ARMY AL&T

November - December 2005

ASC
ACQUISITION SUPPORT CENTER

From the Army Acquisition Executive

FCS Supportability

With this issue, we continue our focus on the Army's Future Combat Systems (FCS). The program is on the contracted schedule, on cost and executing to plan. This success is a source of great pride to us and is the result of a lot of planning and hard work by an integrated industry team that operates in full partnership with the U.S. Army — "One Team" from day one.

FCS is the core building block of the Army's Future Force, a full-spectrum force that is not only more lethal, but also faster to deploy and easier to sustain. The FCS One Team is so committed to reducing the logistics footprint that two of seven key performance parameters (KPPs) are logistics related: KPP 4 Transportability/Deployability and KPP 5 Sustainability/Reliability. This puts these KPPs at the same level as traditional requirements such as lethality, survivability and mobility.

The *Transportability/Deployability KPP* will ensure the global reach of a combat-ready Brigade Combat Team (BCT) by air, ground or sea assets within days — not weeks or months. Innovative survivability techniques, along with other technologies complemented by the network, allow significant weight and size reductions without compromising lethality, mobility or crew protection.

The *Sustainability/Reliability KPP* will meet unprecedented supportability goals by maximizing available combat power through high platform reliability, while significantly reducing the demand for maintenance and supply. The enablers to accomplish these aggressive goals are superior reliability, availability and maintainability, which are further supported by commonality, embedded diagnostics and prognostics, rapid component replacement and minimal tools — all tied together by an integrated network database and an unprecedented level of embedded training that ensures operator/maintainer skill sets as well as en route training and mission rehearsal capabilities.

What will this mean to the Future Force? Picture what it takes to support the force. For example, you must have fuel. You must have trucks to drive the fuel to where it is needed. You must have drivers for those trucks. You must have mechanics for those trucks. You must have cooks for those drivers, you must have medics for those drivers and you must have housing for everyone. Now, what happens if you significantly reduce the fuel requirement? It will have a multiplicative impact in several areas because less fuel means fewer fuel trucks; fewer fuel trucks mean fewer drivers and mechanics; fewer drivers and mechanics mean fewer cooks and medics; fewer cooks and medics mean fewer supply trucks. Fuel efficiency is just one FCS requirement.

The complete FCS System-of-Systems specification contains more than 10,000 technical requirements, of which more than 30 percent are related directly to sustainability. This unprecedented focus on sustainment requirements early in a program will positively influence design during the current System Development and Demonstration phase when the most significant effects on life-cycle cost are achieved. The requirements identified in the tiered series of specifications will ensure that each individual system within the FCS Family-of-Systems has all the required functionality to perform its mission as well as sustain itself in a deployed FCS BCT for a 72-hour combat operation without external resupply/maintenance.

Specific requirements that are revolutionary in comparison to Current Force supportability include a threshold requirement for 95-percent platform operational availability; a requirement for 80 percent of field maintenance tasks to be accomplished by the crew chief in 30 minutes or less using 10 common tools; and total asset visibility of supplies, sustainment resources and needs. These and many other enablers will serve to significantly reduce the logistics footprint and dramatically lower total operating costs.

The FCS program is changing the way we do business, particularly in our approach to sustainment. We must ensure that this "new" approach is promulgated as the way to do business in the Army — not only with FCS, but also with all our future programs. We have a dedicated team, and it is clearly a winning team.

Claude M. Bolton Jr.
Army Acquisition Executive

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Acquisition, Logistics & Technology

ASC to Display at the 2006 AUSA Winter Symposium & Exposition

The U.S. Army Acquisition Support Center (ASC) will exhibit at this year's Association of the United States Army (AUSA) Winter Symposium and Exposition in Fort Lauderdale, FL, Feb. 15-17, 2006.

Visitors to ASC's booth will have an opportunity to learn about Army acquisition through an interactive kiosk display that features Army acquisition good news stories, interesting acquisition facts, a thought-provoking quiz and high-energy video. Acquisition professionals visiting the booth will also be able to discuss their educational and professional career goals with acquisition career management professionals.

Be sure to stop by ASC's booth at the upcoming show! For additional information about AUSA Winter 2006, visit **http://www.ausa.org**.

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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

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0533201

Army Lexicon Changes

Recently, GEN Richard A. Cody, Vice Chief of Staff of the Army (VCSA), announced a series of significant changes in the official terminology used to describe U.S. Army units at various levels of command and organization. This announcement was made, however, well after most of the material for the issue of *Army AL&T* Magazine you are currently reading had already been submitted and edited for publication. We decided, therefore, that the needs of our readers and authors alike would be best served by leaving these articles as they were and implementing the Army lexicon changes in subsequent issues of *Army AL&T* Magazine.

Following are some of the most significant examples of the lexicon changes directed by the VCSA:

- Units of Action (UAs) will now be described as Heavy, Infantry, Stryker or Future Combat Systems (FCS) Brigade Combat Teams (BCTs), as appropriate. Additionally, the 3rd Armored Cavalry Regiment (ACR) will remain an ACR while the 11th ACR will become a Heavy BCT.
- Units of Employment (UE) will now be described as Corps, Divisions and Armies as follows: UEx with two-star headquarters will become Divisions, UEx with three-star headquarters will become Corps and UEy will become Armies.
- Multifunctional Aviation Brigades (MFABs) will now be referred to as Combat Aviation Brigades (CABs).
- Of particular impact to the acquisition community, FCS, which became UA, will be renamed Program Manager Future Combat Systems (BCT) or PM FCS (BCT) upon signing of a new charter.
- For several Army organizations in Europe, the following name changes have been implemented: Base Support Battalions (BSBs), Area Support Groups (ASGs) and Area Support Teams (ASTs) will now be known as U.S. Army Garrisons (USAGs).

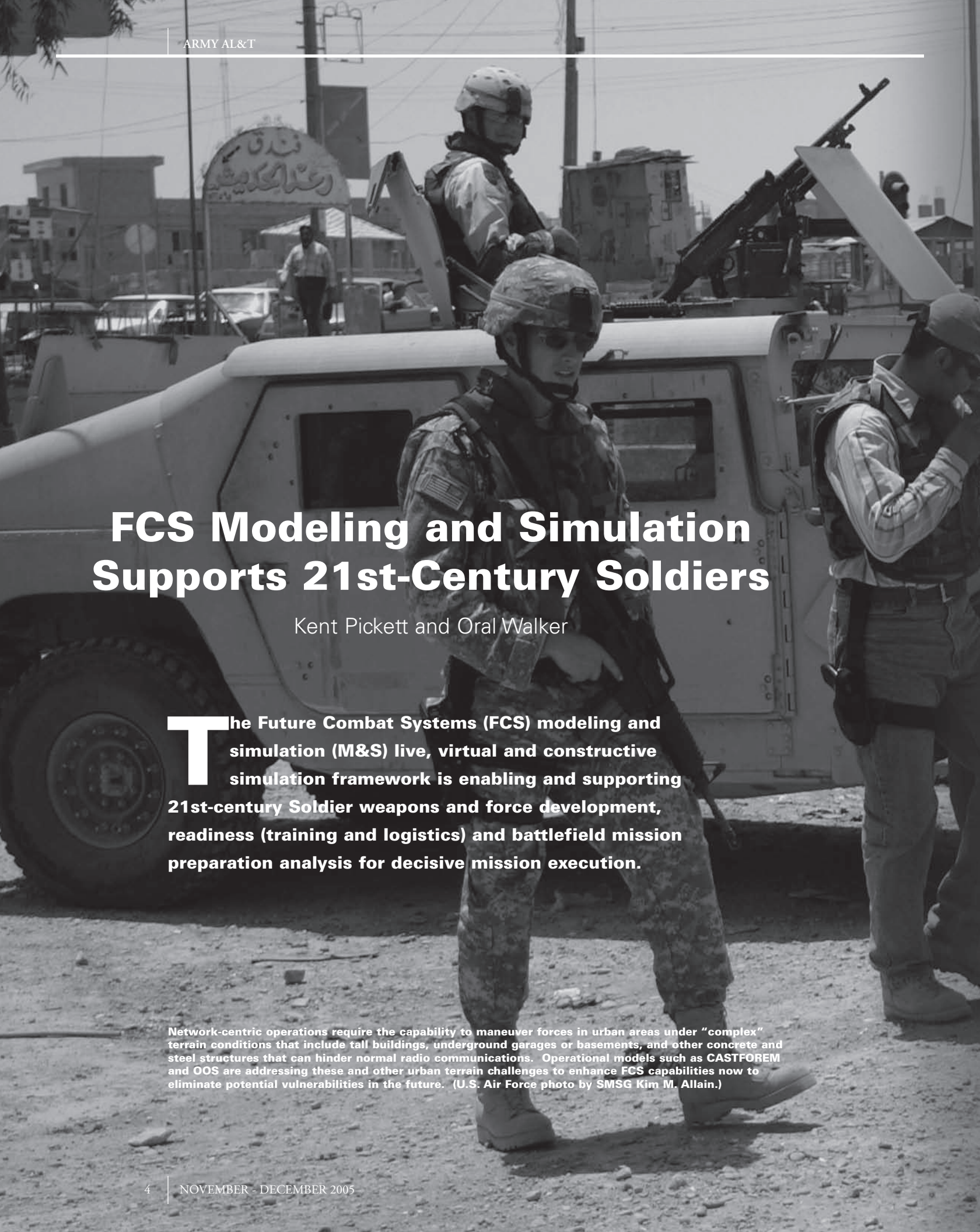
All of these lexicon changes, and others as terminology is updated, will be reflected in future issues of *Army AL&T* Magazine and on the U.S. Army Acquisition Support Center Web site at **http://asc.army.mil**.

Editor-in-Chief

FCS Modeling and Simulation Supports 21st-Century Soldiers

Kent Pickett and Oral Walker

The Future Combat Systems (FCS) modeling and simulation (M&S) live, virtual and constructive simulation framework is enabling and supporting 21st-century Soldier weapons and force development, readiness (training and logistics) and battlefield mission preparation analysis for decisive mission execution.



Network-centric operations require the capability to maneuver forces in urban areas under "complex" terrain conditions that include tall buildings, underground garages or basements, and other concrete and steel structures that can hinder normal radio communications. Operational models such as CASTFOREM and OOS are addressing these and other urban terrain challenges to enhance FCS capabilities now to eliminate potential vulnerabilities in the future. (U.S. Air Force photo by SMSG Kim M. Allain.)

FCS is the Army's flagship Simulation and Modeling for Acquisition, Requirements and Training (SMART) program. The SMART concept brings all stakeholder communities together using an Advanced Collaborative Environment (ACE) to support an integrated M&S capability. The M&S strategy's core — achieved by the FCS Lead System Integrator (LSI), One Team Partners and Program Manager Unit of Action (PM UA) — is a collaborative effort aimed at developing and maintaining a consistent and credible FCS-equipped UA System-of-Systems (SoS) simulation representation. The FCS Simulation Framework (S2F) will meet the program's life-cycle requirements while enabling the execution of concurrent systems engineering development; producing and/or acquiring software and hardware products; executing a broad range of test, experimentation, analysis, training and operational applications; and providing support to the FCS capability spin-out concept.

The FCS M&S strategy emphasizes product line and tool kit commonality, repeatable processes and reuse throughout FCS internal development and the Army. Critical to M&S acquisition support is the concept of standards and an SoS simulation architecture that guides the acquisition of M&S assets that will be documented in the FCS product line repository.

Supporting the UA Operational Context

The FCS S2F must replicate at effective levels of fidelity and resolution everything that is represented in the operational space — including embedded M&S — as communicated in the FCS Operational Requirements Document. Also, it must virtualize, synthesize and functionally enable all items in the natural operational environment encountered by the FCS, including terrain; weather; gravity; and chemical, biological and nuclear components. The S2F must also consider the FCS embedded tactical software, including battle command, mission rehearsal, course-of-action analysis and training. Creating the S2F involves selecting, modifying and developing M&S tools — using a program-approved, structured make/buy process — from the M&S community at large. One of our challenges in this area is to transition the Army M&S components that were created for Cold War contexts to the network-centric warfare contexts for the Future Force.

Network-Centric Warfare Simulations

Over the past 5 years, the Army M&S communities have made significant changes in their warfare representation. The operational simulations used by today's Army have their historical roots in the emergence of force-on-force simulations in the 1950s. However, prior to 2000, many Army models represented warfare as the classic Cold War engagement duel between combat vehicles and opposing forces. Vehicles moved into line of sight (LOS) of each other, spent time in the detection process and then fired and assessed system damage. But today, and for the immediate future, network-centric warfare will ensure that FCS vehicles have extensive knowledge of the enemy at beyond-LOS (BLOS) ranges and possess the capability for instant network fire access to many friendly engagement resources from BLOS.

In 2000, it became apparent that the new concept of network-centric warfare would require significant changes in operational simulations. That change will include a focused partnership to support FCS requirements between the Army analysis, training and testing communities; Program Executive Office for Simulation, Training and Instrumentation (PEO STRI); U.S. Army Research, Development and Engineering Command — principally the Communications-Electronics Research Development and Engineering Center (CERDEC); and the Army Materiel Systems Analysis Activity (AMSAA) — and PM UA M&S Management Office (MSMO).

BG(P) Charles Cartwright (left), PM UA, and Dennis Muilenburg, Boeing Vice President and FCS PM, receive ribbon-cutting assistance from PackBot — the robotic prototype for the Small Unmanned Ground Vehicle being developed for FCS — to mark the FCS SoSIL's official opening at the Boeing facility in Huntington Beach, CA. Seated from left are Dan Zanini, FCS Deputy PM, Science Applications International Corp.; LTG Joseph L. Yakovac Jr., Military Deputy to the Assistant Secretary of the Army for Acquisition, Logistics and Technology; and Jim Albaugh, President and Chief Executive Officer, Boeing Integrated Defense Systems. (U.S. Army photo courtesy of PM UA.)

Future M&S must assess the operational effectiveness of how tactical information is transported to combatant commanders and account for the operational effects that information has on the decision-making process. Here, Soldiers from 1st Battalion, 15th Infantry Division, provide perimeter security during search-and-seizure operations near Samarra, Iraq, May 29, 2005. (U.S. Air Force photo by SMSG Kim M. Allain.)

Many changes to operational models throughout the Army have occurred, including the Combined Arms and Task Force Evaluation Model (CASTFOREM) and the OneSAF Objective System (OOS).

CASTFOREM is the Army's principal analytic combat model representing platform- and personnel-level entities at brigade and in a battlespace that considers the geometries of complex terrain and the atmospherics of multispectral regions. It is the principal model for FCS operational analysis and is used in almost all trade studies affecting the UA force structure. It plays all aspects of a battle and is routinely called upon to answer questions about numbers, types and placement of equipment in the UA.

The OOS, and its predecessor the OneSAF Test Bed (OTB), have been used extensively to provide an FCS battlespace that drives human-in-the-loop testing of the "fighting network-centric" concept. During the exacting FCS development process, OTB has been upgraded to simulate many of the FCS' subsystems. These certified representations of FCS vehicles will be moved to OOS as this large-scale constructive simulation system replaces OTB.

CASTFOREM

The architecture for the Army's CASTFOREM analytical combat model is stochastic. It often requires 20 to 30 UA force-on-force battle runs to generate a representative view of the distribution of battle parameters. Prior to 2002, the principal development in CASTFOREM was in the play of individual weapons, sensors, command and control of individual units, and the necessary upgrades to the natural battlespace affecting weapons and sensors. Today, CASTFOREM's FCS network represents:

- The number of Joint Tactical Radio System (JTRS) radios, their location, type and waveforms available.
- FCS network performance and its ability to dynamically reconfigure by determining subnets and gateways into adjacent regions.
- The impact of foliage, distance and terrain on the network and its ability to maintain connectivity.
- The quality of service that enables high-priority traffic to receive preference.
- Unicast versus multicast message transport environment reliability.
- The ability to dynamically reconfigure the ad hoc network with new members and gateways in a region.

While these are principally FCS network physical characteristics, CASTFOREM simulates these characteristics in a battle environment providing valuable insights into FCS network-centric operational effectiveness. The model has been used to:

- Examine the transport of tactical information and account for the operational effects of information not being processed in a scenario context, as well as assess how messages influence decisions.
- Assess how netted fires can be used most effectively.
- Assess the importance of sensors of all types, including unattended ground sensors (UGSs) and unmanned aerial vehicles (UAVs), in supporting maneuver operations.
- Investigate the threat force's ability to interrupt the network and the resulting impact on operations.

Through the efforts of the U.S. Army Training and Doctrine Command Analysis Center (TRAC), CERDEC, AMSAA and PM UA, CASTFOREM has become an important tool in assessing the

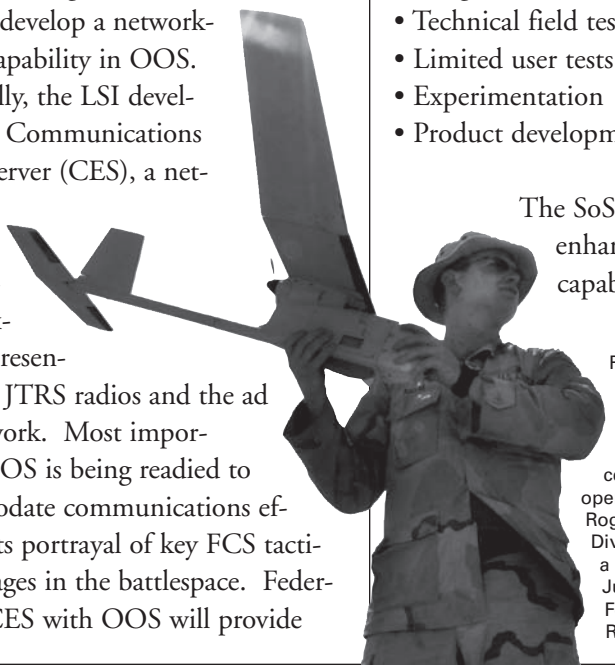
FCS network's impact and design. PM UA is currently supporting improvements to CASTFOREM, focusing on developing an urban network operations capability using JTRS radio signals to propagate in urban areas and the complex terrain that buildings present. This capability will further move CASTFOREM toward representing the full spectrum of FCS operational capabilities.

OOS

Programmatically, OOS has been developed based on the Army's need for a single simulation to drive all platform-training simulators and is a real-time, distributed, platform-based simulation that can run in either a stochastic or deterministic mode. OOS has been selected to provide embedded training on all FCS vehicles as well as to provide the battlespace in the developmental environment of the System-of-Systems Integration Laboratory (SoSIL).

> SoSIL is the collection of laboratories and test facilities housing the hardware and software required to develop, analyze, integrate and test various FCS program systems.

In FYs 05 and 06, PM UA, PEO STRI and the LSI began a focused effort to develop a network-centric capability in OOS. Specifically, the LSI developed the Communications Effects Server (CES), a network simulation providing explicit representation of JTRS radios and the ad hoc network. Most importantly, OOS is being readied to accommodate communications effects in its portrayal of key FCS tactical messages in the battlespace. Federating a CES with OOS will provide the FCS program with a fully network-centric UA battlespace representation.



PM UA is assessing the importance of sensors of all types, including UGSs and UAVs, in supporting FCS network-centric maneuver operations. Here, CPL Jerry Rogers, 1st Amored Division, prepares to launch a Raven near Taji, Iraq, July 19, 2005. (U.S. Air Force photo by TSGT Russell Cooley IV.)

M&S Acquisition Support Aspects

Operational M&S used in acquisition must be credible and consistent with operational contexts and must include models and simulations that are not operational in nature. To support that qualifier, verification, validation and accreditation (VV&A) of M&S assets will be performed. The proper VV&A pedigree is an important component of the make/buy process. To assist in providing part of the data set that will be required to support any accreditation decision, uses of M&S in support of the FCS System Development and Demonstration (SDD) phase will be tapped for usage data to support the VV&A activities, leading to an accreditation decision. These program activities include:

- Trade studies
- Force effectiveness analyses
- Integrated mission tests
- Technical field tests
- Limited user tests
- Experimentation
- Product development

The SoSIL, combined with enhanced Army M&S capabilities, provides an integrated acquisition support capability to develop, analyze, integrate and test the FCS SoS.

The SoSIL is the collection of laboratories and test facilities housing the hardware and software required to develop, analyze, integrate and test various FCS program systems. Each FCS system will be represented and developed as a separate article. The SoSIL concept will interconnect the laboratories, including One Team Partner sites developing these articles, and Army sites used in other SDD activities through a secure wide area network supporting real-time seamless data, voice and video service distributed test capability across the United States. Capabilities also include categories for data transmission, such as viewing portal data, software updates and ACE data. The SoSIL is centrally integrated through Boeing's facility in Huntington Beach, CA.

The FCS program uses SMART applications to confirm design concepts and/or discover required design changes early in the design phase, allowing for timely and efficient engineering changes. The continued, sensible reuse of M&S across and within FCS development will provide a set of integrated M&S capability, which facilitates and enables all aspects of procurement, fielding and maintenance throughout the FCS program's life cycle.

KENT PICKETT is a Simulation and Model Engineer for MITRE Corp. He spent more than 30 years working for TRAC as Director of the Model Management and Development Division.

ORAL WALKER is the Deputy Director for the PM UA FCS MSMO. He holds a B.S. in mechanical engineering from Stony Brook University and an M.S. in technology management from Stevens Institute of Technology.

Spinning Out Future Force Technologies to Warfighters Today

Dr. Richard E. McClelland

Today's Soldiers are at the forefront of the Army's transformation to a more agile, lethal and modular force. The U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC) is making great strides toward Future Force transition, working diligently to provide Soldiers with technologies they need now to make them a lighter, reconfigurable and more deployable force. Revolutionizing warfare through the spin-out insertion of Future Force technologies into current systems will enhance combatant commanders' mobility, survivability, maneuverability and lethality during all potential battlefield operations. TARDEC's top priority programs are leading the Future Combat Systems (FCS)-equipped Unit of Action (UA) vehicle development while infusing technology into the Current Force.

TARDEC's APS has demonstrated that an integrated survivability system on ground combat vehicles can reduce a vehicle's weight while greatly increasing the vehicle's survivability. Here, a 25th Infantry Division Soldier provides overwatch from his Stryker vehicle near Sinjar, Iraq. (U.S. Army photo by Jory Randall.)

TARDEC is organizationally a part of the Army's Research, Development and Engineering Command (RDECOM). TARDEC is also collocated with, and functionally an integral part of, the U.S. Army Tank-automotive and Armaments Command Life Cycle Management Command in Warren, MI. To be effective, TARDEC must have extensive knowledge of all component technologies that are viable for Soldiers. TARDEC has structured its Future Force development around platform-specific technologies in mobility, power and energy (P&E), survivability, intelligent systems, and maneuver sustainment and support, using robust experimentation and evaluation to prove revolutionary concepts, mature architecture and components.

Enhancing Track Mobility

TARDEC has focused on providing Soldiers with advanced lightweight power systems that meet Future Force combat vehicle requirements. From our Track Improvement Program to high-power engine research, TARDEC's mobility team is improving the Current Force while building toward the future.

Since 2004, TARDEC has been working improvements to the Bradley Fighting Vehicle's (BFV) T-157 track system. During testing at Yuma Proving Ground (YPG), AZ, TARDEC found the track system's life span to be 2,400 miles. Yet in Iraq, the same track system was only lasting 400 miles before failure. TARDEC took action by determining through Soldier reports the sources of the failure, which were extremely hot summer temperatures in Iraq, operational use at high speeds on pavement and the vehicle's weight — all of which are outside current Army design parameters. The T-157 was designed for a maximum 25-ton weight limit, yet the current BFV is operating around 36 tons.

TARDEC teamed with industry to develop a new, modernized track system weighing 400 pounds less than the previous track with a 5,000-mile life span. After completing tests at YPG, TARDEC anticipates that the new track system will enter production in 2006.

TARDEC is developing a segmented band track and new lightweight, high-strength steel track system by taking prior track improvement initiatives and looking at Future Force requirements. The segmented band track is easy to install and encompasses the lightweight and high-speed performance of continuous band track technology. The steel track will be developed through the use of high-strength alloy materials and current computerized design tactics for risk mitigation. Together, these modernized track designs will relieve much of the track "repair and replace" burden while also meeting Future Force requirements.

TARDEC is leading the way in track developments that will encompass a new segmented band track and a new lightweight, high-strength steel track system to fulfill FCS manned ground vehicle requirements. The new lightweight track will have the high-speed performance advantages of continuous band track technology. (Photo and diagram courtesy of TARDEC.)

Referring to TARDEC's AP program, Soldiers from the 29th Infantry Regiment, Fort Benning, GA, commented, "This system is great. I wish I had it on my BFV now. Every vehicle needs this system because it improves our chances on the battlefield. The vehicles can spread out and become secure." (U.S. Army photo courtesy of TARDEC.)

Boosting Power Density

TARDEC is also advocating engine technology developments for military vehicle applications because of the increase in power density requirements for the Future Force. Three FCS engine candidates have been supported since the FCS program's start, and selection will likely be made later this fiscal year. TARDEC's FCS Engine Development Advanced Technology Objective (ATO) has designed engines that double the power density of what is currently available from commercial-off-the-shelf engines, concurrently reducing the engine's weight, size and heat rejection. This objective isn't just focused on engine improvements — it looks at the vehicle's entire propulsion system including air filtration, cooling, exhaust and thermal management, turbo-charging, fuel economy and onboard fuel requirements.

But it doesn't stop there. The diesel engine, amazingly, has much more room for improvement. The High Power Engine Research (HIPER) ATO focuses on technologies that significantly increase and improve power density. Under this development, TARDEC will pinpoint investigations on high-speed diesel engine combustion research for applications into future manned and unmanned ground combat vehicles. Concentrating on advanced high-pressure fuel injection systems, TARDEC plans to increase engine speed and power by 50 percent.

TARDEC is also testing prototypes of a modular opposed piston — and an opposed cylinder 2-stroke diesel engine as a second initiative under this development. This effort encompasses the design, fabrication and testing of a ground vehicle engine that will increase power density with a 30-percent reduction in heat rejection and weight because the engine is not equipped with cylinder heads or a valve train. TARDEC will be performing combustion research to maximize air utilization for the cylinder's unique geometry.

P&E

Military requirements demand a 30- to 50-percent reduction in power systems volume. TARDEC is striving to meet the requirement through extensive research in hybrid electric and fuel cell technologies. TARDEC's Hybrid Electric FCS Increment II ATO improves weight, size, operational temperature and efficiency for Future Force vehicles. TARDEC is researching individual

system components including batteries, converters/inverters, controllers, motors, generators and thermal management systems. The greatly improved hybrid electric system will enable silent operation and mobility as well as enhance dash speed and battlefield robustness while reducing acoustic, thermal, visual and electromagnetic interference signatures.

TARDEC has developed a P&E Dynamic Test Rig (DTR), which will also be known as a Dynamic System Integration Laboratory. The DTR is a mobile platform that can qualify advanced hybrid electric power components and subsystems to the point where they are ready to meet performance objectives in relative environments. This 20-ton hybrid-electric-powered track combat vehicle demonstrator allows for the interchangeability of hybrid electric components. TARDEC has added access hatches, internal mounting structures for test articles and a sophisticated data acquisition system to the platform. The DTR will increase a technology's readiness level by showing that hybrid electric propulsion system components can withstand meticulous testing under rugged environmental conditions. These tests simulate real-world scenarios while operating on test tracks, cross-country terrain and paved roads.

TARDEC's Hybrid Electric FCS Increment II ATO improves weight, size, operational temperature and efficiency for Future Force vehicles.

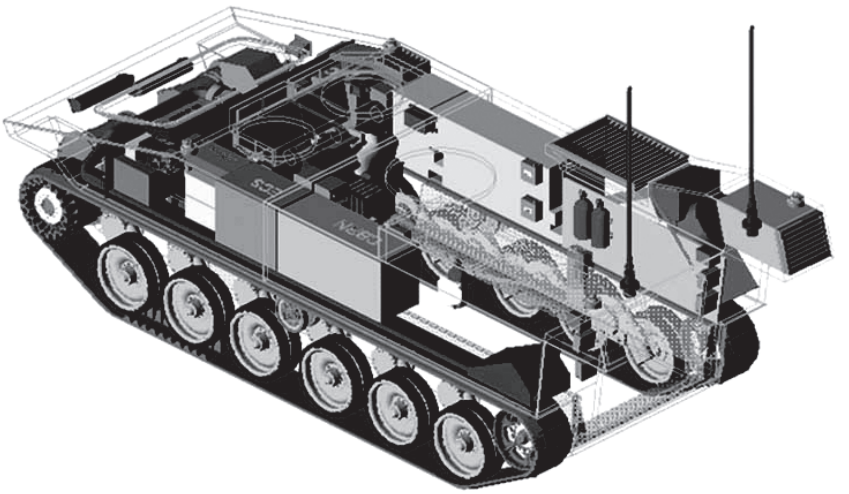
Increasing Survivability

"Don't be seen, hit, penetrated and killed," is TARDEC's leveled approach to increase Soldier and vehicle survivability for Current and Future Forces. TARDEC is leading the Army's Integrated Survivability Advanced Technology Demonstration (ATD), a program that has successfully saved the lives of Soldiers in theater through armor solutions and ensures future survivability through advanced techniques such as active protection (AP).

RDECOM has looked into AP efforts on both close-in and extended threats, as well as chemical energy (CE) and kinetic energy (KE) threats. These survivability technologies are based on both electronic and mechanical threat-defeat approaches. RDECOM has effectively developed and demonstrated AP systems (APS) that have the ability to defeat rocket-propelled grenades (RPGs), CE threats, direct-fired mortars and similar projectiles prior to the projectile defeating the vehicle.

Teaming with industry, TARDEC's Integrated Army Active Protection System (IAAPS) Mature On-the-Move threat-defeat testing sequence is undergoing a series of threat testing against RPGs at YPG. Six threat categories have been successfully completed, including two on-the-move threat defeats. IAAPS is an integrated survivability suite that is outfitted in lightweight armor and is equipped with various sensors, processors and countermeasures. The APS has demonstrated that an integrated survivability system on ground combat vehicles can reduce a vehicle's weight while greatly increasing the vehicle's survivability.

In addition to the Integrated Survivability ATD, RDECOM is developing a tank-fired KE AP (KEAP) system as an FCS solution to KE threats. Currently, APSs only address CE threats, and this program will upgrade and possibly replace some CE APS components to provide military platforms with the countermeasures necessary to defeat and survive KE threats. This effort is a collaboration among TARDEC; the U.S Army Research Laboratory; U.S. Army Armament Research, Development and Engineering Center; and U.S. Army Aviation and Missile Research, Development and Engineering Center (AMRDEC). The team has built and tested countermeasures with the capacity to deflect and defeat a tank-fired KE threat through the integration of accurate passive sensors and radars. The KEAP system will be matured to defeat all



The DTR is a mobile platform that can qualify advanced hybrid electric power components and subsystems to the point where they are ready to meet performance objectives in relative environments. This platform will increase a technology's readiness level by showing that the components of a hybrid electric propulsion system can withstand meticulous testing in rugged environmental conditions. (Image courtesy of TARDEC.)

AMRDEC has successfully demonstrated a close-in APS as an outgrowth of its efforts in counteractive protection for U.S. missiles. This system is undergoing testing on a TARDEC Stryker vehicle. (U.S. Army photo courtesy of *Soldiers Magazine*.)

large caliber tank-fired threats and transitioned into the UA program development as early as FY07.

It's no secret that the Army's current fleet could use enhanced RPG protection now. RDECOM is maturing candidates while the Army solicits for engineering development and rapid fielding. A market survey done earlier by TARDEC identified as many as 15 separate developments worldwide with potential to respond. RDECOM is supporting an important subset. AMRDEC has successfully demonstrated a close-in APS as an outgrowth of its efforts in counteractive protection for U.S. missiles. This system is undergoing testing on a Stryker vehicle. TARDEC has supported a system called Full-spectrum AP Close-in Layered Shield, which is undergoing end-to-end system-level tests. In all, RDECOM is supporting four of the candidate systems and must soon select one for development. Our Soldiers need it now.

Working with the Program Executive Office for Combat Support and Combat Service Support, and capitalizing on current add-on armor successes, a new armor strategy has been adopted. The Advanced Lightweight Vehicle Armor Protection ATO is running alongside a Long-Term Armor Strategy, an effort to armor every tactical-wheeled vehicle. The TARDEC ATO seeks to improve vehicle armor protection levels while greatly reducing the armor's size and weight. This will increase battlefield survivability for Current and Future Force vehicles through the development of highly efficient integral, ceramic and advanced electromagnetic armor solutions. Coupling the armor with lightweight structural materials that have novel defeat-absorbing mechanisms, the Army will be able to increase vehicle survivability against RPGs, heavy machine guns and medium-caliber cannon threats, while reducing an armored vehicle's weight. A key ATO focus will be developing a lightweight armor solution that can be applied to a wide range of tactical vehicles, maximizing commonality among all structural components.

Maneuver Sustainment and Support

TARDEC is seeking to reduce water and petroleum logistical burdens in theater. Breakthrough research has been underway to successfully integrate water generation systems onto various military platforms, giving Soldiers purified water while deployed in remote locations. Army requirements show that a Soldier operating in extreme heat environments needs 1-3 gallons of water per day to prevent dehydration. Adding personal hygiene, combat meal preparation and emergency medical treatment to the mix, one Soldier may need up to 6.6 gallons of water per day. Without advancements in water sustainment technology, water distribution is anticipated to account for 30-40 percent of the UA daily sustainment requirement and logistics burden.

TARDEC is exploring two distinctive systems: Water Recovery Unit from Exhaust (WRUE) and Water Recovery Unit from Air (WRUA). TARDEC's WRUA system produces potable water from air and will be proficient enough to generate potable water in an operating environment of 20-120 degrees Fahrenheit ambient temperatures and 20-100 percent relative humidity, with

a minimum dew-point temperature of 20 degrees Fahrenheit, while supplying purified water for up to 12 Soldiers at a time. During FY06, TARDEC plans to demonstrate water recovery units on Heavy Expanded Mobility Trucks, Family of Medium Tactical Vehicles and Humvees, and both the standalone system and the vehicle-integrated system will be ready for military vehicle integration by 2007.

The WRUE has the capability to generate drinking water by capturing water from fuel expended by engines on the battlefield. This system can be embedded into current and future military platforms and will also feature low energy and lightweight devices that have the ability to purify water on combat platforms.

For each gallon of fuel that is consumed by the vehicle, a half-gallon of drinkable water is recovered for the Soldier. The WRUE system will enable warfighters to operate without an external resupply of water for an extended period.

Military bridging is also a major UA concern. TARDEC's Bridging Simulation Laboratory, located at Selfridge Air National Guard Base, MI, features computer-controlled load test areas that are equipped with automated data acquisition capabilities for structural testing of bridging systems. Both static and dynamic structural load applications are available for structural and fatigue tests.

TARDEC is testing advanced composite materials to see how useful they will be for building a tactical bridge. Under the Advanced Modular Composite Bridge program, TARDEC will determine if the composite material solutions are capable of bridging gaps of 13, 20 and/or 26 meters for Future Force applications. TARDEC is working with the threshold load of a fully loaded Future Tactical Truck System (FTTS) towing an FTTS trailer with a mission load class of 45-70 tons. This initiative is a direct follow-on program of the highly successful Composite Army Bridge and the Modular Composite Bridge programs. The Defense Advanced Research Projects Agency is a major contributor to this effort.

TARDEC's ability to rapidly respond to the immediate needs of Soldiers in theater is an organizational characteristic. TARDEC has fielded life-saving solutions to Soldiers while continuing to develop robust Future Force programs.

While the United States enters a new century of warfighting, TARDEC is ensuring that we understand and meet our Armed Forces' needs and expectations. When Soldiers make suggestions, TARDEC listens. When the Army calls, we respond. As the Army transforms into a more modular, stabilized and flexible force, TARDEC, with more than 50 years of experience, is leading the way — relevant and ready – developing superior technology for a superior Army.

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Robots at War — Revolutionary Warfare Supporting the Homeland and Abroad

Ashley John

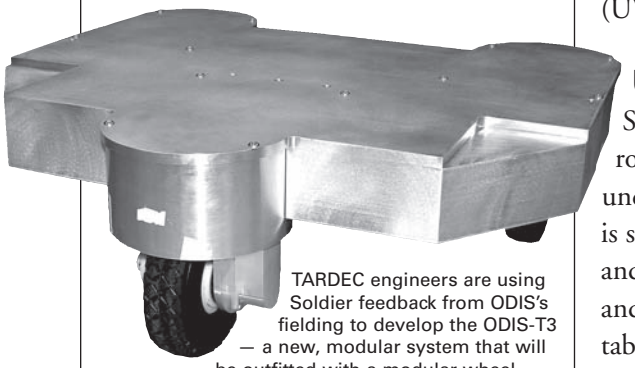
Robots are playing a revolutionary role on the battlefield as the Army continues to fight the global war on terrorism (GWOT). Keeping Soldiers out of harm's way by using unmanned systems has become an operational requirement that has transitioned from original Future Force applications into Current Force operations. From small robots that inspect the underside of vehicles to 20-ton robots that have the capability to engage threats, the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC) is at the forefront of developing unmanned systems to ensure that the Current Force is lighter, reconfigurable and increasingly deployable against enemy threats both on U.S. soil and abroad.

The GWOT has forced advanced robotics program technology to be spun into current operations. This has resulted in an onslaught of robotics technology quickly reaching the hands of warfighters at home and abroad.

As part of the original Future Combat Systems (FCS) requirements, TARDEC robotics engineers have been researching and developing robotic navigation and mobility platforms for many years. This knowledge base has proven key to responding quickly to Soldiers' unmanned system needs during current operations.

ODIS

Advanced robotic mobility research has led to the successful development of the Omni-Directional Inspection System (ODIS) family of robots. ODIS is a robotic delivery platform capable of mounting various chemical and biological sensors to its base. The robot is equipped with a visual camera and an active lighting system, which forms its basic mission package. Like a hovercraft on wheels, ODIS can move forward or backward, left or right and rotate separately or in combination. This unique feature allows the operator to precisely position and maneuver ODIS under a vehicle to view cavities, wheel wells and spaces above and around structural members.



TARDEC engineers are using Soldier feedback from ODIS's fielding to develop the ODIS-T3 — a new, modular system that will be outfitted with a modular wheel design to allow the wheels to be interchanged on the fly and traverse tougher terrain. (U.S. Army photo by TARDEC.)

ODIS has been deployed to various checkpoints in the Central Command theater of operations. According to ODIS Chief Engineer Bill Smuda, who helped field 20 robots in Iraq and Afghanistan, "The Soldiers really liked the technology and were very quick to pick up the use of it." Additional feedback from Soldiers in Iraq has resulted in the development of additional payloads to assist in standoff attempts, including a camera mast system to enable operators to see inside vehicles while operating from remote locations.

ODIS is also helping to defend the homeland by aiding in the detection of bombs and other explosive devices that terrorists may smuggle into the U.S. checkpoints and seaports. The U.S. Capitol Police Bomb Squad Hazardous Materials Unit uses ODIS to perform reconnaissance on vehicles and other suspicious objects. Seaport security units and other police agencies are also using ODIS robots.

Since ODIS's successful fielding, TARDEC engineers are gathering more Soldier feedback and using it to explore what other future technologies can be spun into Current Force applications. Through the use of feedback and engineer philosophy, TARDEC recently completed prototype designs of the Under Vehicle Inspection System (UVIS).

UVIS

Similar to ODIS, UVIS is a small robotic platform that can inspect the underside of vehicles. However, UVIS is smaller, more maneuverable, wireless and outfitted with a first-class camera and lighting system. UVIS is a notably low-cost, standoff solution with the potential ability to support every military checkpoint. UVIS houses a reliable and simple teleoperation capability that focuses on user interface and short user training periods. TARDEC is now looking at alternative payloads for UVIS, one of which encompasses explosive detectors.

UVIS will feature an omnidirectional system — comparable to ODIS —

Soldiers at a checkpoint in Baghdad, Iraq, are trained by TARDEC engineers on how to properly use the ODIS robot. TARDEC engineers used their knowledge of FCS robotics' mobility needs to quickly field ODIS for Central Command use. (U.S. Army photo by TARDEC.)

that can be driven in any direction from any starting point, giving the user extreme ease of use and excellent situational awareness. This capability comes from three independently rotating wheels and an advanced control system. This system can translate user commands via the joystick into commands for the wheel-positioning motors. UVIS was fabricated with a high-quality, tiltable camera system that is fashioned with a ring light-emitting diode that provides a clear and lighted view of the vehicle's underside. TARDEC Research Scientist Dr. Robert Karlsen remarked, "Anywhere you use ODIS, you can use UVIS." Thus far, UVIS has been used for pre-event security sweeps at large inauguration festivities. Karlsen further explained, "The best application for these robots includes investigating mines and improvised explosive devices, exploring rooms and looking in caves. Since robots haven't become autonomous yet, they must be remote controlled or teleoperated."

Chaos

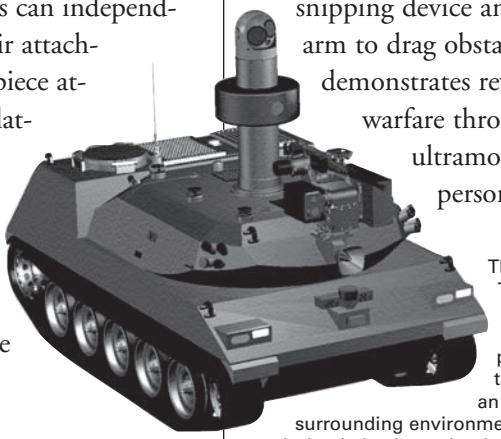
Providing vehicle inspection standoff isn't the only unmanned technology on which TARDEC is focused. TARDEC and industry partner Autonomous Solutions Inc. (ASI) are pushing the limits of small robotics technology

through a newly developed robot named Chaos. Stemming from the PackBot lightweight unmanned reconnaissance and tactical warfare vehicle, Chaos has a combination of four legs, wheels and tracks, giving it extreme mobility performance in a small package.

"You can envision each of the legs as being an elongated circular end with a straight piece in between. This piece can rotate with the track running around it," Karlsen stated. Each of Chaos's tracks and legs can independently rotate about their attachment axis, with each piece attached to either the platform's mid or end point. This increased flexibility allows for amplified maneuverability, giving Chaos an extensive assortment of gaits.

Intended for off-road environments, Chaos is enhanced with various gait controls and self-extraction behaviors. Chaos can also operate successfully in cluttered urban terrain or anywhere that a Soldier needs a small vehicle with high mobility. Ultimately, Chaos will be able to recognize the terrain it is on or about to encounter, and switch into a mode that will be optimal for that specific environment. A prototyped Chaos has already demonstrated its ability to walk up and down stairs and to drive in severe off-road environments.

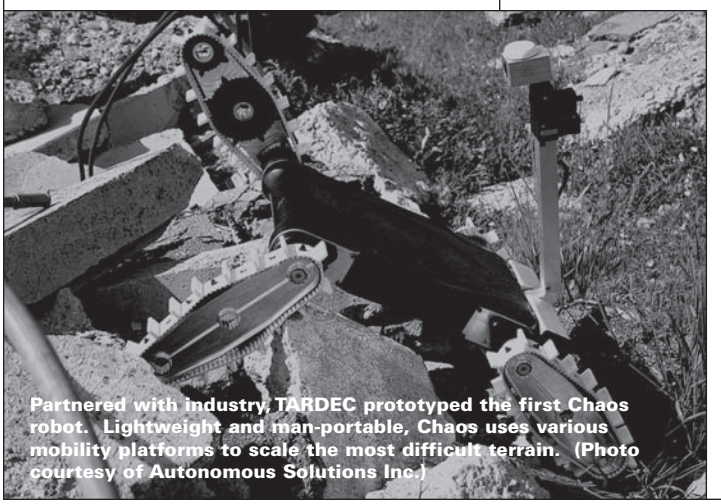
To increase Chaos's perception, two separate camera systems have been fitted to the platform. One system is in the vehicle's front to be used for driving, and the other camera is secured to extend vertically, allowing for augmented perception. Production for Chaos is predicted to begin in 2006, and ASI is looking to add a wire-snipping device and a mobility arm to drag obstacles. Chaos demonstrates revolutionized warfare through its rugged, ultramobile, all-terrain personality.



The ARV Robotic Technologies ATO will increase unmanned platforms' perception technology to provide an accurate view of the surrounding environment and will develop mission behavior technologies to enable tactical maneuverability. (Photo courtesy of U.S. Army TARDEC and BAE Systems.)

Research and Development (R&D)

Even while supporting current operations, TARDEC is continuing its Future Force R&D, where it will not be uncommon to see vehicle-class unmanned systems on the battlefield and in logistics roles. TARDEC is home to three major robotics' Advanced Technology Objectives (ATO). These include Human-Robot Interaction in Soldier-Robot Teaming, Robotic Follower Advanced Technology Demonstration and Armed Robotic Vehicle (ARV) Robotic Technologies.



Partnered with industry, TARDEC prototyped the first Chaos robot. Lightweight and man-portable, Chaos uses various mobility platforms to scale the most difficult terrain. (Photo courtesy of Autonomous Solutions Inc.)

The ARV ATO gives unmanned platforms an increase in perception technology to provide an accurate view of the surrounding environment, while simultaneously developing mission behavior technologies to supply the capability to tactically maneuver the unmanned ground vehicle (UGV).

"This ATO will examine current UGV vulnerabilities, improving survivability through the development of unique anti-tamper countermeasures," explained TARDEC Program Engineer Jeff Jaster. "A surrogate platform will be integrated with the advanced technology software and associated hardware developed under this effort, as well as appropriate mission modules to support warfighter experiments and evaluations in military environments."

The ATO will begin modifying a surrogate platform for future technology insertions of subsystems that will be integrated onto the platform for initial field evaluations in 2006. According to Jaster, ARV is a solid example of how TARDEC will take technological advances and transition them through Unit of Action systems for spin-out integration — leading to rapid deliverables for Soldiers.

As the Army continues to fight the GWOT, TARDEC — with its intelligent systems' core competencies — will continue to spin robotic technology into the Current Force while working with the Lead Systems Integrator to develop future robotic vehicle platforms.

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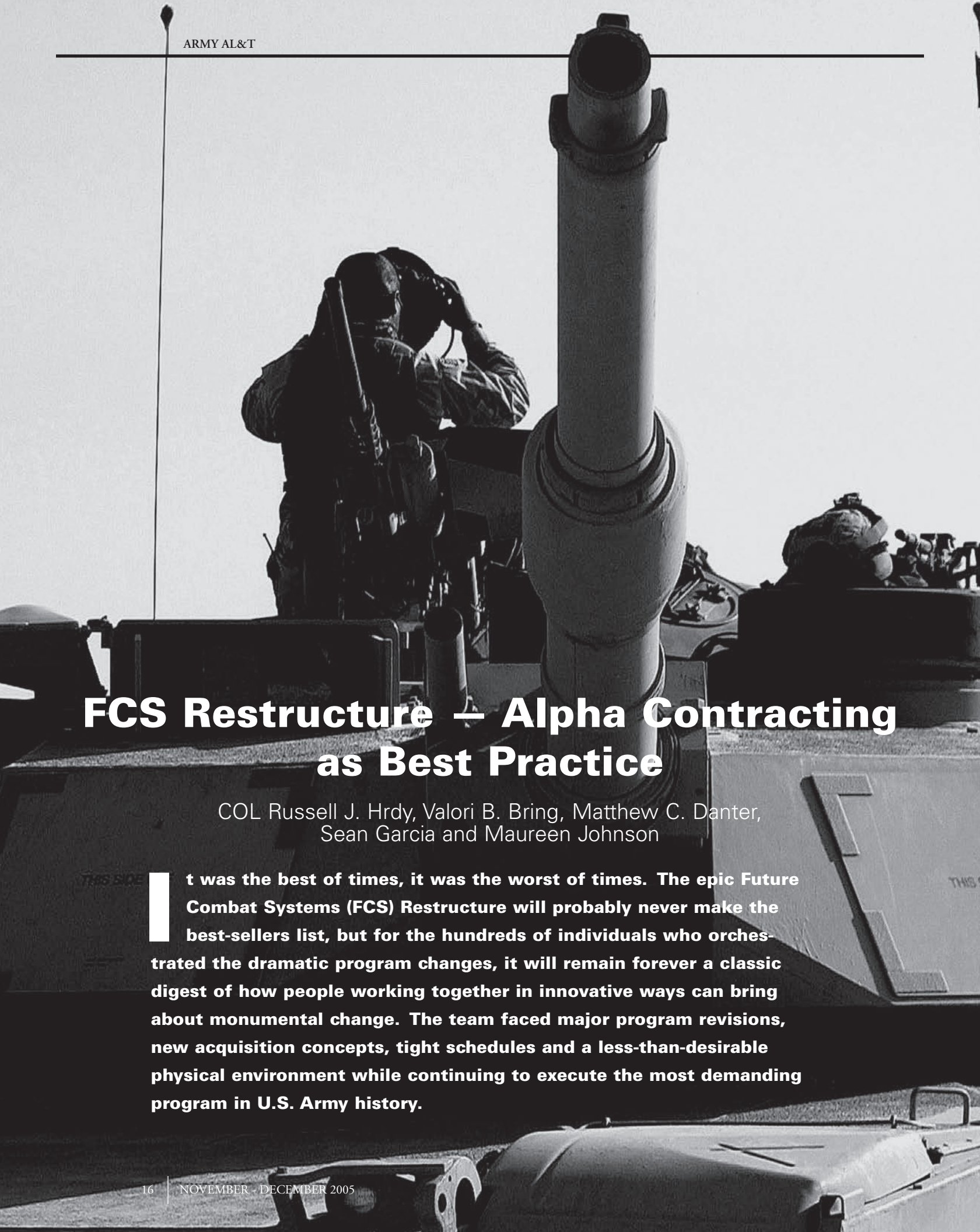


FCS Restructure — Alpha Contracting as Best Practice

COL Russell J. Hrdy, Valori B. Bring, Matthew C. Danter, Sean Garcia and Maureen Johnson

It was the best of times, it was the worst of times. The epic Future Combat Systems (FCS) Restructure will probably never make the best-sellers list, but for the hundreds of individuals who orchestrated the dramatic program changes, it will remain forever a classic digest of how people working together in innovative ways can bring about monumental change. The team faced major program revisions, new acquisition concepts, tight schedules and a less-than-desirable physical environment while continuing to execute the most demanding program in U.S. Army history.

In July 2004, Army leadership directed the Program Manager Unit of Action (PM UA) to change the FCS program by adding a comprehensive experimentation and technical maturation program, returning five major systems previously deferred in the original contract, reprioritizing program technologies development, extending the program schedule and adding four increments of spiraling out FCS capability to the Current Force. This change was issued as a ceiling-priced modification to the existing Other Transactional Agreement in August 2004. This $6.4 billion directive required FCS leadership to address complex uncertainties such as:

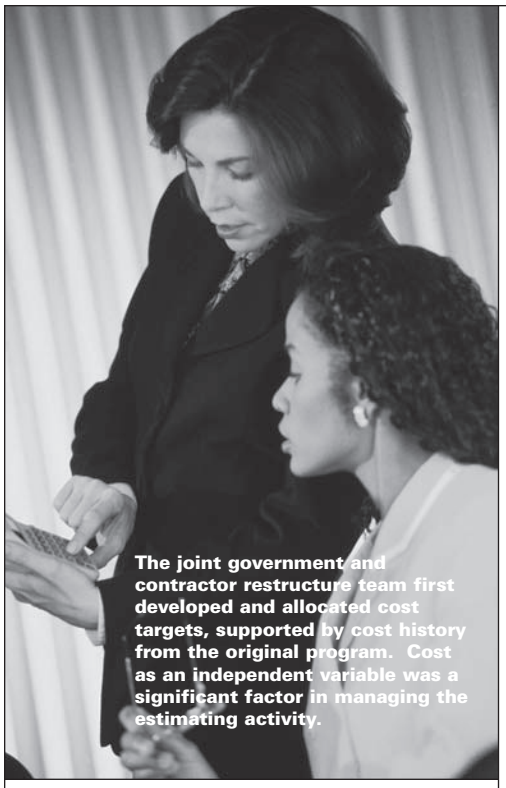
- How do we plan, define and implement these pervasive changes without disturbing the baseline program?
- How do we implement the spin-out (SO) strategy — contractually and programmatically — while sustaining the basic program design activities?
- How do we get everyone on board with these changes as soon as possible?

For FCS, "getting everyone on board" means addressing the One Team Partners (OTPs) comprising government personnel from PM UA, the U.S. Army Training and Doctrine Command, Defense Contract Management Agency (DCMA), Defense Contract Audit Agency (DCAA), various related program executive office user groups, and contractor personnel from Boeing, Science Applications International Corp. and all major subcontractor OTPs. All 7,000 government and contractor personnel supporting the FCS program were affected by the changes the directive presented. Consequently, the challenge for FCS leadership was to build a new program that introduced and integrated those changes seamlessly. This involved creativity and extraordinary decision-making and communication processes, as well as absolute dedication to the contracting effort.

Planning

Setting the Stage. Alpha contracting — government and contractor partnership in developing the modified contract — was determined to be a necessity, not an option. The first major step was identifying government and contractor personnel who would be dedicated to the contracting effort for the ceiling-priced modification initiation. This group, initially consisting of fewer than 100 people, was committed to planning the new restructured program and charged with drafting the overall program plans to capture how the changes influenced the existing baseline. They also had to capture changes represented in the ceiling-priced modification documentation and determine if they could be used as foundation materials for kicking off the Alpha definitization activities. Availability of these documents was essential for communicating the restructure's breadth and depth to the integrated product teams (IPTs). It also provided the foundation for the IPTs to use in detailing the lower- level proposal and implementation documentation.

The $6 billion FCS Restructure Program is one of the largest programs ever undertaken by the Army acquisition community. It returns five major systems previously deferred in the original contract, reprioritizes program technology development, extends the program schedule and adds four increments of spiraled-out FCS capability to the Current Force. Here, Soldiers from the 3rd Infantry Division "mount up" in their M1A1 Abrams tanks for a recon mission near Baqubah, Iraq, Aug. 1, 2005. (U.S. Army photo by SSG Suzanne Day.)



The joint government and contractor restructure team first developed and allocated cost targets, supported by cost history from the original program. Cost as an independent variable was a significant factor in managing the estimating activity.

The Script. The second major planning activity involved organizing the Alpha proposal and definitization efforts. This included decisions that were made regarding who would be involved, how interfaces would work and the location of personnel who would be engaged in the proposal activities. A key element of this plan established empowered IPT government and contractor co-leads as decision makers at all restructure team levels. Collocation of dedicated representatives from each stakeholder and IPT was another key decision considered essential to successfully completing the concentrated effort within the abbreviated schedule.

A plan was formulated that engaged all OTP stakeholders in the effort — government, contractors and their subcontractors — along with details concerning which participants would be required to be involved in a collocated environment during specified activities. Although there were approximately 1,200 personnel involved during the 7 1/2-month period, this planning resulted in approximately 300 people dedicated to the effort at any given point in time.

The most critical planning documents included:

- Plans that represented a new approach to the program and were significantly different from the original program. This was a 3-month effort by government, contractor, subcontractor and user technical teams to construct a new program representing a series of integration phases formed to support SO product delivery. Reviews conducted at the conclusion of each integration phase had defined entrance and exit criteria derived from the new program Integrated Master Plan (IMP).
- Program master schedules and subordinate IPT schedules were developed, aligned and continuously revised throughout the restructure activity. Numerous exercises were conducted with multiple IPTs to ensure horizontal integration across all IPT schedules. As disconnects were identified, the teams corrected and continuously updated their schedules. The new Integrated Master Schedule (IMS) was incorporated into the original program IMS on a 3-month interim basis until the restructure was completed.
- A hardware allocation matrix was another key tool that synchronized the hardware requirements for each IPT. The hardware matrix identified subcomponent deliveries, brassboards and prototypes by month.
- Ground rules and assumptions that incorporated the newly developed program IMPs provided guidance for the estimating process.

Major Roles. With program plans, schedules and ground rules in place, the questions remained: "How do we make decisions quickly to support this monumental effort within the needed schedule?" and "How does this dedicated team synchronize the changes with the original program?" The answer to both questions, and the third key piece of the major plan, was to establish a dedicated board to adjudicate day-to-day proposal/programmatic decisions and to act as the liaison to the original program.

This board was aptly called the Transition Review Board (TRB) because its major focus was to ensure successful transition from the original program to the restructured program. The TRB consisted of senior government and contractor engineering representatives who served as the decision-making body governing technical program development and helped the IPTs meet the plan's cost, schedule and performance requirements. A key indicator of the board's

success was that teams actively sought to bring issues to the board for resolution because swift decisions were essential to the teams' success. Teams knew they would get help solving difficult technical, schedule and hardware problems.

Execution

The Performance. With sound plans established and communicated, the Alpha proposal development began in earnest. The single greatest challenge in drafting it was to achieve balance in cost, scope and schedule to allow the program to proceed without disruption. The proposal process established multiple cycles that formally advanced the maturity of the estimates and related contractual documents.

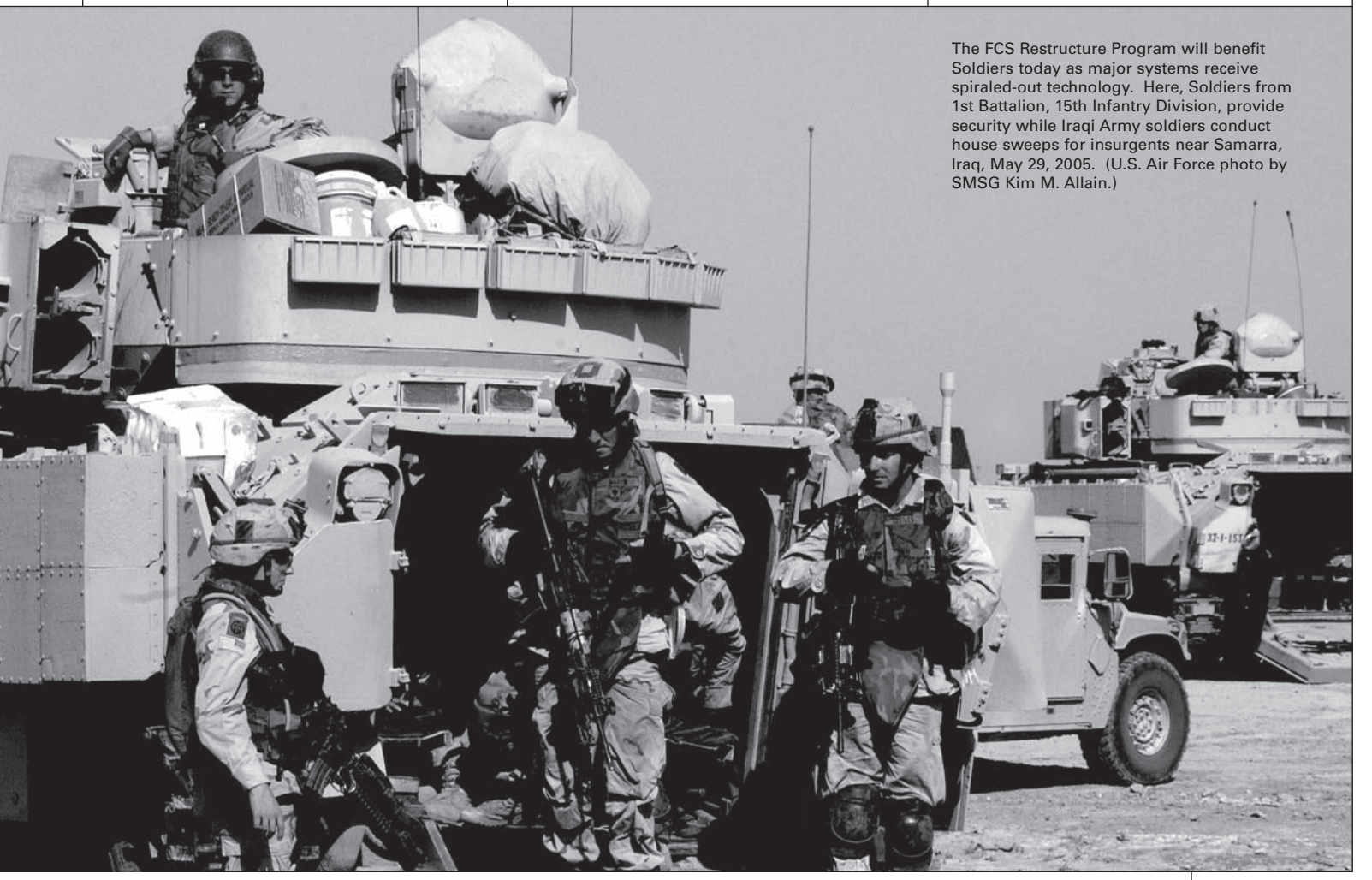
The joint government and contractor restructure team first developed and allocated cost targets based on solid modeling techniques. These models were supported with cost history from the original program.

Next, the restructure team planned two estimating cycles for the IPTs. The first cycle was a leveling exercise designed to ensure the targets were correctly sized and allocated to the subordinate teams. Cost as an independent variable was a significant factor in managing the estimating activity.

The IPTs were encouraged to achieve their cost goals by generating lists of potential capability or scope reductions and process modifications. The TRB subsequently reviewed these lists and approved or disapproved them for implementation. The first estimating cycle completion resulted in adjustments to the IPT targets and provided a solid foundation for the final estimating cycle.

Parallel contract documentation development proved challenging and, again, the need for balance and horizontal integration was crucial to future program performance — both at the prime level and the OTP level. The statement of work, data items, IMP, government property lists and contractual terms had to mature in concert with the proposal estimates. These documents were all worked in an Alpha environment and the contract and subcontract management teams worked side-by-side in preserving all program/proposal developments so that a fully integrated, restructured agreement could be finalized and represented in the resulting prime-level modification and subcontract documentation.

The Reviews. The restructure's size and complexity required reviews from



The FCS Restructure Program will benefit Soldiers today as major systems receive spiraled-out technology. Here, Soldiers from 1st Battalion, 15th Infantry Division, provide security while Iraqi Army soldiers conduct house sweeps for insurgents near Samarra, Iraq, May 29, 2005. (U.S. Air Force photo by SMSG Kim M. Allain.)

a range of stakeholder organizations. Various reviews were conducted by members within the Army hierarchy and the contractor's organization on an interim basis throughout the proposal activity. Reviews normally conducted as "oversight" reviews or audits after the proposal was finished were instead conducted "real time" because major players such as DCAA and DCMA were active Alpha team members. In addition to the required reviews, the restructure team invited some independent organizations to provide feedback and independent perspectives on the proposal products' soundness. These included a "Red Team" and an Independent Schedule Review. The Office of the Inspector General and Cost Analysis Improvement Group reviews were conducted in parallel with the proposal activities. Each analysis resulted in an improvement to the eventual proposal product.

Lessons Learned

The FCS Program Restructure, performed in an OTP-Alpha environment, was one of the most ambitious missions ever undertaken by a major program. The lessons learned were many and, in some cases, what appears to be one of the best features of the undertaking is also one of the worst. What is clear to all who were involved is that the benefit of the multilayered, multifaceted Alpha process was the opportunity to have the best of FCS's best join a common goal of making the FCS program even better.

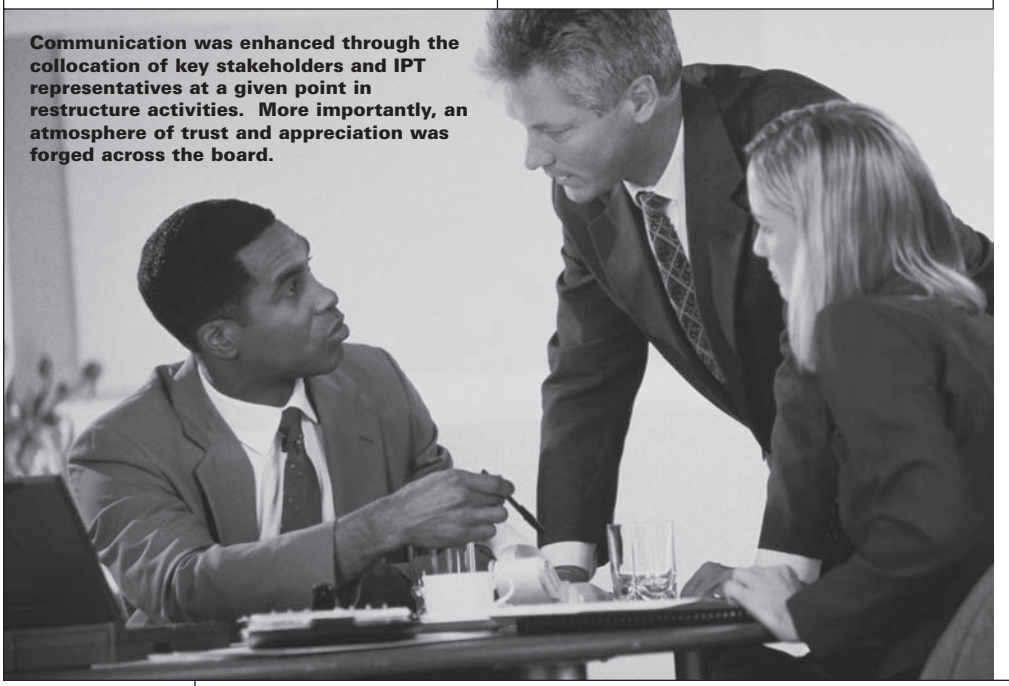
The Best

The restructure team spent an extraordinary amount of time developing program plans and schedules, defining technical approaches, instituting efficient decision-making venues, outlining estimating and proposal strategies and establishing multilayered communication lines.

The TRB proved to be an essential feature of the restructure proposal effort. Because of the board's viewpoint across all IPTs, the TRB performed as an empowered, knowledgeable and responsive source for keeping the IPTs moving as they encountered difficulties and inconsistencies in the challenging process. The board also maintained integration with the baseline program, which was critical to implementing the program restructure.

Collocating all key players at a given point in the activities contributed greatly to improved communication. IPTs heard firsthand how their programmatic decisions impacted other IPTs. Schedules and hardware deliveries were synchronized and all participants gained an in-depth understanding of the work effort.

Collocating all key players at a given point in the activities contributed greatly to improved communication. IPTs heard firsthand how their programmatic decisions impacted other IPTs. Schedules and hardware deliveries were synchronized and all participants gained an in-depth understanding of the work effort. More importantly, an atmosphere of trust and appreciation for one another occurred. Communication was enhanced through the physical environment. Overall, it was clear that FCS has a better, more integrated program because of stakeholder collocation.



Communication was enhanced through the collocation of key stakeholders and IPT representatives at a given point in restructure activities. More importantly, an atmosphere of trust and appreciation was forged across the board.

The Worst

Most participants would say that the worst feature of the collocated Alpha process was the heavy travel commitment that took FCS personnel away from their families for weeks at a time over the 7-month period. Personnel also worked extremely long hours to support the time-critical schedule milestones.

Communication in the Alpha environment and the "pods" was enhanced because of the dedicated, collocated teams, but it was also laborious. The pods forced a collaborative work environment, but they were also a

The AH-64D Apache Longbow helicopter is another Current Force weapons platform that will benefit from SO technology. Here, a 3rd Armored Cavalry Regiment pilot takes off from Forward Operating Base Sykes, Iraq, Aug. 11, 2005, for a security mission over Ninewa Province. (U.S. Army photo.)

source of discomfort and frustration for individuals who are accustomed to working in a quiet office environment.

The restructure teams' separation from the basic program was difficult for both those individuals on the restructure team and those continuing to work on the basic program. Although communication of the changes and progress of the restructure teams was made through the boards, the individuals continuing to work the basic program felt they did not have an in-depth understanding of how the restructure would impact the program until the restructure team was re-integrated into the new program.

Achieving Success

The more than $6 billion FCS Program Restructure was a mammoth undertaking. Doing it in an Alpha environment proved to be the best way to have FCS emerge a better integrated, better understood program — all to the benefit of our Soldiers. The challenge brought out the best in the best FCS team — both government and industry — to restructure this highly complex system-of-systems by employing all stakeholders in the planning, execution and decision-making processes. FCS has a history of people working together in innovative ways to achieve success, and this story is an FCS classic.

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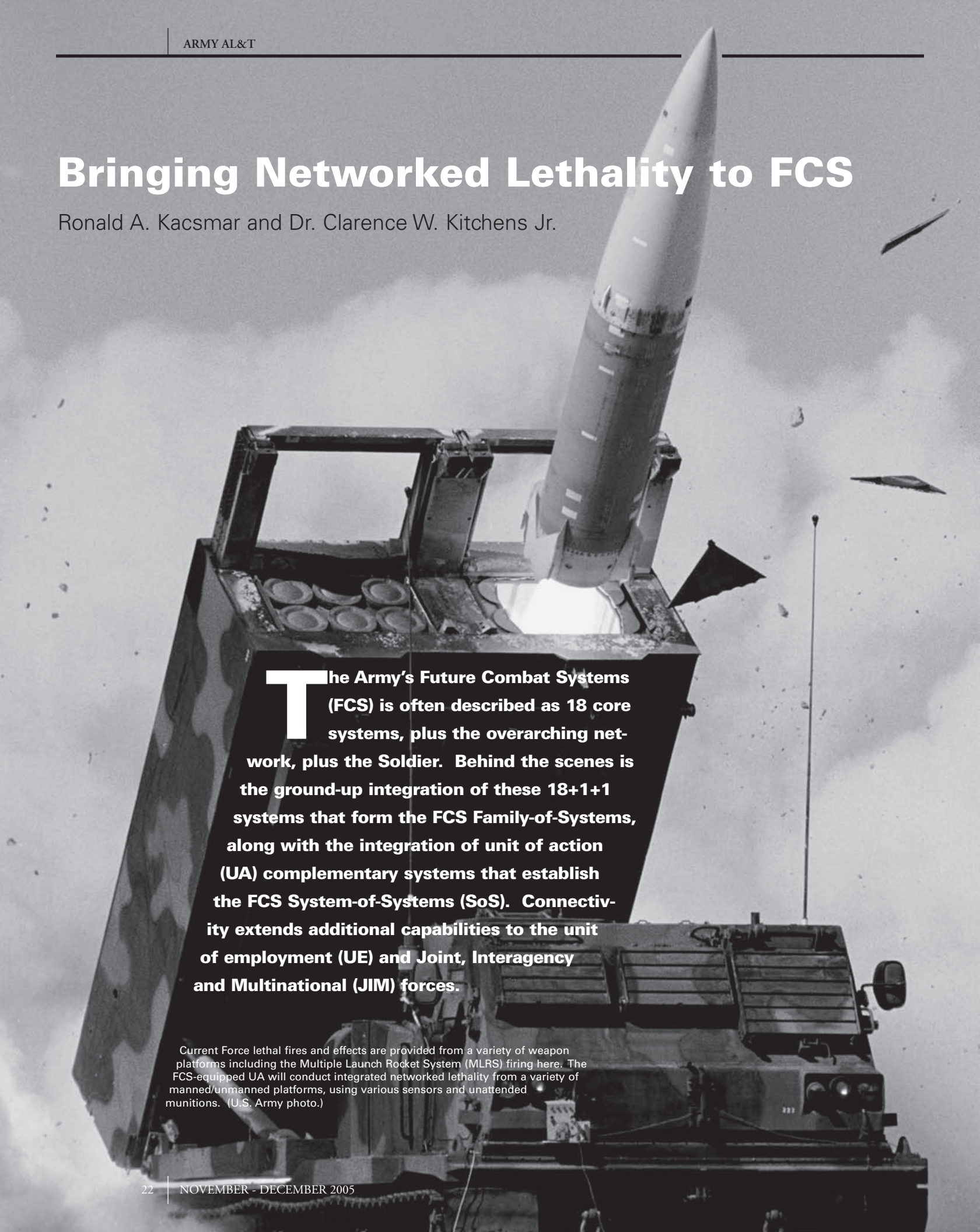
Bringing Networked Lethality to FCS

Ronald A. Kacsmar and Dr. Clarence W. Kitchens Jr.



The Army's Future Combat Systems (FCS) is often described as 18 core systems, plus the overarching network, plus the Soldier. Behind the scenes is the ground-up integration of these 18+1+1 systems that form the FCS Family-of-Systems, along with the integration of unit of action (UA) complementary systems that establish the FCS System-of-Systems (SoS). Connectivity extends additional capabilities to the unit of employment (UE) and Joint, Interagency and Multinational (JIM) forces.

Current Force lethal fires and effects are provided from a variety of weapon platforms including the Multiple Launch Rocket System (MLRS) firing here. The FCS-equipped UA will conduct integrated networked lethality from a variety of manned/unmanned platforms, using various sensors and unattended munitions. (U.S. Army photo.)

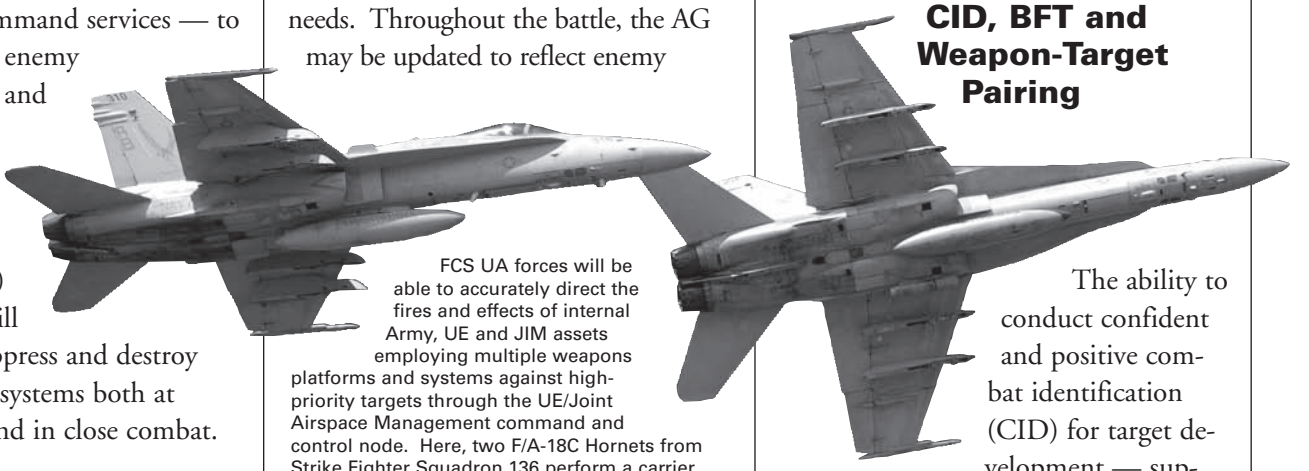
These integrated components will enable numerous advanced capabilities that will make the UA a modular fighting force like none other. The ability to conduct integrated Networked Lethality (NWL) — more broadly known as Networked Fires and Effects (NF&E) — will provide the most decisive advantage for the UA/UE. When integrated with some of the core capabilities and processes, the FCS NF&E will empower a highly effective NF&E-enabled fighting force.

NF&E will be the FCS UA's ability to rapidly leverage and employ UA, UE and JIM sensor and effects assets — through battle command services — to detect and engage enemy targets with lethal and nonlethal fires. line-of-sight (LOS), beyond-LOS (BLOS) and non-LOS (NLOS) fires and effects will be available to suppress and destroy enemy forces and systems both at extended ranges and in close combat.

The FCS NF&E is augmented by the UA's ability to conduct cooperative engagements — such as BLOS, point-and-shoot and avenge kill — through rapidly establishing dynamic sensor-shooter linkages for delivery of precision effects. NF&E cannot be attributed to a single system, but is instantiated by the dynamic and cooperative interaction of these capabilities across the entire UA, UE and JIM forces. Fundamental to their interaction and effectiveness are FCS networked communications and intelligence, surveillance and reconnaissance (ISR) data fusion.

Fires and Effects (F&E) Planning and Preparation

Prior to battle, combatant commanders create their attack guidance (AG) plans delineating target priorities, associated attack methods, desired effects on target and timeliness of target attack, in addition to allocating appropriate targets to the UE and JIM forces. Commanders can perform this through the F&E Planner of the Battle Command Planning and Preparation Services (PPS), which also provides decision-making services for generating weapon-target pairings and decider-sensor-shooter linkages. The AG and associated tools will permit coherent and precise management of targeting information to provide accurate and predictive effects that are responsive, timely and meet the battlefield commander's needs. Throughout the battle, the AG may be updated to reflect enemy attrition, effector status and other evolving battle elements. Also during planning and preparation, the UA will use the PPS for integrated live, virtual and constructive training, and conducting mission rehearsals to optimize attack tactics. Additional planning services contributing to NF&E include the sensor planner, maneuver planner, terrain analyzer, ground space planner and airspace planner.



FCS UA forces will be able to accurately direct the fires and effects of internal Army, UE and JIM assets employing multiple weapons platforms and systems against high-priority targets through the UE/Joint Airspace Management command and control node. Here, two F/A-18C Hornets from Strike Fighter Squadron 136 perform a carrier break maneuver during a tactical air power demonstration Sept. 17, 2005, over Naval Air Station Oceana, Virginia Beach, VA. (U.S. Navy photo by PH2 Daniel J. McLain.)

Sensors and Target Processing

FCS platforms will be equipped with various sensor packages that will be configured and tailored prior to mission execution to best meet commanders' needs for addressing expected threat, terrain, weather and environmental conditions. Targeting data for deployment of effects by the UA can originate from UA, UE or JIM forces. Target processing will be conducted per AG directives and the predefined rules governed by the levels of automation, which control the degree to which a service may make a decision on behalf of a user. Levels of automation include manual, management by consent, management by exception and fully automated modes.

CID, BFT and Weapon-Target Pairing

The ability to conduct confident and positive combat identification (CID) for target development — supported by robust Blue Force Tracking (BFT) to maintain accurate and timely situational awareness — will reduce battlefield areas of uncertainty and thus enable the UA to move rapidly and act decisively. The CID will provide for real-time identification of friendly, threat, noncombatant and neutral forces. The FCS-equipped UA will achieve CID through integrated situational understanding (SU) and battlespace object processes such as detection, classification, recognition and ID. Positive ID of friendly forces will be achieved by UA, UE and JIM forces equipped with compatible and interoperable CID systems.

Additionally, as the Battle Command Mission Execution services process

The FCS-equipped UA will achieve enhanced combined-arms effectiveness across the full spectrum of conflict, day or night, and in all weather, climate and terrain conditions. Here, SGT Shaimon J. Lee (right) passes SPC Earl R. McFee a round for the M109A6 Howitzer during combat operations near Fallujah, Iraq, Nov. 6, 2004. (U.S. Army photo by SFC Johancharles Van Boers.)

targets per the priorities and weapon-target pairings defined in the AG, Blue Force SU will rapidly and accurately select the most appropriate battlefield effector within the required target proximity for completing the fire mission. Sensor-to-shooter linkages will also use Blue Force SU to determine the optimal sensor to link with an effector platform.

Clearance of Fires

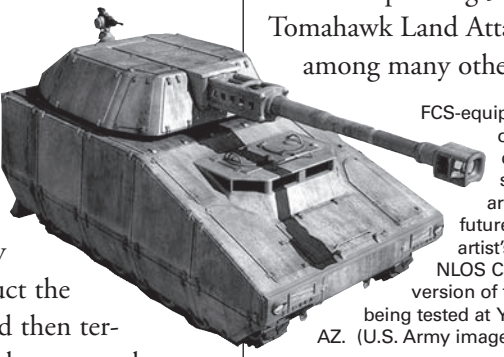
UA clearance of ground and airspace for delivery of effects — in close coordination with the Joint Airspace Control Authority's designated UE/Joint Airspace Management command and control node — will enable, rather than restrict, fires execution. SU will be developed as a result of:

- Continuous BFT and CID processes.
- Cooperation with advanced fire control for the refinement of tactical and technical fire direction.
- Information dissemination via the Common Operating Picture.

The result will be the acceleration of clearance of fires, thus empowering rapid engagement of high payoff, most dangerous and time-sensitive targets.

Sensor-to-Shooter Linkages

Sensor-to-shooter linkages permit near-real-time sensor data to be fed directly from a sensor platform to the firing platform operator to permit clearance of fires and BLOS engagement of targets. The FCS network and battle command system provide a capability to establish sensor-to-shooter links, maintain them as long as they are needed to conduct the assigned mission and then terminate them when they are no longer needed, releasing the sensor platform to conduct other missions.



FCS-equipped UAs will employ overmatching lethal capabilities to full-spectrum, combined-arms dominance on future battlefields. Here, an artist's rendition depicts the NLOS Cannon. A demonstrator version of this system is now being tested at Yuma Proving Ground, AZ. (U.S. Army image.)

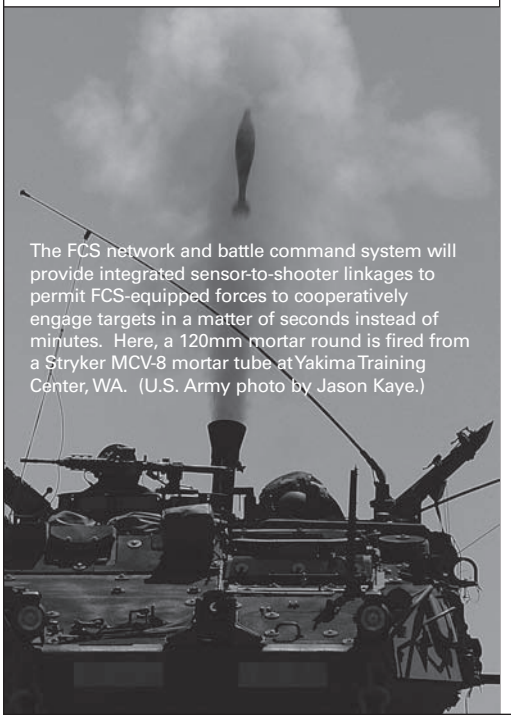
Lethal and Nonlethal Effects

FCS-equipped UAs will employ overmatching lethal and nonlethal F&E in a complementary manner — lethal effects combined with nonlethal effects — to achieve enhanced combined-arms effectiveness across the full spectrum of conflict, day and night, and in all weather and terrain. These UA forces will be able to accurately direct F&E internally, or from supporting UE forces and JIM, assets employing weapons platforms and systems, such as the High Mobility Artillery Rocket System, MLRS, F/A-18 Hornet, Mk84 Joint Direct Attack Munition, Naval surface ships firing 5-inch guns and the Tomahawk Land Attack Missile, among many others.

Lethal effects within the FCS-equipped UA will be provided by Soldiers and weapons platforms such as the Mounted Combat System (MCS), NLOS-Mortar, NLOS-Cannon and Armed Robotic Vehicle-Assault (ARV-A), as well as unattended munitions such as the NLOS-Launch System and the Intelligent Munitions System. Nonlethal effects will be delivered by various means, including Soldiers, LOS, BLOS and NLOS fires and unattended munition systems.

Total time from contact to fire mission generation, to target engagement and defeat will be drastically reduced, permitting FCS-equipped forces to cooperatively engage targets with tactical, operational and strategic level assets in seconds instead of minutes or hours. Every authorized platform and Soldier will have the capability to direct fires from any shooter available to the UA.

Each platform will also be able to take advantage of all available sensors to literally see around corners and achieve lethal and/or nonlethal F&E from BLOS. This will enhance the UA's capability to decisively attack high payoff and most dangerous targets from beyond the range of the enemy's weapon systems, significantly increasing force survivability. The BLOS platform operator, serving as the sensor, shooter and decider, will make the decision to fire based on the rules of engagement, collateral damage considerations and CID enabled by real-time video imagery of the enemy target and its immediate surroundings. Imagery will be provided to the platform operator through the network and battle command system from a sensor that has been placed in a position to serve as "virtual eyes-on-target." The MCS and the ARV-A will be able to deliver BLOS fires when teamed with appropriate sensor platforms.



The FCS network and battle command system will provide integrated sensor-to-shooter linkages to permit FCS-equipped forces to cooperatively engage targets in a matter of seconds instead of minutes. Here, a 120mm mortar round is fired from a Stryker MCV-8 mortar tube at Yakima Training Center, WA. (U.S. Army photo by Jason Kaye.)

Battle Damage Assessment (BDA)

The BDA process provides a timely and accurate estimate of damage resulting from the application of lethal and/or nonlethal military action against a threat force. The FCS battle command system's ability to dynamically synchronize ISR, fires and maneuver, and to dynamically conduct sensor taskings, will significantly enhance the BDA process, making it more efficient. By combining overlapping/layered sensor coverage with automated processing and reporting, BDA will be developed and distributed faster with more accurate results.

During a mission, emerging BDA results are compared with predetermined measures of effectiveness to determine if additional attacks are needed and, if so, the target is recommended for reattack and the reengagement process is initiated. When nonlethal effects are employed, BDA will consider a different set of factors — including changes in human behavior or shifts in social attitudes — in assessing mission success.

Other Supporting Capabilities and Services

Supplemental to the core capabilities described here, other NF&E supporting capabilities and services are being developed that include advanced survivability and reliability initiatives.

Additionally, the Performance-Based Logistics approach adopted by FCS will enable real-time system status data to be collected by the Platform Soldier-Mission Readiness System and then fed to the Logistics Decision Support System within the Forward Support Battalion. Status of critical provisions — such as ammunition, fuel and water — will be continuously monitored and used to support predictive analysis that will ensure resupply occurs well in advance of the need.

In summary, FCS-equipped UA forces will be able to deliver highly effective NF&E and:

- Develop battlefield situations out of contact.
- Engage the enemy in unexpected and highly effective ways.
- Maneuver with speed and agility to positions of advantage.
- Engage enemies beyond the range of their weapons systems.
- Destroy their forces with enhanced fires at the time and place of the commander's choosing.

Each individual capability described in this article provides a significant warfighting advantage. However, when integrated as a complete SoS, they provide an operational capability far greater than the sum of their parts. NF&E will be the embodiment and realization of the UA's quality of firsts paradigm: "See first, understand first, act first and finish decisively."

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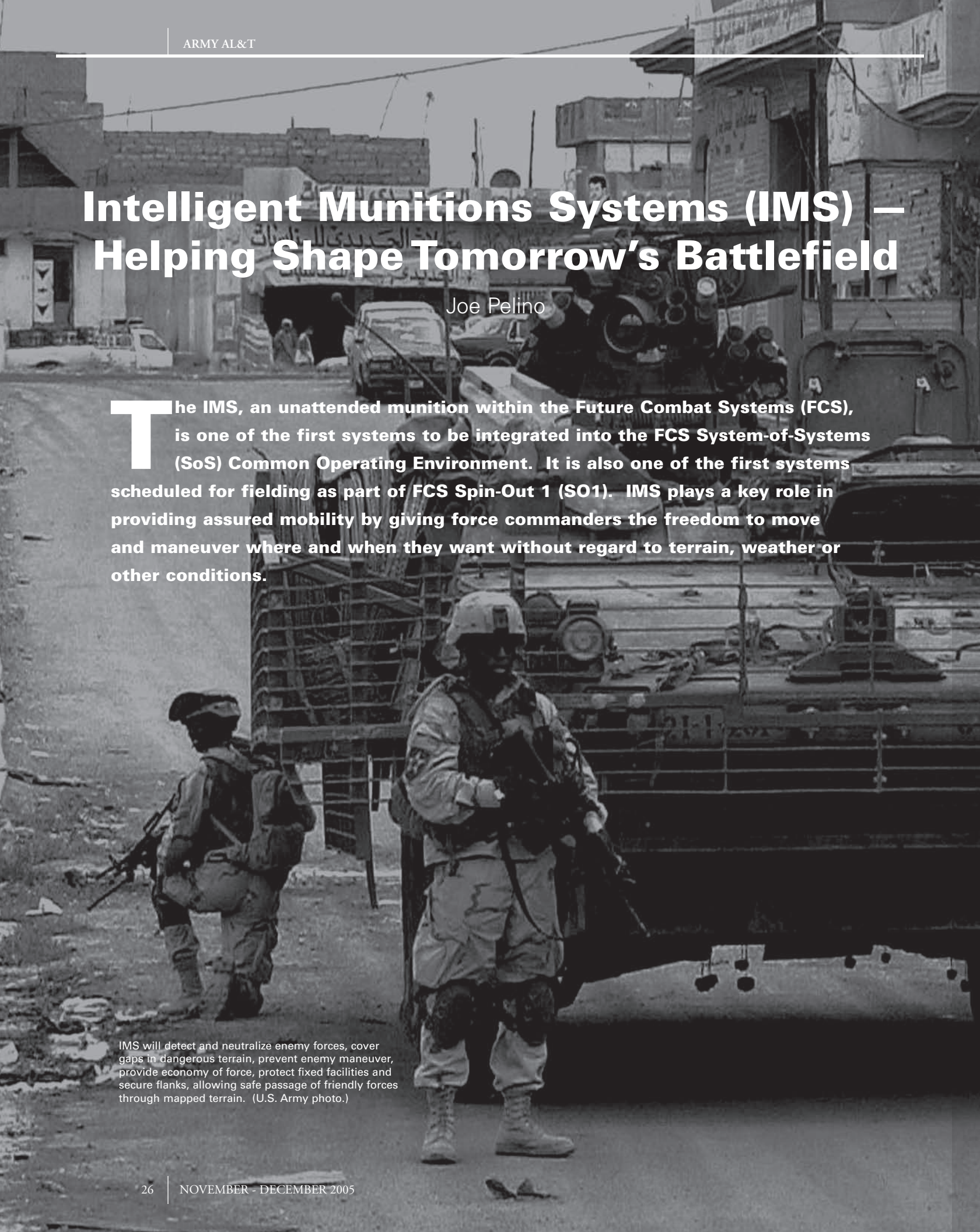
Intelligent Munitions Systems (IMS) – Helping Shape Tomorrow's Battlefield

Joe Pelino

The IMS, an unattended munition within the Future Combat Systems (FCS), is one of the first systems to be integrated into the FCS System-of-Systems (SoS) Common Operating Environment. It is also one of the first systems scheduled for fielding as part of FCS Spin-Out 1 (SO1). IMS plays a key role in providing assured mobility by giving force commanders the freedom to move and maneuver where and when they want without regard to terrain, weather or other conditions.



IMS will detect and neutralize enemy forces, cover gaps in dangerous terrain, prevent enemy maneuver, provide economy of force, protect fixed facilities and secure flanks, allowing safe passage of friendly forces through mapped terrain. (U.S. Army photo.)

IMS is a system of munitions, sensors and communication devices that can implement obstacle intent and attack targets, either autonomously or with man-in-the-loop control. When fielded, it will detect and neutralize enemy forces, cover gaps in dangerous terrain, prevent enemy maneuver, provide economy of force, protect fixed facilities and secure flanks, allow for movement of friendly forces and provide for immediate selective engagement. The fully networked munition allows for a scalable response and provides ultimate flexibility for hand or remote emplacement on the dynamic battlefield. Thanks to the IMS Integrated Product Team's (IPT's) resourcefulness, One Team members from the Army, the Lead Systems Integrator (LSI) and industry will provide advanced warfighting technology and overmatching capabilities that will be in our Soldiers' hands before the decade's end.

IMS is a system of munitions, sensors and communication devices that can implement obstacle intent and attack targets, either autonomously or with man-in-the-loop control.

IMS' ability to detect, classify, identify, track and engage selected targets fits into the FCS concept of providing our Soldiers with an SoS that uses advanced communications and technologies to integrate the Soldier with families of manned and unmanned platforms and sensors.

Evolutionary Acquisition

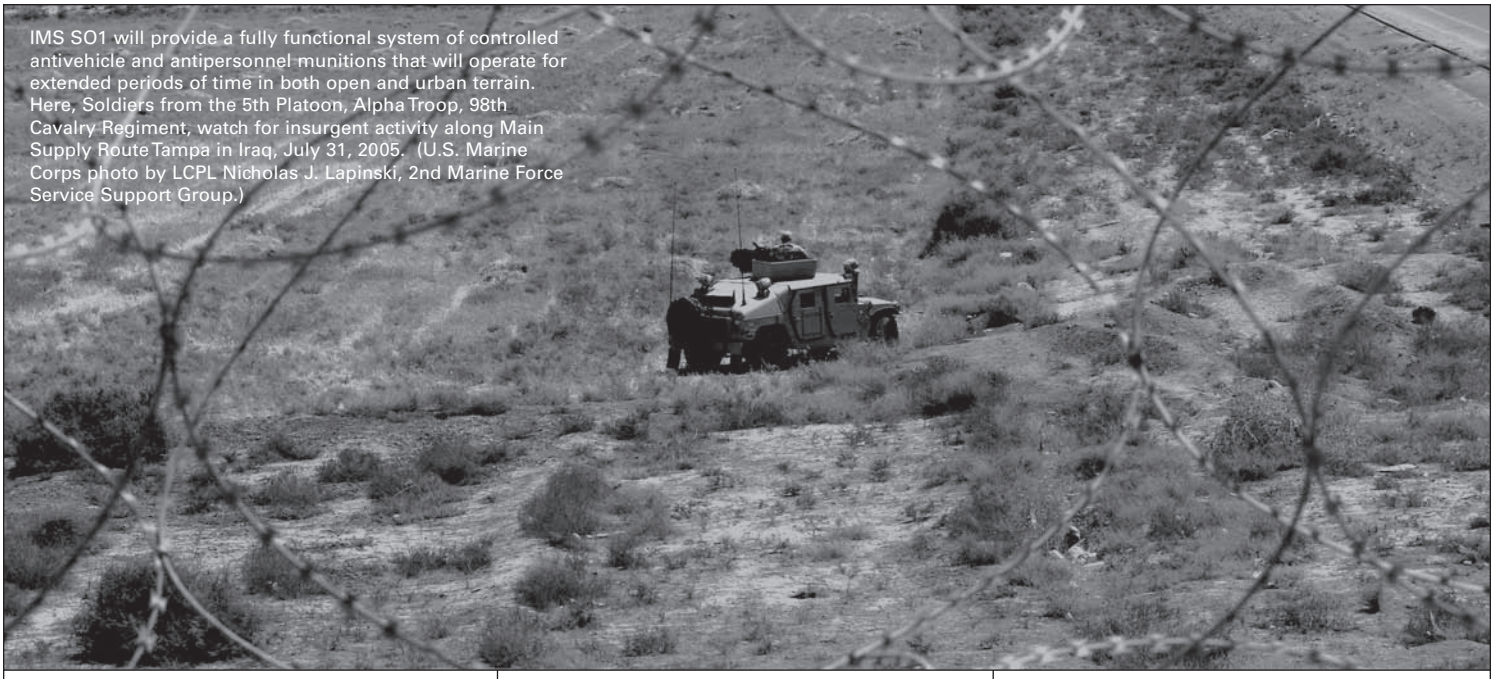
Originally, IMS was a "deferred system" to be fielded as part of the Full Operational Capability. Because the technology is now considered to be vital to the program, IMS is one of the "tip-of-the-spear" systems, and first increment fielding has been accelerated to 2009. To accommodate a more aggressive development schedule, the Project Manager Close Combat Systems (PM CCS) has adopted an evolutionary acquisition strategy that employs an incremental approach. As defined in the *Defense Acquisition Guidebook*, evolutionary acquisition is the preferred DOD strategy for rapid acquisition of mature technology for users. An evolutionary approach delivers capability in increments, recognizing in advance the need for future capability improvements. The objective is to balance needs and available capability with resources, and to put capability into the hands of users quickly. The strategy's success depends on consistent and continuous definition of requirements and the maturation of technologies that lead to disciplined development and production of systems that provide increasing capability toward a materiel concept.

To meet the threshold requirements stated in the FCS Operational Requirements Document (ORD), IMS development is currently divided into three increments, or SOs. SO1 will provide a fully functional system of controlled antivehicle munitions that provide the following capabilities:

- Operate man-in-the-loop or autonomously with Current Force battle command and the extension to the Current Force Network.
- Operate for extended time periods in both open and urban terrain.
- Include a module that allows mechanical dispensing of a 35-meter-diameter obstacle or precision hand emplacement of individual components.
- Able to detect and engage enemy vehicles and personnel.
- Allow friendly forces to traverse emplaced and digitally self-mapped fields (safe passage).
- Able to control Spider munitions (antipersonnel, nonlethal and initiate demolitions).

The two follow-on increments support SOs 3 and 4 and the full unit of action (UA). These increments will add capabilities that include scalable effects, the ability to dispense IMS components from manned and unmanned ground vehicles, remote delivery via non-line-of-sight means and other enhancements that are enabled by developing the FCS battle command

In the near future, Current Force unmanned aerial vehicles and other sensors will be augmented by IMS sensors and communication devices to enhance combatant commanders' SA and provide a common operating picture. Here, 3rd Infantry Division Soldiers prepare a Raven for a surveillance flight near Tikrit, Iraq. (U.S. Army photo by PFC Matthew Acosta.)



IMS SO1 will provide a fully functional system of controlled antivehicle and antipersonnel munitions that will operate for extended periods of time in both open and urban terrain. Here, Soldiers from the 5th Platoon, Alpha Troop, 98th Cavalry Regiment, watch for insurgent activity along Main Supply Route Tampa in Iraq, July 31, 2005. (U.S. Marine Corps photo by LCPL Nicholas J. Lapinski, 2nd Marine Force Service Support Group.)

network. As a network node, IMS will seamlessly feed situational awareness (SA) information to the common operating picture and will enable networked fires and effects.

National Landmine Policy (NLP)

In discussing why IMS was accelerated to become a part of SO1, PM CCS COL John L. Koster remarked, "I think what pushed us to the front of the SO line was the National Landmine Policy. Every step of the way, the IPT synchronized its efforts to ensure that the IMS meets both SO1 and the policy's requirements simultaneously."

The NLP Koster refers to was announced in February 2004, and it requires the United States to end the use of non-self-destructing landmines by Dec. 31, 2010. PM CCS — the Nation's "principal" in landmine technology and acquisition — leads this mission.

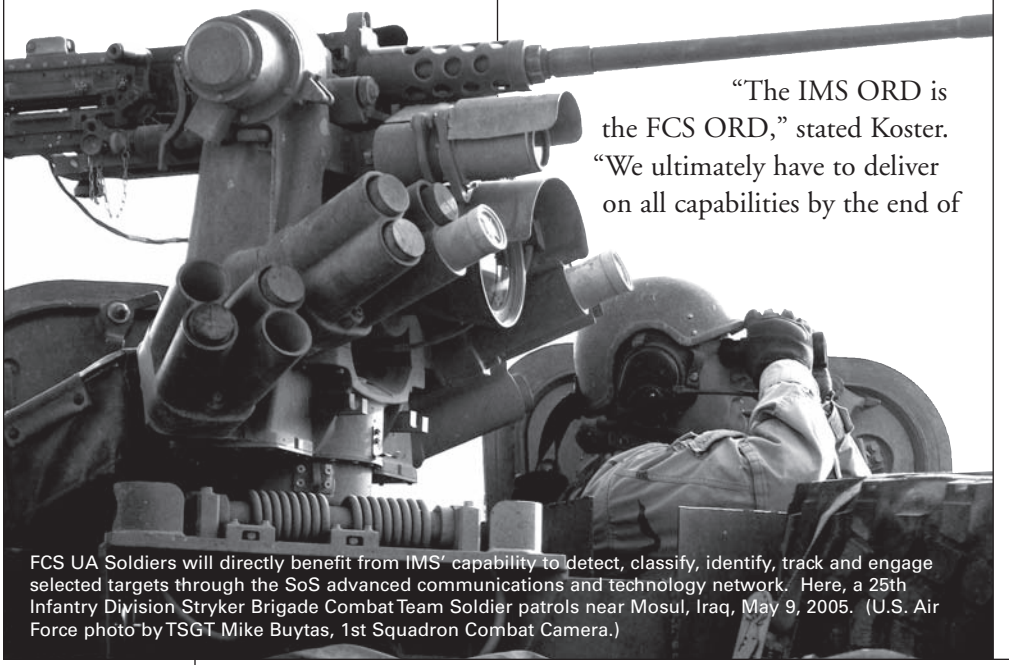
The existing incremental development approach worked in their favor to facilitate the tight NLP deadline.

"The IMS ORD is the FCS ORD," stated Koster. "We ultimately have to deliver on all capabilities by the end of the process. The incremental approach allows us to set aside explicit performance requirements to deliver a working system that replaces persistent, non-self-destructing landmines and meets policy deadlines."

By synchronizing the system to the capability that supports the NLP, the IMS team eliminated a design iteration in the development process, allowing the system to be among the first FCS subsystems to be fielded in SO1.

Aggressive Acquisition Approach

The tight timeline to meet the NLP directive made it clear that ordinary acquisition methods were too limiting. In response, PM CCS adopted an aggressive acquisition attitude and chartered an IPT for this acquisition. Membership selection — which was driven by program objectives, user needs, product quality and fast, low-cost acquisition — was based on a first-time DOD-wide review of facilities, warfighters, peacekeepers, ultra-modern high-tech laboratories (both federal and private), capable contractors, government and business executives and user experts in product evaluation and use.



FCS UA Soldiers will directly benefit from IMS' capability to detect, classify, identify, track and engage selected targets through the SoS advanced communications and technology network. Here, a 25th Infantry Division Stryker Brigade Combat Team Soldier patrols near Mosul, Iraq, May 9, 2005. (U.S. Air Force photo by TSGT Mike Buytas, 1st Squadron Combat Camera.)

The nonparochial member selection concept enriched the acquisition process because members had limited background in traditional military or functional methods. This was particularly evident in the ability to reduce the Concept and Technology Development (CTD) acquisition life-cycle phase by 6 months.

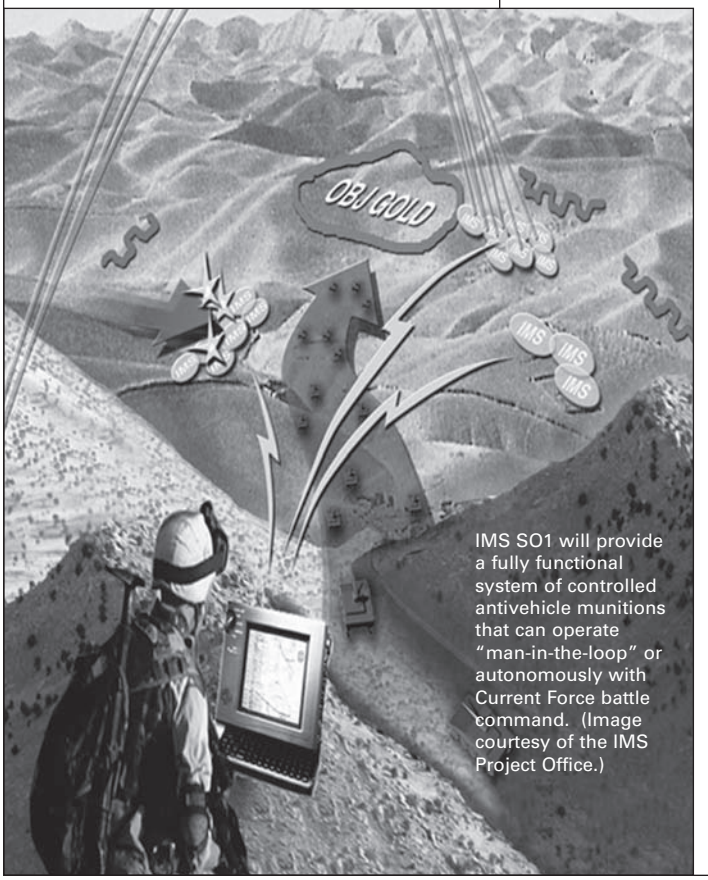
The IMS team also took cues from legacy systems, leveraging and incorporating their technology to help attain FCS ORD and NLP compliance. For example, the Spider, which was originally developed to provide alternatives to antipersonnel landmines in Korea, will incorporate both lethal and nonlethal systems.

Modeling and Simulation (M&S)

At the same time the Army determined IMS would be the replacement capability for the persistent antitank mines, it was also slated for FCS SO1. Now, more than ever, it was imperative that the IMS team maintain, if not exceed, its aggressive schedule. By leveraging the capabilities of M&S and the Comprehensive Munition and Sensor Simulator (CMS2), the IMS team found greater opportunities to expedite the process.

CMS2 is a munition and sensor simulator that models terrain, weather and environmental effects. Integrated into an Over Target Baseline simulation, CMS2 sensors detect, track and provide SA. Current sensors include magnetic, seismic and acoustic unmanned ground sensors, as well as both snapshot and full-motion infrared cameras.

As of July 2005, two companies have been awarded contracts to develop and demonstrate IMS design concepts: General Dynamics Advanced Information Systems and Textron Defense Systems. Rather than contractors developing their own run-time simulation baseline models for testing, the IMS team enlisted the Night Vision Labs from the U.S. Army Night Vision and Electronic Sensors Directorate, Fort Belvoir, VA, to create a single baseline model that housed both contractors' concepts without giving away competition-sensitive data to either company.



IMS SO1 will provide a fully functional system of controlled antivehicle munitions that can operate "man-in-the-loop" or autonomously with Current Force battle command. (Image courtesy of the IMS Project Office.)

"These generic models can be used in UA Maneuver Battle Lab locations and by the LSI to enhance procedure development," explained Doug Paul, IMS M&S IPT member. "Only this model's black boxes contain contractor-specific algorithms."

Already fully embedded with both the U.S. Army Training and Doctrine Command and the LSI, Night Vision Labs will assist the winning contractor with seamlessly integrating the contractor's design into Battle Lab and LSI environments.

Allocating this responsibility to Night Vision Labs team members freed up time for the contractors to create engineering models while concurrently using the generic models to develop and enhance procedures. This also contributed to reducing the CTD phase and allowed the program to get a head start on the next phase because both competing contractors are already modeled.

The life cycle's technical development phase culminated with a 4-week prototype assessment test. Both contractors' concepts demonstrated important capabilities such as SA, command and control and IMS warhead effectiveness. By FY06's second quarter, the IMS team will have down-selected to one supplier and then will move forward to achieving Initial Operational Capability by FY09.

To date, the IMS team has met many challenges in bringing Future Force capabilities to the Current Force on time and within budget. According to Koster, a cohesive IPT that includes Army, LSI, and industry members and an incremental approach toward meeting requirements by extensively using M&S have been the overriding reasons for the successes achieved up to this point.

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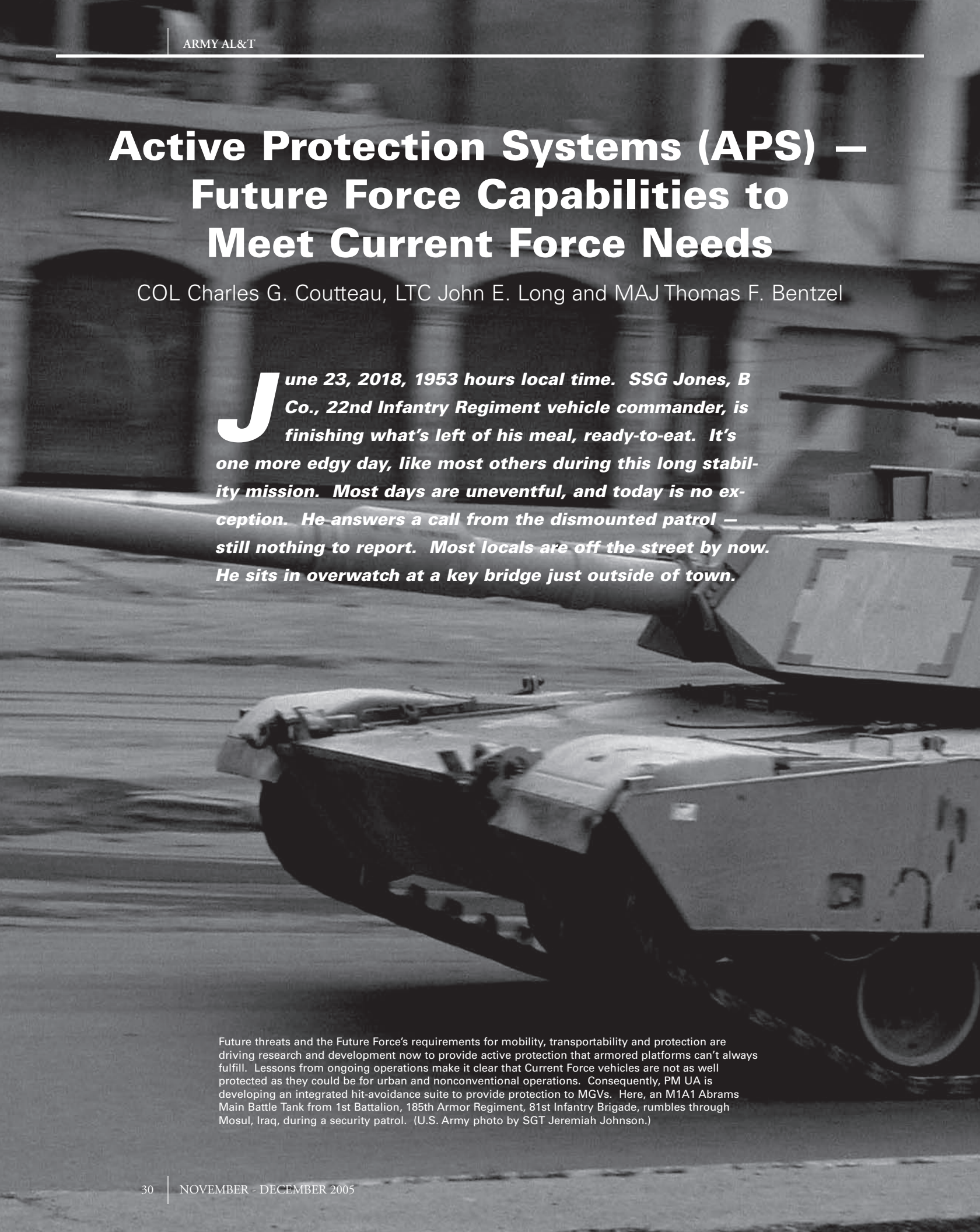
Active Protection Systems (APS) — Future Force Capabilities to Meet Current Force Needs

COL Charles G. Coutteau, LTC John E. Long and MAJ Thomas F. Bentzel

June 23, 2018, 1953 hours local time. SSG Jones, B Co., 22nd Infantry Regiment vehicle commander, is finishing what's left of his meal, ready-to-eat. It's one more edgy day, like most others during this long stability mission. Most days are uneventful, and today is no exception. He answers a call from the dismounted patrol — still nothing to report. Most locals are off the street by now. He sits in overwatch at a key bridge just outside of town.



Future threats and the Future Force's requirements for mobility, transportability and protection are driving research and development now to provide active protection that armored platforms can't always fulfill. Lessons from ongoing operations make it clear that Current Force vehicles are not as well protected as they could be for urban and nonconventional operations. Consequently, PM UA is developing an integrated hit-avoidance suite to provide protection to MGVs. Here, an M1A1 Abrams Main Battle Tank from 1st Battalion, 185th Armor Regiment, 81st Infantry Brigade, rumbles through Mosul, Iraq, during a security patrol. (U.S. Army photo by SGT Jeremiah Johnson.)

Without warning, the silence is shattered by a thunderous explosion. His display flashes and the vehicle's APS has automatically activated, firing one shot to intercept the rocket-propelled grenade (RPG) fired at his vehicle. His radio is now alive with rapid chatter from his wingman and the squad on the ground. He instinctively presses the "slew to cue" command and the vehicle's sight and main weapon are now siting the location from which the attack occurred.

He fires up the vehicle, still not fully aware of what has happened outside. He sees several individuals running over a hill, away from his vehicle, and they disappear around a pile of rubble. A quick tap of the laser range finder and that location has now been sent to the patrol. He and his vehicle are ready to continue the mission, even though he has just been fired upon by a team of insurgents. Damage to the vehicle: none. Crew casualties: none. The APS has done its job.

Responding to Soldier Needs

Future threats and the Future Force's combined requirements for mobility, transportability and protection have made it clear that armor alone can no

Current Force APS capability needs are derived from the survivability requirements of combat vehicle systems such as the Stryker vehicle depicted here. In addition to slat armor, PM SBCT is sponsoring an integration experiment that might lead to APS solutions for these Soldiers from the 2nd Squadron, 14th Cavalry Regiment, patrolling the Iraq-Syria border near Rawah, Iraq. (U.S. Army photo by SSG Kyle Davis, 55th Signal Co. (Combat Camera).)

longer fulfill our Army's platform protection needs. At the same time, lessons from ongoing operations make it clear that Current Force vehicles are not as well protected as they could be for urban and nonconventional operations. Consequently, Program Manager Unit of Action (PM UA) is developing an integrated hit-avoidance suite to provide protection to Manned Ground Vehicles (MGVs). This hit-avoidance suite will work in concert with other networked survivability measures to protect the Future Combat Systems (FCS) UA during full-spectrum operations. The APS comprises systems that sense incoming threats and employ countermeasures to physically intercept and defeat them.

As of 2004, PM UA judged APS technology to be capable of defeating certain short-range threats such as RPGs with minimal added development. Meanwhile, insurgents armed with RPGs presented a known threat to Current Forces operating in Southwest and Central Asia. Therefore, at the end of FY04, PM UA and Program Executive Officer Ground Combat Systems (GCS) initiated a coordinated effort to accelerate and provide the Stryker platform with a short-range Army APS solution — a subset of the FCS APS and the FCS hit-avoidance suite — based on capability needs identified in both the FCS Operational Requirements Document (ORD) and the Stryker ORD.

This coordinated development effort is being led by PM UA, with PM Stryker Brigade Combat Team (SBCT) in support. It is based on a unified APS acquisition strategy for both Current and Future Forces, tailored to address current short-range threats while focusing on the full-spectrum future threat environment. This article describes that strategy to synchronize FCS, Stryker and other Army programs that require active protection.

> APS is a hit-avoidance system providing defense against threat munitions by intercepting the threat munitions prior to them making physical contact with the platform.

Capability Needs

The driving force behind PM UA's APS development effort is the set of capability needs identified for the FCS-equipped Future Force. Simultaneously, Current Force APS capability needs derive from the survivability requirements of current Army combat vehicle systems such as the Stryker. While the PMs for both FCS and Stryker have identified active protection as the technical solution that best meets their requirements, no APS solution is likely to be optimally suited for all platforms. Consequently, PM UA has prioritized FCS requirements over Stryker requirements. While this approach may not provide the optimal APS solution to Stryker, PM UA is committed that the solution provided will satisfy Stryker's essential requirements, with minimal sacrifice in cost, performance or technical characteristics.

To jumpstart doctrine development for the short-range system, PM SBCT is sponsoring an integration experiment that began in 2005, even before the MGV's system maturation work begins. This concept demonstration, integrating and testing Redstone Arsenal's Close-In APS prototype system, will generate early lessons learned and user feedback that will be used to adjust the concept architecture, as well as provide a basis for initiating training support development.

Stryker is not the only Current Force platform to which APS could be applied. Other Army programs have survivability requirements that could also be met by an APS solution, and other programs have expressed interest in the APS acquisition that FCS and Stryker are pursuing. However, at this time, the FCS ORD provides the primary documentation for the Army's comprehensive future APS requirements, while survivability requirements in the Stryker ORD provide the basis for fielding a short-range incremental capability to the Current Force.

System Description

APS is a hit-avoidance system providing defense against threat munitions by intercepting the threat munitions prior to them making physical contact with the platform. Conceptually, an APS can improve survivability by defeating incoming anti-tank guided missiles, RPGs, tank-fired high-explosive anti-tank missiles, tank-fired kinetic energy rounds, indirect fire — including bomblets and mortars — and guided top-attack threats. APS does not totally supplant armor. Vehicle armor must still provide protection against threats that cannot be addressed by the APS. These threats include small arms, mines and explosive fragments, including the residual shrapnel effects resulting from an active protection engagement.

> APS's first increment consists of a short-range hard-kill APS that can be integrated onto Current Force GCS to defeat current short-range, man-portable threats.

A generic APS comprises a sensor subsystem, a countermeasure subsystem and data processing. A typical sensor subsystem includes a threat warner, or cueing sensor, and a tracking sensor. The threat warner identifies a threat and then, through data processing, hands it over to the tracking sensor. The tracking sensor then determines the incoming threat's size, shape and vector. Data processing uses this tracking data to determine the appropriate countermeasure, calculate the firing solution and deploy the countermeasure as depicted by Figure 1. The countermeasure physically intercepts the incoming threat and typically consists of an interceptor launcher and interceptor munition.

The objective full-spectrum FCS APS will employ a full suite of hit-avoidance sensors and countermeasures as depicted in Figure 2. The accelerated short-range APS will employ a more limited set, focused on short-range,

Slat armor is defeating the current insurgent threat from shoulder-fired missiles and RPGs. However, as new weapons threats emerge, Army weapons platforms such as the Stryker will have to adapt to defeat diverse threats posed by urban and nonconventional warfare. APS' hit-avoidance system will deter threat munitions by intercepting them before they can hit the platform. Here, Soldiers from 4th Squadron, 14th Cavalry Regiment, patrol the border in their Stryker near Rawah, Iraq, Sept. 8, 2005. (U.S. Army photo by SSG Kyle Davis, 55th Signal Co. (Combat Camera).)

Figure 1. An APS-deployed countermeasure intercepts an incoming missile.

current threats. A typical short-range APS, with respect to the system's primary elements, is defined as:

- Threat warners.
- Tracking sensors, such as tracking radar.
- Data processors.
- Interceptor launchers.
- Interceptor munitions.
- Countermeasure warheads.

Acquisition Approach

The FCS program has adopted an evolutionary acquisition strategy consisting of technology insertions, and the APS strategy is consistent with this approach. APS's first increment consists of a short-range hard-kill APS that can be integrated onto Current Force GCS to defeat current short-range, man-portable threats. The second increment is a full-spectrum APS that will be an integral element of the FCS Increment 1 MGV hit-avoidance suite, designed to defeat a variety of both short- and long-range threats. Therefore, the short-range APS is a subset of the full-spectrum APS, with interim components added as necessary to make it operate independently on the Stryker platform. As APS technologies mature, they will be incorporated into the full-spectrum design to make the objective APS more capable and suitable.

The two acquisition strategy objectives for the APS provided to Stryker are:

- Seize an opportunity to transfer useful FCS capabilities to the Current Force while reducing risk with regard to integrating and proving out new technologies.
- Achieve commonality among the Army's APS solutions for the Current Force's combat vehicles and the Future Force's MGVs.

The first objective centers on fielding the APS capabilities prior to the first MGV increment, proving their value to the Army's warfighters, while simultaneously identifying the interrelationships between APS and our warfighting tactics, techniques and procedures. The plan for the APS spin-out to Stryker is to award a system maturation contract in early 2006 and enter initial production in 2010 followed by full production in 2011.

The second objective seeks to minimize wasteful duplication in system development, production, training and support costs. This objective establishes the full-spectrum APS as an upgrade to the short-range system, rather than as a replacement. Conceptually, the full-spectrum effort subsumes the short-range effort, rolling them both together into the threshold FCS APS solution.

Both APS program aspects — short-range and full-spectrum — are aggressive in terms of both schedule and technology. The accelerated short-range APS timeline is driven by a Stryker program requirement to field add-on armor to all Stryker units in the field. The full-spectrum APS schedule parallels the FCS MGV Increment 1 project schedule, which forecasts an initial operational capability consisting of fielding to elements of an FCS UA by the end of 2014.

The plan for the APS spin-out to Stryker is to award a system maturation contract in early 2006 and enter initial production in 2010 followed by full production in 2011.

Program Management

APS is managed through the FCS Program's Integrated Product and Process Development (IPPD)-based distributed management structure, with a government management structure overseeing the efforts of a defense industry Lead Systems Integrator (LSI). Structurally, APS is a responsibility of the Hit-Avoidance Integrated Product

Team (IPT), reporting to the MGV IPT within PM UA and the LSI. The Hit-Avoidance IPT will directly coordinate with other FCS IPTs in pursuit of a fully integrated hit-avoidance suite.

The Hit-Avoidance IPT — chaired by PM UA, PM SBCT and FCS LSI representatives — provides functional leadership for APS acquisition. PM UA and the LSI are permanent team leaders, while PM SBCT's leadership is limited to issues dealing with the short-range APS, and will revert to simple membership once Stryker's short-range APS is fielded. In addition to these three organizations, any other vested organizations are welcome to participate as team members using the IPPD model.

APS combines the advantages of armor and mobility by protecting fighting vehicles from enemy fire without overburdening them. FCS' APS initiative exploits emerging and mature technologies, incrementally delivering APS solutions to suit both Current Force operational requirements and Future Force capability needs.

Test and Evaluation (T&E)

T&E is a key component in controlling APS acquisition. Testing will begin early in the short-range APS maturation and continue through full-spectrum system development and demonstration, eventually transitioning to follow-on testing to validate the performance of future technology insertions.

The short-range APS will start testing very early, almost immediately after an award is made. Post-award testing will be conducted to gauge the chosen contractor's precise technological readiness status. This information will enable PM UA to accurately validate the adequacy of the initial cost and schedule baselines.

Following the accelerated testing to qualify APS on Stryker, the full-spectrum APS acquisition effort will follow a test program that is closely synchronized with the FCS MGV development program. A sequence of individual systems and component testing will be followed by integrated testing on the MGV platform.

U.S. forces must be able to deploy quickly and survive once they arrive on a rapidly changing, continuously fluid battlefield. APS combines the advantages of armor and mobility by protecting fighting vehicles from enemy fire without overburdening them. FCS' APS initiative exploits emerging and mature technologies, incrementally delivering APS solutions to suit both Current Force operational requirements and Future Force capability needs. By delivering key FCS technologies, including active protection to the Current Force, the Army fills a critical operational gap now, and supports FCS program maturation through the continuous improvement of its system designs based on early testing and operational use.

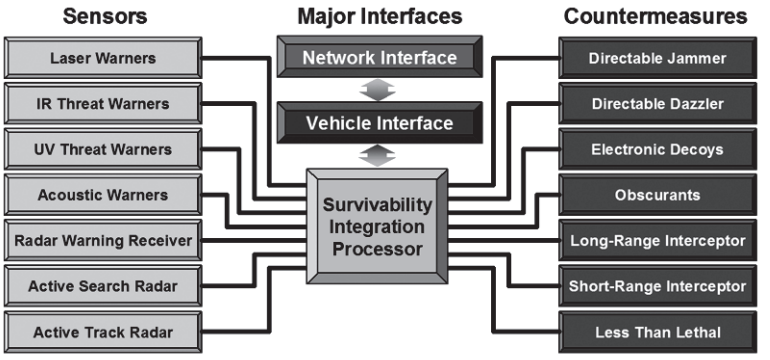


Figure 2. A notional hit-avoidance architecture with full-spectrum APS capability.

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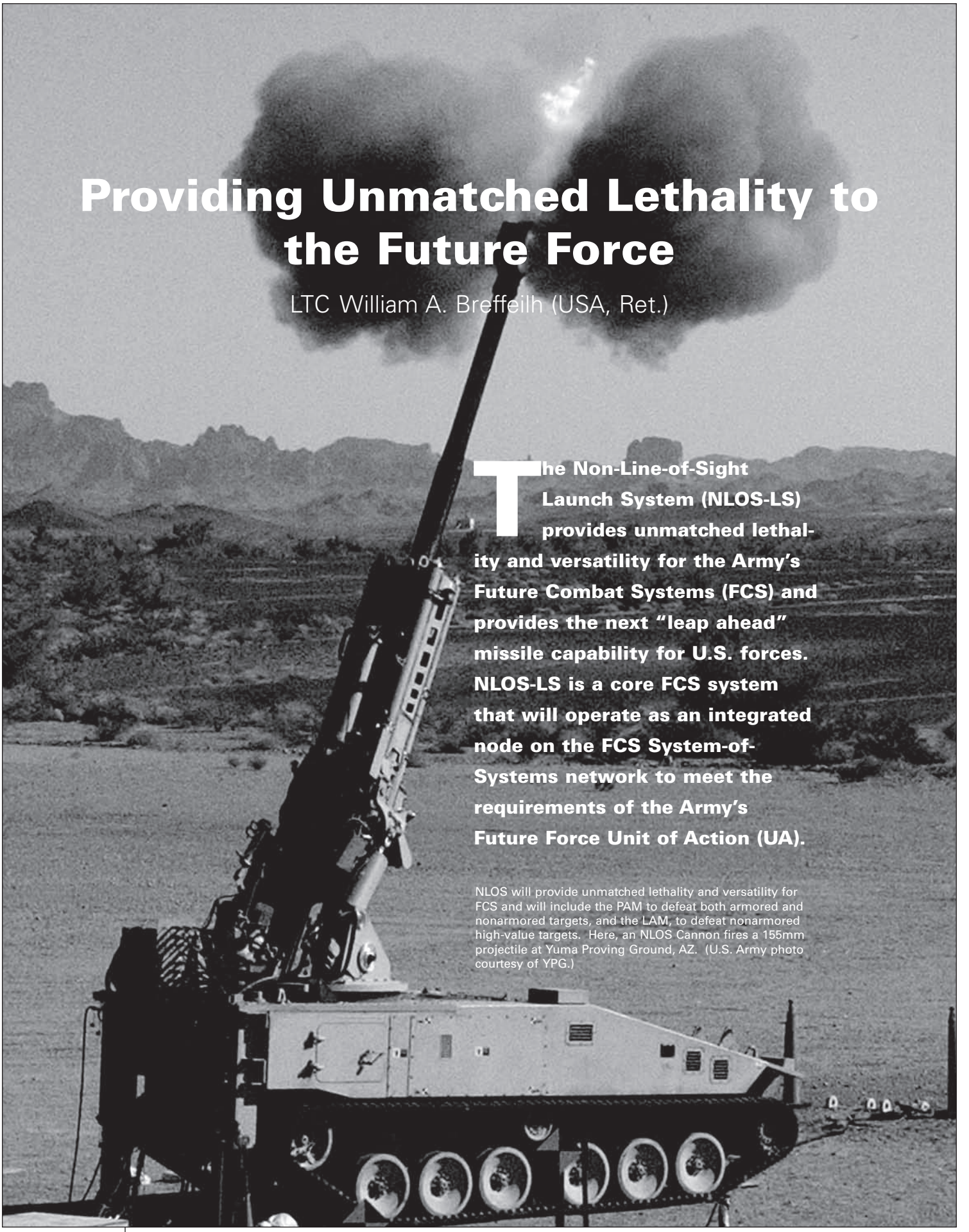
Providing Unmatched Lethality to the Future Force

LTC William A. Breffeilh (USA, Ret.)



The Non-Line-of-Sight Launch System (NLOS-LS) provides unmatched lethality and versatility for the Army's Future Combat Systems (FCS) and provides the next "leap ahead" missile capability for U.S. forces. NLOS-LS is a core FCS system that will operate as an integrated node on the FCS System-of-Systems network to meet the requirements of the Army's Future Force Unit of Action (UA).

NLOS will provide unmatched lethality and versatility for FCS and will include the PAM to defeat both armored and nonarmored targets, and the LAM, to defeat nonarmored high-value targets. Here, an NLOS Cannon fires a 155mm projectile at Yuma Proving Ground, AZ. (U.S. Army photo courtesy of YPG.)

The NLOS-LS is a self-contained system that provides Modular Brigade Combat Teams (MBCTs) and UA commanders with their own precision or loitering attack missile capability. It consists of a family of missiles and a highly deployable (strategic and tactical), platform-independent Container Launch Unit (CLU) with self-contained tactical fire control electronics and software for remote, unmanned operations.

The NLOS-LS is a self-contained system that provides MBCTs and UA commanders with their own precision or loitering attack missile capability.

The NLOS-LS family of missiles currently includes the Precision Attack Missile (PAM) and the Loitering Attack Missile (LAM). The PAM focuses on defeating a variety of both armored and nonarmored targets, including small boats. The LAM focuses on defeating nonarmored fleeting, high-value targets, while also supporting networked fires by providing both targeting information and battle damage assessment (BDA) to enhance the FCS network's Common Operating Picture (COP). Future missiles may include air defense and nonlethal variants.

The NLOS-LS CLU holds All Up Rounds (AURs) — consisting of a missile plus a transportation/firing missile container — in a four-by-four matrix, with the sixteenth socket holding the computer and communications system (CCS). The CCS contains all fire mission processing and communication components, including antenna, position locating, weapon interface, power supply and anti-tamper capability.

The CLU's primary role is to act as the transportation and firing platform for the AURs. The AURs can be fired while on a ground/sea transport vehicle or from a ground emplacement, using command and control information received via a wireless link using a Joint Tactical Radio System Cluster V radio loaded with the Soldier Radio Waveform. Operating as a node on the FCS network, the CLU can feed target data to the FCS COP, along with location and quantity of AURs available for use. The NLOS-LS has the built-in flexibility to respond to calls for fire from different operational echelons or from sensors and forward observers that are capable of interacting directly with the system via the FCS or Littoral Combat Ship (LCS) network. The NLOS-LS family of missiles will have the unique ability to accept in-flight target updates, allowing the missiles to be redirected while in flight from the FCS COP, to a higher-profile target of opportunity.

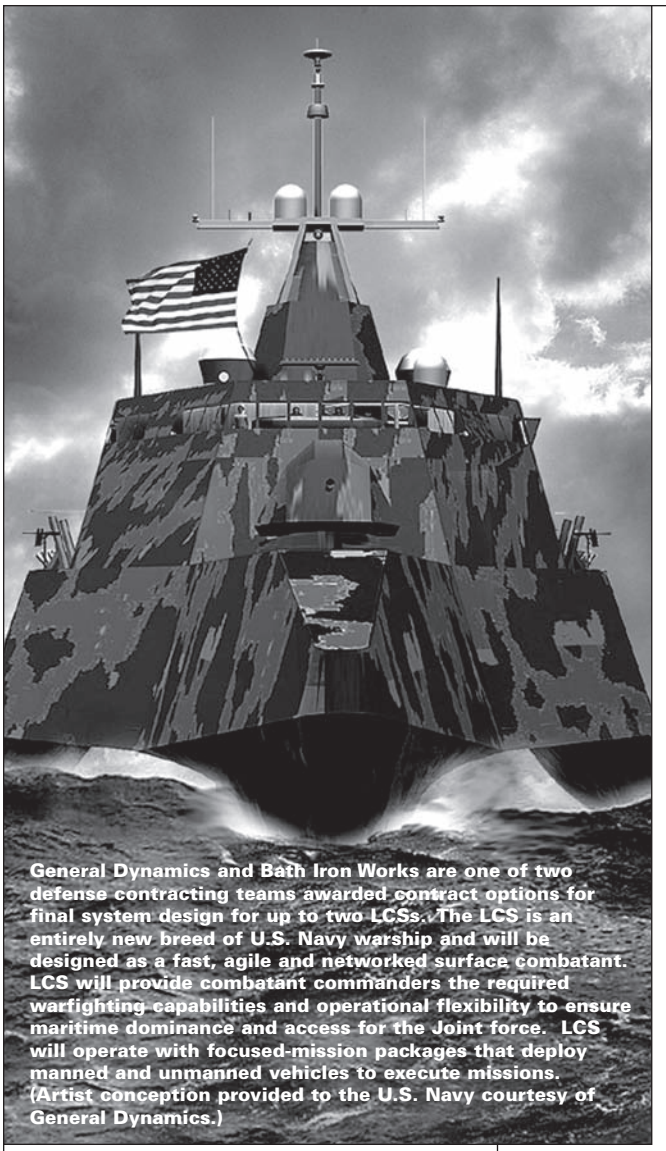
The CLU is self-sufficient and requires no operator or logistics support for extended periods of time. While on a transportation platform, it requires no vehicular interface whatsoever, with the exception of cargo tie-down provisions. However, the CLU will be capable of receiving external supplementary power from its host vehicle via a standard NATO adapter.

Executing to Schedule

In July 2004, the Army revised the FCS program acquisition strategy. Army Chief of Staff Peter J. Schoomaker directed that selected key FCS capabilities be provided to operational forces faster, while maintaining the momentum to develop and field an FCS-equipped UA. The NLOS-LS is one of the crucial systems identified for inclusion in the FCS Spin-Out 1 (SO1) to the Current Force.

The PAM and CLU are on schedule to accomplish this goal and the CLU is slated to be provided to the Experimental Brigade Combat Team (EBCT) for evaluation prior to a production decision. Because the NLOS-LS is an early component to demonstrate the enhanced capabilities that FCS networked fires will provide, EBCT Soldiers can

The Guided Multiple Launch Rocket System (GMLRS) was first test-fired outside the United States in summer 2005 near Tikrit, Iraq. The GMLRS was recently deployed in actual combat at Tal Afar, Iraq, against insurgent forces. Breakthroughs in SO technology are helping to rapidly integrate AFATDS communication architecture to support Current Force interoperability requirements for targeting and BDA. (U.S. Army photo.)



General Dynamics and Bath Iron Works are one of two defense contracting teams awarded contract options for final system design for up to two LCSs. The LCS is an entirely new breed of U.S. Navy warship and will be designed as a fast, agile and networked surface combatant. LCS will provide combatant commanders the required warfighting capabilities and operational flexibility to ensure maritime dominance and access for the Joint force. LCS will operate with focused-mission packages that deploy manned and unmanned vehicles to execute missions. (Artist conception provided to the U.S. Navy courtesy of General Dynamics.)

assist the NLOS-LS Project Office during its development. This Soldier interaction will provide critical user input in the development of tactics, techniques and procedures and enhance future development efforts for NLOS-LS.

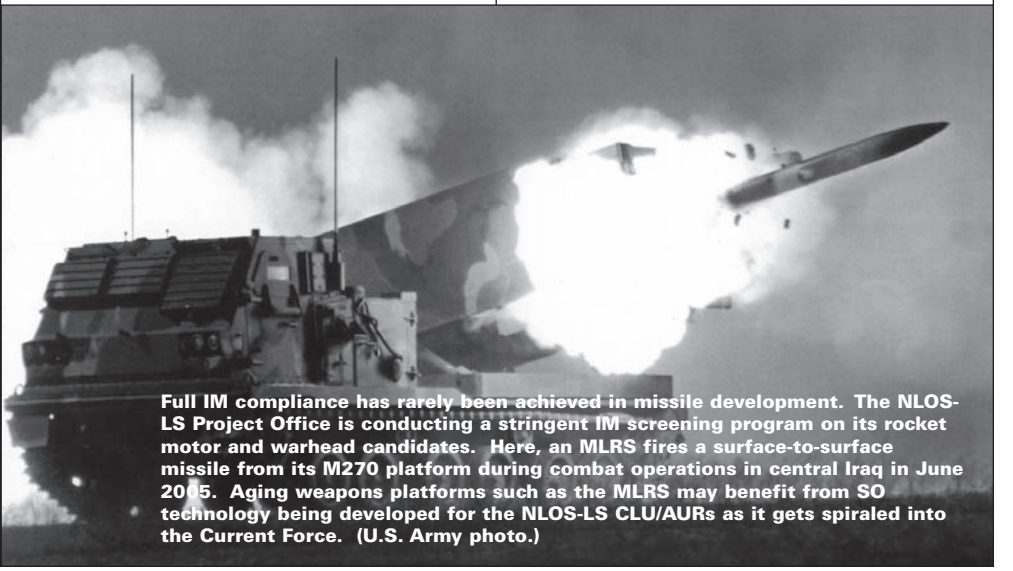
The NLOS-LS program has completed the PAM System Functional Review (SFR) and was scheduled to conduct Preliminary Design Review (PDR) in September 2005. The CLU SFR was held in July 2005 and the PDR is scheduled for January 2006. The program is currently working with Project Manager (PM) Intelligence and Effects to integrate Advanced Field Artillery Tactical Data System (AFATDS) into its communications architecture to support the SO1 Current Force interoperability requirements. The concept for AFATDS interoperability with NLOS-LS was demonstrated with message traffic originating from a forward observer through AFATDS to the NLOS-LS CLU. This successful demonstration was supported by the members of PM UA, the FCS Lead Systems Integrator (LSI) and Program Executive Office Command, Control and Communications Tactical (PEO C3T).

The NLOS-LS Project Office has also demonstrated deployability from a C-130 Hercules aircraft and the ability to employ the system using the Family of Medium Tactical Vehicles (FMTV) for both ground and vehicle operations.

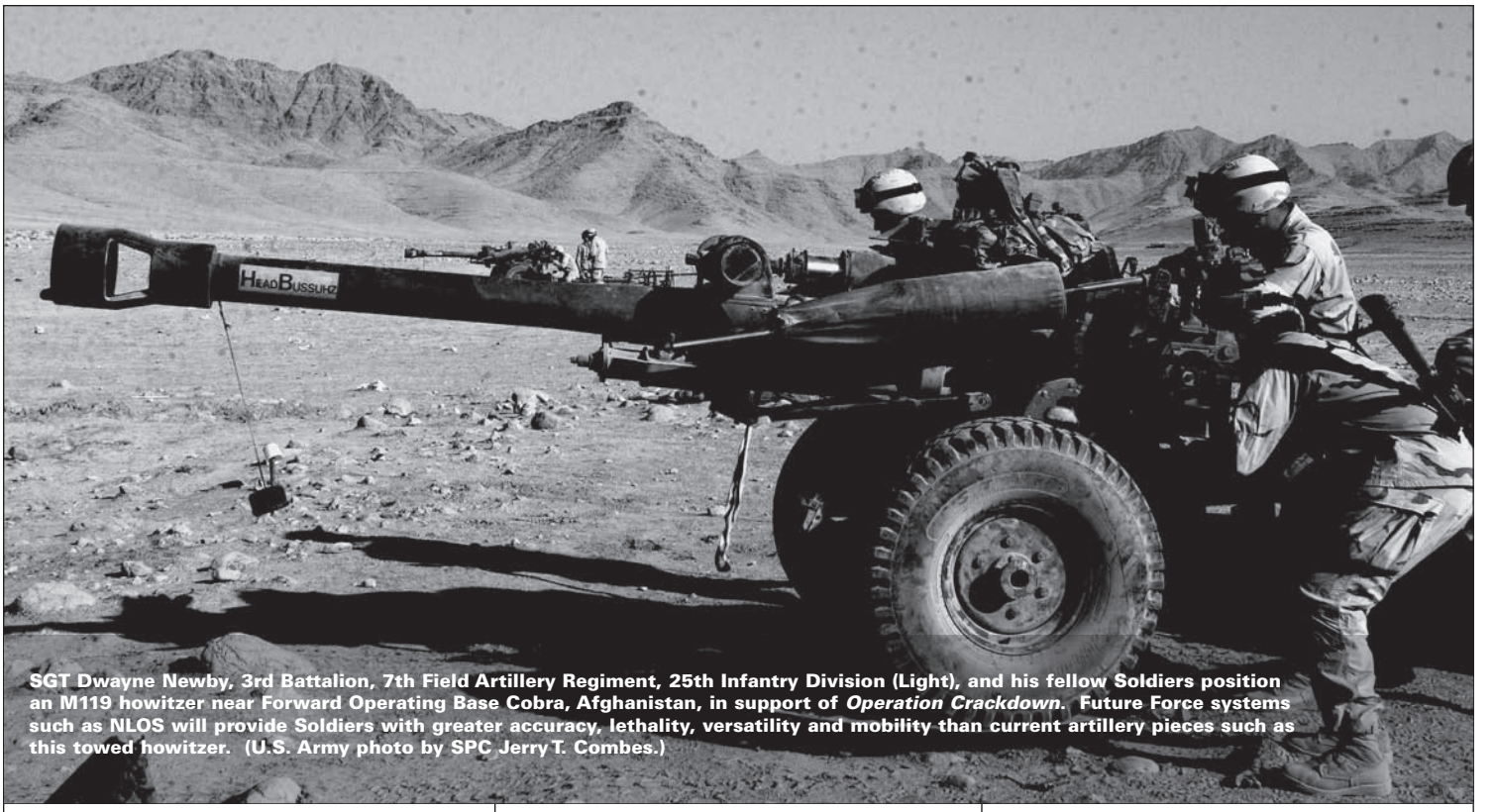
Meeting the Challenge

In FY05, the NLOS-LS Project Office — in conjunction with its LSI and the Navy — initiated several test activities to obtain additional information on certain key system performance specifications. The areas of concentration were network communications, Insensitive Munition (IM) compliance, warhead lethality and seeker performance. To obtain critical warhead data, the NLOS-LS Project Office tested multiple configurations of warheads to evaluate their effectiveness against the various joint target sets and select a design that meets the joint lethality requirements. These static tests evaluated both warhead penetration and fragmentation effects.

Full IM compliance has rarely been achieved in missile development. The two primary IM consideration items are rocket motors and warheads. The NLOS-LS Project Office is conducting a stringent IM screening program on its rocket motor and warhead candidates. The rocket motor alternatives were subjected to several IM screening tests for compliance to Public Law on IM. The rocket motor solution selected will be based on the ability to meet the maximum range requirement and IM compliance. These initial IM screening tests show great promise in achieving a fully IM-compliant rocket motor. Several warhead candidates are also under IM evaluation. Four



Full IM compliance has rarely been achieved in missile development. The NLOS-LS Project Office is conducting a stringent IM screening program on its rocket motor and warhead candidates. Here, an MLRS fires a surface-to-surface missile from its M270 platform during combat operations in central Iraq in June 2005. Aging weapons platforms such as the MLRS may benefit from SO technology being developed for the NLOS-LS CLU/AURs as it gets spiraled into the Current Force. (U.S. Army photo.)



SGT Dwayne Newby, 3rd Battalion, 7th Field Artillery Regiment, 25th Infantry Division (Light), and his fellow Soldiers position an M119 howitzer near Forward Operating Base Cobra, Afghanistan, in support of *Operation Crackdown*. Future Force systems such as NLOS will provide Soldiers with greater accuracy, lethality, versatility and mobility than current artillery pieces such as this towed howitzer. (U.S. Army photo by SPC Jerry T. Combes.)

warheads have undergone IM screening test and additional testing was scheduled in late 2005. Once all the screening tests are completed, a warhead will be selected and its final IM compliance will be determined.

To obtain additional seeker performance data, two captive flight tests were conducted against multiple naval targets with the Naval Surface Warfare Center (NSWC), Dahlgren, VA. These joint tests are providing critical data on the versatility of the Uncooled Imaging Infrared seeker to acquire targets in both ground and sea applications.

Recently, a team comprising members from the U.S. Army NLOS-LS Project Office, industry and the Navy's LCS and Mission Package Project Office, NSWC, successfully completed two major milestones related to transitioning NLOS-LS to the fleet. These included the NLOS-LS Introduction to the Weapons System Explosives Safety Review Board (WSESRB) and the NLOS-LS Introduction to the Software System Safety Technical Review Panel (SSSTRP). The SSSTRP is a critical subset of the WSESRB. The NLOS-LS is slated for delivery to the LCS as part of the Surface Warfare Mission Package.

Midway through FY05, the NLOS-LS PAM was selected as the beyond-LOS missile solution for the Armed Robotic Vehicle-Assault (ARV-A). Since that time, there have been several technical interchange meetings to outline requirements and interfaces. An ARV-A/PAM integration Statement of Work has been developed and the ARV-A environmental performance specifications have been identified for incorporation into the PAM performance specification.

For SO1, the NLOS-LS Project Office will provide the EBCT with three FMTVs and seven CLUs with weighted AUR simulants for training and evaluation. The system will be fully functional, with the ability to enter a network and train the operators in system employment. These same Soldiers will deploy to White Sands Missile Range, NM, and support several developmental test firings. These activities will provide the Current Force Fire Direction Center and the system operators the opportunity to fire tactical PAMs against selected targets.

The NLOS-LS Project Office is poised to provide an integrated operational system in support of the EBCT SO 1-4 evaluations, the MBCT fieldings and the Navy's LCS evaluation.

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General Dynamics and U.S. Army Team to Deliver Cutting-Edge Firepower

John P. Corsello Jr. and LTC Warren O'Donell

General Dynamics Land Systems (GDLS), the vehicle integrator for the Future Combat Systems (FCS) Mounted Combat System (MCS) vehicle, has selected the U.S. Army's Benet Laboratories to develop the XM360 lightweight 120mm gun for the MCS. The XM360 gun will enable the MCS to pack the same punch as the Army's 70-ton M1A2 Abrams Main Battle Tank (MBT), giving it the versatility and firepower needed to attrit enemy forces from afar, before closing with and destroying the remnants of those forces to "finish decisively." Together with its XM360 gun and a suite of advanced ammunition, the MCS will provide the unit of action (UA) commander unprecedented warfighting capabilities through the employment of highly lethal, precise and integrated network fires.

The XM360 gun will enable MCS vehicles to deliver the same firepower, maneuverability and accuracy as the M1A2 Abrams MBT, but on a much lighter platform and with less recoil. Here, Soldiers from the 1st Armored Division maneuver through the Taunus Mountains north of Frankfurt, Germany, during *Exercise Ready Crucible.* (U.S. Army photo by Richard Bumgardner.)

Networked lethality is a critical FCS element and the UA construct for projecting overmatching combat power. It is the FCS System-of-Systems' essential ingredient that will enable the UA to fight lean and win. The MCS is a key component of the UA's maneuver force, intended to provide firepower precisely where and when it is needed. To achieve that goal, it must be light enough to rapidly deploy by air transport, while exceeding the multipurpose lethality of an MBT. Early in the concept development phase, it was recognized that the gun assembly would be a major contributor to the MCS's overall weight. It was here that the XM360 gun found its inception.

XM360 Gun System

Given the operational need for rapid deployment of forces, many countries are now considering fielding Armored Fighting Vehicles (AFVs) that are considerably lighter than today's MBTs. The desire to match or exceed the firepower of today's MBTs, on a much lighter vehicle, is driving designers to reduce the weapon's weight and recoil forces on future AFVs.

To meet that challenge, GDLS has teamed with Benet Labs to develop the XM360 gun for the MCS. The XM360 is a lightweight, low-recoil 120mm gun incorporating the latest advances in gun technology as depicted in the figure. Comprising a cannon assembly and gun mount, its design integrates advanced material and design solutions to minimize weight, recoil and other vehicle burdens, while optimizing it for remote operation from the MCS crew compartment. The XM360's features include:

- An electrically actuated multi-lug breech.
- A cannon tube with integral "pepperpot" muzzle brake to reduce recoil forces.
- A blast deflector to reduce the overpressure vented back toward the MCS.
- A gun tube shroud to mitigate the effects of environmental conditions such as solar heating.
- A gun mount with a modular recoil mechanism.
- A fully integrated sensor suite that will make it possible for the MCS crew to monitor the status and function of the gun's subsystems from the crew compartment and enable the implementation of prognostics and diagnostics.

Networked lethality is a critical FCS element and the UA construct for projecting overmatching combat power. It is the FCS System-of-Systems' essential ingredient that will enable the UA to fight lean and win.

The XM360 makes extensive use of ultra-high-strength gun steel and lightweight materials, such as titanium and composites, to maximize weight savings. The design's modularity lends itself to "Soldier friendly" maintenance and repair, allowing the crew to easily change components such as recoil cylinders and recuperators. All things considered, the XM360 represents the cutting edge in tank gun technology and engineering for the immediate future.

The XM360 had its beginnings in October 2002 as a joint effort between the U.S. Army's Project Manager for Maneuver Ammunition Systems (PM MAS), the U.S. Army Armament Research, Development and Engineering Center (ARDEC) and GDLS. ARDEC and GDLS recognized the need for a lightweight gun that would be capable of firing existing ammunition. Because the 120mm caliber provided greater lethality and growth potential than existing 105mm munitions, it was decided that 120mm would be the caliber of choice. The question that needed answering

was, "Could the combined government/industry team design a 120mm gun whose weight and recoil were low enough to meet MCS needs?"

To address this challenge, GDLS and ARDEC's Benet Labs — the U.S. Army's large-caliber gun design agency — embarked on a collaborative effort known as the Vehicle Dynamic Response Demonstrator (VDRD). The VDRD's purpose was to design, build and demonstrate a gun that could meet MCS fundamental needs. Benet Labs and GDLS agreed to a set of baseline requirements for the new gun, including its maximum weight, recoil impulse and recoil force at the gun's trunnions. Other program goals were to be able to fire the entire family of 120mm tank ammunition, and to manage the muzzle blast that would be vented back toward the vehicle by the gun's recoil-reducing muzzle brake. In designing the gun, Benet Labs leveraged lessons learned from the design of its proven 105mm M35 and developmental 120mm/140mm XM291 gun designs.

Testing Begins

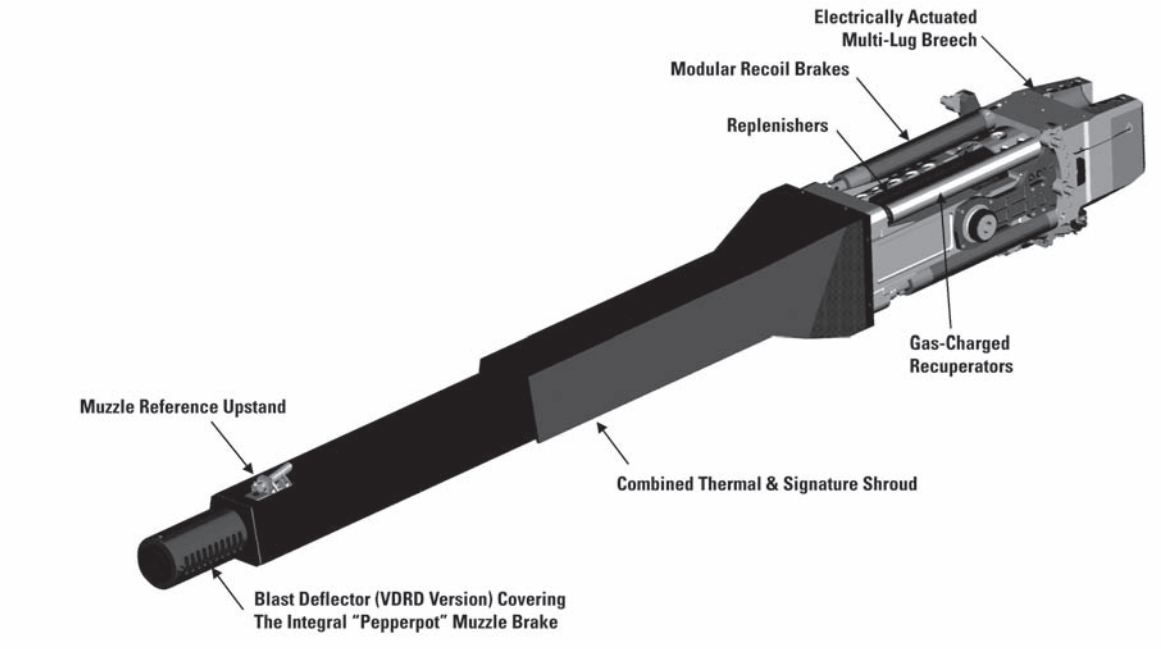
By December 2003, the first lightweight 120mm gun was firing at the U.S. Army's Aberdeen Proving Ground (APG) in Maryland. The VDRD gun met or surpassed its baseline requirements. In doing so, it clearly demonstrated the proof-of-principle and significantly reduced risk for MCS.

Artist rendering of an MCS/XM360 lightweight 120mm gun that will pack the same punch as today's M1A2 Abrams MBT, but provide added transportability, versatility, survivability and lethality. (U.S. Army image courtesy of PM MAS.)

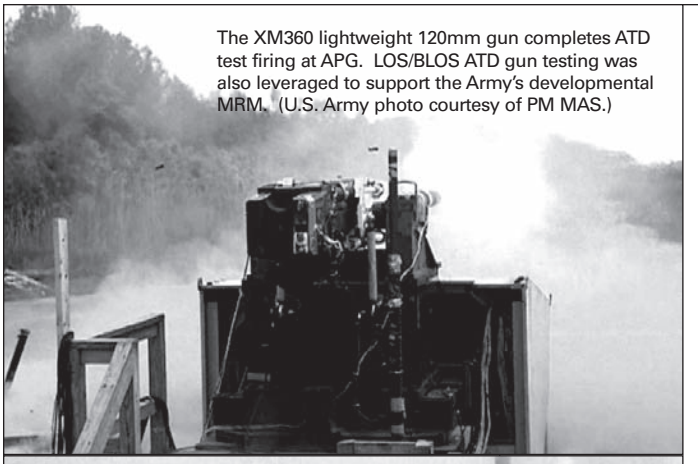
Seeing the need to further refine the VDRD lightweight 120mm gun's design and further reduce MCS armament- and ammunition-related risks, ARDEC decided to pursue an Advanced Technology Demonstration (ATD) program as a follow-on to the VDRD. The Line-of-Sight/Beyond Line-of-Sight (LOS/BLOS) ATD objective was to mature gun, fire control, ammunition handling and ammunition-related technologies with direct application to the MCS.

Although an ARDEC technology base program, much of the work was contracted to GDLS, thereby retaining the government/industry team that was established during the VDRD. Likewise, the LOS/BLOS ATD built upon and improved the VDRD gun design. As GDLS continued to refine its MCS concepts, a complete set of gun interfaces was established, and Benet Labs updated the LOS/BLOS ATD gun design to comply with those interfaces. Watervliet Arsenal purchased ultra-high-strength gun steel to fabricate an all gun steel tube, along with an even lighter composite overwrapped gun tube. Based on input from GDLS' Fire Control Team, Benet Labs designed and had Rock Island Arsenal fabricate a new, stiffer gun mount cradle better suited to meet MCS accuracy requirements.

Other improvements included an electrically actuated breech mechanism and two more blast deflector designs. Advances in modeling and simulation were used to improve the design and test process's



XM360 Lightweight 120mm Gun



The XM360 lightweight 120mm gun completes ATD test firing at APG. LOS/BLOS ATD gun testing was also leveraged to support the Army's developmental MRM. (U.S. Army photo courtesy of PM MAS.)

The XM360 is a lightweight, low-recoil 120mm gun comprising a cannon assembly and gun mount. The system depicted above integrates advanced material and design solutions to minimize weight, recoil and other potential AFV burdens. Here, the XM360 is test-fired at APG. (U.S. Army photo courtesy of PM MAS.)

efficiency. Modeling was used to predict the blast overpressure of candidate blast deflector designs, thus streamlining the down-selection process, while specialized sensors, microphones and a mockup of the MCS front glacis were used to collect more realistic blast overpressure data.

XM360 Gun Mount Clears ATD

By November 2004, the LOS/BLOS ATD's lightweight 120mm gun was installed and firing at APG. The gun met its weight allocation and successfully fired the high-pressure M829A3 at its maximum service temperature. Target impact dispersion testing with this round and others demonstrated acceptable precision. Recoil impulse and recoil forces were within the specified limits, and the ability of the blast deflectors to reduce blast overpressure was demonstrated.

LOS/BLOS ATD gun testing was also leveraged to support the Army's developmental Mid-Range Munition (MRM). The MRM provides MCS the capability to engage BLOS targets at significantly greater standoff ranges, greatly enhancing system survivability. MRM testing included:

- Firing ballistic slugs to assess pressure.
- Firing MRM finned slugs to assess any impact of the integral muzzle brake on fin deployment.
- Determining maximum range.

The testing confirmed predicted pressures and proper projectile fin deployment. In addition, the maximum range requirement was exceeded. Successful lightweight 120mm gun testing brings it to Technology Readiness Level 6 and signals its readiness for integration into the MCS' System Development and Demonstration (SDD).

The XM360 lightweight 120mm gun development is continuing under a Cooperative Research and Development Agreement between ARDEC and GDLS. This effort's focus will be a continued design evolution to support the SDD for MCS. Current plans call for the delivery of nine guns — from 2007 through 2009 — to support development, safety testing and an MCS Integrated Armament Firing Test Rig. An additional six guns will be delivered from 2009 through 2010 for integration into the MCS Pre-Production Vehicles. ARDEC is also continuing technology base work to further reduce the XM360's weight and increase its accuracy.

MCS is a key FCS program component and, more importantly, an essential Army transformation element directly impacting the UA commander's ability to project lethal, networked fires on future battlefields. It will ensure the U.S. Army remains the most capable combat force in the world, able to face any opponent, and win decisively. With continued MCS and XM360 gun development and eventual fielding, the Army is poised to deliver the lightest and most advanced gun system of its type in the world. Together with the ammunition already fielded and the suite of advanced ammunition in development, the XM360 will provide MCS with the versatility and lethal firepower needed to engage and destroy the enemy regardless of where the battlefield takes U.S. forces.

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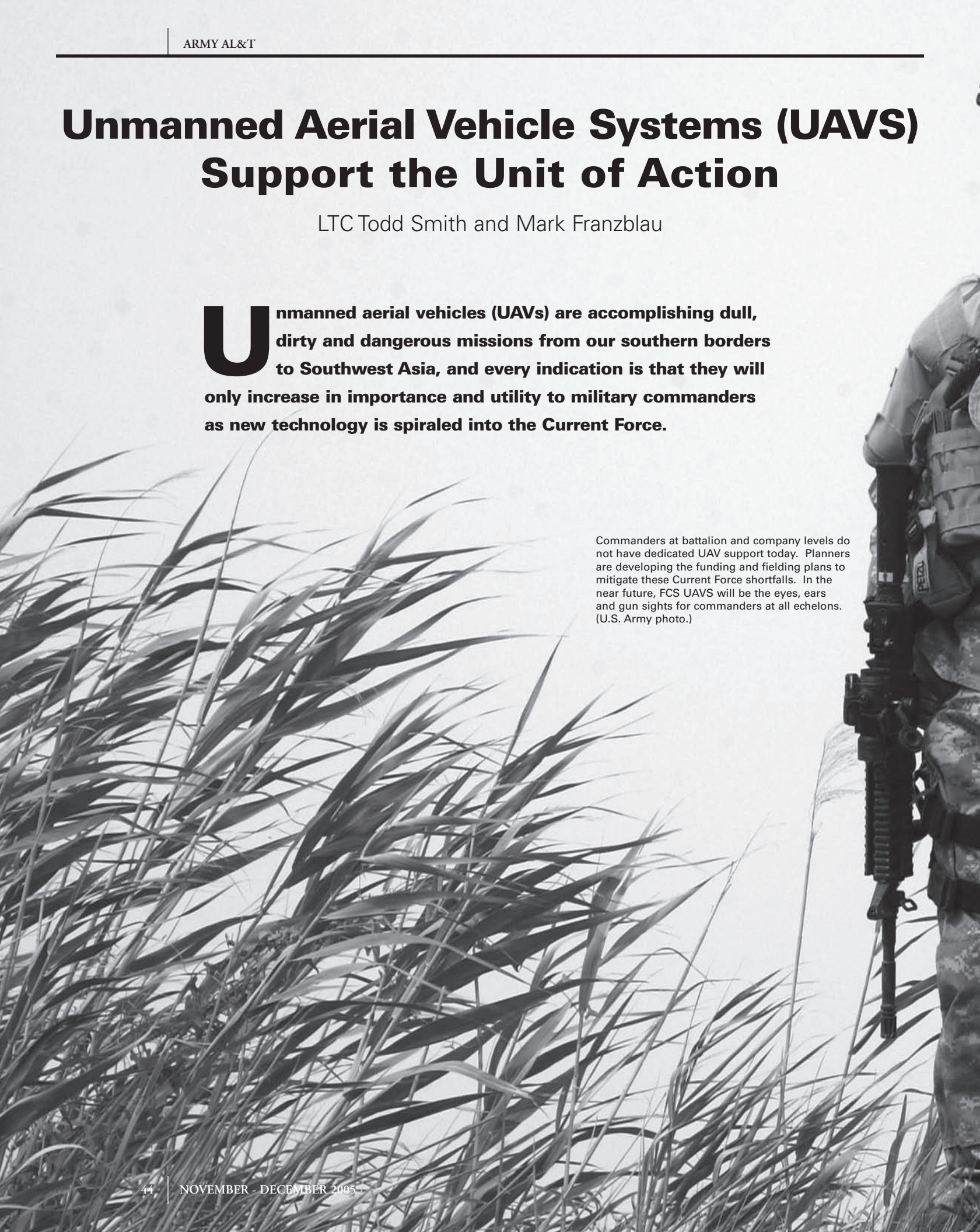
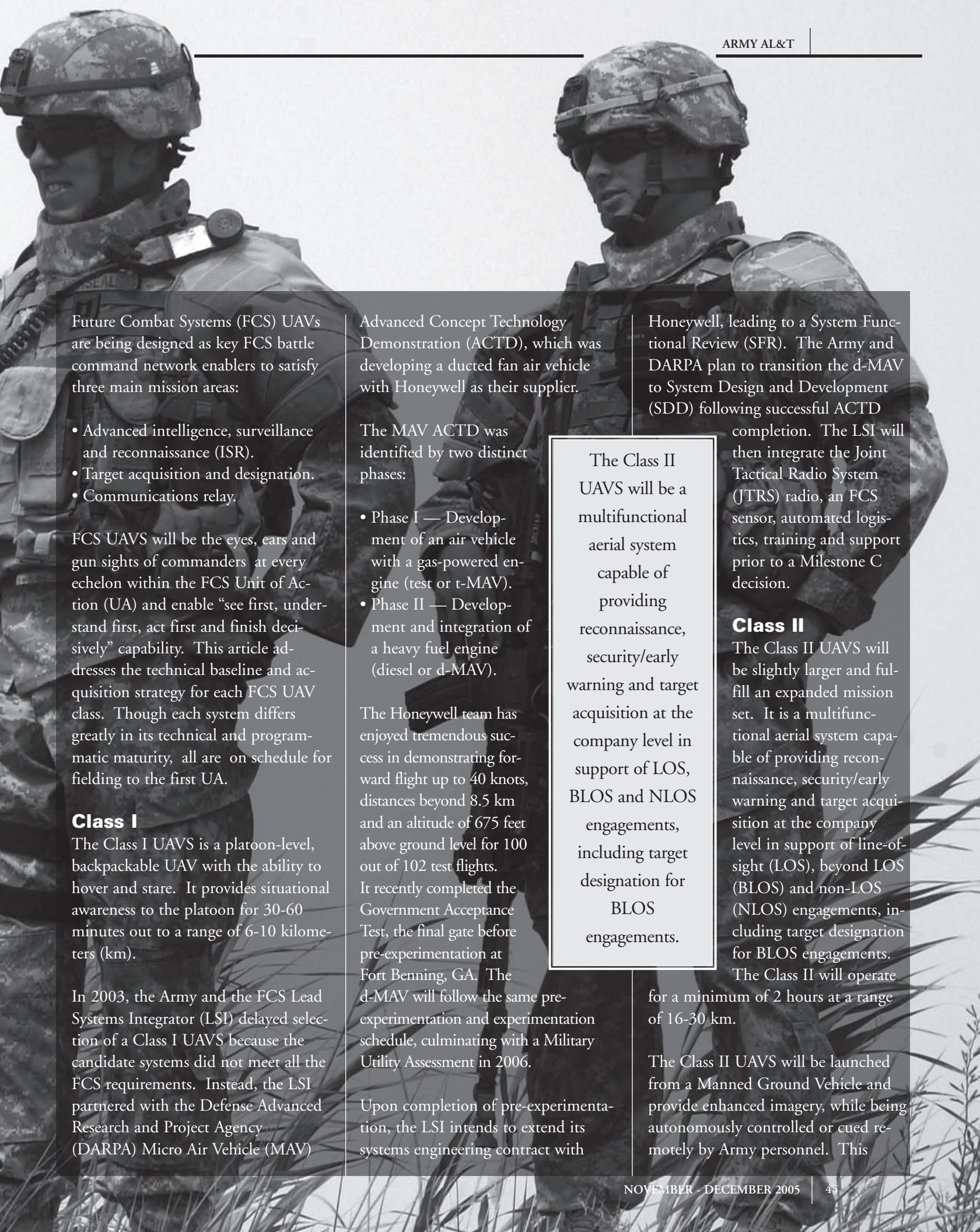
Unmanned Aerial Vehicle Systems (UAVS) Support the Unit of Action

LTC Todd Smith and Mark Franzblau

Unmanned aerial vehicles (UAVs) are accomplishing dull, dirty and dangerous missions from our southern borders to Southwest Asia, and every indication is that they will only increase in importance and utility to military commanders as new technology is spiraled into the Current Force.



Commanders at battalion and company levels do not have dedicated UAV support today. Planners are developing the funding and fielding plans to mitigate these Current Force shortfalls. In the near future, FCS UAVS will be the eyes, ears and gun sights for commanders at all echelons. (U.S. Army photo.)



Future Combat Systems (FCS) UAVs are being designed as key FCS battle command network enablers to satisfy three main mission areas:

- Advanced intelligence, surveillance and reconnaissance (ISR).
- Target acquisition and designation.
- Communications relay.

FCS UAVS will be the eyes, ears and gun sights of commanders at every echelon within the FCS Unit of Action (UA) and enable "see first, understand first, act first and finish decisively" capability. This article addresses the technical baseline and acquisition strategy for each FCS UAV class. Though each system differs greatly in its technical and programmatic maturity, all are on schedule for fielding to the first UA.

Class I

The Class I UAVS is a platoon-level, backpackable UAV with the ability to hover and stare. It provides situational awareness to the platoon for 30-60 minutes out to a range of 6-10 kilometers (km).

In 2003, the Army and the FCS Lead Systems Integrator (LSI) delayed selection of a Class I UAVS because the candidate systems did not meet all the FCS requirements. Instead, the LSI partnered with the Defense Advanced Research and Project Agency (DARPA) Micro Air Vehicle (MAV) Advanced Concept Technology Demonstration (ACTD), which was developing a ducted fan air vehicle with Honeywell as their supplier.

The MAV ACTD was identified by two distinct phases:

- Phase I — Development of an air vehicle with a gas-powered engine (test or t-MAV).
- Phase II — Development and integration of a heavy fuel engine (diesel or d-MAV).

The Honeywell team has enjoyed tremendous success in demonstrating forward flight up to 40 knots, distances beyond 8.5 km and an altitude of 675 feet above ground level for 100 out of 102 test flights. It recently completed the Government Acceptance Test, the final gate before pre-experimentation at Fort Benning, GA. The d-MAV will follow the same pre-experimentation and experimentation schedule, culminating with a Military Utility Assessment in 2006.

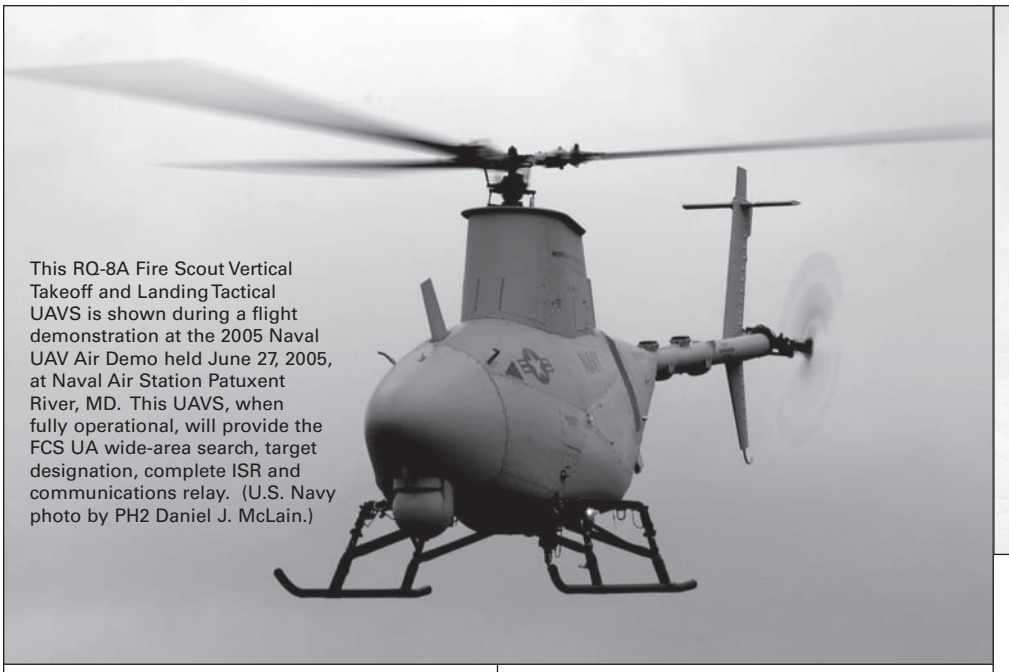
Upon completion of pre-experimentation, the LSI intends to extend its systems engineering contract with Honeywell, leading to a System Functional Review (SFR). The Army and DARPA plan to transition the d-MAV to System Design and Development (SDD) following successful ACTD completion. The LSI will then integrate the Joint Tactical Radio System (JTRS) radio, an FCS sensor, automated logistics, training and support prior to a Milestone C decision.

> The Class II UAVS will be a multifunctional aerial system capable of providing reconnaissance, security/early warning and target acquisition at the company level in support of LOS, BLOS and NLOS engagements, including target designation for BLOS engagements.

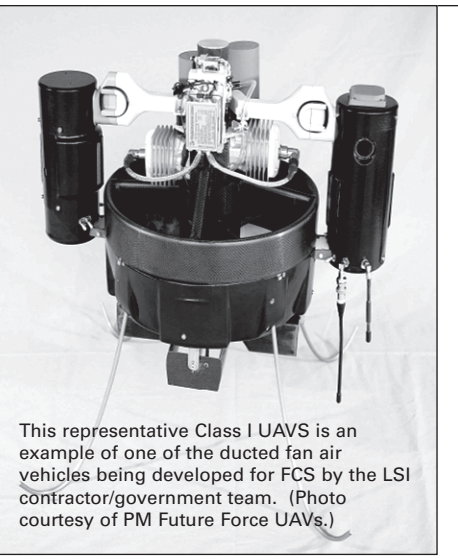
Class II

The Class II UAVS will be slightly larger and fulfill an expanded mission set. It is a multifunctional aerial system capable of providing reconnaissance, security/early warning and target acquisition at the company level in support of line-of-sight (LOS), beyond LOS (BLOS) and non-LOS (NLOS) engagements, including target designation for BLOS engagements. The Class II will operate for a minimum of 2 hours at a range of 16-30 km.

The Class II UAVS will be launched from a Manned Ground Vehicle and provide enhanced imagery, while being autonomously controlled or cued remotely by Army personnel. This



This RQ-8A Fire Scout Vertical Takeoff and Landing Tactical UAVS is shown during a flight demonstration at the 2005 Naval UAV Air Demo held June 27, 2005, at Naval Air Station Patuxent River, MD. This UAVS, when fully operational, will provide the FCS UA wide-area search, target designation, complete ISR and communications relay. (U.S. Navy photo by PH2 Daniel J. McLain.)



This representative Class I UAVS is an example of one of the ducted fan air vehicles being developed for FCS by the LSI contractor/government team. (Photo courtesy of PM Future Force UAVs.)

capability greatly reduces the operational and tactical risks associated with small unit operations in all environments — especially complex ones.

Class II UAVS development will be carried out in three phases, with the FCS LSI and DARPA developing different technologies in tandem until a final candidate system is selected. DARPA initiated the Organic Air Vehicle II program, strictly focused on ducted fan technology, while the LSI will evaluate an alternative nonducted fan approach.

The first phase will include requirements assessment and risk-reduction trade studies on initial UAV concepts before a down-select in mid-2006 to one candidate Class II LSI system. Selected LSI and DARPA candidates will then be evaluated for their suitability to meet FCS requirements during a 24-month concept maturation phase, which will culminate in a flight assessment of developmental prototypes. A down-select will then occur for the final SDD phase when the LSI, Army and DARPA will select the best-value solutions for each UAV class. The first integrated Class II systems will be delivered for FCS system-of-systems testing with fielding to the first UA.

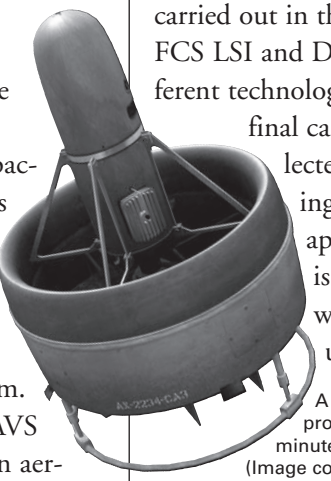
The Class IV UAVS is the largest and most developed of the four UAV classes. It will have a minimum endurance of 6 hours at 75 km, a maximum altitude of 20,000 feet, a maximum speed of 112 knots and carry a payload ranging from 130-600 pounds.

Class III

The Class III UAVS will have greater endurance and a larger payload-carrying capacity than the Class II systems, with a minimum endurance of 6 hours at a range in excess of 30 km. The Class III UAVS is a multifunction aerial system capable of providing reconnaissance, security/early warning, target acquisition and designation for precision fires throughout the battalion area of influence. It will remotely overwatch and report changes in key terrain, avenues of approach and danger areas in open and rolling, restrictive and urban areas, and will be capable of taking off and landing in unimproved areas.

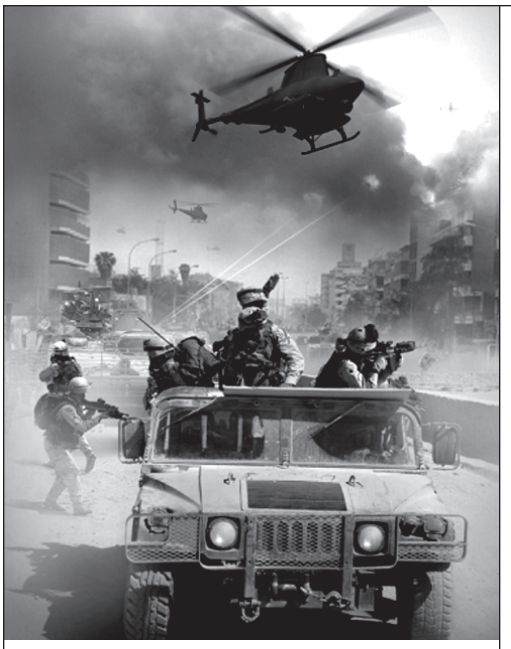
The Class III UAVS will provide information from operating altitudes and standoff ranges in day, night and adverse weather. It will also be capable of communications relay; mine detection; chemical, biological, radiological and nuclear detection; and meteorological survey for the NLOS battalion.

Class III UAVS development will be carried out in three phases, with the FCS LSI and DARPA developing different technologies in tandem until a final candidate system is selected. DARPA is investing in a rotorcraft UAV approach, while the LSI is examining two fixed-wing solutions and an unmanned autogyro.



A Class I UAV will be capable of providing limited SA for 30-60 minutes out to a range of 6-10 km. (Image courtesy of PM Future Force UAVs.)

Similar to the Class II first phase requirements assessment and risk-reduction trade studies, a down-select in mid-2006 from three down to one



FCS UAV capabilities will provide networked sensor data to each modular force echelon, enabling operations in complex urban environments and greatly reducing risks to Soldiers on the ground. (Image courtesy of PM Future Force UAVs.)

LSI system will take place. The selected LSI and DARPA candidates will then be evaluated for their suitability to meet FCS requirements during a 24-month concept maturation phase, which will culminate in flight assessments of developmental prototypes. During the final SDD phase, the LSI, Army and DARPA will select the best-value solutions for each UAV class. Although planned for fielding with the first UA in 2014, the Class III is a candidate for delivery in an earlier technology spin out (SO).

Class IV

The Class IV UAVS is the largest and most developed of the four UAV classes. The LSI awarded Northrop Grumman Corp. (NGC) a system development contract through a best-of-industry competition in September 2003 to become the Class IV One Team Partner.

The MQ-8B Fire Scout provides ISR, wide-area search, target designation, communications relay and manned/unmanned teaming for the UA. It will have a minimum endurance of 6 hours at 75 km, a maximum altitude of 20,000 feet, a maximum speed of 112 knots and carry a payload ranging from 130-600 pounds.

The Army and Navy are jointly developing the airframe to decrease development costs and maximize commonality between the Army and Navy versions. The Navy will equip its version with communications and sensors appropriate for shipboard environments, and the Army will equip the Class IV UAVS with the JTRS, the Integrated Computer System and sensors more appropriate for land warfare.

The Navy and NGC have already conducted more than 100 successful test flights, including a demonstration at the Association of Unmanned Vehicle Systems International Conference in June 2005 and a weapons demonstration in July 2005. The Navy will field Fire Scout 2 years prior to the Army.

The Army will equip the Class IV UAVS with the JTRS, the Integrated Computer System and sensors more appropriate for land warfare.

The Class IV System will have its SFR in December 2005 and Preliminary Design Review in June 2006. First flight in the Class IV configuration, including the FCS embedded systems and payloads, will occur in 2008 with fielding as early as 2010.

FCS UAVs reside within the UA and are complemented by manned aviation and UAVs supporting the unit of employment. The Armed Reconnaissance Helicopter, Apache Block III and Extended Range/Multipurpose UAV will share sensor data and provide network support through the use of common software and hardware applications.

The Army is also developing a transition that accommodates the development of FCS UAVs. Commanders at battalion and company levels do not have dedicated UAV or aviation support today, and planners are developing the funding and fielding plans to provide these capabilities.

At the same time, an Army/LSI team is reviewing the feasibility of providing FCS UAV capabilities in FCS SO2 to the Current Force. This would provide networked sensor data to each modular force echelon, which would enable operations in complex urban, jungle and mountainous terrain.

UAVs will contribute immeasurably to the UA, adding robustness to the network, enabling air-to-air and air-to-ground teaming, and penetrating the enemy's decision cycle regardless of weather without risking the lives of our Soldiers.

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MARK FRANZBLAU is the Director, FCS UAV IPT for the LSI. He has a B.A. in biology from Colorado College, an M.S. in zoology from Arizona State University and an M.B.A. from Southern Illinois University. Additionally, Franzblau is a graduate of the Defense Systems Management College Program Manager Course and Boeing's Program Manager Course.

Command and Control of Robotic Entities (C2ORE) in Future Combat Systems

LTC Karen D.H. Saunders, Rex Howe and Carolyn Holguin

Down the streets of a foreign city, a small unmanned aerial vehicle (SUAV) scouts purposefully for signs of a hidden enemy. The SUAV swivels and moves in a new direction upon detecting an electronic signal transmission. With electronic eyes and ears, the SUAV detects heavily armed hostile forces emerging from a warehouse on the outskirts of town and instantly sends images to an unmanned communications relay hovering above the city.

C2ORE will support the C2D's F2BCI initiative through network-enabled battle command and other command and control efforts encompassing the entire FCS fleet of UAVs, UGVs and UGSs. Here, CPL Jerry Rogers from the Scout Platoon, 1st Battalion, 13th Armor Regiment, 3rd Brigade, 1st Armored Division, assembles an RQ-11 Raven UAV for aerial reconnaissance over Taji, Iraq, June 21, 2005. (U.S. Air Force photo by TSGT Russell E. Cooley IV, 1st Squadron Combat Camera.)

Like a chess master arranging pieces against an unsuspecting novice, mastermind decision support software begins cross-cueing firing units and additional sensors. Each Future Combat Systems (FCS) Unit of Action (UA) element moves with precision and shared intent to accomplish specific objectives. Manned units take up positions to prevent threat escape, inhibit the arrival of enemy reinforcements and provide both direct and indirect fire while simultaneously monitoring live sensor updates from the SUAV scouts.

The year is 2014 and a key enabler for unmanned and manned force collaboration is the U.S. Army Communications-Electronics Research Development and Engineering Center (CERDEC) technology program C2ORE.

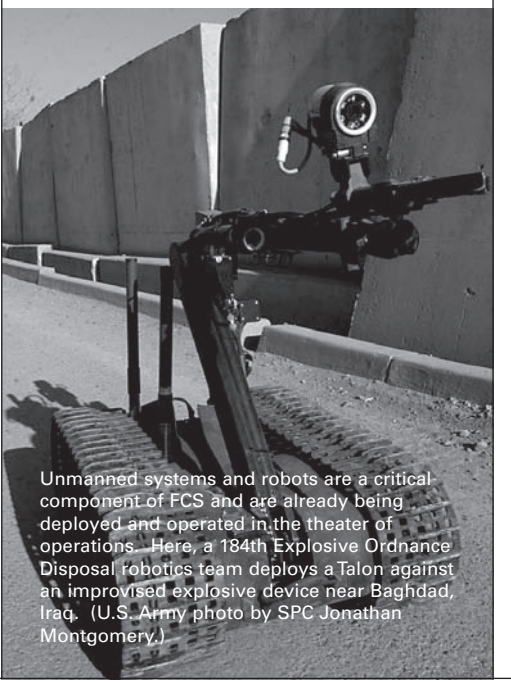
FCS comprises a family of advanced, networked air- and ground-based maneuver, maneuver support and sustainment systems that will include manned and unmanned platforms. The UA is a "network-enabled" force equipped with a multitude of sensor arrays that will permit leaders and commanders to achieve dramatic improvements in mission success.

According to the *U.S. Army Future Force Operational and Organizational Plan*, by 2014, FCS intends to have approximately 398 unmanned systems in the objective UA. The C2ORE Army Technology Objective (ATO) is a 5-year effort being executed in the CERDEC Command and Control Directorate (C2D) to develop software services to support the multilevel system of unmanned systems, enabling teaming and tactical control of unmanned air and ground systems for the UA FCS Battle Command System.

C2ORE will also support the C2D's Future Force Battle Command Integration (F2BCI) initiative, an umbrella program encompassing Network Enabled Battle Command ATO and other command and control efforts within C2D. C2ORE software services will be developed and continually assessed through modeling and simulation demonstrations and live field experiments.

C2ORE will transition products to the FCS program in 2006, 2007, 2008 and 2009 per the Technology Transition Agreement with the UA Network Systems Integration Program Management Office (PM UA NSI) and the FCS Lead Systems Integrator (LSI). C2ORE will support risk mitigation of FCS battle command functionality by:

- Transitioning prototype software services that are fully FCS System-of-Systems Common Operating Environment compliant.
- Providing experimentation/analysis reports and lessons learned.
- Contributing to FCS Battle Command System Family of Services development — specifically planning and preparation services — battle command mission execution services and situation understanding services.



Unmanned systems and robots are a critical component of FCS and are already being deployed and operated in the theater of operations. Here, a 184th Explosive Ordnance Disposal robotics team deploys a Talon against an improvised explosive device near Baghdad, Iraq. (U.S. Army photo by SPC Jonathan Montgomery.)

C2ORE Software Services

There are two classes of C2ORE Software Services: Tactical Battle Command Services and Air/Ground Collaboration Services. These services will include, but are not limited to, information management techniques, intelligent agents and decision aids to support unmanned systems planning and replanning.

Tactical Battle Command Services. Tactical Battle Command Services will be designed to dynamically monitor mission execution and provide courses of action (COAs) for unmanned air and ground systems based on a commander's intent, evolving situation, resource availability and capability. Some services include unmanned aerial vehicle (UAV) flight path generation, unmanned ground vehicle (UGV) ground path generation, unattended ground sensor (UGS) placement, resource analysis, battlespace environment analysis services, dynamic COA generation, and modification and repair to operational plans. These services will integrate planning of unmanned entities into the FCS Battle Command System, thereby enabling a commander to create a plan with the optimal mix of both manned and unmanned platforms.

Air/Ground Collaboration Services. Air/Ground Collaboration Services will be designed to enable teaming between UAV and UGV systems to provide a cohesive workflow to achieve operational missions. Services will include teamed missions where UAVs and UGVs work together to provide navigation assistance, terrain updates, obstacle detection and enemy situation reports. Likewise, Air/Ground Collaboration Services will also provide peer-to-peer UGS and UGV networks and collaborative group behaviors for UGVs and UAVs.

F2BCI is a CERDEC R&D effort that marshals the resources required to establish a groundbreaking, end-to-end battle command system supporting development and experimentation. Here, SFC Patrick Edwards operates a Force Battle Command Brigade and Below system during a series of demonstrations and experiments to test network-centric operations and the use of voice and data networks to link platforms and units during time-critical operations. (U.S. Navy photo by PH2 David Mercil, Fleet Combat Camera.)

All technology development and experiments undertaken by C2ORE will be in close coordination with the U.S. Army Training and Doctrine Command, PM UA NSI and the FCS LSI, and the Research Development and Engineering Command Robotics and Networks Integrated Product Teams. This coordination will serve to ensure validation of command and control functional requirements and information exchange requirements that drive software design.

Experimentation

Experimentation is essential in today's world to validate new technologies and software with current military computer systems and communications before fielding it to our warfighters. The C2ORE software services will be assessed through numerous laboratory demonstrations and live field experiments.

In August and September 2005, C2ORE participated in the Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance On-the-Move (C4ISR OTM) Testbed Exercise at Fort Dix, NJ. The C4ISR OTM Testbed's purpose is to support FCS program risk reduction through reducing identified C4ISR risk areas, investigating the value and contribution of emerging technologies and expanding the understanding of imprecisely defined conceptual requirements.

This venue will provide lessons learned and support for Joint Expeditionary Forces Experiment 2006 (JEFX06) and FCS Experiment 1.1. The OTM Testbed will use the C2ORE sensor planning and placement software for UGSs, UAVs and UGVs. Additionally, the C2ORE software will be used as the UGS controller for the surrogate FCS Tactical UGS and demonstrate control functionality such as on/sleep mode, exclusion zones and sensitivity.

During FY06, C2ORE will participate in JEFX06, the F2BCI Demonstration and FCS Experiment 1.1. JEFX06 will provide a multidimensional, multinational, multiservice environment for an end-to-end process of exploration, assessment and transition of capabilities within 6-24 months that will provide Joint and coalition warfighters with solutions to gaps identified in the Integrated Capability Review and risk assessment process and through lessons learned in recent and current operations.

Specifically, JEFX06 will continue the exploration of network-centric operations (NCO) begun in JEFX04. NCO broadly describes the combination of emerging tactics, techniques and procedures that a fully — or even partially — networked force can employ to create a decisive warfighting advantage.

"My intent is to leverage JEFX series of experiments as a cornerstone of our experimentation plan," Army Chief of Staff GEN Peter J. Schoomaker said. "At JEFX06, the plan is to experiment with the FCS capabilities that will spiral into our Current Force in the 2008 time frame and will be an integral part of the first fielded Unit of Action in 2014." For JEFX06, PM UA NSI Joint Interagency Multi-National Interoperability and PM UA NSI Battle Command selected C2ORE software to provide UGS planning, placement and control tools for both Current and Future Force units in line with the FCS concept.

C2ORE will play a key role in the F2BCI Demonstration Initiative. F2BCI is a CERDEC research and development effort that marshals the

The FCS UA network-enabled force will be equipped with a variety of sensor arrays like those displayed on this Multifunctional Utility/Logistics and Equipment Vehicle. (U.S. Army photo courtesy of Program Manager UA.)

Tactical Battle Command and Air/Ground Collaboration Services will dynamically monitor mission execution and help combatant commanders develop COAs for deployment of critical unmanned air and ground systems. Here, a Northrop Grumman RQ-8A Fire Scout UAV test-fires a Mark-66 2.75-inch unguided rocket during weapons testing at Yuma Proving Ground, AZ. The Army hopes to spiral this technology and capability into the Current Force in the near future. (U.S. Army photo.)

resources required to establish a groundbreaking, end-to-end battle command system supporting development and experimentation. F2BCI establishes a venue that supports holistic systems analysis, prototyping and experimentation to collectively address Current Force, UA, Unit of Employment (UE), Joint and coalition battle command issues.

F2BCI activities include a capstone exercise scheduled for fourth quarter, FY06 at the C4ISR OTM Testbed at Fort Dix. The exercise will provide insight into the performance and interaction of key C2ORE functionality as an SoS operating in an operationally relevant field environment. C2ORE will demonstrate UAV, UGV and UGS Intelligent Munitions Systems simulators in conjunction with live sensor planning, placement and control for a complete command and control thread between the UA and the UE.

The Road Ahead

Additional experiments will include two live field tests in FY07 and FY09 and a laboratory demonstration in FY08. Each experiment will assess software services in a tactical scenario, using prototype FCS robotic systems, with military communications and personnel. An Experimentation and Analysis Report will be published detailing lessons learned, metrics evaluated and follow-on requirements for service development and enhancement.

Metrics to be evaluated during each experiment will include:

- Network load assessment based on parametric variance of scenario, including variances in available bandwidth, quality of service and latency.
- Robotics controller threat management effectiveness, including responsiveness of the battle command system to support the robotics controller to manage threat situations with unmanned systems.
- Level of Air-Ground Collaboration, measuring effectiveness and improved operational capabilities through collaboration of air and ground platforms.
- Decision cycle time for unmanned systems planning/replanning, measuring improvement and decreased decision cycle time through information management techniques and battle command decision aids.

The notional C2ORE Capstone Experiment will demonstrate the new integrated, system of unmanned systems concept within an FCS tactical scenario using UGSs, UAVs and UGVs. Ultimately, C2ORE algorithms and software services will assist commanders to successfully complete their missions by using unmanned systems within the UA.

Unmanned systems will be a critical part of FCS and the Future Force, so managing them to optimize their effectiveness and exploit their complementary capabilities becomes essential. Through the Technology Transition Agreement with PM UA NSI and the FCS LSI, C2D has been identified as a partner on the FCS Team. C2ORE will provide the tools and technology needed for the warfighter to successfully use and manage unmanned systems effectively and efficiently.

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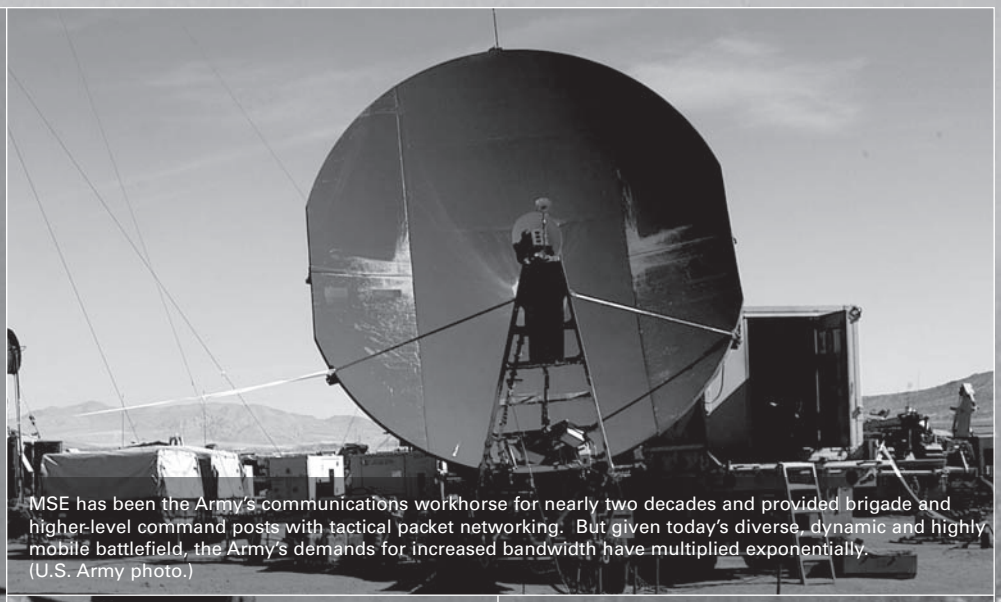
Designing for Network-Centric Warfare

Jeffrey P. Keehn, Aristides Staikos and Gerald T. Michael

As DOD transforms to a network-centric architecture, effective management of increasing bandwidth demands become a more critical element for its success. This article describes a design process that is being pursued to ensure the network has sufficient bandwidth to support successful network-centric warfare implementation.

The Space and Technology Communications Directorate's Multifunctional On-the-move Secure Adaptive Integrated Communications Advanced Technology Demonstration (ATD) included mobility protocols that allow warfighters to transparently join or leave sub-networks in an efficient and timely manner using routing protocols that select the best route/network to use when multiple routes are available, a critical capability for maneuver units. Here, Soldiers from the 1st Squadron, 4th Cavalry Regiment, 1st Infantry Division, move their M1A2 Abrams Main Battle Tank into position during *Operation Iraqi Freedom*. (U.S. Army photo by PVT Brandi Marshall.)

Prior to 1992, exchanges between computers in the tactical environment were performed manually via swivel chair or sneaker net. In 1992, the Army fielded the first tactical packet network as part of Mobile Subscriber Equipment (MSE) for brigade and above command posts, which opened the door for direct Internet-like exchanges between weapon systems. Over the next decade, we saw advances in computer technology and extension of the tactical Internet down to the company level and individual platforms, such as command vehicles and tanks.



MSE has been the Army's communications workhorse for nearly two decades and provided brigade and higher-level command posts with tactical packet networking. But given today's diverse, dynamic and highly mobile battlefield, the Army's demands for increased bandwidth have multiplied exponentially. (U.S. Army photo.)

Combatant commanders quickly recognized that digital exchanges between computer-based weapon systems provided our warfighters a distinct advantage over enemy forces. This transition was the start of network-centric warfare. As more sophisticated systems emerged, the need to transport large volumes of information increased. In parallel, battles were being fought more dynamically, with far greater mobility and over much larger battlefield areas.

It has been stated that there will never be enough bandwidth to satisfy all the unconstrained users' desires. However, with a methodical approach and strategic management oversight, we can use the available bandwidth to provide our commanders a network that will still give them a decisive advantage in battle. The science and technology (S&T) community is taking a three-pronged approach to address the bandwidth issue. Specifically these areas are:

- Communications System Improvements. Focus on improving communications systems individually to increase throughput capacity.
- Bandwidth Management Mechanisms. Focus on developing network mechanisms, such as quality of service (QoS) and access controls, which will allow the network to more efficiently use the available bandwidth.
- Application/System Network Integration. This most important prong is engineering the efficient integration of the applications/systems onto the network.

The combination of these three thrust areas will lead to a system-of-systems (SoS) network that will optimize bandwidth usage and ensure that critical information arrives at its final destination in actionable time.

First, we must ask, "What is enough bandwidth?" It can be defined as the amount of bandwidth necessary to support the information flow that provides the commander decisive battlefield advantage. In a fully integrated SoS that shares information dynamically in real time, optimum individual system performance is not as important as those systems working effectively and efficiently together. The next step is to determine what level of throughput is sufficient, whereby "sufficient" is defined as an appropriate amount of information dissemination that leads to a decisive battle command advantage. Because of the many variables associated with this complex problem, the most cost-effective, practical way one will be able to determine what is sufficient is through extensive modeling and simulation (M&S), supplemented with small-scale experiments and exercises.

Communications System Improvements

The thrust of this prong is to obtain greater throughput out of our communication systems. Enhancements are being pursued for each component of the transmission and switching systems, from the waveform and protocols to the antennas. As a result of fewer available frequencies and congestion in the lower bands, there has been a move to develop systems that operate at higher frequency. Higher frequency provides greater bandwidth but at the expense of less robust propagation characteristics. Military satellite systems are migrating to Ku/Ka and extra high-frequency bands with consideration for laser communications for various applications.

Waveforms have been making steady advances to provide more bits per hertz, therefore providing more data to be packaged in a given frequency. Turbo coding and Orthogonal Frequency Division Multiplexing are two examples. The Defense Advanced Research

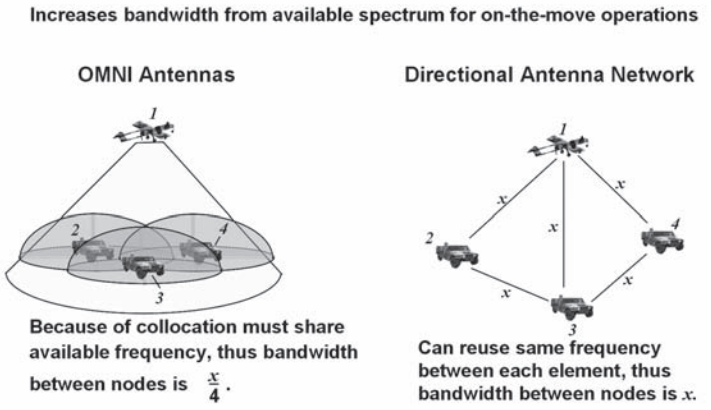


Figure 1. Directional Antenna Networking

Projects Agency and the Army are developing frequency agile waveforms that will allow the radios to monitor the local spectrum and automatically operate in the unused frequencies.

Directional networking antenna employment provides another area where considerable increases can be achieved in throughput within a given area and frequency. As depicted in Figure 1, by reusing the frequencies we can increase the throughput by 2-4 times.

Bandwidth Management Mechanisms

Bandwidth Management Mechanisms are defined as the protocols that will seamlessly bind the sub-networks — such as satellite, Joint Tactical Radio System, Soldier Radio Waveform, Wideband Networking Waveform and Warfighter Information Network-Tactical — into a coherent overall network that will control information flow. Present tactical wireless networks lack appropriate control mechanisms such that as the load on the network increases, network performance degrades rapidly. What makes these control mechanisms challenging is that they need to be designed for use in low-bandwidth, mobile wireless networks where most paths encompass multiple hops that are constantly moving and reorganizing.

However, QoS protocols designed for this mobile wireless heterogeneous environment have major technology challenges in controlling and efficiently using the precious bandwidth in these networks. QoS, in layman's terms, is about "guaranteeing" network performance to ensure higher priority traffic is handled in an appropriate manner.

The Space and Technology Communications Directorate's (S&TCD's) Multifunctional On-the-move Secure Adaptive Integrated Communications Advanced Technology Demonstration (ATD) took a first step in developing QoS protocols for the networking and link layers that work over mobile, multihop heterogeneous networks. Results demonstrated an improvement from 6.0 to 0.95 seconds for latency, and packet completion increase from 40 percent to more than 90 percent in a small multihop network for high-priority traffic. In this case, the best effort traffic suffered so that the higher priority traffic gets the network services it requires. Also included are mobility protocols that allow the warfighter to transparently join and leave subnetworks in an efficient and timely manner, and routing protocols that select the best route/network to use when more than one route is available. S&T programs are addressing these bandwidth requirements as well as providing the commanders management tools to change and optimize the network to match the battle tempo, such as shifting priority from video in the planning stage, to voice and data in the execution phase, to support calls for fire and battle command.

Application and System Network Integration

The most important piece of the process is to design the applications and systems to more efficiently use the network. This design approach requires a teaming effort between the systems and applications engineers and the network designers to be successful. It is critical that these groups meet during the early design phases to ensure the design incorporates and satisfies the requirements and constraints of each other's programs. A team effort using the various techniques shown in Figure 2 and others will bring the applications and systems needs closer to the available bandwidth.

A key driver is to identify and prioritize each piece of transported information within each application or system so that the network can handle it appropriately. It is important to note that all traffic cannot be treated as high priority. If that were the case, networks would revert back to "best-effort" service, which quickly degrades as network loading

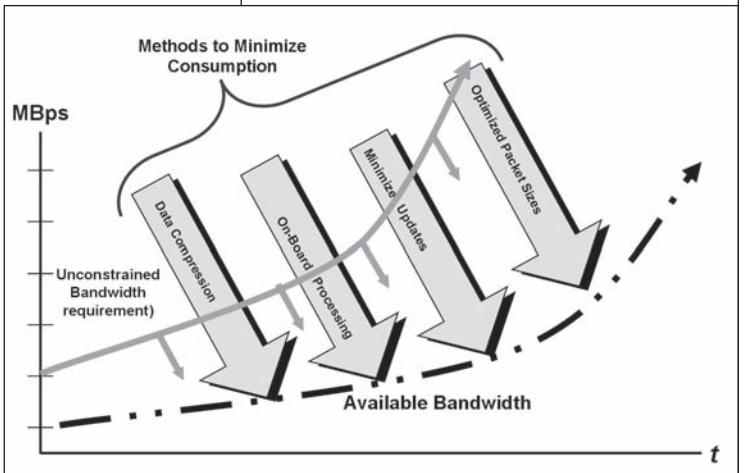
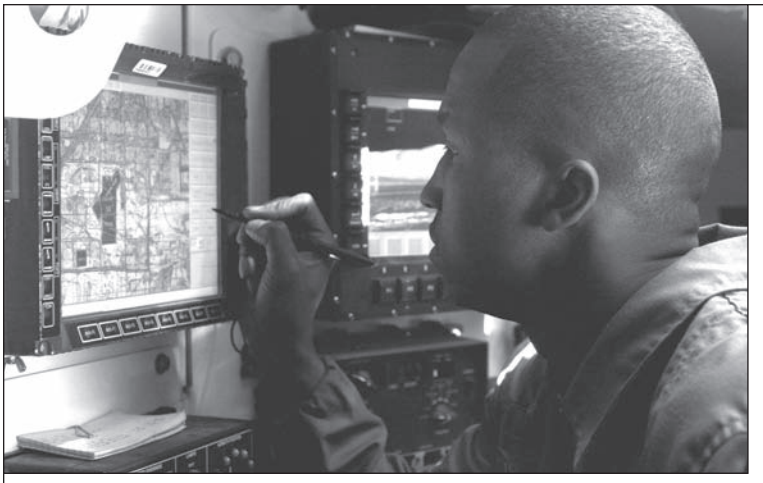


Figure 2. Consumption Mitigation



SFC Kenneth R. Dawson checks the map on his Force XXI Battle Command Brigade and Below display during a live-fire training exercise at the National Training Center, Fort Irwin, CA. Present tactical wireless networks experience degraded network performance as network demands increase. CERDEC has developed an adaptive application middleware that will dynamically control what the application offers to the network based on the network's health at any given point in time. (U.S. Army photo by CPT Tim Beninato, 28th Public Affairs Detachment.)

increases. The network also requires an understanding of other performance metrics associated with varying traffic and application types. Some messages require speed of service, such as "call for fire," while voice calls and video are sensitive to jitter. Other types of applications require zero packet loss such as intelligence imagery to remain effective. The M&S sensitivity analysis addressed earlier is a tremendous tool in determining appropriate priority and other governing attributes for each piece of information.

The U.S. Army Communications-Electronics Reserve, Development and Engineering Center (CERDEC) Command and Control Directorate, under the Agile Commander ATD, developed an adaptive application middleware that dynamically controls what the application offers to the network based on the network's health. Their approach adjusts the contents of a video application's transmission as the network load increases by using various techniques that include compression, reduced frames per second and conversion to black and white.

Another design decision for the application or system user is whether or not to send information via Transmission Control Protocol (TCP) or User Datagram Protocol (UDP). TCP provides mechanisms for "assured delivery," however, at the expense of increased overhead. UDP, on the other hand, doesn't carry the overhead burden, but UDP also does not provide ensured delivery. As the network becomes increasingly congested, message completion falls rapidly.

There are, however, various techniques that exist and are being developed to allow you to transport messages using UDP with the reliability attributes of TCP. Intelligent employment of multicast and anycast transmissions, in place of broadcast, will also contribute to reducing the network's overall load. Another consideration is to adjust update frequency for items such as situational awareness. Great strides have been made in compressing multimedia traffic, including video, voice, data (header and payload) and imagery. Greater collaboration is required between the network and applications and systems engineers to take advantage of these capabilities.

The research and development community has many emerging and promising technologies that will result in greater, more efficient bandwidth utilization. However, these advances will be in vain if the systems and applications are not engineered and designed to take advantage of them. This includes prioritizing each piece of information that the application or system transmits and considering the transport constraints, such as latency and fidelity, associated with each. If a concerted effort is applied to the aforementioned three-prong approach described herein, achieving sufficient bandwidth to make network-centric warfare a reality is possible for the Future Force.

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FCS Supportability — Where We Are Going and How We Are Getting There

Phillip Hodges, William F. Moore and Leonard Konwinski

The Future Combat Systems (FCS)-equipped Future Force Unit of Action (UA) will transform our Army's ability to conduct warfare. For supportability, the transformation brings a full-spectrum force with a much smaller logistics footprint than that required to support the Heavy Modular Brigade Combat Team (MBCT). This aspect helps achieve strategic responsiveness and allows tactical maneuver to be uninhibited by logistics constraints and linear links to echelons above the UA for up to 3 days of battle. This article focuses on how Program Manager (PM) UA is influencing the FCS program design for supportability to provide 21st-century Soldiers the best possible combat-ready systems while also reducing logistics footprint and life-cycle costs (LCCs).

A 4th Infantry Division artilleryman guides a Multiple Launch Rocket System vehicle onto a rail car in preparation for deployment April 21, 2005. (U.S. Army photo.)

When the Army developed and approved the FCS requirements — based on how the UA is expected to operate on future battlefields — more than 100 critical requirements were established that focus on supportability. The Army set aggressive thresholds that will enable reduced logistics footprint and LCCs inside FCS-equipped UAs. These requirements include extremely high operational availability, reliability at levels 2-8 times greater than Current Force systems, maintainability at levels 2-4 times greater than Current Force systems, fuel efficiency, water generation, "pit-stop" engineering, automated resupply, diagnostics, prognostics, 80-percent maintenance performed by the crew, minimal tools, very low repair times, onboard sensors, limits on scheduled services, interactive technical manuals and, most importantly, network-centric logistics enablers.

How Requirements Are Being Met

More than 200 logistics engineers and logisticians from the PM and Lead Systems Integrator (LSI) work side-by-side with design engineers to incorporate supportability requirements into emerging design concepts. Initially, this work focused on numerous "trade studies" to determine the best practical way to meet requirements, particularly when requirements are competing for limited weight and space on FCS platforms. These trade studies also provided a systematic way to challenge requirements that were deemed unachievable because of technical, cost or weight constraints associated with the program.

As a result, all supportability requirements have now been translated into the system-of-systems (SoS)-level specifications that will become part of the government's contract with the LSI. More than 3,500 of the 10,000-plus individual SoS specifications are supportability-related. The focus will soon turn to translating and decomposing these SoS specifications out to the numerous suppliers for their platform-level specifications — an enormous systems' engineering challenge.

Supportability Network

As mentioned earlier, the network developed under FCS offers great warfighting advantages, while also greatly improving supportability. Situational awareness (SA), particularly when applied to supply levels, combat damage, casualties and maintenance status, is critical to supporting maneuver units. The network will provide this information in near real-time, automating much of what is "hand-jammed" in today's force.

The PM/LSI has funded two major logistics systems as part of the network — the Platform-Soldier Mission Readiness System (PSMRS) and the Logistics Decision Support System (LDSS). The objective is sustainment integrated with maneuver planning and UA operations, with near-perfect SA of what's needed by the unit, when they need it and how to get the necessary services to them on a non-contiguous battlefield. PSMRS/LDSS integrated into the network enables this critical program aspect.

More than 200 logistics engineers and logisticians from the PM and LSI work side-by-side with design engineers to incorporate supportability requirements into emerging design concepts.

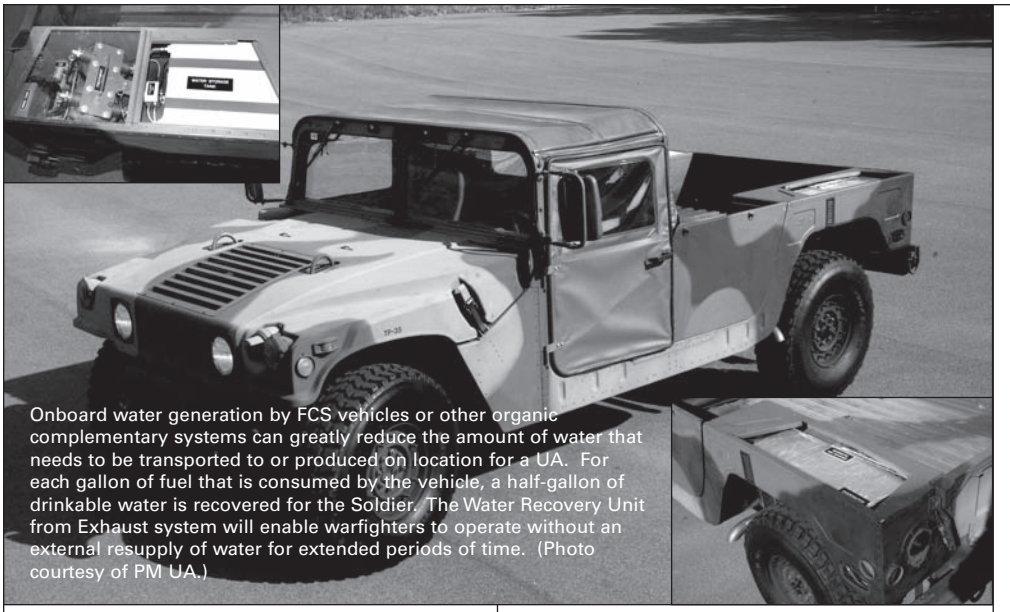
Reliability Influences Design

Reliability was deemed both a critical requirement and a technical challenge early in the program's development. The PM/LSI — understanding the criticality of high reliability to maintaining the goal of reducing logistics footprint and LCCs — entered into intense negotiations with suppliers, eventually developing a "Reliability Improvement Program" (RIP). RIP incentivizes industry to incorporate state-of-the-art best design practices, which enables industry to exceed the reliability levels necessary to meet area of operation (AO) requirements.

More than $400 million in research and development funding has been set aside for this effort. In parallel, the U.S. Army Training and Doctrine Command adjusted the reliability requirements to be consistent with the higher priority AO requirement, which resulted in "order of magnitude" improvements when compared against currently fielded Army systems.

Maintainability Reduces Logistics Footprint

FCS will be one of the first Army

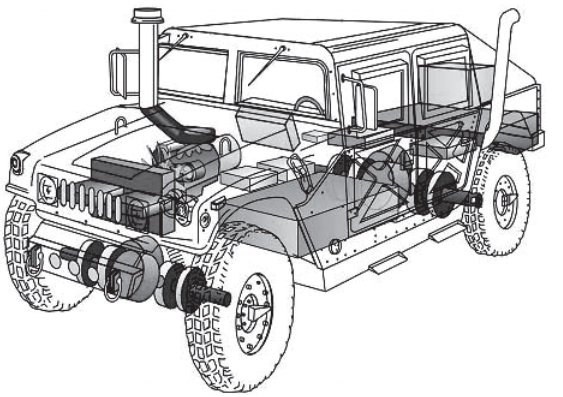


Onboard water generation by FCS vehicles or other organic complementary systems can greatly reduce the amount of water that needs to be transported to or produced on location for a UA. For each gallon of fuel that is consumed by the vehicle, a half-gallon of drinkable water is recovered for the Soldier. The Water Recovery Unit from Exhaust system will enable warfighters to operate without an external resupply of water for extended periods of time. (Photo courtesy of PM UA.)

programs designed from the ground up for two maintenance levels. FCS will take this initiative even further by directing that 80 percent of all field-level repairs be performed by the crew. This approach, coupled with commonality and other enablers, is a remarkable improvement when compared against current combat systems. Today's systems have numerous echelons of mechanics and supply stocks — logistics footprint — available to keep the systems operationally ready for combat.

Under the FCS program, it will primarily be the crew's responsibility to care for their platform, with a minimal number of dedicated mechanics in the UA to make repairs that exceed the crew's capabilities, including combat damage. It is a huge challenge providing the crew the technical ability and training necessary to make these repairs. FCS logisticians and engineers are designing features to ease this burden and to ensure that crews will be able to maintain their platforms. These actions include:

- *Minimizing maintenance workload.* Current air and ground combat systems require anywhere from 30 minutes to well over an hour of maintenance for every hour of operation. Most FCS platforms are limited to no more than 1 hour of maintenance for every 20 hours of operation. This "maintenance ratio" is a key requirement that supports crew maintenance and dramatically reduced maintenance infrastructures. Also, specific maintenance tasks can take no longer than 30 minutes for the crew to repair. Integrated logistics support (ILS) managers will work closely with design engineers to maximize accessibility for maintenance, including locations of fasteners and connectors to assist in achieving these goals.
- *Ease of maintenance.* For those repair actions that must still be done, FCS is pursuing a suite of initiatives to reduce maintenance task efforts and complexity for the crews and remaining maintainers. FCS is aggressively working to simplify maintenance actions via a concept known as pit-stop repair, which leverages ideas from a NASCAR-derived think tank headed by Dennis Carlson of Carlson Engineering, Livonia, MI. Carlson demonstrated this concept by dramatically redesigning the command shelter used by the Army's high-altitude air defense system. He reconfigured the interior by restacking the electronics into trays allowing easy identification and tool-less removal/replacement of failed components. Carlson is working with design engineers/logisticians on the PM/LSI team and with the primary platform contractors to ensure FCS platforms will be easy to maintain with minimal crew impact.
- *Embedded diagnostics/prognostics and automated supply transactions.* Embedded software and sensors will predict failures and initiate supply requests with limited to no crew involvement, optimizing crew time and the platform's operational availability. Crew chiefs will be informed of failed/failing parts and will be linked to repair procedures via the onboard PSMRS. Additionally, this approach eliminates the need for ancillary diagnostics equipment within the UA, reducing yet another logistics footprint aspect.
- *Line replaceable module (LRM).* The PM/LSI is redesigning how electronics are packaged on FCS platforms to ensure that high failure points will no longer be buried within large and expensive electronic line replaceable



Vehicles with hybrid-electric drive trains — like that shown in this artist's rendition of a hybrid-electric Humvee — use much less fuel than conventional vehicles and can greatly reduce the tonnage of fuel transported to the UA AO. (Image courtesy of PM UA.)

units. FCS will maximize the use of LRMs, which are durable, sealed circuit boards and power supplies that are plugged into highly reliable backplanes. Embedded diagnostics will "fault isolate" down to failed LRMs, which can then be easily removed or replaced by the crew with few or even no tools.

- *Limit on tools.* FCS platform crew maintenance actions will be accomplished with no more than 10 common tools, which will be carried onboard each platform. The entire suite of UA tools will be limited to a common list of 20 tools for all FCS field-level maintenance actions.
- *Commonality.* FCS has a design requirement to implement commonality across FCS platforms. The goal is to have 90-percent commonality of spare parts across systems, and the baseline is 70 percent. All components replaced in the field will be required to use metric fasteners. Commonality, along with common fasteners, will allow a much greater probability of having the necessary spare within the UA when needed. This will dramatically lower the platform-level downtime we see in today's combat units as they await parts.

Reducing Supply and Demand Requirements

The PM/LSI has numerous initiatives to first reduce demand for supplies within the UA, then to appropriately plan to efficiently provide the supplies at the right place and right time. The FCS program has set aggressive goals for fuel efficiency, as well as building platforms much lighter than today's combat systems, which will result in much less Class IIIB fuel required to cover comparable distances. Hybrid-electric drives are considered state-of-the-art in efficient drivetrains and are being incorporated into manned ground systems and other platforms.

Water generation is another innovative technique to reduce the second greatest tonnage (behind fuel) class of supply distributed on the battlefield. While onboard water generation was not technically achievable within weight/space constraints on the FCS manned ground systems, the PM/LSI is investigating the possibility of placing water generation on other UA organic complementary systems, minimizing the need to transport water to the UA from other areas within a theater.

To better address Class V ammunition storage and transport concerns, precision munitions are being developed/used on FCS platforms to reduce the rounds required. Automated resupply for large caliber ammunition on specific platforms is also being pursued to minimize the stress and workload on Soldiers, allowing them to focus on their combat missions.

To address future Class V ammunition storage and transport concerns, precision munitions will be developed for all FCS platforms. Precision munitions, ultimately, will reduce the number of rounds required for specific platforms. Here, SFC John Konken (left) and SPC Darryl Leija load sabot tank rounds into an M1A2 Abrams Main Battle Tank at Camp Taji, Iraq. (U.S. Army photo.)

Finally, PM/LSI is implementing a Performance-Based Logistics (PBL) concept to manage and provide Class IX repair parts. PBL is a strategy exercised by DOD Weapon System Managers, PMs, industry partners and system integrators to increase key warfighter performance metrics, while reducing total ownership costs and logistics footprints. Implementing PBL support strategies aids in reducing the logistics footprint through distribution-based logistics, total asset visibility and a seamless logistics system integration across all platforms.

FCS PBL support strategies are being designed to provide a single point of accountability for sustainment stocks. This enables optimal consolidation of shipments and resupply loads, decreasing the number of travel assets required for UA support, while enabling Soldiers to track the status of requested parts. Another key PBL advantage is that the suppliers will be incentivized to increase system and component reliabilities, as opposed to generating profits through the sale of expensive repair parts.

> FCS will maximize the use of LRMs, which are durable, sealed circuit boards and power supplies that are plugged into highly reliable backplanes. Embedded diagnostics will "fault isolate" down to failed LRMs, which can then be easily removed or replaced by the crew with few or even no tools.

Measuring Progress

To ensure that the FCS program achieves its supportability goals, the PM/LSI has instituted periodic supportability assessments in sync with design reviews that will include technical performance measures (TPMs) and measures of effectiveness (MOEs) designed to provide quantitative estimates of progress. The TPMs are UA self-sustainment index and system operational availability. The MOEs are UA footprint index, UA sustainment efficiency index, UA maintenance efficiency index and SoS operational availability. The UA footprint index MOE quantifies the footprint of a UA and compares it to the footprint of a like-sized MBCT. As such, the MOE will clearly indicate whether the UA has achieved a significant reduction in footprint as measured in total metric tons.

The PM/LSI has an aggressive and disciplined effort in place to influence FCS design and supportability. At this point in the program's Systems Development and Demonstration phase, this effort has made a tremendous impact in setting the azimuth for FCS, delivering maximum combat power and a minimal logistics footprint and LCC to 21st-century Soldiers. While PM UA has numerous challenges ahead of it, the end result will be a modernized fleet of combat systems with high operational availabilities and reduced logistics footprints and LCCs. This effort will provide future Soldiers the best possible capabilities to meet tomorrow's threats without leaving them with unnecessary logistics burdens.

The TARDEC Mobility Group is beginning an exciting new project to acquire a Dynamic Test Rig, which is also known as a Dynamic System Integration Laboratory. The new asset is a mobile platform for qualifying advanced hybrid-electric power components and subsystems to Technical Readiness Level 6. The platform will actually be a modified 20-ton hybrid-electric powered tracked combat vehicle demonstrator. (U.S. Army photo courtesy of TARDEC.)

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LEONARD KONWINSKI is the Associate Director for ILS in PM UA. He holds a B.A. in journalism and an M.A. in public administration, both from Central Michigan University.

Passing the Test for Success

Success on the modern battlefield can be measured in lives — those of enemy forces killed during the fulfillment of U.S. Army objectives in *Operations Enduring* and *Iraqi Freedom* and, more importantly, those of American personnel saved in the course of those same operations.

The Acquisition, Logistics and Technology (AL&T) Workforce understands that it holds the keys to warfighter success on the battlefield. It takes pride in its accomplishments and accepts the challenge and responsibility of providing superior weapons, equipment, services and support.

The AL&T Workforce is joined in these efforts by numerous other activities, including the various U.S. Army Life Cycle Management Commands (LCMCs), program and project managers and program executive offices (PEOs).

"We are saving lives through a holistic approach to force protection," Army Acquisition Executive Claude M. Bolton Jr. recently said, "including personal body armor, vehicle armor, electronic countermeasures, greater situation awareness, improved weapon system capabilities, and better training and operational focus. ... Our warfighters rely on and deserve the very best protection, equipment and weapon systems that America can provide."

Some of the systems that have helped save the lives of those Soldiers, or allowed them to more effectively perform their missions and thus secure the frontline of defense for our Nation, are highlighted on the following pages.

Editor-in-Chief

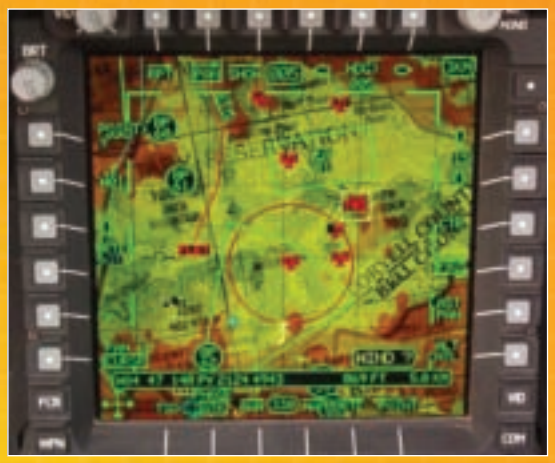
Soldiers from the 720th Military Police Battalion, 151st Field Artillery Regiment, react to enemy small-arms fire near Baghdad, Iraq, in late October 2005. (U.S. Army photo by SPC Gul A. Alisan.)

PEO Aviation

Apache Map Keeps Both Crew Members in the Fight

Some AH-64D Longbow Apache helicopter crews now have digital maps that allow them to quickly orient on key terrain features, negating the need for one member to refer to a cumbersome paper map while in flight. This system can cover an area up to 300 kilometers square and display maps in a variety of scales, types, views, contour line intervals, levels and elevation color schemes. These maps can be panned, oriented, used to depict threat rings and intervisibility and de-centered to show greater area ahead of a helicopter. The system is being used in Iraq by the 1st Battalion, 3rd Aviation Regiment, and 3rd Battalion, 3rd Aviation Regiment, 3rd Infantry Division.

Aircrews can now also count on the infrared (IR) strobe, which helps friendly aircraft pick each other out against an urban background at night, significantly reducing midair collisions and the potential for fratricide. Installation began in October 2004, and all Kiowa Warrior and Apache aircraft operating as part of *Operations Enduring* and *Iraqi Freedom* are now equipped with them.



An Apache digital map image. (U.S. Army image courtesy of PEO Aviation.)

An IR strobe shown circled in red. (U.S. Army photo by Albert Eaddy.)

After providing a night of close combat air support for ground forces, an AH-64 Apache helicopter prepares to land at Camp Taji, Iraq. (U.S. Army photo by TSGT Russell Cooley IV, 1st Squadron Combat Camera.)

U.S. Army Tank-automotive and Armaments Command (TACOM) LCMC

Stryker Cupola Shield

Constructed of ballistic-grade titanium, the Stryker Cupola Shield is a lightweight protective device that attaches to the sides of the rotating cupola on Stryker fire support and reconnaissance vehicle variants, providing added protection for exposed Soldiers. The shield was developed by the U.S. Army Armament Research, Development and Engineering Center at Picatinny Arsenal, NJ, in response to an urgent need requirement issued by the Project Manager Stryker Brigade Combat Team (SBCT). It is lighter than conventional steel and, thanks to advanced materials and rapid manufacturing technologies, costs 30 percent less to produce than traditional titanium products. The Stryker Cupola Shield is being used in Iraq by SBCT 2 (1st Brigade, 25th Infantry Division), which received it just as the team was deploying in March 2005. Eventually, all five SBCTs will be equipped with this innovative ballistic solution, which reduces the continued threat from small arms fire and improvised explosive devices that U.S. Soldiers face in Iraq.

A Stryker Cupola Shield. (U.S. Army image courtesy of TACOM LCMC.)

Soldiers from the 25th Infantry Division patrol an area near Mosul, Iraq, in April 2005, in their Stryker Armored Vehicles. (U.S. Air Force photo by TSGT Mike Buytas, 1st Squadron Combat Camera.)

Manufacturer's rendering of the CROWS system. (Image courtesy of Recon/Optical Inc.)

CROWS being installed on Humvees in April 2005. (U.S. Army photo by PFC Jerome Bishop.)

(U.S. Army photo by Mike Roddin.)

PEO Soldier

CROWS: A Night Hunter

Gunners have one of the Army's most dangerous jobs. Thanks to the Common Remotely Operated Weapon Station (CROWS) — a stabilized targeting system that integrates sensors and fire control capabilities and allows gunners to engage targets on the move using controls from inside a vehicle — the job just got a lot safer. CROWS' vehicular mount supports a variety of heavy weapons and includes a daytime video camera, thermal imagery and a laser rangefinder. CROWS also provides improved accuracy and increased range. "We came under fire at night," recalled CROWS operator SPC Kendall Hargis, Troop K, 3rd Battalion, 278th Armored Cavalry Regiment. "After we maneuvered through the kill zone, I got some hot spots on my thermals about 450 meters away. I could have taken those guys out pretty easy ... CROWS is a night hunter." CROWS' success prompted the Army to announce an Urgent Materiel Release for the weapon, and more than 300 of the systems will be fielded by 2007.

CROWS on vehicles deployed to Iraq. (U.S. Army photo.)

M-113 armored personnel carrier equipped with add-on armor. (U.S. Army photo courtesy of Project Manager Combat Systems.)

Soldiers in a Bradley Fighting Vehicle, from the 15th Infantry Regiment, 3rd Infantry Division, support Iraqi troops as they search for insurgents near Samarra, Iraq, in June 2005. (U.S. Army photo by SMSG Kim M. Allain.)

Project Manager Combat Systems

Bradley Reactive Armor Tiles Beat the HEAT

A number of add-on armor (AoA) programs have recently contributed to the survivability of both Soldiers and their equipment. Among these are Bradley Reactive Armor Tiles (BRAT), designed especially to defend Bradley Fighting Vehicle Systems against High Explosive Anti-Tank (HEAT) shaped-charged weapons systems like rocket-propelled grenades (RPGs). To date, more than 675 of the required 738 BRAT sets have been acquired and fielded through a rapid procurement program and accelerated production and delivery schedules.

Another AoA program is the rapid procurement initiative to meet Coalition Forces Land Component Command requirements for 734 armor suites for the M113 Family of Vehicles (inset). This suite consists of high hard steel that provides up to 14.5 mm perimeter protection, bar armor application to defeat RPGs, Transparent Armor Gun Shield and cupola protection, and belly mine armor providing protection against improvised explosive devices (IEDs) and mines of up to 22 kg. Currently, more than 220 AoA suites have been installed and fielded.

Army Research Laboratory (ARL)

Untended Transient Acoustic Measurement and Signal Intelligence System (UTAMS)

UTAMS is an acoustic mortar detection system developed by ARL that has been deployed to both Iraq and Afghanistan. It locates the source of an acoustic event — such as mortars, IEDs, RPGs and other explosives attacks — by triangulation. Soldiers at UTAMS location sites sleep better knowing that it helps pinpoint and get "eyes on" opposing forces much faster. It can also be interfaced with certain camera systems. Shown here is Tank Automotive Research, Development and Engineering Center (TARDEC) engineer Karl Tebeau installing a UTAMS array in Iraq.

(U.S. Army photo courtesy of TARDEC.)

Joint Land Attack Cruise Missile Defense Elevated Netted Sensor Project Office

A-170 Airship

The A-170 airship is a 178 foot, free-flying mobile aerial reconnaissance platform that uses the Rapid Aerostat Initial Deployment System to reach an altitude of 10,000 feet, putting it beyond the range of ground-based weapons. The A-170 can be deployed either manned or unmanned and remain aloft several hours even if punctured. It uses cameras and sensors to produce a detailed view of events on the ground.

(U.S. Army photo by SFC Antony M.C. Joseph.)

TARDEC

Armor Survivability Kits (ASKs) for Wheeled Vehicles

Reacting to an urgent need, TARDEC quickly provided ASKs to truck drivers in Iraq and Afghanistan needing better protection against small arms fire and IEDs. TARDEC and ARL produced a complete armored solution to upgrade Humvees that includes armored doors, fortified windows and armored rocker and rear panels.

(U.S. Army photo by MSG Maurice Hessel.)

Communications-Electronics LCMC

Joint Network Node (JNN)

JNN is a state-of-the-art commercial-off-the-shelf (COTS) communications system that enables exchange of voice, video and data throughout the tactical division and into the sustaining base. It leverages commercial satellite technology to provide beyond-line-of-sight capabilities and commercial Internet networking technology to increase functionality and efficiency while reducing size, weight and power. JNN also provides a high-speed and high-capacity backbone communications network focused on rapidly moving information to support commanders, staffs, functional units and capabilities-based formations; and enables commanders to plan, prepare and execute multiple missions and tasks simultaneously. JNN has been fielded to the 3rd Infantry, 4th Infantry, 10th Mountain and 101st Airborne Divisions.

(U.S. Army photo courtesy of Communications-Electronics LCMC.)

PEO Enterprise Information Systems

Combat Service Support Satellite Communications (CSS SATCOM)

The CSS SATCOM system is a COTS solution that includes CSS Very Small Aperture Terminals in tandem with the CSS Automated Information Systems Interface, a secure wireless interface. CSS SATCOM provides Non-secure Internet Protocol Router net access via satellite to the Army logisticians who order everything from bullets to butter. It is the centerpiece of the Army Deputy Chief of Staff for Logistics' (G-4) goal to "Connect Army Logisticians" and increases CSS enterprise effectiveness by increasing the number of requisition transactions that actually get through, and saves lives by reducing the need for Soldiers to go outside the wire to hand-deliver logistics data to other locations.

(U.S. Army photo by Stephen Larsen.)

PEO STRI

Training Improvised Explosive Device (TIED)

TIED is a modular, reconfigurable training system that trains warfighters to recognize and react to IEDs. TIED can be employed by opposing forces in force-on-force training exercises and can be used to replicate roadside bombs, vehicle-borne IEDs and booby traps. It is being used at the Training Support Center at Camp Arifjan, Kuwait, and more than 400 systems were fielded throughout the Army, Marine Corps, Special Operations Command and other services as of September 2005.

(U.S. Army photo courtesy of PEO STRI.)

PM SBCT

Stryker Battle-Damage Repair Facility (BDRF)

The BDRF was set up in late April 2005 to repair battle-damaged Strykers to Full Mission Capable status and return them to the fight. Qatar was chosen because it afforded ready access to air and sea transportation and has an existing industrial base. The BDRF is operated by General Dynamics Land Systems (GDLS) under the U.S. Army's Interim Contractor Logistics Support contract. Thirteen GDLS employees are on-site and five mechanics from Anniston Army Depot are on a 90-day work visit to the repair facility learning to repair battle-damaged Strykers. A PM SBCT representative is on-site maintaining oversight of the BDRF, which contains state-of-the-art equipment comparable to a repair facility located in CONUS.

(U.S. Army photo courtesy of PM SBCT.)

U.S. ARMY CHEMICAL MATERIALS AGENCY

CMA

Chemical Demilitarization Program Enhances National Security

An element of CMA, the chemical demilitarization program is the Army's third largest acquisition program and is responsible for eliminating in a safe, environmentally friendly and cost-effective manner an entire class of weapons of mass destruction and the facilities formerly used to produce them. This reinforces U.S. leadership in implementing the Chemical Weapons Convention and achieving the worldwide goal of completely eliminating such weapons by 2012. Currently, the U.S. stores chemical weapons at installations in Alabama, Kentucky, Indiana, Arkansas, Colorado, Utah and Oregon, and destroyed stockpiles at Johnston Atoll in 2000 (shown at right before and after destruction) and in Maryland in 2005. Elimination of recovered chemical weapons has required development of new technologies, including the Explosive Destruction System, a mobile unit used to destroy chemical-filled explosives with complete blast, vapor and fragment containment (inset below). CMA also produces payloads for smoke, nonlethal, incendiary, illumination and infrared uses, as well as for riot control and distraction grenades.

CMA's Explosive Destruction System. (Photo courtesy of CMA.)

(Photo courtesy of CMA.)

CMA makes and tests chemically protected field hospital shelters and decontamination systems. (Photo courtesy of CMA.)

Johnston Atoll chemical disposal facility before and after dismantling and environmental remediation. (Photo courtesy of CMA.)

An RG-31 armored car in Iraq. (U.S Army photo by CPL Joe Niesen.)

(Photo courtesy of PEO Ammunition.)

PEO Ammunition

Countermine Vehicles

The 24-ton Buffalo vehicle offers combat engineers a safe, effective means of searching for IEDs, using a 30-foot, remote-controlled, hydraulic arm to prod suspicious items until it is determined whether they are a threat. Blast resistant and heavily armored, Buffalo provides protection from explosives for the vehicle's crew during detection and confirmation missions along roadways and minefields. Another countermine asset, the RG-31 Mine Protective Vehicle (inset at left), serves as an armored personnel carrier for use on- and off-road that can carry 10 Soldiers and provides protection from small arms fire and antitank devices. Pictured are SSGT Owen Rice and SPC4 Marc Fickas, both from Bravo Co., 367th Engineer Combat Battalion, who wrote, "While on a vehicle patrol in southeastern Afghanistan, our vehicle suffered a possible mine strike or IED attack. All five passengers were able to exit the RG-31 and run to the next vehicle in the convoy."

The Buffalo can also be equipped with attachments, such as this roller array. (Photo courtesy of PEO Ammunition.)

UNITED STATES ARMY
TARDEC
TANK AUTOMOTIVE RESEARCH, DEVELOPMENT AND ENGINEERING CENTER

Mobile Parts Hospital (MPH)

Conceived of by TARDEC engineers, the revolutionary MPH consists of three individual modules — a Communications and Control Center, a Rapid Manufacturing System and an Agile Manufacturing Cell — that can efficiently fabricate standard and customized parts for vehicles or systems with critical battlefield needs. Since October 2003, MPHs have been deployed to Camp Arifjan, Kuwait; Camp Anaconda, Iraq; and Bagram Air Force Base, Afghanistan, where they have worked vigorously to meet identified maintenance needs and rapidly serviced and repaired parts. Accomplishments include manufacture of the Squad Automatic Weapon (SAW) vehicle mount, recognized as one of the greatest military inventions of the past two years.

"Simply put, the Mobile Parts Hospital has saved lives," said 2LT Bruce Neighbor, 1486th Transportation Co., deployed in Iraq. "I continue to bring more and more orders to the MPH, and they have fulfilled my every need."

TARDEC has also been striving to keep Soldiers out of harm's way through the development of unmanned robotic systems, including the Talon, a Small Unmanned Ground Vehicle (SUGV) used to defuse explosive ordnance; the Omni-Directional Inspection System (ODIS), a robotic delivery platform equipped with a visual camera and an active lighting system that is capable of carrying chemical and biological sensors on its base; the Under Vehicle Inspection System, a prototype small robotic platform that can inspect the underside of vehicles; and Chaos, a robot scheduled to go into production in 2006 that will be able to walk up and down stairs, drive in severe off-road environments and be equipped with a wire-snipping device and a mobility arm that will allow it to drag obstacles.

A Lathe Manufacturing Module (LMM) is put in place by a Rough Terrain Container Handler. (U.S. Army photo by Randy Talbot, TACOM Historian.)

The Talon SUGV has saved lives by helping dispose of explosive ordnance. (U.S. Army photo.)

SAW gun vehicular mounts are one of the critical things manufactured by the MPHs. (Photo courtesy of TARDEC.)

An ODIS robot. (Photo courtesy of TARDEC.)

Rudy Miller, TARDEC/National Automotive Center, sets up the LMM (U.S. Army photo by Randy Talbot, TACOM Historian.)

Mid Range Munition — Delivering the Lethality to Finish Decisively

Robert Muth

A key Army Future Combat Systems (FCS) component is to execute the "Quality of Firsts" — See First, Understand First, Act First and Finish Decisively. One area where the synergy of sensors and lethality offers decisive advantages is beyond-line-of-sight (BLOS) engagements. The BLOS capability provided by FCS gives the maneuver commander unprecedented access to targeting sensors, enabling him to effectively engage and defeat stationary and moving targets at extended ranges. The FCS Mounted Combat System's (MCS's) ability to rapidly deliver BLOS fires is vital to the FCS-equipped Unit of Action's (UA's) survivability, lethality and overall effectiveness.

General Dynamics Land Systems is developing the MCS and Abrams MBT upgrades to ensure maximum synergy of designs is achieved and risk is mitigated through fire control and gun modifications. Here, Soldiers from A Co., Task Force 1st Battalion, 35th Armor Regiment, 1st Armored Division, patrol a street in Baghdad, Iraq. (U.S. Army photo.)

The Mid Range Munition (MRM) is the gun-fired, precision BLOS munition that enables the MCS to deliver the lethality necessary to finish decisively. With FCS spin-out (SO) capabilities, MRM can be fielded to a modified M1A2 System Enhancement Package Abrams tank that will constitute the Modular Heavy Brigade Combat Teams (HBCTs). These HBCTs will fight side-by-side with the UAs well into the future. The Project Manager for Maneuver Ammunition Systems (PM MAS) at Picatinny Arsenal and its Armament Research Development Engineering Center (ARDEC) partner are prepared to execute an evolutionary incremental acquisition strategy to develop and field MRM's revolutionary BLOS capability.

MRM development and fielding will provide the UA and FCS-equipped HBCTs with the ability to perform BLOS and NLOS fire missions from multiple platforms. Here, SPC John L. Jackson, Alpha Battery, 3rd Battalion, 83rd Field Artillery Regiment, 1st Cavalry Division, loads the primer into his M109A6 howitzer during combat operations near Fallujah, Iraq, in November 2004. (U.S. Army photo by SFC Johancharles Van Boers.)

Standoff Capability for Organic Forces

An FCS Operational Requirements Document key performance parameter is networked lethality. Networked lethality distributes line-of-sight (LOS), BLOS, and non-line-of-sight lethality across the UA.

> The MRM is the gun-fired, precision BLOS munition that enables the MCS to deliver the lethality necessary to finish decisively.

BLOS is an extension of traditional LOS in that the MCS vehicle commander firing the munition has "eyes on target" and is responsible for identifying the target. BLOS is enabled in the FCS by integrating communications and controls that allow firing platforms to control targeting and designating sensors — such as unmanned aerial vehicles — that will be resident in UA echelons down to company level. By separating the physical location of the sensor from the shooter, BLOS enables missions to be executed across terrain compartments and at extended ranges.

Exploiting terrain and range provides the tactical standoff capability to act first. MRM provides the MCS with an organic BLOS capability, without the need to queue fires. MCS can fire MRM while stationary or on the move, providing precision defeat of single-point, high-payoff targets, including stationary or moving main battle tanks (MBTs), light armor, self-propelled howitzers and air defense artillery assets.

While an overwhelming majority of MRM-executed missions will be BLOS, MRM can also be used in LOS and extended-range engagements. A significant body of operational studies has repeatedly verified the utility of MRM in BLOS engagements and FCS requires this capability. Because of this, MRM is positioned to complement the MCS gun's propulsion and pointing accuracy to meet the platform's lethality requirements, at nominal ranges, providing many stowed kills per vehicle. The platform/munition system approach to lethality allows the MRM to realize a lower unit production cost (UPC) and provide the finishing lethality that synchronizes the ability of other smart munitions to effectively shape the battlefield at even longer ranges.

MRM 101

The MRM mission starts with a target being identified and a decision to engage. Targeting data — such as the target's location, type and speed — is transmitted to the MCS through the network. A firing solution is calculated and the gun is automatically aimed. Using the two-way data link, target and other necessary data is transferred to the MRM cartridge and receipt is confirmed back to the MCS crew.

Upon trigger pull, the round exits the muzzle and deploys fins to start flying a ballistic trajectory. At a point after apogee, the projectile begins the acquisition phase, searching for either an infrared or millimeter wave signature and/or a semiactive laser (SAL) designation return from the target. After the target is acquired, the projectile

Future MCS- and FCS-equipped Abrams MBTs will fire MRMs. Hardware and software modifications to the Abrams MBTs will include breech changes, ammunition stowage enhancements, fire control updates and data links. Here, 3rd Brigade Combat Team Soldiers assigned to the 1st Infantry Division return from a combat mission near Baqubah, Iraq. (U.S. Army photo by SSG Klaus Baesu.)

tracks the target, guiding toward it as necessary. The projectile then strikes and defeats the target.

The MRM employs three modes of operation as follows:

- Autonomous Mode. The MRM searches for and engages targets using data downloaded to the projectile prior to firing to aid in target acquisition.
- Designate Mode. The munition searches for a SAL designator return from the target and engages it. The munition switches to the autonomous mode in the terminal phase. This allows for sensor-fused aim point refinement to maximize lethality. If the laser spot is lost or not present, the projectile will automatically revert to autonomous.
- Designate-only Mode. This is similar to designate except if the laser spot is lost or not present, the munition does not revert to the autonomous mode. This allows for added control where potential fratricide or collateral damage could be a concern in various operational or urban environments.

Competing Technologies Offer Options

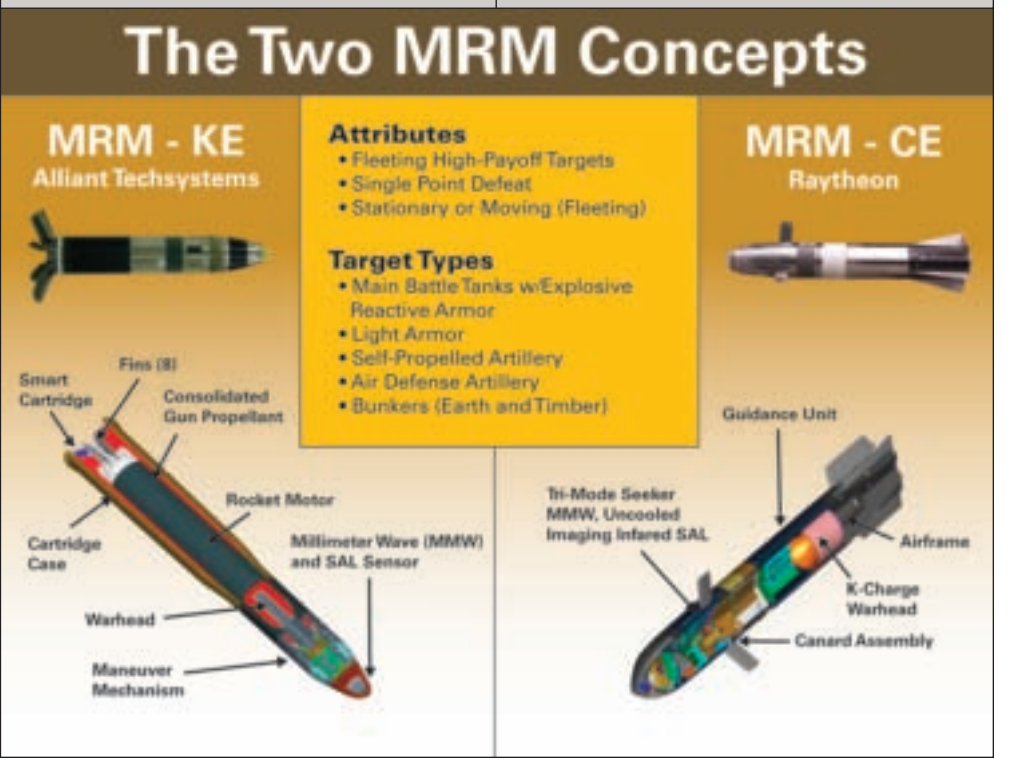
MRM concept maturity has been demonstrated in two separate versions as depicted in the figure. The kinetic energy (KE) version, being developed by Alliant Techsystems, and Raytheon's chemical energy (CE) version have both undergone a series of subsystem demonstrations to validate performance and the ability to survive high-g gun shock of the seekers, guidance and control, airframe, propulsion and lethal mechanism.

The subsystems — minus the warheads and SAL sensor — were then integrated and gun-fired at Yuma Proving Ground (YPG), AZ, in a series of Autonomous Seeker Guide-to-Hit demonstrations for both concepts. Both concepts proved successful in meeting most test objectives, including surviving gun launch and acquiring targets. One concept scored a direct hit against a T-72 MBT at 5,200 meters.

These accomplishments were realized during the FCS 120mm LOS/BLOS System Advanced Technology Demonstration program run by ARDEC in partnership with PM MAS. Currently, integration of a full dual-mode seeker — autonomous and designated — is being conducted under the MCS Ammunition System Technologies Army Technology Objective. This concept is at Technology Readiness Level (TRL) 6 for an integrated autonomous-only MRM with TRL 6 for a dual-mode flight demonstration to be achieved by the end of FY07.

Involving Stakeholders

PM MAS formed an Overarching Integrated Product Team (OIPT) last year to address the overall systems-level requirements and strategy for the MRM.



FCS SO technology will be spiraled into most MCS platforms to help deliver more accurate precision munitions that will provide unprecedented lethality. Here, an NLOS cannon fires a round downrange at YPG. (U.S. Army photo courtesy of YPG.)

The OIPT included representatives from the UA Maneuver Battle Lab, U.S. Army Training and Doctrine Command (TRADOC) System Manager for the Abrams tank, PM Combat Systems, PM Mounted Combat Systems, PM UA Lethality Systems Integration and ARDEC.

The OIPT recommended that MRM be developed in two increments for fielding with both the MCS and the Abrams MBTs that will be part of FCS-capable HBCTs. The plan called for the first increment to develop an interim BLOS capability starting in FY08, with Milestone C occurring in early FY11. This increment will be fielded to Abrams MBTs in 2014.

MRM Increment 2 development will build upon the first design with Milestone B to occur in FY11 and Milestone C in FY13. Increment 2 MRMs will be used in both MCS- and FCS-equipped Abrams. Hardware modifications to the Abrams MBTs, including a data link, breech changes, ammunition stowage enhancements and fire control updates, will be incorporated one time and will be implemented in time for Increment 1. It is anticipated that only software updates to the Abrams will be required to accommodate Increment 2 MRMs.

Strategy Offers Advantages

The incremental strategy offers numerous benefits and program management advantages as follows:

- Earlier production of an initial capability can be achieved, starting at the end of FY10, compared to an MCS-only program that would start producing MRM in mid-FY12.
- Process reduces risk of not delivering fully capable ammunition to the MCS by producing an early increment of MRM.
- Lessons learned can then be fed into the development and production of a fully capable Increment 2 MRM.
- Process initializes a production capacity, so proven production lines can be used to start Increment 2 production.
- Strategy offers payback in reducing the overall UPC.

MCS risk can also be reduced as the first version of fire control and gun modifications is produced and exercised on an Abrams MBT. Because the same prime contractor — General Dynamics Land Systems — is developing the MCS and Abrams upgrades, maximum synergy of designs can be achieved. From an operational standpoint, future tactics, techniques and procedures (TTPs) are also enhanced in that Increment 1 will allow the FCS Experimental BCTs to vet the operational issues of using MRM. This will allow TRADOC and other users the capacity to optimize TTPs for the final FCS fielding.

A Decisive Finisher

The final and most important benefit is that MRM increments will help bridge the lethality gap from the Current Force to FCS. Developing and fielding MRM in two increments provides the UA and FCS-equipped HBCTs the flexibility to execute BLOS missions from multiple platforms. This approach permits the FCS MCS to achieve both lethality and survivability requirements. If the network sees and understands first, MRM will help assure that the FCS force can "finish decisively."

ROBERT MUTH is the Systems Integration Lead for the MRM program currently assigned to PM MAS from ARDEC. He has both a B.E. in electrical engineering and an M.E. in integrated engineering from Stevens Institute of Technology. Muth is Level III certified in systems planning, research, development and engineering and has more than 17 years of acquisition experience.

The XM395 Precision Guided Mortar Munition (PGMM) Delivers Increased Range and Lethality

Peter J. Burke

In less than 5 years, the U.S. Army will begin arming maneuver commanders with precision munitions that they can fire from their own 120mm mortar systems. The XM395 PGMM is a smart 120mm mortar round currently under development by Product Manager (PM) Mortar Systems, the total life-cycle manager for advanced mortar weapon, digital fire control and ammunition programs. It is scheduled to be completed in 2008 and fielded by 2010.

(Top) The 120mm smooth-bore, semiactive laser PGMM looks, feels and loads almost identically to the mortar system in service today. It is capable, however, of defeating hardened and stationary targets with far fewer rounds, at greater ranges and with much less collateral damage than current mortar ammunition. (U.S. Army photo courtesy of PM Mortars.)

(Background) PFC Joshua Wood, 1st Battalion, 198th Armor Regiment, 155th Brigade Combat Team, sets up a tank-mounted 120mm mortar system near Najaf, Iraq. The XM395 PGMM will also be fielded to wheeled and tracked armor forces that currently employ 120mm mortar systems on their vehicles. (U.S. Army photo by Edward Martens.)

The 120mm mortar system is a key lethality component of Army modularity, giving both light and heavy forces extended range and increased accuracy with this highly flexible and deployable weapon system. Light forces will all be receiving the ground-mounted 120mm system to increase their combat power and precision fires. Mobile variants will also be fielded to forces that currently employ the 120mm mortar system on wheeled (Stryker) and tracked (M113 variant) vehicles. PGMM also complements Future Combat Systems, which will include 120mm Non-Line-of-Sight Mortar variants.

PGMM is following an incremental development approach at the request of its combat developer, the U.S. Army Infantry Center. Increment 1, scheduled to begin flight demonstrations in 2006, will give maneuver commanders the ability to defeat high-payoff targets — such as enemies protected by earth and timber bunkers, masonry walls or lightly armored vehicles — with just one or two rounds. Future versions will have increased maximum range beyond 7,200 meters, be able to engage more targets and have increased maneuverability.

The system's prime contractor, Alliant Techsystems, of Plymouth, MN, is responsible for system integration as well as subsystems and software development. Key subcontractors include BAE Systems (Nashua, NH), which is developing the semiactive laser seeker, and Pacific Scientific (Valencia, CA), which is developing the midbody thrusters that will maneuver the round.

PM Mortars has also established close ties with government organizations that provide the key enabling systems or personnel that will make PGMM a success when fielded. These include the:

- U.S. Army Field Artillery School, proponent for forward observers and equipment.
- U.S. Army Aviation Center, proponent for reconnaissance, attack and unmanned aerial vehicle designators.
- Program Executive Office (PEO) Simulation, Training and Instrumentation, proponent for live, constructive and virtual training systems.
- PEO Ground Combat Systems, proponent for mortar prime movers.
- PM Sensors and Lasers, proponent for laser designators.

An XM395 round looks very much like a standard 120mm mortar round, with fixed tail fins, a four-zone charge system and a large warhead. The main difference is the incorporation of a semiactive laser seeker in the nose, coupled to thruster rockets in the sides of the round, which will provide the endgame guidance required to hit small targets with a high degree of accuracy.

How It Works

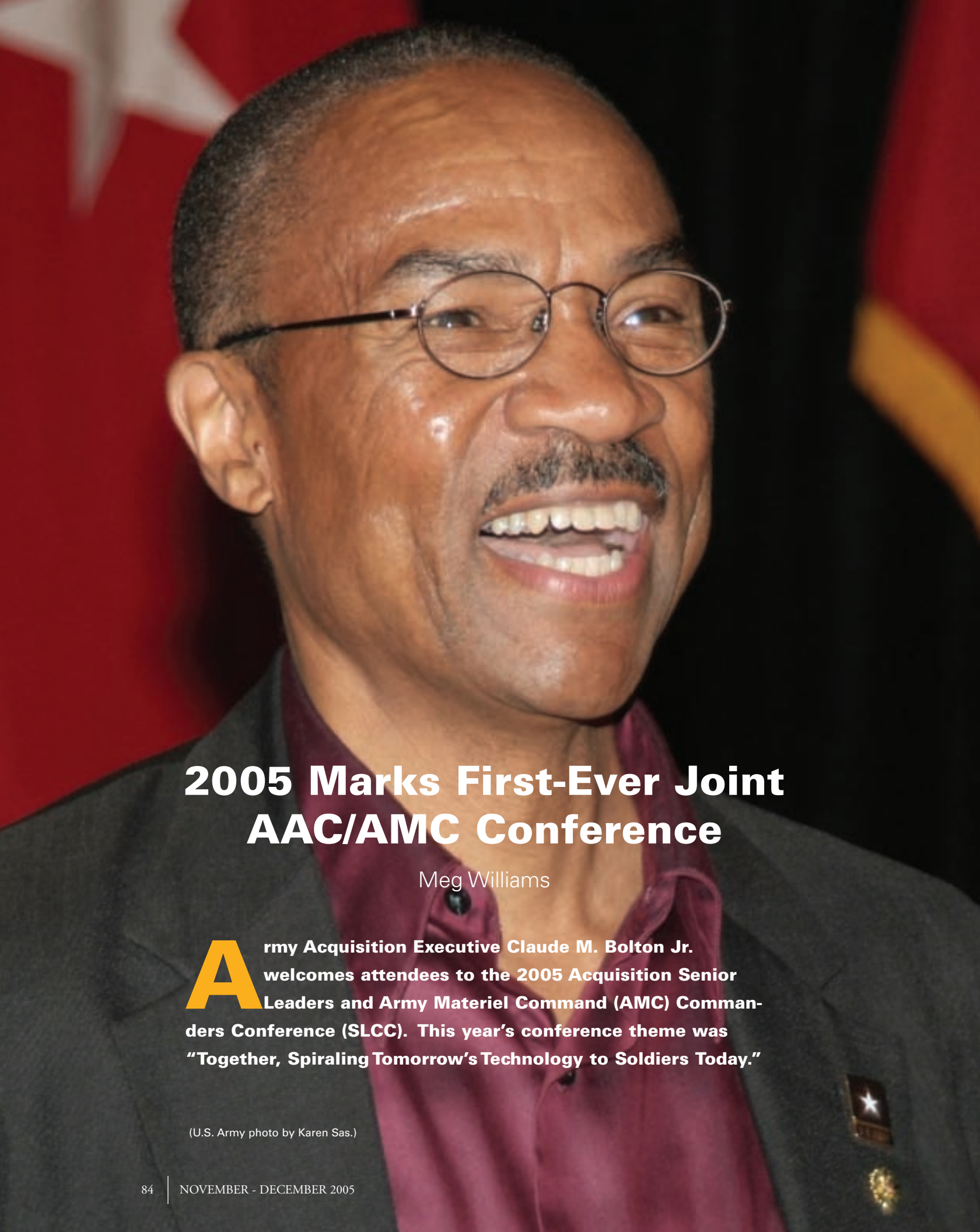
To employ the XM395 PGMM, a forward observer identifies a target and then sends a request for fire digitally or by voice to the Battalion Fire Support Element. Once the mission is approved, a message goes directly to the Mortar Fire Direction Center, which then chooses the mortar weapon platform best positioned to conduct the fire mission. The mortar crew then prepares the round for firing, just as they would a standard round.

After the fire command, the round flies ballistically to apogee and then begins looking for the laser energy reflected off the target. Within approximately 10 seconds of impact, the forward observer receives a message to begin lasing the target. The round's seeker detects this energy on the target and commands itself to fire thruster rockets to move itself to the target. Upon impact, the warhead detonates, with a high probability of eliminating the target.

The XM395 PGMM will deliver an increased maximum range beyond 7,200 meters and allow Soldiers to defeat a variety of hardened and stationary targets using fewer rounds than conventional mortar rounds. Here, SPC Camille Fossier, 2nd Battalion, 156th Infantry Regiment, 3rd Infantry Division, fires his mortar during a recent combat mission in Iraq. (U.S. Army photo.)

PM Mortars is working very closely with the U.S. Army Infantry Center to make certain that it has correctly translated user requirements and is on track to develop an affordable and effective training concept and deliver a precision mortar munition that will be economical, simple to use and highly effective against multiple target types.

PETER J. BURKE is Chief, Precision Effects Branch, PM Mortar Systems. Burke's prior PM Mortars assignments include managing the PGMM Component Advanced Development program and Project Director, XM95 Mortar Fire Control System. Burke has a B.S. in industrial engineering from the New Jersey Institute of Technology and an M.B.A from the Florida Institute of Technology. He is an Army Acquisition Corps member and is Level III certified in systems planning, research, development and engineering.



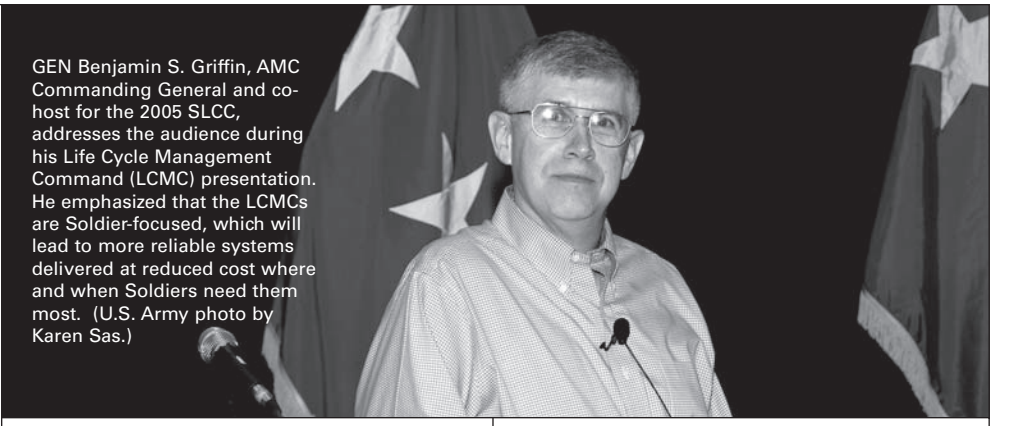
2005 Marks First-Ever Joint AAC/AMC Conference

Meg Williams

Army Acquisition Executive Claude M. Bolton Jr. welcomes attendees to the 2005 Acquisition Senior Leaders and Army Materiel Command (AMC) Commanders Conference (SLCC). This year's conference theme was "Together, Spiraling Tomorrow's Technology to Soldiers Today."

(U.S. Army photo by Karen Sas.)

More than 430 senior Army leaders and civilians attended the 2005 SLCC held in Detroit, MI, Aug. 23-25. This was the first joint conference held by the U.S. Army Acquisition Corps (AAC) and AMC. Army Acquisition Executive/Assistant Secretary of the Army for Acquisition, Logistics and Technology Claude M. Bolton Jr. and AMC Commander GEN Benjamin S. Griffin co-hosted 3 busy days of seminars and workshops. Highlights from the conference were remarks by Secretary of the Army (SECARMY) Dr. Francis J. Harvey and a tour of the Ford River Rouge plant.



GEN Benjamin S. Griffin, AMC Commanding General and co-host for the 2005 SLCC, addresses the audience during his Life Cycle Management Command (LCMC) presentation. He emphasized that the LCMCs are Soldier-focused, which will lead to more reliable systems delivered at reduced cost where and when Soldiers need them most. (U.S. Army photo by Karen Sas.)

SECARMY

Dr. Harvey began by telling the audience he thought it was a great idea that AMC and the AAC came together at this annual meeting. "As you fully integrate acquisition and sustainment you should focus on unburdening the Soldier," Harvey remarked. "Solve problems in development, not in the field."

His speech also covered Army transformation, modular forces and reducing stress on the force. "Active and Reserve Component rebalancing of the modular force will reduce stress on the force by enacting predictable rotation cycles and longer dwell times at home," explained Harvey. The SECARMY also urged those present to reduce Army business costs by applying Lean/Six Sigma practices to improve processes and output quality. "The net result of these improvements is for the warfighter," Harvey said. "Free up resources for the warfighter."

From the Front Lines

Freeing up resources for warfighters was a sentiment echoed by Army Aviation Task Force Director BG Stephen P. Mundt in his "From the Front Lines" presentation. "How many program managers (PMs) in here have products that they don't need?" asked Mundt. "Let's see a show of hands. Nobody, right? Folks, we need your help because there's not enough money anymore. If you can't deliver on time, you need to ask yourself if the product is really still needed. That money needs to go somewhere else."

"Our contracting guys know — we're broke and it shows," he continued. "I don't know how we can build swimming pools in Iraq and yet we can't put safe electrical power in buildings. I feel directly responsible. I lost a Soldier in Iraq who was taking a shower, touched a pole and died. I now know more about electricity and circuit breakers than I ever knew. Our contracting officers need to ensure that we get enough money and the money goes to the right place and does the right thing."

Consider the Second-Order Effects

Mundt asked the acquisition officers to think about ramifications of new equipment, clothing and weapons in terms of the captains and first sergeants on the other end. Mundt listed the successes he's seen in the field: the outer tactical vest and small arms protective insert (SAPI) plates, neck protectors, groin protectors, deltoid and axillary protectors, up-armored Humvees and advanced combat helmets. "My hat's off to all of you here because we see your efforts working on weekends and nights to get us the right stuff," Mundt said.

Mundt brought nine warfighters to the conference to talk about their experiences with equipment and systems developed by acquisition professionals. These Soldiers talked about the negative and positive aspects of their weapons and systems. "As we talk about more examples, some of you are saying to yourselves, 'I know about that. I'm working on a fix for that,'" Mundt pointed out. "That's not the gist of what we're here to discuss. You're fixing things very, very fast. What we hope is to come to an understanding that as you fix things, you consider the second-, third- and fourth-order effects of the solutions you provide. The more you do in that vein, the fewer problems for the young captains and their first sergeants."

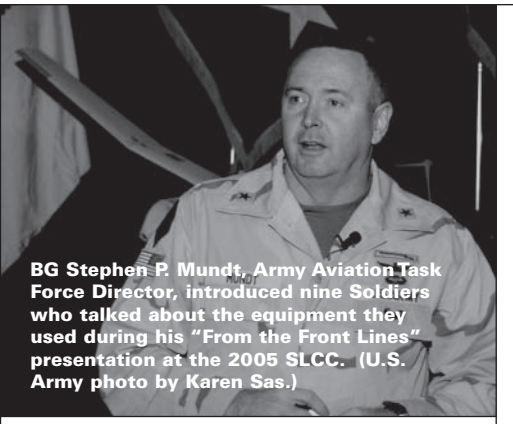
Add-on Armor (AoA)

"Our Army had less than 500 up-armored Humvees when we went to war," Mundt recalled. "Now, there are nearly 40,000. In less than 3 years, that's a pretty amazing feat." He went on to explain that bolt-on armor protected Soldiers very well, but the additional armor blocked air from getting to the vehicle's engine and alternator causing them to choke. Plus, the drivers and passengers were subjected to extreme heat. Many people then worked to provide solutions to the air conditioning problem.

The up-armored Humvee's door locks and seatbelts are giving Soldiers problems. It's very hard to get into the vehicle from the outside. Also, Soldiers are wearing so much protective gear that it's very difficult to latch the seatbelt, and it's even harder to unlatch it. Mundt said that Soldiers in Humvees who have gone into the dikes of Iraq often drown because they cannot unbuckle their seatbelts and rescuers cannot unfasten the Humvee doors to get to Soldiers trapped inside. "Even if we have to go back and redesign the interior frame of that seat, it is worth it," Mundt explained. "We are going to lose Soldiers who cannot get out if we don't redesign it."

MAJ Vince Stephan, Assistant PM for Heavy Tactical Vehicle Modernization, was Site Manager for AoA installation at Logistics Support Area Anaconda in Iraq. Stephan managed five contracts with five different companies and more than 200 civilian contractors and 50 U.S. Air Force mechanics who were installing AoA kits. These circumstances called for clearly stated objectives and required everyone to pull together and work as one team. "More than 50 percent of our contractors were ex-military so they understood what it was like to be in that type of environment," said Stephan.

The sand and dust were harsh on hand tools and air compressors. Those environmental factors, along with 24/7 usage, contributed to a short life



BG Stephen P. Mundt, Army Aviation Task Force Director, introduced nine Soldiers who talked about the equipment they used during his "From the Front Lines" presentation at the 2005 SLCC. (U.S. Army photo by Karen Sas.)

expectancy of many tools. Working with the vehicles themselves sometimes presented problems. AoA is designed to be put on trucks without any welding as bolt-on equipment, but some vehicles are beat up and twisted from damage sustained during accidents or improvised explosive device attacks. Stephan praised the welders who worked tirelessly to cut and weld the armor applied to the damaged vehicles. He also advocated bringing in field service representatives from the truck and armor manufacturers whose expertise sped the process. "Our contractors on the battlefield took it personally and we all benefited from that," Stephan said.

Advanced Combat Helmet (ACH)

Everyone Mundt has spoken to who has the new ACH likes it, he said. He went on to say that the press has said that the ACH is not all it's cracked up to be. There were some tests that pointed out that injuries would be sustained if Soldiers did not put the helmet on correctly. "People who are responsible for training and sustaining that piece of equipment need to teach Soldiers how to wear the helmet," Mundt advised. "At the end of the day, what saves lives is to enforce the standards of wearing and using the gear correctly."

Rapid Aerostat Initial Deployment (RAID)

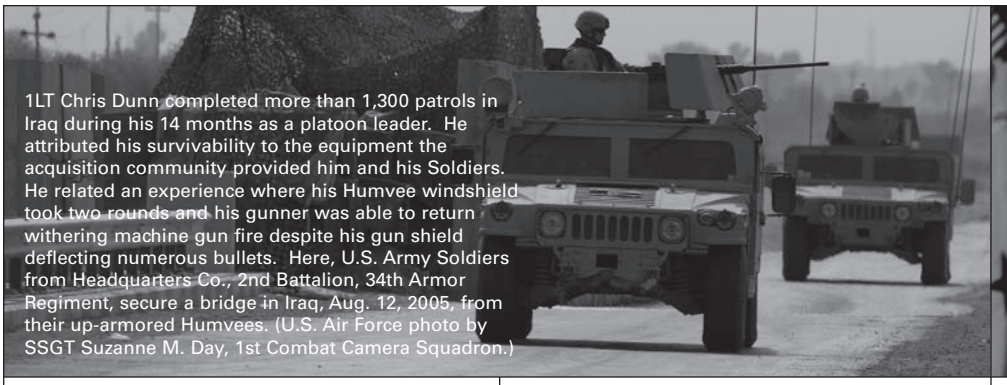
SGT Chad Baughman described the RAID system he worked with from March 2004 to March 2005 at Camp Victory, Iraq. This system consists of a tethered balloon equipped with a thermal high-speed camera. The camera follows patrols beyond Camp Victory boundaries and conducts searches to compare stretches of land and see if there are any changes from one night to the next. Its photos of crowds around an explosion near a convoy were used to identify individuals involved in the incident. "It's like a superhero," Baughman said, describing the balloon. "Ten feet tall and bulletproof. It's a resilient piece of equipment."

Better Connectivity Needed

MAJ Kevin Fittz, Unmanned Aerial Vehicle System (UAVS) Action Officer and Deputy Director of Plans and Operations, Aviation Directorate, said Soldiers are taking UAVSs and doing more with them than intended by design. UAVSs were not designed or manned to support ground operations 24/7, but that operations tempo is the

SGT Chad Baughman worked with the RAID system in Iraq. (U.S. Army photo by Karen Sas.)

A RAID system is received at Bagram Air Field, Iraq, by its military/contractor support team following a reconnaissance mission of the surrounding countryside. (Photo courtesy of Raytheon.)



1LT Chris Dunn completed more than 1,300 patrols in Iraq during his 14 months as a platoon leader. He attributed his survivability to the equipment the acquisition community provided him and his Soldiers. He related an experience where his Humvee windshield took two rounds and his gunner was able to return withering machine gun fire despite his gun shield deflecting numerous bullets. Here, U.S. Army Soldiers from Headquarters Co., 2nd Battalion, 34th Armor Regiment, secure a bridge in Iraq, Aug. 12, 2005, from their up-armored Humvees. (U.S. Air Force photo by SSGT Suzanne M. Day, 1st Combat Camera Squadron.)

1LT Chris Dunn was a platoon leader in Iraq who conducted more than 1,300 patrols in a 14-month period. (U.S. Army photo by Karen Sas.)

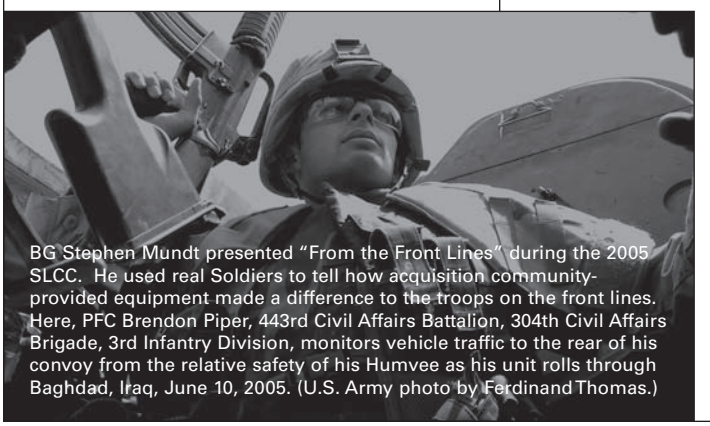
reality of war. He gave nighttime and daytime examples where Soldiers used UAVs to locate the enemy. The Soldiers who man UAVS equipment need better connectivity to Soldiers who are using the information from the UAVs, Fittz pointed out. And the Army is actively responding to this need with a way to get in and out of the network — a Radio Video Transceiver that leverages the network. "We need to do a better job of writing requirements," he added. "Those of us in the Army need to get involved with the Air Force (Joint Provider) Capabilities Development Documentation.

There were many leaders who spoke with the gravitas of rank and age at the SLCC. And there was one speaker who offered only the raw experience of the front line itself. Sometimes it's this kind of story that leaves a more lasting impression. 1LT Chris Dunn spoke about one battle that stood out during the 14 months he spent as a platoon leader in Iraq, where he went on more than 1,300 patrols in Baghdad, Fallujah and An Najaf. Dunn fought in An Najaf in August 2004 when Moqtada al-Sadr's militia was fighting from the Imam Ali Mosque near a cemetery. He was traveling in a Humvee when it was hit in the windshield on the driver's side by two rounds. "They tell us that a windshield will hold three rounds, but we didn't stick around to find out." Dunn said. "The windshield saved the driver's life that day. My gunner was taking bullets across his gun shield left and right and his life was saved countless times."

Dunn and his men were on their way to rescue a tank that was immobilized. The tank was commanded by a buddy of Dunn's and was firing rounds next to a building when an insurgent dropped from the building onto the top of the tank. "If you've ever been in a tank during a fight, it's really loud," Dunn explained. "You can't hear anything. They didn't even know he was there." The tank was engaging targets in the city, and SPC Mark Anthony Zapata popped the hatch to look outside. The insurgent shot him from behind and then reached into the hatch and shot Dunn's buddy, 2LT James Michael Goins, in the side between the SAPI plates. Both died. Dunn went on to tell those assembled that there's a definite need for better optics in the Humvee and tank, more and better crowd control equipment and a better system to protect gunners.

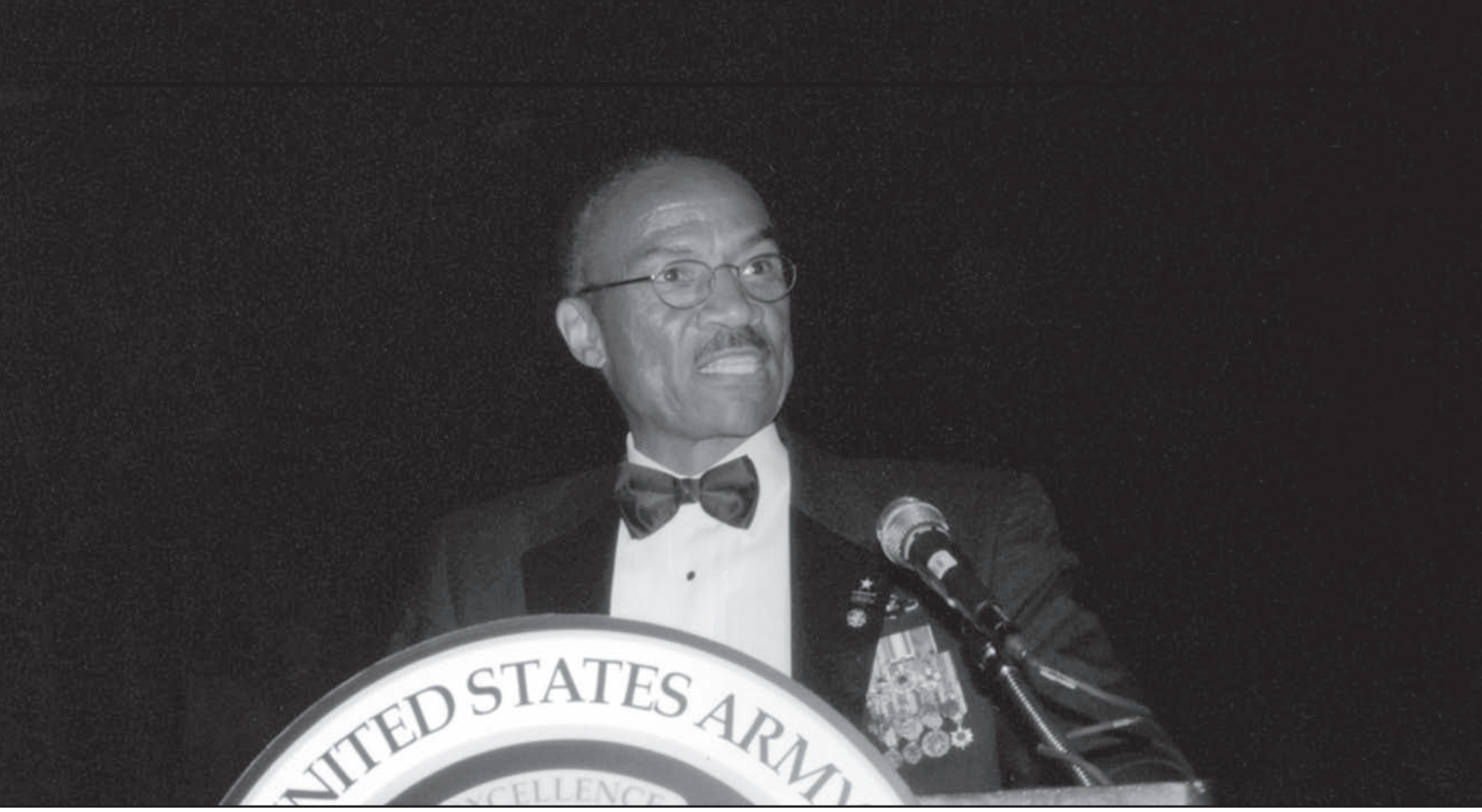
When asked after the presentation if he got to see the first Iraqi election, Dunn blushed and admitted he had slept through that day. "We patrolled heavy for 2 days prior and on election day, we finally got to rest," Dunn explained. "Other guys told me stories about the long lines. One family brought their 80-year-old mother. They pushed her in a shopping cart for 10 miles to bring her to cast a vote." And with that image, you realize that in Dunn's short military career he has seen comrades at the beginning of their lives die for the chance for an old woman to finally choose how her last years are governed. It is too soon to know how the crucible of Iraq will render the Army's future leaders, but we should seek them out, listen to their experiences and give them the tools they need to continue their work.

To see photos taken at the 2005 event, go to **http://asc.army.mil/events/slc_2005_pics.cfm**.



BG Stephen Mundt presented "From the Front Lines" during the 2005 SLCC. He used real Soldiers to tell how acquisition community-provided equipment made a difference to the troops on the front lines. Here, PFC Brendon Piper, 443rd Civil Affairs Battalion, 304th Civil Affairs Brigade, 3rd Infantry Division, monitors vehicle traffic to the rear of his convoy from the relative safety of his Humvee as his unit rolls through Baghdad, Iraq, June 10, 2005. (U.S. Army photo by Ferdinand Thomas.)

MEG WILLIAMS is the *Army AL&T* Magazine Web Editor and provides contract support to the 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.



Celebrating Our Acquisition Stars 2005!

Mike Roddin

The *2005 Army Acquisition Corps (AAC) Annual Awards Ceremony* was held Oct. 2, 2005, at the Crystal City Gateway Marriott in Arlington, VA. The event recognized the accomplishments of the acquisition workforce's most extraordinary members and the teams they lead. The ceremony's theme, "Celebrating Our Acquisition Stars!" was a tribute to the uniformed and civilian professionals who work tirelessly behind the scenes to provide combatant commanders and their Soldiers the weapons and equipment they need to execute decisive, full-spectrum operations in support of the global war on terrorism (GWOT).

Army Acquisition Executive Claude M. Bolton Jr. recognized the accomplishments of the acquisition workforce's most extraordinary members and the teams they lead at the 2005 AAC Awards Ceremony. (U.S. Army photo by Richard Mattox, PEO EIS.)

The Army Acquisition Executive (AAE) and Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASAALT) Claude M. Bolton Jr. hosted the prestigious ceremony. In kicking off the event, Bolton remarked, "Tonight we honor some of the outstanding men and women — military and civilian — of the Army Acquisition Corps and the greater Army Acquisition, Logistics and Technology Workforce. As a community, we are facing some of our greatest challenges. We are serving a Nation at war and a military force that is transforming while fighting. It is clear that we have charted the right course — increasing capability, flexibility and sustainability — and that we must maintain the tremendous momentum we have built. With great challenges come great opportunities for success."

Bolton further observed, "Our courageous men and women in uniform display unrelenting tenacity, steadfast purpose, quiet confidence and selfless heroism. Let us continue to work hard and work together to ensure their decisive victory and safe return. They face threats that change — quite literally — overnight, and their success in meeting these challenges rests squarely on our collective shoulders as a community."

U.S. Army Acquisition Support Center Director Craig A. Spisak presided over the event as master of ceremonies. Other Army and defense acquisition senior leaders present included Dean G. Popps, Principal Deputy to the ASAALT and Director for Iraq Reconstruction and Program Management; LTG Joseph L. Yakovac Jr., Military Deputy to the ASAALT and Director, Acquisition Career Management; Dr. Nancy Spruill, Director, Acquisition Resources and Analysis, Office of the Under Secretary of Defense for Acquisition, Technology and Logistics; Tina Ballard, Deputy Assistant Secretary of the Army for Policy and Procurement; Wimpy D. Pybus, Deputy Assistant Secretary of the Army for Integrated Logistics Support; Dr. Thomas H. Killion, Deputy Assistant Secretary for Research and Technology and Chief Scientist; and former Military Deputy to the ASAALT LTG (Ret.) John S. Caldwell.

Craig Spisak, U.S. Army Acquisition Support Center Director, and master of ceremonies for the 2005 AAC Awards Ceremony, presents Mari Feller with a bouquet of flowers. Feller opened the event by singing *The Star Spangled Banner* and closed the event with *America the Beautiful*. (U.S. Army photo by Richard Mattox, PEO EIS.)

Secretary of the Army (SECARMY) Excellence in Contracting Awards for FY04

The *Excellence in Contracting Awards* recognize individuals, teams and organizations for outstanding achievement, dedication and professionalism in executing the contracting mission in support of the Soldier and the U.S. Army around the world.

* Please note that each category contains the names of the nominees, and the winner's name is highlighted in bold text.

Outstanding Contracting Officer (Civilian) at Installation-Level Center

Nancy F. Brown, U.S. Army Contracting Agency (ACA) Southern Region (SR)
Denise Conklin, ACA Northern Region (NR)
Patrick Hogston, ACA NR
Annemarie Kopko, ACA NR
Jane M. Lemmon, ACA NR
Beth A. Mendell, ACA NR
Stephan Russell, ACA Pacific Region

Outstanding Contracting Officer (Civilian) at Installation-Level Satellite

Steven J. Fries, ACA SR
Kristine L. Murray, ACA NR
Mary Pat Shanahan, ACA NR
Jeanne Shykes, ACA SR
William Willis, ACA NR

Outstanding Contracting Officer (Civilian) in Specialized Contracting

James R. Chiarizio, U.S. Army Aviation and Missile Life Cycle Management Command (LCMC)
Matthew J. Franzen, U.S. Army Tank-automotive and Armaments Command (TACOM) LCMC
Janet L. Schwarzbart, U.S. Army Space and Missile Defense Command (SMDC)
Patricia D. Thompson, Surface Deployment and Distribution Command

Outstanding Contracting Officer (Civilian) in Systems Contracting

Pamela A. Demeulenaere, U.S. Army TACOM LCMC
Johanna T. Hersch, Communications-Electronics (CE) LCMC

(Left to right) LTG Yakovac, Tina Ballard, Pamela A. Demeulenaere (U.S. Army TACOM LCMC) and Secretary Bolton recognize Demeulenaere for her selection as Outstanding Contracting Officer (Civilian) in Systems Contracting. (U.S. Army photo by Richard Mattox, PEO EIS.)

Gloria E. McCracken, TACOM LCMC
Mary K. Rehm, TACOM LCMC

Outstanding Contracting Officer (Military) at Installation-Level Center
MSG Christopher W. Chapple, ACA SR
MAJ Kelvin L. Robinson, CELCMC

Outstanding Contracting Officer (Military) in Contingency Contracting
MAJ Kathleen Jacobson, ACA SR
MAJ Roderick D. Sanchez, ACA NR
MAJ Robert W. Shelton, ACA NR
MSG David C. White, ACA SR

Professionalism in Contracting (Civilian)
Leslie H. Carroll, ACA SR
Sarah L. Corley, ACA SR
Ellen C. Dennis, TACOM LCMC
Peter D. DiPaola, ACA NR
Wendy J. McCutcheon, CELCMC
Frank A. Ruzicka, TACOM LCMC
Bernard Valdez, ACA SR

Professionalism in Contracting (Military)
LTC Anthony J. Nicolella, ACA SR
COL Scott O. Risser, ACA HQ

Unit/Team for Installation-Level Contracting Center
Anniston Army Depot Directorate of Contracting (DOC), TACOM LCMC
Fort Carson DOC, ACA NR
Fort Eustis DOC, ACA NR
Fort Hood Contracting Command, ACA SR
Government Purchase Card Team, Fort Bragg DOC, ACA SR
Logistics Support Contract Team, ACA SR
Southwestern Division, Task Force Restore Iraqi Oil, U.S. Army Corps of Engineers (USACE)

Unit/Team for Installation-Level Contracting Satellite
Aberdeen Proving Ground DOC, ACA NR
Fort Campbell DOC, ACA SR
Fort Dix DOC, ACA NR
Fort Drum DOC, ACA NR
Fort Knox DOC, ACA SR

Unit/Team for Specialized Contracting
Armor Survivability Kit Material Central Procurement Team, TACOM LCMC
Contracting Division, Jacksonville, USACE
Health Care Acquisition Activity, U.S. Army Medical Command
Iraq Reconstruction and Program Management Team, TACOM LCMC
Iraqi Armed Forces Battalion Sets, TACOM LCMC
Iraqi Ministries Civilian Vehicles Support Contracting, TACOM LCMC
Partnering Division, Maintenance and Special Projects, Aviation and Missile LCMC
Small Business Innovation Research, Contract and Acquisition Management Team, SMDC
ACA Southwest Asia, ACA Pacific Region

Unit/Team for Systems Contracting
Future Combat Systems (FCS) Contracting Team, TACOM LCMC
Guardian, TACOM LCMC
Stryker Brigade Combat Team, TACOM LCMC
Tactical Wheeled Vehicle Armor Contracting Team, TACOM LCMC

Exceptional Support of the Javits-Wagner-O'Day Act Program
Russ Hite, ACA Information Technology, E-Commerce and Commercial Contracting Center
Mark Lumer, SMDC

2005 SECARMY Life Cycle Logistician of the Year Award

The Life Cycle Logistician of the Year Award recognizes excellence in the field of Life Cycle Logistics and achievements in improving the Total Life Cycle Systems Management process. Army military and civilian personnel are eligible for the award, and nominations were open to all Life Cycle Logisticians residing in program executive and program management offices, the U.S. Army Materiel Command, U.S. Army Training and Doctrine Command (TRADOC) and other acquisition logistics and sustainment organizations. The AAE/ASAALT annually recognizes one military or civilian logistician with this award for significant Life Cycle Logistics achievements.

Linda Beltran, Logistics Readiness Center (LRC), CELCMC
William L. Bidwell, Program Executive Office (PEO) Aviation
Randy Burton, LRC, CELCMC
Gerald Christophe, PEO Enterprise Information Systems (EIS)
Jeffrey M. Forgach, Project Manager Force XXI Battle Command Brigade and Below
Philip J. Gaylardo, PEO Simulation, Training and Instrumentation (STRI)
Michael J. Jackson, PEO EIS
John K. Jolly, PEO Soldier
Glenn Kerley, Project Manager Close Combat Systems

David W. Manning, PEO STRI (center right), was selected from 15 nominees for Army Life Cycle Logistician of the Year honors for 2005. Presenting the award (left to right) are LTG Yakovac, Wimpy D. Pybus and Secretary Bolton. (U.S. Army photo by Richard Mattox, PEO EIS.)

David W. Manning, PEO STRI
Jean M. Salvatore, Joint Project Manager Nuclear, Biological, Chemical (NBC) Contamination Avoidance
Edward W. Schmidt, PEO Aviation
Eric Steckmann, PEO Ammunition
Leroy J. Weaver, PEO EIS
Mark Weston-Dawkes, Project Manager, LandWarNet

Army Research and Development (R&D) Laboratory of the Year Awards

The Army's R&D Laboratory Awards Program was established in 1975 to honor R&D labs that have made the most outstanding contributions in science and technology, providing U.S. warfighters with the best capabilities in the world.

All 12 Army laboratories and the two collaboration teams that competed this year are commended for their outstanding R&D efforts and warfighter focus, as well as their support to Soldiers in direct support of national homeland defense and GWOT. The Army's labs are critical enablers for achieving the Army Vision, its objectives and the Army's transformation from the Current to Future Force. These exceptional R&D organizations continue to provide the unmatched technical advantage in support of the Army's non-negotiable contract with the American people — to fight and win our Nation's wars.

Large Research Lab of the Year Award
U.S. Army Engineer Research and Development Center
U.S. Army Medical Research and Materiel Command Laboratories
U.S. Army Research Laboratory (ARL)

Large Development Lab of the Year Award
U.S. Army Armament Research, Development and Engineering Center (ARDEC)
U.S. Army Aviation and Missile Research, Development and Engineering Center

U.S. Army Communications-Electronics Research, Development and Engineering Center
U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC)

Small Development Lab of the Year Award
U.S. Army Edgewood Chemical Biological Center
U.S. Army Natick Soldier Center
U.S. Army Research Institute for Behavioral and Social Sciences
U.S. Army Simulation and Training Technology Center
U.S. Army Space and Missile Defense Technical Center

Also receiving Collaboration Team of the Year Award honors were ARL and ARDEC for the "Barrel Reshaping Initiative." Pictured left to right are LTG Yakovac; Dr. Killion; Dr. Joseph Lannon, ARL; John Miller, ARDEC; and Secretary Bolton. (U.S. Army photo by Richard Mattox, PEO EIS.)

Collaboration Team of the Year Award
U.S. Army Natick Soldier Center, TARDEC and the **U.S. Army Research Institute of Environmental Medicine (USARIEM)** for the "Cool the Force" Vehicle Mounted Personal Cooling Program
U.S. ARL and **ARDEC** for the "Barrel Reshaping Initiative"

SECARMY Awards for Acquisition Commander, Product and Project Manager of the Year Awards

These awards recognize the expertise and ability needed to research, manage, develop, test, evaluate, contract, field and sustain the Army's warfighting systems to ensure that Soldiers have the material they need to fight with greater lethality, survivability and sustainability, regardless of where the battlefield or mission takes them. When faced with numerous challenges, and an environment characterized by change, deployments, unit rotations

Collaboration Team of the Year Award honors went to the U.S. Army Natick Soldier Center, TARDEC and USARIEM for the "Cool the Force" Vehicle Mounted Personal Cooling Program initiative. Pictured left to right are LTG Yakovac, Dr. Killion, COL Beau J. Freund, Edward Doucette, Dr. Richard McClelland and Secretary Bolton. (U.S. Army photo by Richard Mattox, PEO EIS.)

LTC Shane Dietrich (center), Yuma Test Center, ATEC, was selected for Acquisition Commander of the Year honors at the lieutenant colonel level. Here, Secretary Bolton and LTG Yakovac present him his award. (U.S. Army photo by Richard Mattox, PEO EIS.)

and high operations tempo, these nominees demonstrated exceptional skill and service above and beyond the call of duty to the Army, AAC and the Soldiers they support.

Acquisition Commander of the Year — LTC/GS-14

LTC Mark E. Ballew, Defense Contract Management Agency (DCMA) Boeing Philadelphia
LTC Craig A. DeDecker, ACA NR
LTC Shane Dietrich, Yuma Test Center, U.S. Army Test and Evaluation Command (ATEC)
LTC Robert W. Schumitz, XVIII Airborne Corps Contracting Command, ACA

Acquisition Commander of the Year — COL/GS-15

COL Victoria H. Diego-Allard, U.S. Army Contracting Command-Europe, ACA
COL Stephen D. Kreider, U.S. Army Yuma Proving Ground (YPG), ATEC
COL Paul M. McQuain, DCMA, Dallas and Iraq

Product Manager of the Year Award

LTC Darryl J. Colvin, Field Artillery Launchers, PEO Missiles and Space
LTC Jeffrey A. Gabbert, Medium Altitude Endurance Unmanned Aerial Vehicle Systems, PEO Aviation
LTC Joseph A. Giunta, Ground Tactical Trainers, PEO STRI
LTC Linda R. Herbert, Forward Looking Infrared, PEO Intelligence, Electronic Warfare and Sensors (IEWS)
LTC Claude Hines Jr., Medical Communications for Combat Casualty Care, PEO EIS
LTC Kevin N. Jennings, Demilitarization, PEO Ammunition
LTC Daniel McCormick, NBC Reconnaissance and Obscuration Systems, Joint PEO Chemical and Biological Defense
LTC Kevin P. Peterson, Light Tactical Vehicles, PEO Combat Support and Combat Service Support (CS & CSS)
LTC Kevin P. Stoddard, Crew Served Weapons, PEO Soldier
LTC Michael Van Rassen, Air Missile Defense Command and Control Systems, PEO Command, Control and Communications Tactical (C3T)

Project Manager of the Year Award

COL Damian P. Bianca, Ground Based Interceptor, Joint Program Office Ground Based Missile Defense
COL David W. Coker, Logistics Information Systems, PEO EIS
COL William Crosby, Cargo Helicopters, PEO Aviation
COL Timothy G. Goddette, Force Projection, PEO CS & CSS
Robert F. Golden, Tactical Radio Communications Systems, PEO C3T

COL Stephen D. Kreider (center), YPG ATEC, receives his Acquisition Commander of the Year Award from Secretary Bolton and LTG Yakovac. (U.S. Army photo by Richard Mattox, PEO EIS.)

Robert F. Golden (center) receives his Project Manager (PM) of the Year Award from Secretary Bolton and LTG Yakovac. Golden was one of three PMs honored at this year's awards ceremony.

COL Jeffrey L. Gwilliam, Joint Services, PEO Ammunition
COL Camille Nichols, Guardian, Joint PEO Chemical and Biological Defense
COL Kevin S. Noonan, Combined Arms Tactical Trainers, PEO STRI
COL John D. Norwood, Soldier Equipment, PEO Soldier
COL Jess A. Scarbrough, Tactical Exploitation of National Capabilities, PEO Missiles and Space

2005 Army Acquisition Excellence Awards

The Army Acquisition Excellence Awards — new this year — recognize acquisition workforce members and teams whose performance and contributions set them apart from their peers. The nominees worked at all levels of the acquisition community from senior leaders to newly hired interns. The awards directly reflect their outstanding achievements in support of the Army's Soldiers and the Army's transformation efforts.

Equipping and Sustaining Our Soldiers Individual Award

MAJ Cary Ferguson, U.S. Army Transportation Center
Saleem Ghazi, 120mm Illuminating Mortar Program, PEO Ammunition
LTC Robert Lunn, PEO Aviation
Gloria M. Martinez, Gulf Region Central District, Pacific Ocean Division, USACE
BG Stephen M. Seay, PEO STRI
Mike Sprang, Crew Protection Kits, TACOM LCMC

Bob L. Thomas, Unmanned Ground Vehicles, PEO Ground Combat Systems

Equipping and Sustaining Our Soldiers Team Award
Constructive Training Intelligence Team, PEO STRI
Electronic Countermeasure Device Team, CELCMC, PEO IEWS
Ground Mobile Forces Tactical Satellite Terminal Life Extension Program, Tobyhanna Army Depot
Improvised Explosive Device Countermeasure Equipment Team, U.S. Army Research, Development and Engineering Command (RDECOM)
M95 Mortar Fire Control System Integrated Product Team, PEO Ammunition
Ground-Based Midcourse Defense Operations Support Group, Alaska, Missile Defense Agency, Ground-Based Midcourse Defense Joint Program Office
ACA NR, Army Reserve Contracting Center
Office of the TRADOC System Manager, Tactical Wheeled Vehicle Modernization, U.S. Army Transportation Center
Partnering Division of the Logistics Maintenance and Special Project Directorate, U.S. Army Aviation and Missile Command
Product Manager Tactical Radios-Current Force, CELCMC/PEO C3T
Project Management Office Soldier Equipment, PEO Soldier
Sherpa Guided Parachute Cargo System, YPG
U.S. Army Materiel Systems Analysis Activity's Artillery Team, RDECOM
United States Special Operations Command Team
Vicksburg Consolidated Contracting Office, Vicksburg District, USACE

Information Enabled Army Individual Award
Steven T. Chizmar, RDECOM
MAJ Michael Devine, PEO EIS

Secretary Bolton (right) presents MAJ Michael Devine, PEO EIS, with the Information Enabled (Individual) Award for Army Acquisition Excellence as LTG Yakovac looks on. (U.S. Army photo by Richard Mattox, PEO EIS.)

Information Enabled Army Team Award
Defense Language Institute Foreign Language Center Curriculum Development Division, Familiarization Project Team, TRADOC
Product Manager Joint-Automatic Identification Technology Team, PEO EIS
Knowledge Management Division, U.S. Southern Command Joint Intelligence Center, U.S. Southern Command
Project Manager Unit of Action (UA) Network Systems' Integration, Program Manager UA

Transforming the Way We Do Business Individual Award
Sharon H. Butler, Huntsville Center, USACE
Rodney A. Gelhaus, Program Management Office FCS UA
LTC Patricia Larrabee, Office of the ASAALT
Brian Riley, U.S. Army White Sands Missile Range
Keith G. Schwanke, ACA

Transforming the Way We Do Business Team Award
Aberdeen Proving Ground DOC, ACA
Cargo Helicopters' Soldier-Focused Logistics, PEO Aviation
Lewis & Clark Facility Project Delivery Team, Kansas City District, USACE
NR Contracting Center, DOC, ACA
Regional Contracting Office, Hawaii, ACA

In closing the 2005 AAC Annual Awards Ceremony, the master of ceremonies thanked everyone for attending the event. "A special thanks goes to all those who helped make this a memorable evening," Spisak remarked. "Although numerous awards were presented to individuals on behalf of teams, it was the contributions of many of our workforce members that made these successes possible. So please let's give one final round of applause for all nominees, award winners and their teams who achieved so much for our Soldiers."

This year's event attracted nearly 400 guests, and ASC Event Coordinator Betisa Brown suggested that it's not too early to mark your calendars for next year's awards ceremony that will be held Sunday, Oct. 8, 2006. Brown can be reached at (703) 805-2441 or via e-mail at **betisa.brown@us.army.mil**. Questions on awards submission criteria and timelines should be directed to ASC Awards Coordinator Merrilee Feller at (703) 805-2992 or **merrilee.feller@us.army.mil**.

MIKE RODDIN is the ASC Strategic Communications Director and *Army AL&T* Magazine Editor-in-Chief. He has an M.A. in marketing from the University of Southern California and B.S. degrees in English and journalism from the University of Maine. Roddin is also a U.S. Army Command and Staff College graduate and three-time Army Keith L. Ware Journalism Award recipient. Additionally, Roddin was selected as the 2005 Secretary of the Army Editor-of-the-Year (Departmenal).

From the Acquisition Support Center Director

Like every Army organization, the Acquisition Support Center (ASC) continues to search for the most cost-effective means to meet our mission. In that vein, we've been moving forward to more efficiently provide customer service to the Army acquisition community. We're changing the way we do business. This includes the way we're organized and several of our processes for how we handle acquisition workforce procedural issues.

I'd like to run through some of the changes we're making here at ASC. In October, we conducted a beta test at Program Executive Office Combat Support and Combat Service Support that allowed workforce members to enter information in their Acquisition Career Record Brief (ACRB). Previously, an acquisition career manager (ACM) had to make any changes or enter new information into the ACRB. After reviewing results and implementing corrections from the beta test, ASC will begin offering all acquisition workforce members more capabilities to edit their ACRBs. These capabilities involve changes to how people can access, view and edit their own records. We are giving people more control over their own records and making it easier to access those records.

We have also implemented a single user name and password for Individual Development Plans and ACRBs. Users now have one password to access all their individual career development tools. In addition, we are in the process of automating the Acquisition Education and Training Experience applications.

As some of you might already know, the Corps Eligible (CE) status will soon be terminated. This program had value at the time it was enacted. The program's logical termination at the end of this calendar year was facilitated by the *Defense Acquisition Workforce Improvement Act* revisions implemented in 2004 and 2005. Applications for boards and programs requiring CE status will remain in effect until the program is terminated and individuals who obtained CE status will retain that designation. If you have any questions, please contact an ACM for assistance (go to **http://asc.army.mil/contact/acms.cfm** for a list of ACMs servicing your region).

We have also structurally reorganized ASC so that when people need our assistance we are better aligned to provide it. Civilians who worked out of the Acquisition Management Branch are now part of the National Capital Region Customer Support Office (CSO). Now, all ACMs are doing the same types of jobs. As of October 2005, Army Acquisition Corps (AAC) membership applications are accepted in all three regional CSOs. The CSOs now provide career management for any individual in the acquisition workforce, including AAC members.

ASC continues to employ initiatives to further the workforce and Army transformation. We're streamlining the organization to become less prescriptive and less bureaucratic. Most importantly, we welcome your ideas to help us provide better service. We welcome any and all suggestions that can save the U.S. Army time and money.

On a personal note, a longstanding member of our workforce and pillar at ASC, Maxine Maples Kilgore, recently retired. Maxine was Regional Director of ASC's Southern and Western Region and we wish her the best in her retirement. We welcome Shirley Hornaday, the new Southern and Western Regional Director.

Sadly, I have one final note to report. The ASC family has lost a long-time acquisition professional, colleague and friend. Janice Kurry succumbed to her battle with cancer Saturday, Nov. 12, 2005. A consummate ACM and dedicated Army civilian for more than 18 years, Janice will be dearly missed by her family, friends, co-workers and the hundreds of customers she supported on a regular basis. For more on Janice, please see the inside back cover of this edition. For those inclined, donations in her memory can be made to Manchester PBA 246, c/o Arielle, P.O. Box 52, Lakehurst, NJ 07833, or the Susan B. Komen Breast Cancer Foundation, P.O. Box 650309, Dallas, TX 75265-0309.

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

MILDEP Speaks to Natick Workforce

Military Deputy (MILDEP) to the Assistant Secretary of the Army for Acquisition, Logistics and Technology (AL&T) and Director of Acquisition Career Management (DACM) LTG Joseph L. Yakovac Jr. visited the Soldier Systems Center (SSC) in Natick, MA, July 13, 2005. Yakovac addressed key workforce issues with different audiences throughout the day. He also met with Natick senior leaders, discussing technology's growing role in today's wartime environment, as well as government recruiting and hiring strategies. In the afternoon, Yakovac stressed to SSC's AL&T Workforce the importance of finding members who are willing and able to take on new, exciting challenges in product and project management and grooming these employees to truly "be all they can be."

MILDEP/DACM LTG Joseph L. Yakovac Jr. (center right) meets with ASC Director Craig Spisak, Natick ASC Customer Support Office Administrative Assistant Caitlin Fitzgerald and Natick Acquisition Career Manager Diane Nyren during a "Meet the MILDEP" visit to SSC. (U.S. Army photo.)

Yakovac focused on transforming the Army Acquisition Corps (AAC) and the mission to align and horizontally integrate the AAC with the overall Army Campaign Plan. He emphasized that the move from the current to the future AAC would be catalyzed by factors such as an increasingly agile and decisive U.S. Army, the rapid rate of technological change, new demands for full-spectrum acquisition and increasing dependency on global industry, commercial solutions and contractors on the battlefield. These factors will transform the core capability of the AL&T Workforce, one of the three main strategic objectives Yakovac addressed.

Yakovac's other two objectives related to the human aspect of the AAC mission, which he emphasized was a key to the success of the AL&T Workforce. Yakovac stressed that developing flexible, well-rounded leaders prepared to lead the AAC into the future was a critical objective. His goal has been to make jobs in product and project management more appealing to those workforce members who show the potential to be outstanding leaders. To add weight to his plan, Yakovac eliminated mobility agreements from these positions, created monetary incentives for these key leadership roles and developed educational and training plans to provide workforce members a more thorough understanding of duties and responsibilities.

Actions such as these correspond directly to the final strategic objective: to develop an expert, relevant and ready workforce.

"The number one job is always to support our deployed forces," Yakovac noted. This last objective will allow workforce members to do so even more effectively.

As part of Yakovac's human-aspect vision for transforming the AAC, supervisor outreach was an important topic. "I can't manage 40,000 civilians from Washington," Yakovac said, explaining the importance of supervisors in grooming high-potential workforce members and acting as change agents within the workforce. The Acquisition Support Center's (ASC's) Supervisor Outreach program has emphasized the vitality of this role as well, assigning supervisors responsibility in helping to achieve the human resource objectives Yakovac outlined.

Yakovac provided the Natick AL&T Workforce with a snapshot of his goals for the AAC's and AL&T Workforce's future. Emphasizing the importance of revitalizing the human resources in the workforce and recognizing those with the potential to be outstanding leaders, Yakovac challenged supervisors and workforce members to "be all they can be."

Although he identified challenges, Yakovac certainly was not short on appreciation for all that the workforce has done in the past. He asked attendees to thank the person to the right and left of them for all that they do for our Soldiers, giving the Natick AL&T Workforce a balanced sense of past accomplishment and motivation to achieve even more in the future.

DAU Midwest Develops Systems Engineering Courses

Brian D. Sturdevant

Defense Acquisition University (DAU) Midwest has developed two systems engineering (SE) revitalization courses for the Army. Program Executive Office Ground Combat

Systems (PEO GCS), part of the Tank-automotive and Armaments Command Life Cycle Management Command community in Warren, MI, requested a 5-day SE course to revitalize SE use. The Tank Automotive Research, Development and Engineering Center's (TARDEC's) Advanced Concepts Team requested a 4-day SE revitalization course tailored for concept development activities.

Then Acting Deputy Under Secretary of Acquisition, Technology and Logistics Michael W. Wynne directed the SE revitalization in his Feb. 20, 2004, and Oct. 22, 2004, policy letters. While many people view SE as a specialized technical field, Dr. Donald McKeon, lead course developer and professor of systems engineering management at DAU Midwest's satellite campus in Warren puts SE in a different light. He says SE is "disciplined technical planning and management used to provide a balanced total solution for the warfighter." It has many common elements with program and business management.

Key objectives of the 5-day SE class developed for PEO GCS were to:

- Introduce an SE mindset into the PEO and the Army.
- Provide an overview of recent Office of the Secretary of Defense (OSD) and DA SE policy changes.
- Define SE plan contents.
- Discuss how SE supports spiraling new technology to the Current Force.
- Discuss the role and responsibilities of government engineers with contractors in regard to SE plans.

The class was targeted for experienced systems planning, research, development and engineering (SPRDE) associates and other experienced career professionals, including those involved with logistics, program management, business, cost estimating and financial management. The lead SE for PEO GCS, Roberta Desmond, requested special emphasis on discussing the roles of logistics, analysis and cost estimating within the SE umbrella. As such, the course was developed for a wider audience than just SPRDE professionals.

Key objectives of the 4-day SE class for TARDEC's Advanced Concepts Team were to:

- Review recent OSD and DA policy changes regarding SE.
- Provide a top-level overview of the Army/DOD acquisition and requirements development processes.
- Show how SE is used during the Concept Refinement and Technology Development phases of the DOD Acquisition Framework.
- Show how to transition new technology to the warfighter.
- Present and discuss the SE process and systems analysis and control tools.
- Discuss the role of modeling and simulation in the process, especially in concept development.
- Discuss transitioning new technologies to demonstrators and into system development.
- Develop methodologies to innovate the acquisition process.

Professor Donald McKeon helps Elizabeth Schultz, a business analyst with the Stryker program, review systems analysis and control tools during a DAU Midwest SE revitalization course in Warren, MI. (Photo courtesy of DAU Midwest.)

Course planning started in November 2004 and memorandums of understanding were finalized in December 2004. Several hundred hours of preparation went into each course's development. The course content covers some of ACQ-201A/B, all of SYS-201A/B and most of SYS-301. Other sources of information for the classes included the Air Force Institute of Technology's SYS 282 course and numerous published papers from open literature.

The first class, piloted May 23-26, 2005, was for TARDEC's Advanced Concepts Team. Since then, two 5-day classes for PEO GCS have been held. Before the end of FY05, one 4-day and two more 5-day classes were held. A 1-day executive course is being developed for program managers, assistant program managers and supervisors.

High-level OSD and DA personnel in the SE community are invited to kick off each class to reinforce SE's importance. For example, Kevin Fahey, PEO GCS, discussed his views on SE's importance and how better SE will improve weapon systems acquisition for the Army. The class uses short, group-based case studies to allow students to practice key SE concepts and tools.

Student feedback has been impressive, and instructors are working to improve the lesson on writing SE plans because it is a difficult topic for most program offices and is still evolving, even at the OSD level. At least one SE class is planned for FY06.

Brian D. Sturdevant is a Student Intern Program Analyst at DAU Midwest.

News Briefs

Joint Army-Navy Team Provides Water for Biloxi Hospital

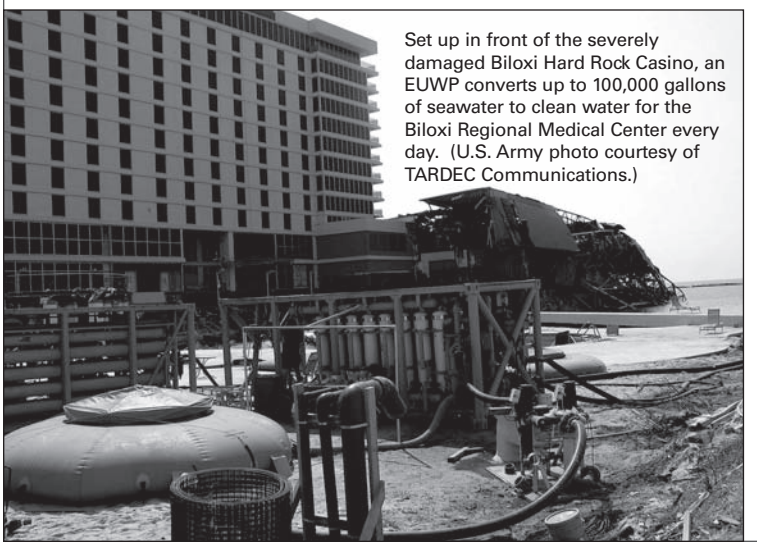
Paul D. Mehney and Susan Pierchala

A U.S. hospital without running water was hardly imaginable early last August but it became a reality. When Hurricane Katrina slammed into the Biloxi, MS, region Aug. 29, 2005, it did not differentiate between hospitals or hotels, and destruction was swift and complete.

"Immediately after the hurricane struck, we were without any clean water for drinking, cleaning or surgical tasks," said Darrin Ivey, Biloxi Regional Medical Center facilities manager. To make matters worse, injured and displaced residents were streaming in for medical care. Soon, the Federal Emergency Management Agency (FEMA) dispatched dozens of tanker trucks to the location with thousands of gallons of clean water, but it was not enough.

"For a few days, we didn't have water at all," said Biloxi Regional's Lori Derouen. "When we finally were able to get water running in the building, it wasn't potable. We had to boil everything to cook the food. We were using bottled water, sanitizer to rewash our hands." The situation was dire.

Sitting on the Gulf of Mexico, Biloxi had no usable water. On Sept. 4, 2005, FEMA requested that the Office of Naval Research (ONR) in Arlington, VA, release two Expeditionary Unit Water Purifiers (EUWPs) — a program still in research and development. Although one EUWP was at a Bureau of Reclamation (BoR) site in New Mexico and another in California, ONR Commander Rear Admiral Jay M. Cohen ordered them sent with all possible speed to Mississippi. Under FEMA direction, one unit was immediately slated to provide potable water to the Biloxi Medical Center and another was dispatched to a site in Pascagoula, MS. Four BoR researchers volunteered to stay with and operate the Biloxi unit. As BoR Project Manager John Walp was leaving for Biloxi, he said, "We'll be cleaning up the water and we're glad to do this, we are really proud to provide Katrina relief."



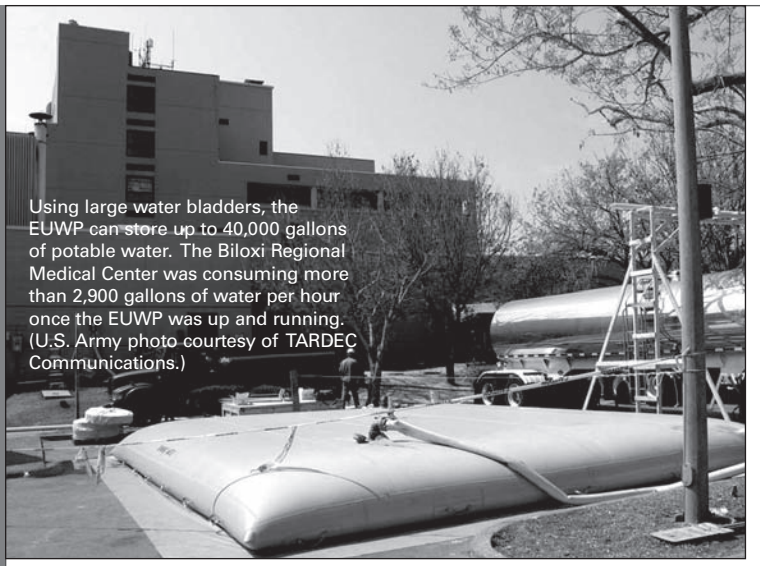
Set up in front of the severely damaged Biloxi Hard Rock Casino, an EUWP converts up to 100,000 gallons of seawater to clean water for the Biloxi Regional Medical Center every day. (U.S. Army photo courtesy of TARDEC Communications.)

Jointly developed between ONR and the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC), with testing performed by the BoR, EUWPs can supply potable water from virtually any water source, including nuclear, biological and chemical contaminated sources. Originally designed to support large military units during deployment and sustainment operations but now being used for disaster relief, each EUWP can produce up to 100,000 gallons of water per day from seawater or 200,000 gallons from freshwater.

The EUWP consists of two separate International Organization for Standardization-configured platforms that are compatible with the military's Palletized Load System trucks and most commercial line haul transports. The system uses ultrafiltration to process freshwater and reverse osmosis technology to filter seawater.

Using large water bladders, the EUWP can store up to 40,000 gallons of potable water and is powered by a 60-kilowatt diesel generator. According to TARDEC Program Engineer Drew Downing, "The whole system is self-contained. All we need is diesel fuel to operate. Although this system is still in the research and development phase, it was proven that we can respond in a matter of days, set up in a couple of hours and generate potable water."

The first EUWP arrived in Biloxi Sept. 7 and TARDEC engineers working with BoR staff were, within a matter of hours, able to begin converting Gulf Coast seawater directly to potable water. Getting the water from the EUWP to the hospital proved more challenging than decontaminating it. With help from hospital staff and Mississippi Department of Transportation personnel, a system of PVC pipe was installed to reach the hospital — three uphill blocks off the coast where the unit was positioned. Part of the pipeline ran under US 90 — not a small engineering feat considering most of the road was destroyed.



Using large water bladders, the EUWP can store up to 40,000 gallons of potable water. The Biloxi Regional Medical Center was consuming more than 2,900 gallons of water per hour once the EUWP was up and running. (U.S. Army photo courtesy of TARDEC Communications.)

After a system flush and testing by the U.S. Health Service and the Mississippi Department of Health, water was soon flowing to the hospital. Ivey commented, "No one on this end of town has potable water. TARDEC's EUWP has given us the ability to have water. Without it, everything was reduced — from surgery to food preparation to hygiene — and we are still very busy." The medical center is now consuming more than 2,900 gallons of EUWP-provided water per hour.

Paul D. Mehney is TARDEC's Communications Officer.

Susan Pierchala is a quality assurance specialist working with Program Management Tactical Vehicles and currently on a developmental assignment as a Marketing Specialist with the TARDEC Communications Team.

PM DWTS Quickly Supports Katrina Relief Efforts

Sandy Santiago

Within days of Hurricane Katrina's devastating path through several Gulf Coast states, Project Manager Defense Communications and Army Transmission Systems' (PM DCATS') Product Manager Defense Wide Transmission System (PM DWTS) quickly deployed communications systems to replace the destroyed communications infrastructure in Louisiana.

PM DWTS received an Army directive Aug. 31, 2005, to provide two satellite communications (SATCOM) terminals and two accompanying technicians to support relief efforts in Baton Rouge. According to PM DWTS Thomas Lucy, within 2 days his organization had two Combat Service Support Very Small Aperture Terminals (CSS VSATs) and technicians Efren Morales and Christopher LaSalle on the ground in the beleaguered city.

PM DWTS was tasked Sept. 9 to deploy eight additional CSS SATCOM systems along with seven additional technicians to Louisiana to support relief efforts. Lucy said PM DWTS responded by sending CSS SATCOM systems, including CSS VSATs in tandem with the CSS Automated Information Systems Interface, which wirelessly connects the system to a local or wide area network.

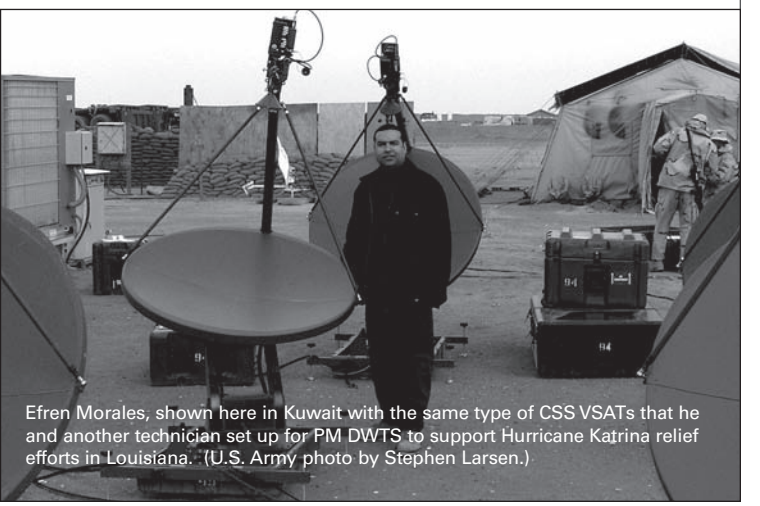
PM DWTS had these additional systems and technicians on the ground by Sept. 11. Lucy noted that these CSS SATCOM systems are "the same seamless solution PM DWTS is providing to Soldiers in Iraq and elsewhere around the world to support the Army G-4's 'Connect Army Logisticians' initiative."

On Sept. 3, the Army Field Support Command (AFSC) headquarters also directed PM DWTS to deploy two AFSC-owned vehicle-mounted Multi-Media Communications Systems (MMCSs), which provide satellite access for NIPRNET (Nonclassified Internet Protocol Router Network) and SIPRNET (Secret Internet Protocol Router Network) connectivity.

These two vehicle-mounted MMCSs were to meet up with a vehicle-mounted MMCS already located at Fort Polk, LA. PM DWTS had the systems on the ground in Louisiana and on line by Sept. 5, serving as the main command and control systems for relief effort logistics.

"We also have a fourth vehicle-mounted MMCS here at Fort Monmouth [NJ], which we've got standing by for deployment, if needed," said Lucy.

Lucy was pleased, but not surprised, by how quickly his team was able to respond to the call for help. "What you've got to



Efren Morales, shown here in Kuwait with the same type of CSS VSATs that he and another technician set up for PM DWTS to support Hurricane Katrina relief efforts in Louisiana. (U.S. Army photo by Stephen Larsen.)

understand is that when our people first got to Louisiana, there was nothing — absolute devastation," said Lucy. "We now have three vehicle-mounted MMCSs and 10 CSS SATCOM systems on-site. In less than 2 weeks, we helped to get a viable logistics communications backbone up and running in a disaster zone."

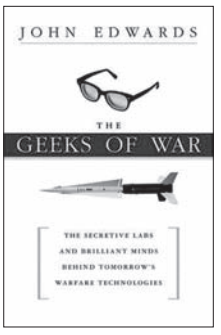
PM DCATS and PM DWTS, located at Fort Monmouth, report to the Program Executive Office Enterprise Information Systems (PEO EIS), located at Fort Belvoir, VA.

Sandy Santiago is an information specialist with Symbolic Systems Inc., providing support to the PEO Command, Control and Communications Tactical Chief Information Office; the Communications-Electronics Life Cycle Management Command Chief Technology Office; and the Team Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance Knowledge Center.

Worth Reading

The Geeks of War: The Secretive Labs and Brilliant Minds Behind Tomorrow's Warfare Technologies

John Edwards
AMACOM, 2005, New York



Reviewed by Joe Sites, Executive Vice President of BRTRC Inc., Fairfax, VA.

A military Internet group member recently forwarded a *Boston Globe* review of *The Geeks of War*. Immediately, a number of complaints regarding bias, politics and myriad other things were posted. I had intended to read this book, and these complaints only ensured that I would. I did, and I highly recommend it to members of the acquisition, logistics and technology (AL&T) community.

To use a familiar expression, the book's coverage is a mile wide and an inch deep. If you are a specialist in one area — for example, smart weapons — you will find that the material hits only the high spots of that area and that the particular section may not be informative to you. There are, however, so many areas covered it is almost certain that this book will provide useful information in other areas that could be applied to your field of expertise. In keeping with the current emphasis on systems integration, this book provides scientists and engineers a good overview on technologies that can greatly influence the development of military systems.

The introduction to *The Geeks of War* is titled "The Military-Technology Matrix" and it provides an excellent summary of government's and industry's roles and activities in the development of military technologies. This discussion not only lists organizations, it also provides a list of national critical technologies. In telling who and what are involved in military technologies, the author prepares the reader for a better understanding of what is happening in ongoing activities.

Edwards has divided these activities into seven broad areas, each of which is covered in a separate chapter. The spectrum of the material covered in this book can best be understood by listing the subjects in each of its seven chapters: tactical systems; information systems; telecommunications, health, medicine and biotechnology; vehicles and logistics; security and cryptography; and uniforms, protective gear and other equipment.

Of particular interest to me was the discussion of blogs by groups working on a special project. We have recently seen contributions to blogs by some of our junior officers in sharing their experiences in combat. While these have undoubtedly expanded the capabilities of the participants, it has been recognized that without proper security, these blogs could aid a potential enemy. It does not take too much of a stretch of the imagination to consider the possibility of blogs permitting members of different technical organizations with different specialties to make contributions in areas where input would be helpful from a variety of sources.

Now, I have a couple less complimentary comments. I do not like the title *The Geeks of War*. In the current vocabulary, the word "geeks" may be acceptable, but because of my age and many years working with Army research and development scientists and engineers, I find it difficult to use the word geeks in describing them. They are a dedicated group of highly skilled professionals.

My second comment involves the number of projects and the changing environment. It is extremely difficult to keep all the material current. This became evident with one item in the health, medicine and biotechnology chapter. I had

barely finished reading about one product, which was described as very effective, when I was asked if I could help respond to a request from Iraq for a new product to replace the one about which I had just read. Apparently, the product described by the author had not demonstrated the capability described in the book's glowing report.

These comments are not meant to discourage reading *The Geeks of War*, but are meant to make the obvious points that different people use words differently and that success in the lab does not always mean success in the field.

I believe that the scientists and engineers in our AL&T community will find *The Geeks of War* a useful and informative book — even if I don't like the title.

ALTESS News

ALTESS Creates Process Center of Excellence

Pauline Davy and Betty Hearn

The Army's business transformation goals are derived from the Transformation Strategy's key elements. These goals are also *Army Campaign Plan* and *Army Posture Statement* components, as follows:

- Manning the force — Improve manning, readiness and well-being.
- Paying the force — Improve business practices and financial accountability.
- Equipping the force — Improve processes and systems to deliver warfighting capabilities.
- Sustaining the force — Enhance Joint and focused logistics.
- Stabilizing the force — Improve stability operations and procedures.

The Assistant Secretary of the Army for Acquisition, Logistics and Technology's (AL&T's) strategic goal for equipping the force is to develop and institutionalize a process that provides a single integrated life-cycle management view. Implementing an AL&T common business process portal and environment will better facilitate decisions. Core to a common business process portal and environment is collaboration, which primarily involves data exchange between different information systems and functions that center around people.

Transformation — changing the way the Army does business — is a continuous effort that depends on people, processes and technology. As Secretary of Defense Donald H. Rumsfeld explains it, "Transformation is not an event — it is a process."

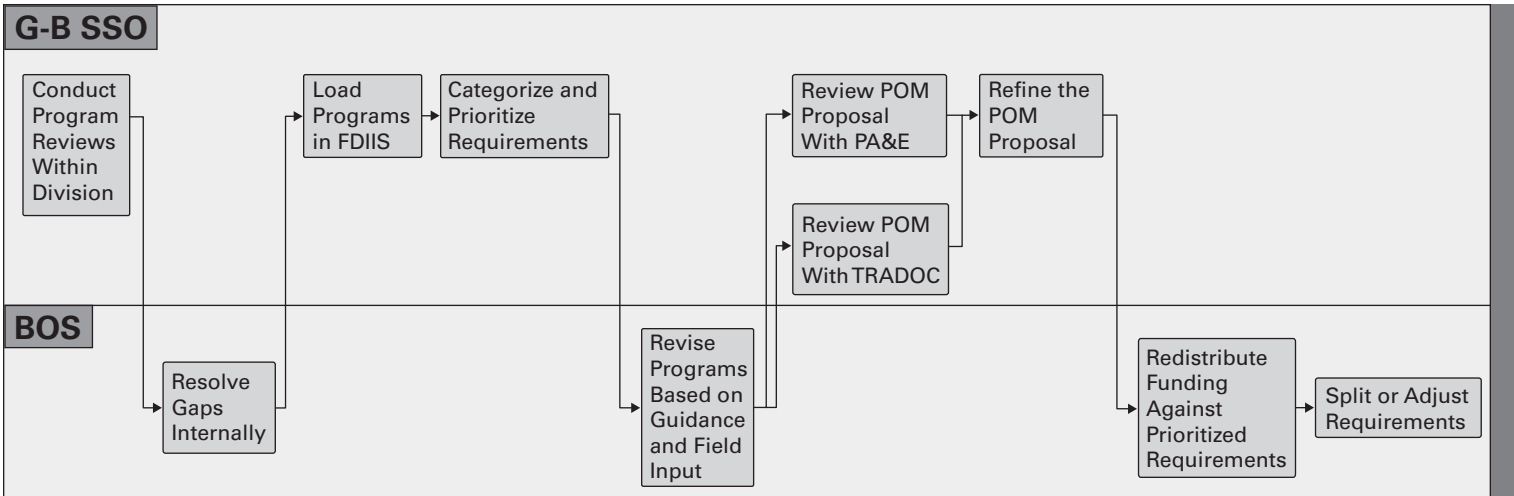
The Product Manager Army Acquisition, Logistics and Technology Enterprise Systems and Services (PM ALTESS) is taking a leadership position in helping the acquisition community focus on improving process excellence. A process is a coordinated, repeatable series of activities performed by people and technology that create an end product of value. Process examples include requirements definition, product development and system testing.

Understanding and working effectively with processes can be difficult and elusive. The challenge is to represent complex activities, interactions and decisions in a visually appealing and flexible way so that a team of analysts working together can find the best solution. To accomplish this, ALTESS has established a Center of Process Excellence to provide organizations the following:

- A flexible process-modeling tool
- A process improvement methodology
- A set of supporting services

The software tool, ProActivity®, is housed in Radford, VA. All process data is stored in a central Oracle® database that is maintained by ALTESS. Users can be located anywhere and gain access from the ALTESS home page via Citrix®. Process analysts can build a process by simply dragging and dropping activities. Users can then view the processes in various ways that are dynamically and automatically generated, as shown in the figure. Analysts can also create reports that analyze the processes in terms of cost, time and resources.

Step 1 of the process improvement methodology is to define the "As-Is" process — describing the process as it is done today. Step 2 is to perform a diagnostic analysis of the As-Is process to pinpoint its issues and weaknesses. Step 3 is to design a "To-Be" process that corrects these problems. Analysts can run reports that compare the To-Be with the As-Is in terms of resources, automation, cost and process duration.



Improving Process Excellence

SSO: Synchronization Staff Officer
BOS: Budget Operating System
FDIIS: Force Development Investment Information System
POM: Program Objective Memorandum
PA&E: Program Analysis and Evaluation
TRADOC: U.S. Army Training and Doctrine Command

Supporting services provided by the Center of Excellence include central database, backup and application administration, project security, user training, software license management and consulting.

ALTESS, in cooperation with subject matter experts within the Army acquisition community and Defense Acquisition University (DAU), is employing the ProActivity analysis tool, modeling the Equipping Program Execution Group (PEG) process, and DAU's Twelve-Step Model for Integrated Program Management. Using this analysis tool, ALTESS can capture, validate and share access to the digital blueprint for documenting the end-to-end processes associated with acquisition business management knowledge. ProActivity allows for cross-enterprise process modeling and simulation, auto-generation of enterprisewide swim-lane views and dynamic enterprise process business activity monitoring dashboards and alerts. The result is a platform for ongoing process optimization that is flexible to responding to the evolving business transformation.

Equipping PEG process validation and DAU Twelve-Step Model for Integrated Program Management decomposition was presented at the Acquisition Enterprise User Group Conference in Louisville, KY, Oct. 31-Nov. 4, 2005.

Questions about the Center of Excellence should be directed to Pauline Davy at (703) 704-0102 (DSN 654-0102) or **pauline.davy@us.army.mil**. You may also contact Betty Hearn at (703) 704-0107 (DSN 654-0108) or **betty.hearn @us.army.mil**.

Pauline Davy is an Information Technology Specialist with PM ALTESS. She is Level III certified in information technology.

Betty Hearn is an Information Technology Specialist with PM ALTESS. She has an A.A. in computer and information science, is Level III certified in information technology and is Level II certified in program management.

Call for Articles and Photographs

Army AL&T Magazine is looking for timely and relevant articles on acquisition, logistics and technology processes, procedures, techniques, management philosophy and professional development. Publishing a feature article, news brief, success story, career development announcement or book review in our award-winning magazine promotes your organization, and is an excellent addition to your list of personal accomplishments.

Accompanying Photography
Written submissions to *Army AL&T* Magazine must be accompanied by high-resolution illustrations with complete captions. We are especially looking for action photographs showing Soldiers and civilians performing their duties. If you are shooting digital pictures, please be sure to use a high-resolution setting (300 dpi at 4x6" or 3x5"). Published photographs will be credited to the photographer and his or her command.

Please send all submissions to the Executive Editor at **cynthia.hermes@us.army.mil**. Writers Guidelines are available at **http://asc.army.mil/pubs/alt/default.cfm**. Scroll down the left side and click on **Writers Guidelines**.

Contracting Community Highlights

In *Army AL&T* Magazine's "Contracting Community Highlights" section, each feature article is intended to provide in-depth information relative to a contracting organization, mission or process. This issue's feature article, "Tools for Better Contracting," gives an in-depth overview of a one-stop, Web-accessible place to get helpful contracting information. Joe Myers, Procurement Analyst, Army Contracting Agency Northern Region, provides this article as an instructive tool on this concept.

In addition to the feature article and the regular DAR Council Corner, we provide news that highlights a number of our contracting organizations, including the U.S. Army Communications-Electronics Life Cycle Management Command Graduates, 2005 Presidential Award for Leadership in Federal Energy Management, U.S. Army Aviation and Missile Command Award to Support Apache Block III Program and Notice to All Army Requiring Activities.

We appreciate the continued support from the field in providing material for publication, and we hope you find the submissions informative and interesting. If you need more information on any of the topics presented, contact Ann Scotti at (703) 604-7107 (DSN 664-7107) or **ann.scotti@hqda.army.mil**.

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

Tools for Better Contracting

Joe Myers

The amount and complexity of work being accomplished in contracting offices and directorates of contracting (DOCs) continues to increase. In addition to contracting regulations and trends that are constantly in flux, requiring activities have customers who also make demands on their time and resources.

To help out, Army Contracting Agency Northern Region (ACA-NR) headquarters staff developed the ACA-NR Toolbox, a one-stop, Web-accessible place where customers — including DOCs, contracting centers and contract specialists — can get helpful information. The site is located on the ACA-NR home page at **http://www.aca-nrhq.army.mil**. Scroll down and click on **Toolbox**. Tools currently available include:

- Non-Standard Clause Review Form — a new downloadable form to use when preparing nonstandard clauses.
- Performance Work Statement (PWS) Scorecard — an interactive tool designed for the two functions involved in PWS preparation for the requiring activity (the user) and the contracting office. Each has a scorecard to rank various PWS characteristics. Once completed, it supplies a "final score" plus a recommendation for improvement based on the PWS' average score.
- Independent Government Cost Estimate (IGCE) Tool — an interactive and practical way for the using/requiring activity to develop an IGCE. Contracting offices can e-mail this tool to their customers. Following the interactive directions, users gain an understanding of the process and receive help in finding the data needed. This tool provides many users with sufficient help to create the IGCE without further assistance. Once the blanks are filled in, the tool automatically creates a form with a signature block for inclusion in the requirements package.
- Performance-Based Service Acquisition (PBSA) tutorial — a tutorial on how to prepare PBSA documentation for the using activity. Starting with the Performance Requirements Summary and PWS, and leading to Quality Assurance Surveillance Plan development, this presentation is designed to be given in a relatively short time period by contracting personnel to users, yet provide detailed instructions for preparing the documents needed to begin the contracting process.

Also on the Web site, clicking on **Reference Library** brings up several resources, including new Web Guides. These interactive resources include a formal desk guide in an easy-to-navigate, Web-based format. The Web Guides provide links to DOD, Army and other agency regulations and guidance. There are also links to training opportunities for both contracting and user activity personnel and other related Web sites. Web Guides are currently available for PBSA and for Green Procurement.

By putting each of these resources in a centrally managed Internet location, we have created a branded approach to helping our customers help their customers. Also, making the tools useful, as well as regularly updating and adding to them, creates increasing interest in the site. The end result will be a useful Web site on many users' "favorites" lists.

Joe Myers is a Procurement Analyst, ACA-NR Headquarters, Innovations and Efficiencies Branch. He can be reached at (757) 788-3799/DSN 680-3799 or ***joe.myersjr@us.army.mil****.*

Notice to All Army Requiring Activities

The Army policy memorandum *Proper Use of Non-DOD Contracts*, dated July 12, 2005, established Army policy for reviewing and approving non-DOD contract vehicles when procuring supplies or services on or after Jan. 1, 2005, for amounts greater than the simplified acquisition threshold (SAT). The generally applicable SAT is currently $100,000. This policy applies to all Army Requiring Activities, including requirements officials, item managers, program managers, financial managers, engineers, logisticians, contracting officers and legal counsel. It applies to both direct acquisitions, such as orders placed by an Army contracting or ordering officer against a non-DOD contract, and assisted acquisitions, which include contracts awarded or orders placed by non-DOD organizations using Army funds for required supplies and services. Major command commanders, program executive officers and direct reporting program managers shall ensure that requiring activities comply with this policy, including submitting an annual report titled *The Army Assisted Acquisition Summary Report* no later than Nov. 1 each year.

To view the July 12, 2005, Army policy *Proper Use of Non-DOD Contracts* memorandum, go to **https:// webportal.saalt. army.mil/saal-zp/armypolicyuseofnon-dodcontracts.pdf**.

For frequently asked questions, go to **https://webportal. saalt.army.mil/saal-zp/armypolicyuseofnon-dodcontracts-faq.doc**.

The Army Assisted Acquisition Summary Report is available as a downloadable Excel spreadsheet at **https://webportal. saalt.army.mil/saal-zp/armyreportforassistedacquisition.xls**.

DOD is presenting Roadshow Training Seminars on the DOD-wide policy. For more information on when training is available in your area, go to **http://www.acq.osd. mil/dpap/specificpolicy/Proper_Use_of_Non-DoD_Contracts.htm**. Video teleconference links are also available for reaching the local point of contact at the training site.

For more information, contact Ed Cornett in the Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology, Policy and Support, at (703) 604-7142 or DSN 664-7142.

Contracting Successes

ACA-SR and IMA SERO Team Receive Federal Energy Management Award. The Army Contracting Agency Southern Region (ACA-SR) and the Installation Management Agency Southeast Region Office (IMA SERO) were honored with the 2005 Presidential Award for Leadership in Federal Energy Management at an awards ceremony held Oct. 27, 2005, at the U.S. Department of State in Washington, DC.

ACA-SR, IMA SERO and the Department of Energy formed a partnership to support the Army's goal of reducing energy consumption and encouraging all Army installations to expand, promote and accelerate use of Utility Energy Savings Contracts and Energy Savings Performance Contracts.

The ACA-SR and IMA SERO directors signed a joint memorandum that provided guidance on using energy efficiency tools and discussed services and products needed to establish more energy-efficient facilities. This guidance was disseminated to the ACA-SR Directorates of Contracting, IMA SERO Garrison Commanders and IMA SERO Directors of Public Works. As a result of the team's proactive efforts, the Army achieved streamlined procurement processes, flexible contracts, relationships with long-standing entities, payments through utility bills, water savings and flexibility in measurement and verification, and saved approximately $23 million in FY04.

At the Oct. 27 ceremony, Vickie Jordan was recognized as the ACA-SR participant and IMA SERO Director Joseph Plunkett, Jerry Kaylor, Georges Dib, Gary Meredith, Tommy Baldwin Jr., Michael Frnka, John R. Stoudenmire and Steve Jackson were recognized as the IMA SERO participants. With ACA-SR's assistance, IMA SERO has been a

leader among the IMA regions in promoting energy efficiency and providing the tools and support to achieve the goals of *Executive Order 13123, Greening the Government Through Efficient Energy Management*.

Kudos to CELCMC Graduates. The U.S. Army Communications-Electronics Life Cycle Management Command (CELCMC) is pleased to announce that the following Acquisition Center personnel have recently graduated from acquisition-related programs.

Carmel Costa, Kenneth MacFarlane and Robert Tiedeman have successfully completed the Darden Business School's U.S. Army Advanced Program in Acquisition Excellence course. The program presented the very latest thinking on acquisition and procurement — the strategic sourcing model. Costa, MacFarlane and Tiedeman all said that this program was one of the best training courses they had experienced and highly recommend it for acquisition professionals.

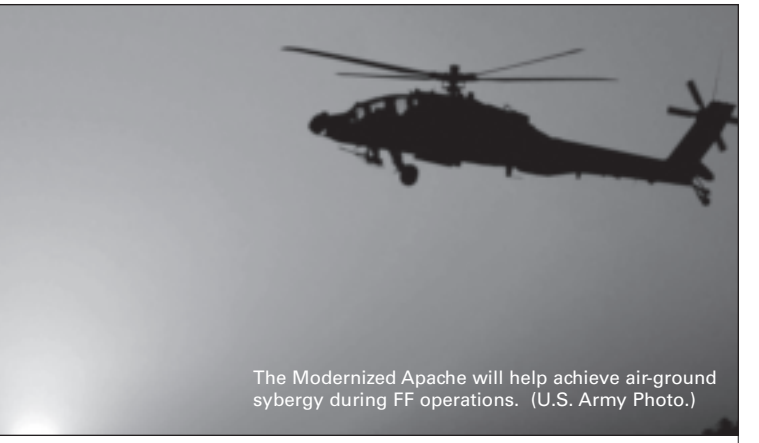
Judith Anderson, David Fieltsch, William Frantz, Kathrine Freeman, Johanna Hersch, Estelle Klose, Kathleen Rizzo and Diane Meickle are Army Management Staff College graduates of the Non-Resident Class of 2005. They successfully completed the "Sustaining Base Leadership Management" yearlong, non-resident program.

Congratulations to all!

McDonnell Douglas Awarded Contract to Support Apache Block III Program

As a result of U.S. Army transformation initiatives, emerging Future Force (FF) organizational changes and a changing operational environment, the Modernized Apache is integral to achieving air-ground synergy during FF operations. The Apache Block III program's upgraded system architecture, combined with upgraded communications capability, will enable interim FF compatibility. Apache Block III enables incremental insertion of increased operational capabilities, platform system performance and reliability, and is the logical continuation of an Apache program that dates back to the 1970s.

The initial FY05 Non-Recurring Engineering (NRE) effort to support the Apache Block III program was awarded June 28, 2005. A Request for Proposal for the FY05 NRE was



The Modernized Apache will help achieve air-ground sybergy during FF operations. (U.S. Army Photo.)

issued Jan. 26, 2005, to the contractor, McDonnell Douglas Helicopter Co., a subsidiary of Boeing. The contractor submitted the formal proposal March 21, 2005. In less than 60 days, the $27-plus million, cost plus fixed fee effort was negotiated and settlement was reached by May 19, 2005. Award was held until June 28, 2005, however, because of Congressional funding re-programming.

The team — which included the Apache Program Executive Office, Aviation and Missile Command's Acquisition Center and Legal Office, Defense Contract Audit Agency, Defense Contract Management Agency and contractor counterparts — successfully used the ALPHA streamlined approach in awarding this contract.

DAR Council Corner

Consider Participating on *DFARS* Committees and *FAR* Teams

The successful implementation of the statutes, executive orders, DOD policy and other regulatory directives in the *Federal Acquisition Regulation (FAR)* and the *Defense Federal Acquisition Regulation Supplement (DFARS)* depends on Army civilian and military personnel volunteers who typically take this part-time responsibility on as an additional duty. These personnel bring subject matter expertise, general policy advice and work experience in several functional areas including contracting, legal, quality assurance, environmental, government property, industrial base, information technology, finance, transportation, utilities, logistics, hazardous material and critical safety. Even if you don't have the subject matter expertise but an interest in working closely and learning more about a part of *DFARS*, then consider this as a hands-on way to explore that interest.

Members of these committees and teams represent the Army and DOD in deliberations on issues presented in *FAR* and *DFARS* cases. Committee teamwork is of the utmost importance across the DOD acquisition community.

As committee and team members transition, an e-mail will be sent to the Army contracting community requesting nominations for a specific *Defense Acquisition Regulations (DAR)* committee or *FAR* team. *DAR* committee members must have a military grade of O-4, O-5 or O-6 or civilian grade of GS-13 to -15 (or payband equivalent). All committee members must be Level III certified.

DAR committee work falls into the "other duties as assigned" category and participants must have supervisor approval to join. Participation is on a part-time basis — approximately 10-25 percent of total workload depending on the committee — with little to no travel required. Each year, *DAR* committee members usually participate in a 1-day, off-site training program. Caseloads fluctuate, depending on the committee. At the beginning of the fiscal year, some cases will be opened as a result of the *DOD Authorization Act*. The *DAR* director requests that committee chairs be local to the Washington, DC, area.

Because there are only five *FAR* teams, caseloads are heavier and probably would involve about 30-35 percent of a permanent member's time and about 10 percent of a rotational member's or supplemental advisor's time. *FAR* meetings are held in the Washington metropolitan area and occur regularly, so it is best for permanent team members to be local. Rotational members or supplemental advisors could be located outside the Washington, DC, area.

Members located outside the DC area may be able to link into meetings via video teleconference (VTC) or conference call. Of course, there is also e-mail. The communication and collaboration means are expanding over time with the Shared Transformation Acquisition Regulations System's (STARS's) implementation, a joint system led by DOD, with NASA and General Services Administration participation, that will develop Internet capabilities to enable real-time collaboration with the committee from one's desk.

A typical *DAR* committee or *FAR* team assignment is 2 years. Because caseloads vary among the *DAR* committees, meetings are scheduled by the respective committee chair as needed. With STARS' implementation, *DAR* committee members can participate either at face-to-face meetings or via telephone conference calls, VTC or, possibly, at your desk through your computer.

There are 25 standing *DAR* committees that work cases related to specific *DFARS* parts. There are five *FAR* teams that work *FAR* cases. These teams are Acquisition Strategy, Acquisition Implementation, Acquisition Finance, Acquisition Law and Acquisition Technology. Ad hoc teams are formed as necessary.

For general information on the *DAR* Council and *DAR* committees, go to the *Defense Acquisition Regulations System* Web site at **http://www.acq.osd.mil/dpap/dars/ index.htm**.

Anyone interested in learning more about these committees in general, or if you'd like to be considered for a committee position as openings become available, please contact Barbara Binney at (703) 604-7113 or DSN 664-7113 or **Barbara.binney@saalt.army.mil**.

Joint Meritorious Unit Award (JMUA) Presented

During an October 2005 ceremony at the Pentagon, Project and Contracting Office (PCO)-Baghdad personnel were presented the JMUA, which was signed by Secretary of Defense Donald H. Rumsfeld. Award recipients included PCO Joint Contracting Command-Iraq, U.S. Army Corps of Engineers (USACE), former Coalition Provisional Authority and former Program Management Office members.

The PCO distinguished itself through exceptionally meritorious achievements from Jan. 1, 2004 to June 30, 2005. During this period, PCO personnel contributed significantly to

U.S. Army MG Daniel Long, former Director, PCO-Baghdad, displays the JMUA citation presented at the awards ceremony held at the Pentagon. Behind Long (left to right) are Claude M. Bolton Jr., Army Acquisition Executive/Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASAALT); Kathye Johnson, Deputy Director, PCO-Baghdad; Dr. Edwin Theriot, Army Corps of Engineers; Dean Popps, Principal Deputy to the ASAALT/Director, Iraq Reconstruction and Program Management; Jim Crum, Director, PCO-Washington; and Lee Thompson, Assistant Deputy Assistant Secretary of the Army (Policy and Procurement), Iraq.

Operation Iraqi Freedom's ongoing success through their commitment and expert stewardship of more than $13 billion in Iraq relief and reconstruction funds. They meticulously planned projects and executed contracts that led to successful completion of more than 1,875 infrastructure, humanitarian and security projects, and provided vital oversight to the 1,019 projects still in progress in the theater of operations.

The PCO staff's dedicated efforts won the hearts of Iraqis nationwide through the rebuilding of essential infrastructure facilities, including 37 power production and transmission projects, 56 transportation projects, 800 schools and 142 primary healthcare facilities. Through their unrelenting efforts, PCO personnel delivered more than 10,000 vehicles and 62 million individual equipment items used by Iraqi forces to reclaim and rebuild their country. The PCO members' exemplary performance brought great credit to themselves and to DOD.

Conferences

Human Capital Conference to Take Place in February

Human Capital Management for Defense (HCMD) 2006 — Meeting Critical Demands Through Seamless Workforce Transformation will take place Feb. 6-8, 2006, at the Renaissance Hotel in Washington, DC.

DOD is anticipating and undergoing the first of a very large retirement wave. In addition, the strategic management of human capital was the #1 issue on the President's Management Agenda and, therefore, DOD is taking immediate actions to implement how they derive high performance from human capital. HCMD targets DOD personnel responsible for human capital management, operations, manpower, human resources, force transformation, training, recruitment, performance, pay and civilian readiness.

Facing the demands of an aging workforce and an increasingly competitive marketplace would be monumental tasks for any company. For DOD, the Nation's largest employer, overseeing a seamless workforce transformation into a mission-ready, results-oriented agency doesn't end with hiring the right people. It goes beyond integrating the best business practices to put those right people in the right jobs at the right time. A successful strategic HCM system means:

- Using performance metrics to identify skill gaps.
- Fostering long-term career development and promoting employee retention.
- Leveraging technology to support institutional memory.
- Making the DOD workforce mission-ready.

HCMD 2006 is the only cross-service forum that brings together HCM leaders and industry experts to share information. Where private-sector conferences lack the understanding of DOD needs and "closed" DOD-sponsored conferences lack commercial industry insights, HCMD brings together the public sector's ingenuity and a first-hand understanding of DOD's specific personnel needs.
HCMD 2006 key speakers will include:

- LTG Franklin Hagenbeck, Deputy Chief of Staff, G-1, U.S. Army.
- Marilee Fitzgerald, Acting Deputy Under Secretary for Civilian Personnel Policy, Office of the Under Secretary of Defense (Personnel and Readiness).
- Mary Lacey, Program Executive Officer, National Security Personnel System.
- Robert Danbeck, Associate Director and Chief Human Capital Officer, Office of Personnel Management.
- Linda Meeks, Director, Boeing Human Resource Systems.
- Keith Glennan, VP, Chief Technology Officer, Strategy, Architecture and Integration, Northrop Grumman.
- Susan R. Meisinger, President and CEO, Society for Human Resource Management.

For more information or to register, go to **www.hcmd2006.com**.

IN MEMORIAM

Janice Kurry

The Army Acquisition Support Center (ASC) staff is deeply saddened by the death of our colleague and friend, Janice Kurry. Janice came to ASC in October 2000 as a Career Management Support Specialist and was promoted to Acquisition Career Manager (ACM) in April 2003. As an ACM in ASC's Northeast Region Career Management Office, Fort Monmouth, NJ, she served as advisor, technical expert and recognized authority to the Deputy Director, Acquisition Career Management. She was responsible for program management and evaluation functions for all acquisition career fields within the Northeast Region.

Janice was an ultimate team player and valuable member of the acquisition community. She executed partnering arrangements for the 2005 Army Acquisition Workforce and served as an Officer-in-Charge (OIC) for the 2005 Acquisition Senior Leaders and Army Materiel Command Commanders Conference. As OIC, she was the lead for, and took great pride in, such high-visibility efforts as planning Secretary of the Army Francis J. Harvey's attendance and escorting him at the conference, as well as coordinating the entire general session portion of the agenda. The consummate acquisition professional, Janice received numerous awards including Superior Civilian Service Awards, the U.S. Army Communications-Electronics Command Top 10 Employee of the Year Award and Special Act Awards for performance of her duties at special events such as conferences and road shows. Janice had more than 18 years of government service and, prior to working at ASC, was employed by the Deputy Chief of Staff for Resource Management, Fort Monmouth.

In addition to her ACM duties, Janice volunteered as a mentor in a work-study program for a group of special needs children from Dorothy B. Hersh High School in Eatontown, NJ. Every Wednesday, Janice mentored these students in performing a variety of tasks to better prepare them for the future workplace, while teaching them to develop people skills and professional relationships.

On a personal note, Janice was a huge fan of Aerosmith — Steven Tyler, in particular. She was also dedicated to physical fitness. She took great pride in decorating her home and was a passionate shopper. Janice was also extremely proud of her children and spoke often of their accomplishments.

She leaves behind her husband, Gerry Kurry; children, Michael and Stephanie Reichman; sister, Suzanne Levy; brother, Douglas Levy; her beloved dog, CoCo; and extended family and friends from across the country. Janice's expertise and commitment to duty provided each and every one of us a great example. Her ASC family will sorely miss Janice's professionalism, smiling face and, most importantly, her friendship.

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