cycle management issues. An EVSMA session set the stage for identifying key processes for improvement throughout the community. Additionally, the MILDEP convened a series of results-oriented

Deputy Under Secretary of the Army for Business Transformation Michael A. Kirby spoke about the need to make the institutional Army more efficient. (Photo by Scott Finger, U.S. Army War College.)

workshops to develop "way forward" action plans for these critical issues:

- Rapid Acquisition Fielding, Support and Sustainment of Full-Spectrum Operations.
- Requirements Generation and Transfer Process.
- Core Acquisition Process.
- Acquisition Systems Resourcing Process.
- Industrial Base Agility.

Workshop findings were presented to the entire group on the final day. Enlightening speakers addressed forum attendees as well. Sue Payton, Air Force Acquisition Executive (AFAE), was the keynote speaker. She provided forum leaders a candid look at what she has done since becoming the AFAE. "We have acquisition under attack," Payton remarked. "You can read in the media of our failings. To counter this, the Army, Navy and Air Force Acquisition Executives are working together, showing one face to industry and leveraging off each other.

"The Service Acquisition Executives [SAEs] have effectively implemented change by forming the BEP [Bolton-Etter-Payton] Caucus. Industry partners were shocked to see how closely we were working on the Joint Strike Fighter program," Payton explained. "The Air Force has to rebuild trust and it must be transparent to Congress. We believe in good governance; we need to include people with different opinions in our decision-making processes. Acquisition must be collaborative and cooperative."

AFAE Sue C. Payton keynoted the 2007 SLTF. (U.S. Air Force file photo.)

Levator Norsworthy Jr., Deputy General Counsel, Acquisition, briefed leaders on the *Report of the Acquisition Advisory Panel*. (Photo by Charity Murtorff, U.S. Army War College.)

Payton firmly believes that acquisition leaders need to start saying "no." "We can't buy billion-dollar items with $1.50," she said. "We need to divest ourselves of some old systems that are expensive to maintain and start making capital investments."

Another key presenter was Levator Norsworthy Jr., Deputy General Counsel, Acquisition. He briefed forum leaders on the recent *Report of the Acquisition Advisory Panel* and its recommendations. Some of the recommendations included an increase in performance-based contracting, extending the fair opportunity process to task orders and services, and adopting more commercial processes.

Dr. Karen Stephenson, President, NetForm International, discussed how social capital influences the way organizations operate. NetForm staff performed an analysis for the U.S. Army Tank-automotive and Armaments Command (TACOM) and they are now working with the Joint Munitions Command. "If you want to change culture, you must influence 5 percent of an organization's population: the hubs, gatekeepers and pulsetakers of your organization," Stephenson suggested.

Dr. Karen Stephenson, President of NetForm International, told senior acquisition leaders they could enhance their decision-making abilities by identifying human social networks within their organizations. (Photo by Charity Murtorff, U.S. Army War College.)

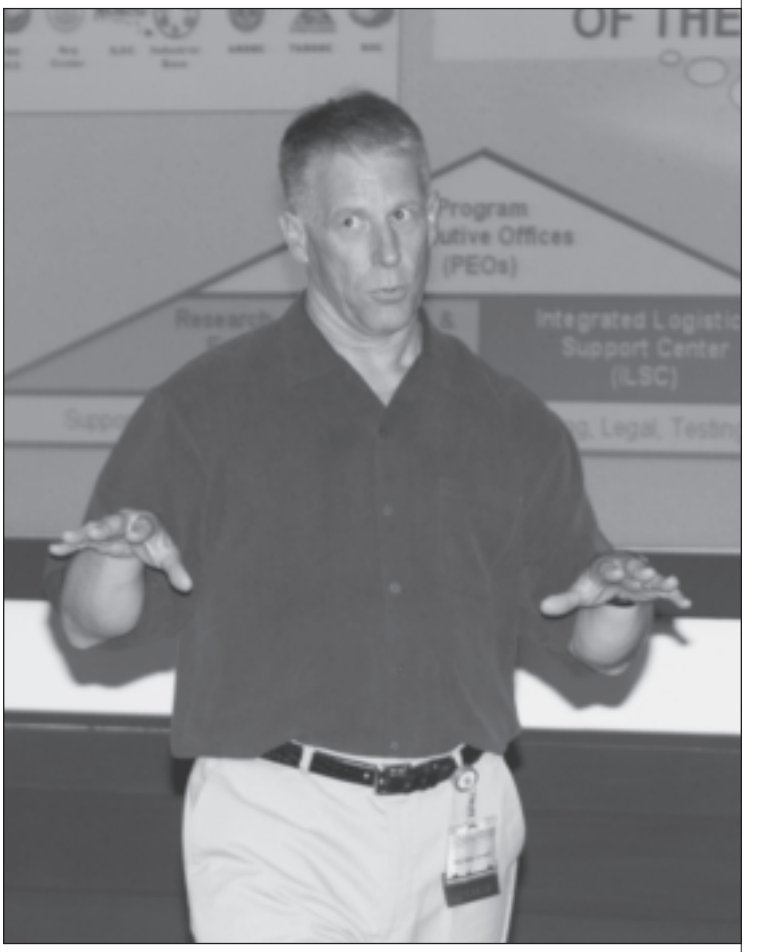
MG William M. Lenaers, TACOM LCMC Commanding General, described NetForm's analysis of TACOM's human networks as an epiphany for him. "Dr. Stephenson showed me a way to interconnect silos and do it smart," Lenaers stated. "I have zero command authority over anybody, no funding control. I can't even give bonuses to people who are doing the right thing because they are in different pay systems. And they're different even under the National Security Personnel System. We need to change our processes so they're not personality driven but process driven."

Following the NetForm analysis, TACOM began actively working on its funding processes, bringing in people identified during the analysis as hubs, gatekeepers and pulsetakers — the organization's key influencers. As a result, the analysis has helped TACOM change its processes by bringing together the right people to effect change.

Participants also heard from Deputy Under Secretary of the Army for Business Transformation Michael A. Kirby who emphasized that acquisition leaders must make the business side of the Army as efficient as the warfighter side. "Army business transformation is really a 3-7 year project consisting of continuous process improvement, organizational analysis and design, and situational analysis," Kirby remarked. "Chief of Staff of the Army GEN George W. Casey Jr. is focusing on the institutional Army. He wants to bring business structure and the institutional side of Army in line with the velocity and process innovation he sees on the warfighter side. He sees this as his legacy."

During the MILDEP presentation, Thompson emphasized that changing processes must take place in an era of persistent conflict. He told forum attendees that he is going to enforce training and education requirements for the acquisition workforce. He expects them, as well as all workforce supervisors, to uphold training and certification requirements for all Acquisition, Logistics and Technology (AL&T) Workforce members.

"I need your help sitting down with people and doing individual development plans and putting the demand on the system for training courses at the Defense Acquisition University," Thompson implored. "I need that to happen. I need your help in getting people the certification they need to do their jobs. I'm going to be very hard-nosed. You may put personnel in a job that they don't have the certification for when they go into it. After 2 years, if the certification is not completed, I'll pull them out. I don't care which PM



MG William M. Lenaers, TACOM LCMC Commanding General, enumerated the practical applications his LCMC applied after it learned the results of Dr. Stephenson's analysis of TACOM. (Photo by Charity Murtorff, U.S. Army War College.)

MILDEP LTG N. Ross Thompson III explains that process changes must take place in an era of persistent conflict. (Photo by Scott Finger, U.S. Army War College.)

[Program Management] shop it is, if the certification's not done, I'll pull them out. I'm serious when I say that. So you need to get that message out to everybody. In my view, we've got very good training and experiential programs to get people the skills they need for the jobs we're asking them to do.

"As the Director of Acquisition Career Management, I'm responsible not just for the military Army Acquisition Corps [AAC] officers, but for the 43,000 people that comprise the AL&T Workforce," Thompson continued. "I take that responsibility very seriously.

"LTC Bob Marion heads our Acquisition Management Branch at the Human Resources Command. He manages a big piece of the uniformed AAC, including working with the U.S. Army Reserve [USAR] and National Guard. Currently, we have 600 contingency contracting spaces and about 240 are in the Active Duty Army and the rest are in Guard and Reserve.

"BG George Harris just took over as the MILDEP Reserve Component Advisor," Thompson remarked. "He started his new job on Sept. 1. He'll join us full time because there's enough work to accomplish with force structure issues to get the Reserve, Guard and Army Reserve Sustainment Command functioning. We are going to work to properly size the contingency contracting structure. We have four brigades, one active battalion, one USAR battalion and one National Guard battalion. We need 175 more spaces to perform contingency contracting missions across the Army, both at the officer and noncommissioned officer [NCO] levels. We have 242 51C NCO spaces right now and 65 have been recruited into that workforce. We're actively recruiting quality NCOs right now. We are sending our contingency contracting NCO recruits to the U.S. Air Force basic course at Lackland Air Force Base, FL. I don't want to duplicate a course that's already very good. As we examine military force structure, I believe the AAC needs to grow by about 100 51C NCOs.

"We have seven field support brigades [FSBs] and that's the right number. We have only four contracting support brigades [CSBs]. The FSB and CSB mirror one another. The direction we're going is to have one CSB in support of every armed services component command. Part of the work we're doing with the task force on contracting is to move the overseas contracting piece, currently under the Army Contracting Agency [ACA], move that to the U.S. Army Sustainment Command under the U.S. Army Materiel Command [AMC]. That's the direction I'm going — focus the ACA on the CONUS mission, supporting installation management commands as their primary customer. We're doing that because it's not just contracting, it's the whole package of capability that you get, and I think AMC as a command is much better to do that for the Army.

> Improving processes was the training forum's theme and participants collaborated in teams working on life-cycle management issues. An EVSMA session set the stage for identifying key processes for improvement throughout the community.

The 3.5-day event also included a tour of and reception at the U.S. Army Heritage & Education Center, Carlisle, PA, where attendees learned about the history of the Army from displays on American military artifacts documenting the development of arms, uniforms and equipment from everyday mess gear to experimental and prototype equipment inside the center as well as by touring the outdoor displays.

Meg Williams provides contract support to the U.S. Army Acquisition Support Center through BRTRC Technology Marketing Group. She has a B.A. in English from the University of Michigan and an M.S. in marketing from Johns Hopkins University.

EDITOR'S CALL FOR ARTICLES AND PHOTOGRAPHS

Army AL&T Magazine continually looks for timely and relevant articles on acquisition, logistics and technology processes, techniques, management philosophy and professional development. Having a feature article, news brief, success story, career development announcement or book review published in our award-winning magazine is an excellent way to promote your organization and add to your résumé's list of personal and professional accomplishments.

Accompanying Photography

Written submissions to *Army AL&T* Magazine must be accompanied by high-resolution photo images or illustrations with complete captions that identify the who, what, when and where of each photo image or graphic. We are especially looking for action photographs that depict Soldiers, civilians and contractors performing their acquisition-related duties. Imbedded graphics and PowerPoint® charts are great for briefings but don't reproduce well in printed media.

If you are shooting digital pictures, please ensure that you use a high-resolution setting (300 dpi at 4" x 6" or 3" x 5"). Published photographs will be credited to the photographer and his or her command, so please also provide that information as well.

Upcoming Themes

To help you develop your articles, we are providing the below schedule of upcoming themes assigned by the *Army AL&T* Magazine Editorial Advisory Board:

- *January-March 2008* (Submission deadline for articles is 1 October.) This issue will focus on BG William N. Phillips organization's responsibilities at Picatinny Arsenal, the Joint Munitions and Lethality Life Cycle Management Command (LCMC) and Program Executive Office Ammunition. The suggested lead article will be an interview, with additional articles focusing on how the application of sound business practices has advanced the LCMC's mission and how all subordinate commands are working together to ensure that: the right equipment/munitions (Excalibur, etc.) gets to the Soldier faster, systems are readily available when needed, readiness is improved, new technology is being inserted as it matures and that infrastructure and processes are in place to provide for total life-cycle management support to the warfighter.
- *April-June 2008* (Submission deadline for articles is 1 February.) This issue is scheduled to focus on Future Combat Systems and provide an update on the National Security Personnel System implementation.
- *July-September 2008* (Submission deadline for articles is 1 May.) This issue will focus on Rapid Acquisition Support and Sustainment of Full-Spectrum Operations, Rapid Equipping/Support and the U.S. Army Materiel Command's Rapid Support Network. This issue will also discuss how the LCMC concept is working and what the LCMCs are delivering to warfighters.

Additional Information

Please send all article and photographic submissions for *Army AL&T* Magazine to Cynthia Hermes, Executive Editor, at **cynthia.hermes@us.army.mil**. If you have questions, she can be reached at (703) 805-1034/DSN 655-1034.

Writer Guidelines for the magazine can be found at: **http://asc.army.mil/docs/pubs/alt/ALT_Writer_Guidelines_Sep06.pdf**.

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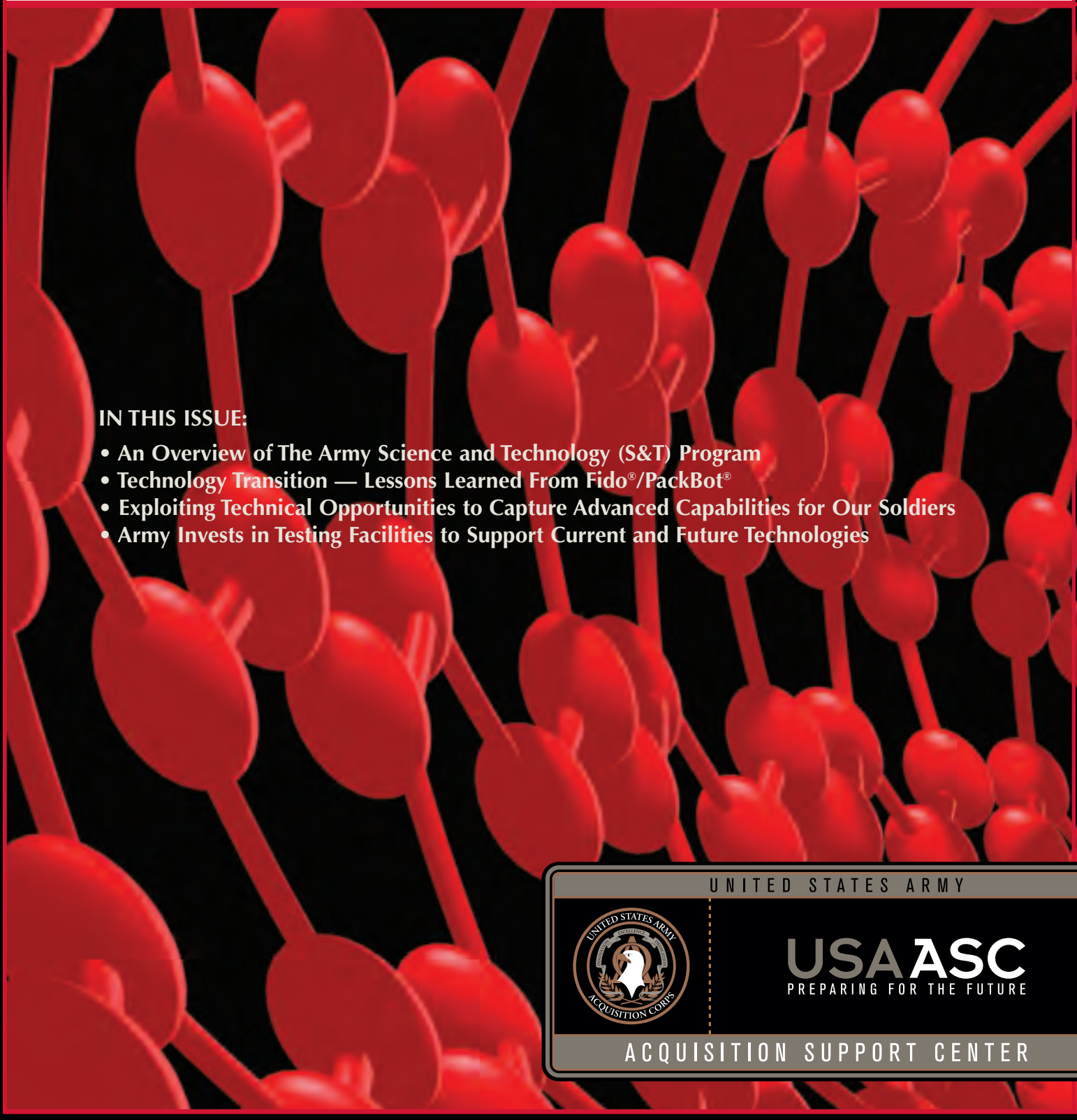

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- **Technology Transition — Lessons Learned From Fido®/PackBot®**
- **Exploiting Technical Opportunities to Capture Advanced Capabilities for Our Soldiers**
- **Army Invests in Testing Facilities to Support Current and Future Technologies**

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