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Future Combat Systems

In This Issue

- Unit of Action and Future Combat Systems
- The FCS One-Team Approach
- System-of-Systems Integration
- FCS and the New DoD 5000 Acquisition Guidance

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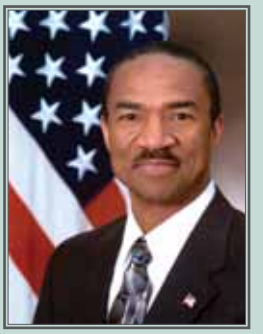
From the Army Acquisition Executive

Future Combat Systems: A Single Entity



This issue showcases one of the most important aspects of the Army's Future Combat Systems (FCS) — the far-reaching and talented team that is developing and will eventually provide Combatant Commanders with an unprecedented warfighting capability. With FCS, we are redefining the term integration as it applies to weapon systems development. The FCS One-Team includes the Defense Advanced Research Projects Agency (DARPA) and the Lead Systems Integrator (LSI) team of Boeing Co. and Science Applications International Corp. (SAIC) — with its 23 industry partners — working closely with the Army to aggressively develop FCS and achieve initial operational capability by 2010.

With this issue, we welcome LTG Joseph L. Yakovac Jr. to his new position as Military Deputy. In an in-depth interview, he highlights his priorities as he leaves his duties as Program Executive Officer for Ground Combat Systems, home of FCS, to take on new responsibilities in acquisition career management and the global war on terrorism. He brings a wealth of knowledge and experience to his new position.

The articles that follow demonstrate just how differently we do business with FCS. From the structure of the program manager's shop to the close collaboration among program executive officers, the science and technology community, the Army's Training and Doctrine Command, our Test and Evaluation Command, the Defense Contract Management Agency and others, we are developing FCS — from its earliest stages — as a single entity.

An important factor in FCS' success to date is the Boeing-SAIC LSI, our management partner and program integrator. The LSI oversees the program and ensures that all program objectives are met — continuously soliciting the best experts in each program area from around the globe to deliver advanced military capability to the force as soon as possible.

By definition, FCS is the networked system-of-systems — 19 in all — that serves as the core building block within modular maneuver echelons to give our Future Force overmatching combat power, sustainability, agility, lethality and versatility. FCS-Equipped Units of Action will be capable of full-spectrum operations against the entire range of threats in any operating environment and in all weather and terrain. Most importantly, FCS will enable the Future Force to see first, understand first, act first and finish decisively. FCS will use advanced communications and technologies to link Soldiers with both manned and unmanned ground and air platforms as well as data-collecting sensors.

In May 2003, the program entered the System Development and Demonstration (SDD) phase. During SDD, the LSI — with its best of industry team — actually designs and develops FCS. In the Acquisition Decision Memorandum announcing the move, the Under Secretary of Defense for Acquisition, Technology and Logistics, wrote, "I approve the Army's request to manage the FCS program as a single Major Defense Acquisition Program, to maintain a single funding line with a single Acquisition Program Baseline at the family-of-systems level, the organizational structure of the program and the planned time-phased development approach for individual systems leading to initial operational capability."

Keeping the program elements to an absolute minimum is key to successful program management. Keeping the program healthy is enabled by the principles of earned value management (EVM). The key tenet of EVM is the ability to provide performance status in the same manner in which efforts are planned, executed and managed. Performance is the common denominator between the originally planned efforts (work and schedule) and the actual cost to complete those efforts. These three factors of the originally planned efforts — schedule, achieved results and actual costs — provide the basis for an array of analytical capabilities to include accurately accounting for cost and schedule variance on both a cumulative and current basis.

FCS will, over time, replace the current fleet of heavy vehicles such as the Abrams tank and the Bradley Fighting Vehicle with the new family of manned and unmanned ground and aerial vehicles. The new manned ground vehicles will be both lighter and smaller and designed to fit into a C-130-like aircraft. This will allow them to be flown to a conflict anywhere in the world in 96 hours, rolled off and ready to fight.

FCS adheres to an evolutionary acquisition strategy that will allow for upgrades in capability and rapid insertions of advanced technologies throughout the program's life cycle. This will ensure the FCS program remains flexible, expansible and open to accommodate trades in the system architecture and in the individual design of systems.

It's clear that we've assembled a talented team with sound business practices to ensure program success. Read on!

Claude M. Bolton Jr.
Army Acquisition Executive

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Cover Story

Unit of Action and Future Combat Systems — An Overview

BG Donald F. Schenk,
COL Daniel J. Bourgoine and
Brian A. Smith

Page 3

Features

Page 74

New Military Deputy LTG Joseph L. Yakovac Jr. Plans to Put People First

Meg Williams

ARMY AL&T
January - February 2004

ACQUISITION, LOGISTICS & TECHNOLOGY

FCS Family-of-Systems

FCS Poster

The 19 family-of-systems that make up Future Combat Systems are depicted in a pullout poster on Pages 50-51.

Departments

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By order of the Secretary of the Army

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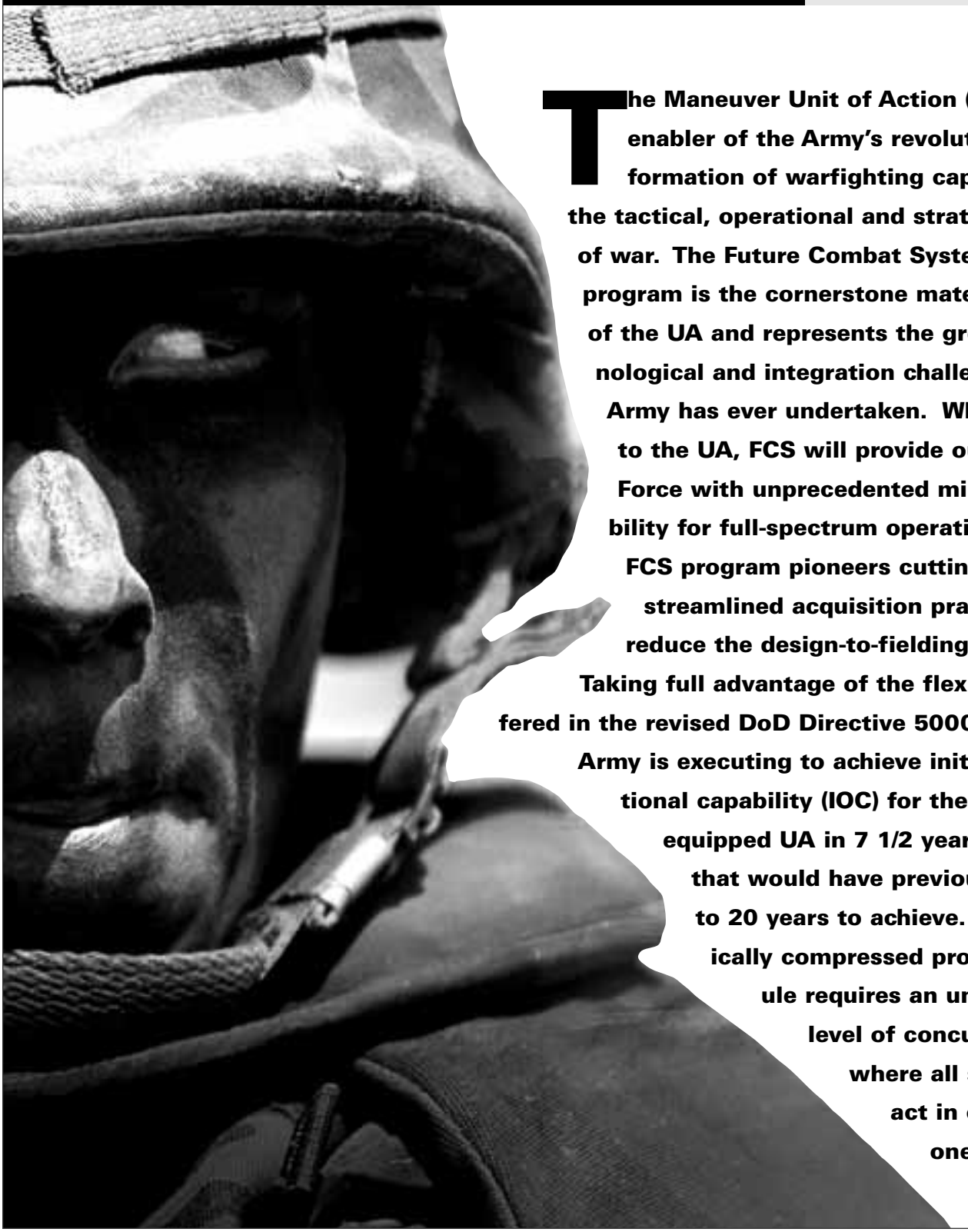
Unit of Action and Future Combat Systems — An Overview

BG Donald F. Schenk, COL Daniel J. Bourgoine and Brian A. Smith

FUTURE COMBAT SYSTEMS
FCS
One Team-The Army/Defense/Industry



The Maneuver Unit of Action (UA) is a key enabler of the Army's revolutionary transformation of warfighting capabilities at the tactical, operational and strategic levels of war. The Future Combat Systems (FCS) program is the cornerstone materiel element of the UA and represents the greatest technological and integration challenge the Army has ever undertaken. When fielded to the UA, FCS will provide our Future Force with unprecedented military capability for full-spectrum operations. The FCS program pioneers cutting-edge and streamlined acquisition practices that reduce the design-to-fielding cycle time. Taking full advantage of the flexibility offered in the revised DoD Directive 5000 series, the Army is executing to achieve initial operational capability (IOC) for the first FCS-equipped UA in 7 1/2 years, a task that would have previously taken 15 to 20 years to achieve. The dramatically compressed program schedule requires an unprecedented level of concurrency where all stakeholders act in concert as one team.

Background

The final decade of the 20th century saw the decisive victory of the U.S.-led coalition forces over the Iraqi army in the desert of Kuwait and Iraq. To many, this indicated that the weapons, doctrine and training of the U.S. Army were among the best in the world and that no foe could militarily challenge this Nation. The popular view was that there would be little need for a change in the U.S. Armed Forces for years to come because our victory was so decisive and complete.

However, the Army did not rest on its laurels. It understood after *Operation Desert Storm (ODS)* that the world was changing and so too were our adversaries. Through studies and analyses such as the Army After Next Study initiated after *ODS*, the Army understood that at one end of the spectrum, creative and adaptive opponents could be expected to employ strategies to destroy U.S. resolve by attacking our homeland, killing innocent civilians and conducting prolonged urban or guerilla operations. Some would immerse themselves in our culture, exploit our vulnerabilities and seek to create maximum fear in the hearts of our citizens and coalition partners as witnessed by the infamous attacks on 9/11. Studies predicted that our future adversaries would also seek to fracture confidence in public institutions, generate economic uncertainty and divide the focus as well as the will of the general public.

> The hallmark of UA operations will be the significant abilities to develop situations out of contact, engage the enemy in unexpected ways, maneuver to positions of advantage with speed and agility, engage enemy forces beyond the range of their weapons, destroy enemy forces with enhanced fires and assault at times and places of our choosing.

Respecting the superior power of U.S. military forces, some of our future adversaries would employ asymmetric options to avoid U.S. strengths and exploit U.S. vulnerabilities. This is evident today in Iraq where the enemy has significantly changed from the one defeated only a decade ago during *ODS* and again last year.

So, the Army was cognizant after *ODS* that while the *nature* of war remains constant, the *conduct* of war is continually undergoing change in response to new concepts, technologies and capabilities. How our Army was to adapt to such changes would determine our readiness to confront future operational challenges and threats. The Army studied future war and the results of Force XXI, Army After Next and other key studies and analyses, and informed the then incoming Army Chief of Staff (CSA), GEN Eric K. Shinseki, of the results. In October 1999, under the CSA's leadership, the Army published The Army Vision that prescribed the key tenets for transforming the Army into a force that is *strategically responsive and dominant at every point on the spectrum of conflict*, not solely major contingency operations like *ODS*.

Subsequently, the U.S. Army Training and Doctrine Command (TRADOC), as the Army's "architect of the future" and a partner with the Army's materiel development community, developed detailed warfighting concepts and doctrine, organizations, training, materiel, leadership, personnel and facilities requirements that would help achieve the Army Vision for the Army's Future Force. Two of the key foundational products to emerge from this work included: the Maneuver UA Operational and Organizational (O&O) Plan and the FCS Operational Requirements Document (ORD). Together they have become foundational blueprints for setting the Army on the path to making the Future Force a reality.

Maneuver UA

An increasingly demanding operational environment, coupled with America's future strategic, operational and tactical military art, clearly defined the necessity to build a ground force capable of rapid deployment and operations across the full spectrum of operations. The FCS-equipped UA represents a capability critical to the Army's Future Force and the accomplishment of the goals of the Joint Vision, Army Vision and other applicable policy documents. Although the Future Force's deployability qualities are significant, it is the Future Force's operational maneuver capability to conduct decisive operations that is most relevant to the Joint Force.

The Army's Maneuver UA will be part of a Joint team that is decisive in any operation, against any level threat in any environment. The UA balances the capabilities for strategic responsiveness and battlespace dominance. The UA also balances deployability and sustainability with responsiveness, lethality, survivability, agility and versatility. Although optimized for offensive operations, the UA can execute stability and support operations as well. It employs its revolutionary command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) architecture to expand

or contract its span of control and integrate unit of employment (UE) or joint task force (JTF) supporting capabilities to accomplish missions. The hallmark of UA operations will be the significant abilities to develop situations out of contact, engage the enemy in unexpected ways, maneuver to positions of advantage with speed and agility, engage enemy forces beyond the range of their weapons, destroy enemy forces with enhanced fires and assault at times and places of our choosing.

The UA is designed to ensure campaign quality. Although it has the responsiveness and deployability to achieve all Army deployment goals, it is designed with the durability, endurance and stamina to fight battles and engagements for the duration of a campaign and to aggressively focus on decisive points and centers of gravity. It can also perform tactical and operational maneuver by land, air and sea. Given its inherent tactical mobility, it can land at points removed from its objectives, out of range of enemy defenses, then move by land to complete its mission. This capability applies not only to entry operations, but also to theater operations throughout the campaign.

The UA will master the transitions in warfare that sap operational momentum and threaten initiative retention. Situational awareness (SA) delivers the advantage required to close with and destroy the adaptive and asymmetric adversaries of the future and allows the commander to set the requisite conditions for mission success. Most importantly, the UA is based on capable, lethal small units. At every echelon, the UA forces dominate their combat environments during entry operations, movement to the fight, decisive operations and transition. Commanders, who are expert in using terrain and knowing the enemy, and who also have the instincts to "feel" the battle, will lead this force. The UA is not a fixed organization. It has the capability to command and control up to six combined arms battalions. It is also able to employ a range of supporting capabilities from a UE or JTF to perform a variety of missions including reinforcing fires, engineers, military police, air/missile defense, psychological and civil military operations. The UA can be tailored with additional capabilities for specific missions and between missions in the campaign. The forward support battalion can likewise be tailored with additional sustainment capabilities when required to support UA augmentation.

The UA fosters the ability of Soldiers and leaders to achieve lethality and survivability overmatch. It presupposes platform superiority and emphasizes combined arms teams to achieve combat power synergy. The Soldier is the centerpiece of the Future Force.

The Maneuver UA is not just a unique brigade combat team, built around a family-of-systems, but a new concept for fighting those systems. It is optimized to develop the situation out of contact, throwing the enemy off balance by destroying its high-payoff systems before forces are joined, and maneuver to a position of advantage. The UA sets the conditions and isolates enemy formations to enable it to close with and destroy the enemy at a time and place of its choosing. During contact, the UA continues to develop the situation by integrating intelligence, surveillance, reconnaissance, fires and maneuver. The UA finishes engagements decisively with precision assaulting fires supporting mounted or dismounted assault.

The UA is a "network-enabled" force. It is equipped with a vast sensor array that permits leaders and commanders to achieve dramatic improvements in SA. This significantly improved ability to collect and process information by using organic sensors, as well as rapid access to information from UE and higher, will ensure commanders possess the timely, accurate intelligence necessary to achieve decision superiority. Decision superiority will permit the UA to maneuver forces and destroy enemy systems throughout its area of influence.

Also built into the organization is the ability to employ lethality from external sources. Structurally and through the network, sensor-shooter relationships begin at the Soldier level and exist throughout the formation, providing the UA the ability to accurately direct effects internally or from supporting UE forces and joint assets. This ability to cooperatively engage targets with tactical, operational and strategic-level assets will be accomplished in seconds rather than minutes. The UA fosters the ability of Soldiers and leaders to achieve lethality and survivability overmatch. It presupposes platform superiority and emphasizes combined arms teams to achieve combat power synergy. The Soldier is the centerpiece of the Future Force.

FCS Program

FCS is comprised of a family of advanced, networked air- and ground-based maneuver, maneuver support and sustainment systems that will include manned and unmanned (MUM) platforms. FCS is networked via a

C4ISR architecture including networked communications, network operations, sensors, battle command system, training and MUM reconnaissance and surveillance capabilities that will enable SA levels and synchronized operations heretofore unachievable.

FCS will operate as a system-of-systems (SoS), as defined in *Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3170.01B*, that will network existing systems, systems already under development and new systems to be developed to meet future UA needs. The network will enable improved ISR, enhanced analytical tools, joint exchange of blue and red force tracking down to the tactical level, battle command, real-time sensor-shooter linkages and increased synergy between echelons and within small units. It will also enable the UA to connect to UE and Joint, Interagency and Multinational capabilities, making these capabilities available to the UA's small units as well as with adjacent, noncontiguous units. FCS enables the networked UA to develop the situation in and out of contact, set conditions, maneuver to positions of advantage and to close with and destroy the enemy through standoff attack and combat assault per the Maneuver UA O&O Plan, as outlined in the FCS ORD (April 14, 2003, Page 10).

Unlike other acquisition programs that focus primarily on one system or vehicle platform, the FCS program focus is on systems integration, C4ISR networks, logistics and training to ensure operational requirements — such as lethality and survivability — are achieved. C4ISR networks must provide commanders and their supporting staffs the ability to see first, understand first, act first and finish decisively. An integrated C4ISR network empowers leaders with access to external information, combined with information from organic sources that can be distributed rapidly to small units for greater operational effectiveness. In the UA, relevant information raises combat power exponentially and becomes actionable knowledge for the commander as expressed in the following formula: Combat Power=((Maneuver+Firepower+Protection)+(Leadership)) Information

FCS will enable the UA to achieve SA through direct collection and integration of intelligence, instead of waiting for it to be filtered down through upper echelons. Data will be collected from Joint and national intelligence assets and from organic sources as well. The UA C4ISR technologies will integrate the data collected locally with its own advanced onboard ground and MUM aerial sensors as well as data from external sources, allowing commanders the best possible SA. This awareness does not just extend to enemy/ friendly positions and terrain, but to weather, local languages and customs. The UA will be uniquely equipped with a wide array of sensor-carrying platforms, particularly unmanned ground and aerial vehicles that are organic down to the squad, neatly integrated in the FCS SoS, allowing units at all levels to have superior battlespace vision.

FCS enables the networked UA to develop the situation in and out of contact, set conditions, maneuver to positions of advantage and to close with and destroy the enemy through standoff attack and combat assault per the Maneuver UA O&O Plan, as outlined in the FCS ORD.

Every platform and Soldier will have the ability to both see the battlefield as their commanders do and possess the capability to direct fires from any shooter available to the UA. Each platform will have the ability to take advantage of every sensor available to literally see around corners and achieve direct fires from "beyond line of sight." This makes every contact by the UA potentially a lethal one. Latency from contact to fire mission will be drastically reduced.

FCS ground platforms will also be highly mobile and survivable. Mobility will be enhanced through advanced technologies that increase speed and reliability while keeping weight down. SA will decrease the platforms' encounters with obstacles, and sensors will provide standoff mine detection. Active and passive survivability technologies will protect the vehicles and their crews and provide valuable threat information to the UA C4ISR network, pinpointing enemy shooters and allowing them to be targeted.

FCS Acquisition Approach

The FCS program employs an evolutionary acquisition strategy consisting of a series of increments leading to FCS objective capability. This new approach mitigates the risk associated with the FCS's compressed and challenging program schedule and scope. Succeeding increments of FCS capabilities will have a structure similar to Increment I. Technology insertion to the FCS/UA will continue throughout each increment as high-payoff technologies mature and are ready for integration.

Incremental development of FCS SoS allows the Army to field capabilities to warfighters faster by producing and deploying systems as their technologies

mature. When initially fielded, the first increment of FCS capability will meet many, but not all, SoS-desired objective capabilities. However, sufficient FCS capabilities will be met with Increment I to enable the UA to effectively execute its O&O Plan at full operational capability (FOC). Subsequent increments will incorporate new technologies that have matured since the previous increment of capability was fielded to the UA and will further enhance the UA's ability to execute missions as articulated in the UA O&O Plan. The series of increments leads to full objective FCS capability and ensures that the UA can execute its O&O Plan over time to dominate ground combat at any time and any place.

The FCS-equipped UA is being developed by clearly and unambiguously empowering the network SoS integration activities as the cornerstones upon which the FCS program is built. The day-to-day mindset of these integration activities involves thinking through tasks hierarchically (top-to-bottom) and temporally (today to FOC in 2012), with a special emphasis on near-term activities focused on allocation of requirements to baselines, and then to product build, verification, deployment and support at the SoS level. Multidisciplinary integrated product teams and working groups address the diverse interconnections that exist in complex SoS.

The FCS program also uses an advanced collaborative environment to facilitate collaborative development between PM FCS, Lead Systems Integrator (LSI) and TRADOC, and uses other initiatives to address program risk and to refine solutions to meet user requirements in the FCS ORD and consistent with the UA O&O Plan.

To obtain the best value for the Army, PM FCS is using the LSI as the single accountable, responsible contractor to integrate the FCS on time and within budget, while reducing the logistics footprint and achieving user requirements. The LSI acts on the Army's behalf throughout the FCS program's life to optimize FCS capability, maximize competition, ensure interoperability and maintain commonality while also reducing life-cycle cost. Army leaders have made risk management a program cornerstone, implementing risk management tools at all program levels. Program risks are identified and mitigation plans developed with a special emphasis on technology maturity.

To obtain the best value for the Army, PM FCS is using the LSI as the single accountable, responsible contractor to integrate the FCS on time and within budget, while reducing the logistics footprint and achieving user requirements.

The FCS program is vital to UA development and fielding and is the Army's top materiel development program that will provide unprecedented military capability for the Future Force. FCS development is a collaborative effort between PM FCS, LSI, TRADOC, Defense Advanced Research Projects Agency, other Army stakeholders, sister services, U.S. Joint Forces Command, the Joint Staff, Office of the Secretary of Defense, and other DOD agencies requiring active involvement from industry. The Army will lead overall program management and development efforts while using the LSI to manage SoS integration efforts. The Army is executing an aggressive and compressed schedule to develop, test and field an IOC by 2010. Success will require the application of sound SoS architecture engineering and integration, and software engineering processes, proactive risk management, stable requirements and an appropriate level of oversight to maintain the program schedule and established cost goals. The "One-Team" approach is the linchpin for program management success and fielding the FCS to the Future Force.

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COL DANIEL J. BOURGOINE is the UA Division Chief of the Requirements Integration Directorate of TRADOC's Futures Center. He has a B.A. degree in history from Wheaton College and an M.S. in international relations from Troy State University.

BRIAN A. SMITH is the Director for Business Management at the PM FCS Office. He holds a B.A. degree in psychology from Wabash College and an M.A. degree in public administration from Webster University.

The FCS One-Team Approach — The Linchpin for Program Management Success

COL Daniel J. Bourgoine, Matthew C. Danter, John Morrocco and Brian A. Smith

The Future Combat Systems (FCS) program is the greatest technology and integration challenge the Army has ever undertaken. Thus, it requires continuous input from multiple partners — government, Lead Systems Integrator (LSI) and subcontractors — covering broad areas of concurrent development. The Army has adopted the FCS One-Team approach to ensure all partners act in concert together. With this approach, each team member's unique talents, capabilities and perspectives create, synergistically, the best the U.S. Army has to offer the Soldier. This article briefly describes how the FCS One-Team accomplishes its mission through its organization into integrated product teams (IPTs) at two levels. Additionally, contributions by key FCS One-Team partners such as the LSI, U.S. Army Training and Doctrine Command (TRADOC) and Defense Contract Management Agency (DCMA) are further highlighted.

The Stryker brings enhanced mobility, maneuverability and firepower to the modern battlefield making our Soldiers more lethal and survivable than ever before.

Mission Accomplishment

The Program Manager (PM) FCS maintains LSI progress oversight through joint government/LSI leadership of the product- and process-oriented IPTs. As described below, a Level I IPT for overall program management and 14 Level II IPTs (seven for system-of-systems (SoS) integration and seven for systems' integration) are established and staffed with government/LSI membership — each IPT has an LSI team leader and a government co-chair — to foster a collaborative working relationship and to ensure successful execution of program plans, cost, schedule, performance and supportability objectives. The following are the initial IPTs the system development and demonstration (SDD) phase will commence with:

- PM IPT (Level I).
- Advanced Collaborative Environment IPT (Level II).
- Complementary Programs IPT (Level II).

- Force Development IPT (Level II).
- Integrated Simulation and Test IPT (Level II).
- Logistics Requirements and Readiness Systems IPT (Level II).
- SoS Engineering and Integration IPT (Level II).
- Training Systems IPT (Level II).
- Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance Systems Integration IPT (Level II).
- Spiral Development and Technical Planning IPT (Level II).
- Lethality Systems Integration IPT (Level II).
- Manned Ground Vehicle Systems Integration IPT (Level II).
- Soldier Systems Integration IPT (Level II).
- Unmanned Aerial Vehicle Systems Integration IPT (Level II).
- Unmanned Ground Vehicle Systems Integration IPT (Level II).

Each IPT has identified its roles, responsibilities and authorities in a team execution plan. The IPT tasks include configuration, data and requirements management; design reviews; trade studies; technical performance measurement; risk management; and cost as an independent variable implementation. The IPTs are also responsible for preparing milestone documents. Levels below Level II include sub-IPTs and ad hoc working groups set up as needed to accomplish specific tasks.

LSI

In structuring its systematic approach to transformation, the U.S. Army has chosen a nontraditional way of doing business because the task's sheer magnitude requires an entirely new approach. As conceived by Army leadership, this new approach involves nothing less than a revolutionary change in the relationship between the Army and its private sector industrial partners. The new relationship is based on the LSI concept that operates much like the general contractor of a house — seeking out the best experts in each area.

The FCS LSI team from the Boeing Co. and Science Applications International Corp. (SAIC) are responsible for total systems integration. The LSI team manages major system and subsystem identification, selection and procurement. The LSI assembled a global team from General Dynamics and United Defense Limited Partnership to lead the manned ground vehicle design team — a logical choice because the two companies have built most of the Army's heavy combat vehicles for the past 40 years.

From July to August 2003, the LSI, with government cooperation, selected another 21 industry partners ranging from companies with long histories of cooperation with the Army to small, entrepreneurial firms shaped by Information Age demands. They, in turn, will bring more than 100 subtier suppliers to FCS.

The selection process conducted by the LSI included the Army and other government agencies. Specific measures were taken to ensure the evaluation process was equitable and would produce a standard-setting "FCS One-Team."

"From the beginning of our involvement with FCS, we aimed at assembling an industry team composed of the best in the business," said Dennis Muilenburg, Vice President and FCS PM for Boeing. "We used an innovative and very efficient approach to put our FCS One-Team together, entirely in keeping with the goals we share with the Army."

"From the beginning of our involvement with FCS, we aimed at assembling an industry team composed of the best in the business," said Dennis Muilenburg, Vice President and FCS PM for Boeing. "We used an innovative and very efficient approach to put our FCS One-Team together, entirely in keeping with the goals we share with the Army."

To jump-start the ambitious schedule mandated by FCS requirements, the Boeing-SAIC LSI team kicked off the first in a series of One-Team meetings with other key industry partners in mid-August. Top executives from the partner companies that were selected to provide major systems for the program met with senior Army acquisition officials and the LSI team to begin setting the foundation for moving forward on this top priority transformation program.

The new partners merged with the LSI in a One-Team Council that meets regularly to integrate major FCS SoS elements. The council's goal was to standardize processes and share best practices, as well as set goals and schedules for moving ahead with the program's SDD phase.

TRADOC SDD Support

As the Army's "architect of the future," TRADOC will continue to provide the warfighter perspective to the integration of doctrine, organizations, training, materiel, leadership, personnel and facilities to enable the Army to achieve Future Force capabilities by decade's end. TRADOC will closely collaborate with PM FCS and LSI to ensure

simultaneous and parallel Future Force, Unit of Action (UA) and FCS developments are properly synchronized and integrated to meet user requirements.

The FCS program will require a continuous and consistent refinement of SDD requirements, particularly in the first 18 months. During SDD, TRADOC's efforts have shifted from operational requirements document (ORD) production to integrating the UA Operational and Organizational Plan and the FCS ORD into the design and development efforts by the LSI and PM FCS. This effort demands a sustained level of TRADOC involvement by its subject matter experts (SMEs) and commandants. TRADOC is committed to providing user support to a program that is characterized by innovation, forwarding thinking, collaboration, cooperation and team play.

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To accomplish this on the aggressive SDD phase timeline, TRADOC is committed to support the program with unprecedented effort distributed across the command, but integrated using a UA- and FCS-responsible agent: the UA Maneuver Battle Lab (UAMBL), a TRADOC Systems Manager (TSM) FCS and the Futures Center.

On Oct. 1, 2003, TRADOC established the Army Futures Center. TRADOC's Commanding General (CG) will leverage Futures Center assets to ensure holistic and integrated FCS Program support and see that FCS is developed and synchronized with the Future Force's larger development efforts. At HQ TRADOC level, the Future Center supports the TRADOC CG by providing bimonthly written reports, monthly face-to-face staff updates and quarterly reviews with UAMBL and the commandants in a requirements integrated concept team.

The Futures Center is strengthening its collaboration with the Joint Forces Command to ensure joint integration. It is also strengthening TRADOC's links to the Marine Corps Combat Developments Center to ensure that Army and Marine Corps FCS common requirements are synchronized when the FCS program transitions to a Joint Program Office.

TRADOC is harnessing user/SME expertise from throughout TRADOC to support the FCS program. TRADOC has enhanced UAMBL with both personnel and resources in unprecedented ways to provide user focus and FCS program support. Furthermore, TRADOC has in place an FCS support directive that establishes support relationships between UAMBL and other TRADOC centers and schools and TSMs to guarantee effective user support to UAMBL and the FCS program. The command is also assigning TRADOC user personnel to collocate with PM FCS and LSI main facilities involved in FCS developments to ensure rapid user feedback to design issues as they arise during SDD. TRADOC has networked its battle labs to conduct extensive UA experimentation during the SDD phase to provide real-time user feedback to the FCS program as the family-of-systems (FoS) is designed and developed.

> TRADOC has networked its battle labs to conduct extensive UA experimentation during the SDD phase to provide real-time user feedback to the FCS program as the family-of-systems is designed and developed.

TRADOC is also committed to supporting the One-Team in daily SDD management. TRADOC has designated colonels and other SMEs from throughout the command to serve on each of the 14 IPTs. TRADOC also provides two colonels who participate in the weekly Change Control Board meetings and 2-star level participation from UAMBL and Futures Center on the FCS Program Change Control Board. The Futures Center and UAMBL participate as partners with the PM in monthly, quarterly and other major program reviews and support integrating IPT and overarching IPT issues resolution with the Office of the Secretary of Defense.

Bottom line: TRADOC is committed to providing FCS program user support that is characterized by innovation, forward thinking, collaboration, cooperation and team play. TRADOC will have to make the hard calls, when necessary, to ensure that FCS delivers what Soldiers will need to win wars in the next decade.

Customer Focus Drives DCMA Commitment

DCMA is a key player in the FCS

One-Team concept. DCMA's mission is to provide customer-focused, acquisition life cycle and combat support (CS) to ensure worldwide warfighter readiness. As a DOD CS agency, DCMA aligns its operations with its customer's program requirements, wherever they may be. This results in acquisition support that is flexible, mobile, innovative and customer-centric. This approach to customer support solidifies DCMA's role with the Army, LSI and other government and industry players.

DCMA's support starts in the early phases of major programs and is there until the end. For example, DCMA has provided detailed pricing analysis of the LSI's basis of estimate to determine ways to assure the best value for scarce government resources. DCMA's Industrial Analysis Center has provided information on the industrial base's capabilities to support Future Force requirements. Further, as DOD's executive agent for earned value management (EVM), DCMA provided significant support in FCS Program Management Plan development. As part of the program's EVM system, DCMA actively tracks the other transactional agreement (OTA) schedule at all tiers to identify potential risks to cost, schedule and performance. This effort has forged a true collaborative atmosphere of trust and mutual responsibility with the LSI and PM FCS.

As DOD's executive agent for earned value management, DCMA provided significant support in FCS Program Management Plan development. DCMA actively tracks the other transactional agreement schedule at all tiers to identify potential risks to cost, schedule and performance.

DCMA's key strength in supporting the program is its organizational flexibility. With its main program focal point located at DCMA Boeing St. Louis (collocated with the LSI Program Office), the DCMA team coordinates support functions provided by the worldwide network of contract management offices that oversee FCS supplier partners. This unique relationship provides the FCS team immediate insight into the suppliers' ability to meet cost, schedule and technical performance thresholds. Additionally, because of its intimate knowledge of the contractors' processes and products, the DCMA team works to predict potential program risks and then engages with other FCS team members to mitigate those risks before they lead to unforeseen problems.

A technically diverse workforce is another important DCMA strength. The Army asked for systems engineering support to perform functional decomposition of ORD requirements to SoS specification. Further, the PM wanted assistance in developing technical performance measures that allocated the SoS key performance parameters to the appropriate FoS. DCMA was able to provide that assistance by tapping into its in-house system engineers.

DCMA performs a wide array of business and technical surveillance activities in support of the program's IPTs. The collective result of these efforts is predictive analysis that provides the FCS One-Team early warning of shifts in program risks that require management actions to mitigate potential cost, schedule and performance issues.

The FCS team DCMA component is dedicated to providing the program — and the warfighters who will ultimately employ the systems — the best acquisition support and contract management services available anywhere.

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The Network — The Key to Transformation

COL Jonathan A. Maddux and Dr. Gerardo J. Melendez

FUTURE COMBAT SYSTEMS
FCS
One Team-The Army/Defense/Industry

The Army's Future Combat Systems (FCS) network allows the FCS Family-of-Systems (FoS) to operate as a cohesive system-of-systems where the whole of its capabilities is greater than the sum of its parts. As the key to the Army's transformation, the network enables the Future Force to employ innovative and revolutionary operational and organizational concepts and enables Soldiers to perceive, comprehend, shape and dominate the future battlefield at unprecedented levels as defined by the FCS Operational Requirements Document.

The FCS network consists of four overarching building blocks: System-of-Systems Common Operating Environment (SOSCOE); Battle Command software; communications and computers (CC); and intelligence, reconnaissance and surveillance (ISR) systems. The four building blocks synergistically interact enabling the Future Force to see first, understand first, act first and finish decisively.

SOSCOE

Central to FCS network implementation is SOSCOE, which supports multiple mission-critical applications independently and simultaneously. It is configurable so that any specific instantiation can incorporate only the components that are needed for that instantiation. SOSCOE enables straightforward integration of separate software packages, independent of their location, connectivity mechanism and the technology used to develop them.

SOSCOE architecture uses commercial-off-the-shelf hardware and a Joint Tactical Architecture–Army compliant operating environment to produce a nonproprietary, standards-based component architecture for real-time, near-real-time and non-real-time applications. SOSCOE also contains administrative applications that provide capabilities including login service, startup, logoff, erase, memory zeroize, alert/emergency restart and monitoring/control. SOSCOE's framework allows for integration of critical interoperability services that translate Army, Joint and coalition formats to native, internal FCS message formats using a common format translation service. Because all interoperability services use these common translation services, new external formats will have minimal impact on the FCS software baseline. The FCS software is supported by application-specific interoperability services that act as proxy agents for each Joint and Army system. Battle command (BC) can access these interoperability services through application program interfaces that provide isolation between the domain applications, thereby facilitating ease of software modifications and upgrades.

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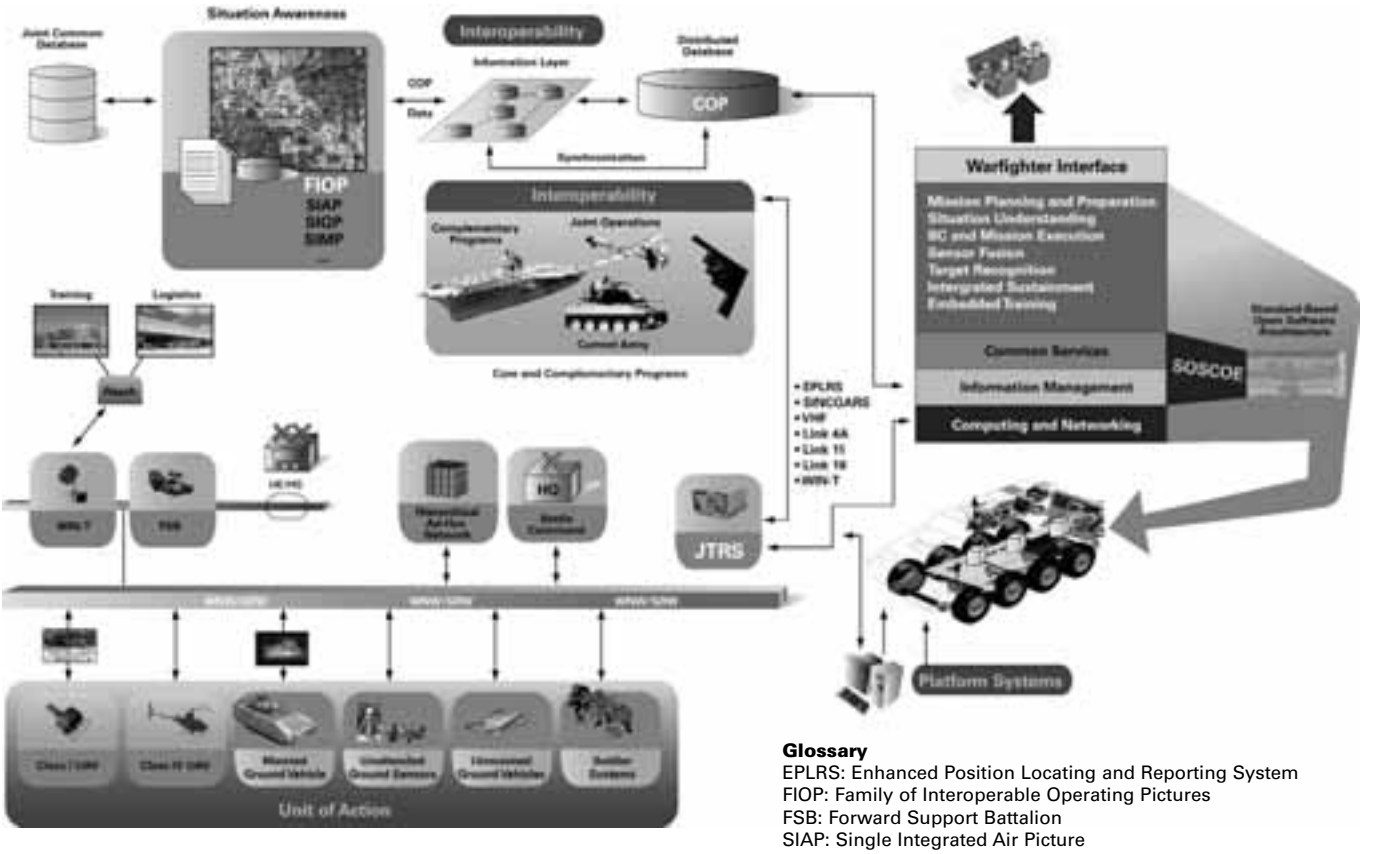
BC Software

BC mission applications include: mission planning and preparation, situation understanding, BC and mission execution and warfighter-machine interface (WMI). These four software packages' combined capabilities enable full interaction among the FCS-equipped Units of Action (UAs) with systems. BC capabilities will be common to, and tightly integrated into, all FCS and will share a common framework to achieve the long-desired goal of an integrated and interoperable system with no hardware, software or information stovepipes.

The *Mission Planning and Preparation* package consists of 16 services embedded within SOSCOE. They support the development of deliberate, anticipatory and rapid-response plans;



Glossary
EPLRS: Enhanced Position Locating and Reporting System
FIOP: Family of Interoperable Operating Pictures
FSB: Forward Support Battalion
SIAP: Single Integrated Air Picture
SIGP: Single Integrated Ground Picture
SIMP: Single Integrated Maritime Picture
SINCGARS: Single Channel and Ground Airborne Radio System
UAV: Unmanned Aerial Vehicle

The FCS Network Management System

the ability to perform plan assessments and evaluations; terrain analysis; mission rehearsals; and after-action reviews for the UA. As an example of the capabilities provided by this package, consider the FCS-networked fires key performance parameter (KPP). This package's predictive planning capabilities pre-approve airspace for weapons/munitions to target pairings so that when the decision to engage a target is made, the available weapons/munitions are already understood.

The 10 *Situation Understanding* package's services allow warfighters to better comprehend the battlespace and gain information superiority. The package includes map information and situational awareness (SA) database maintenance, which performs fusion as follows:

- Situation refinement that fuses spatial and temporal relationships among objects, grouping objects and abstract interpretation of the patterns in the order of battle.
- Threat refinement that combines activity with capability of enemy forces, infers enemy intentions and performs threat assessment.
- Process refinement that monitors the fusion process itself, assesses the accuracy of the fusion process and regulates the acquisition of data to achieve optimal results.

The *BC and Mission Execution* package contains planning and decision aids that assist the commander in making quick, informed and accurate decisions to best prosecute the battle. These services are fully independent of mode — training, rehearsal or operational — and are intended to support manual to autonomous operations.

The *WMI* package provides the capabilities to present Soldier information and receive Soldier information. WMI provides a common user interface across multiple platforms supporting the common crew station and "personal digital assistant" display system. It considers parameters such as echelon, type of system being used and the warfighter's role to tailor information presentation.

CC Systems

The FCS FoS are connected to the command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) network by a multilayered CC network with unprecedented range, capacity and

dependability. The CC network provides secure, reliable access to information sources over extended distances and complex terrain. The network will support advanced functionalities such as integrated network management, information assurance and information dissemination management to ensure dissemination of critical information among sensors, processors and warfighters within and external to the FCS-equipped organization.

The CC network does not rely on a large and separate infrastructure because it is primarily embedded in the mobile platforms and moves with the combat formations. This enables the C4ISR network to provide superior BC on the move to achieve offensive-oriented, high-tempo operations.

The FCS communication network is comprised of several homogenous communication systems such as Joint Tactical Radio System (JTRS) Clusters 1 and 5 with Wideband Network Waveform (WNW) and Soldier Radio Waveform (SRW), Network Data Link and Warfighter Information Network–Tactical (WIN-T). FCS leverages all available resources to provide a robust, survivable, scalable and reliable heterogeneous communications network that seamlessly integrates ground, near-ground, airborne and space-borne assets for constant connectivity and layered redundancy.

The figure on Page 13 shows that every FCS vehicle in the UA will be equipped with a 4- or 8-channel JTRS Cluster 1. Soldiers and other weight- and power-constrained platforms will be equipped with a 1- or 2-channel JTRS Cluster 5. In addition to the WNW and SRW communications backbone, the software-programmable JTRS will support other waveforms to ensure current force Joint, Interagency and Multinational (JIM) interoperability. The WIN-T will provide additional communications capability within the UA, as well as reach to echelons above — intra- and inter-UA, and UA to unit of employment (UE) — and range extension.

The FCS Network Management System manages the entire UA network including radios with different waveforms, platform routers and local area networks (LANs), information assurance elements and hosts. It provides a full spectrum of management capabilities required during all mission phases, including pre-mission planning, rapid network configuration upon deployment in the area of operations, monitoring the network during mission execution and dynamic adaptation of network policies in response to network performance and failure conditions.

FCS will employ an integrated computer system to host the SOSCOE, ensure common processing, support networking and employ consistent data storage/retrieval across all FCS platforms and applications. The integrated computer system consists of processors, storage media, dynamic memory, input/output devices, LANs and operating systems. A suite of seven computing system types have been identified to meet the various FCS platform-specific requirements for security, processing capability, computational capacity, throughput, memory, size, weight and power.

> The *BC and Mission Execution* package contains planning and decision aids that assist the commander in making quick, informed and accurate decisions to best prosecute the battle. These services are fully independent of mode — training, rehearsal or operational — and are intended to support manual to autonomous operations.

ISR

A distributed and networked array of multispectral ISR sensors provides FCS with the ability to "see first." ISR assets within the UA — as well as those external to the UA and at higher echelons — will provide timely and accurate SA, enhance survivability by avoiding enemy fires, enable precision networked fires and maintain contact throughout engagement. FCS will process real-time ISR data, outputs from survivability systems, SA data and target identification information to update the common operating picture (COP) containing information on friendly forces, battlespace objects (BSOs), BSO groupings and their associated intent, threat potential and vulnerabilities. The real-time distribution and dissemination of information and data are reliant on robust, reliable and high-capacity network data links.

To provide warfighters with actionable information, the data from the various distributed ISR and other sensor assets are subject to complex data processing, filtering, correlation, aided target recognition and fusion. The Sensor Data Management (SDM) software organizes all the sensor data — including detection reports — and tracks information as received from the sensor packages. Data are then processed and fused to synthesize information about the object, situation, threat and ongoing ISR processes. In addition to receiving data from FCS organic sensors, SDM has the capability to receive sensor data

from nonorganic sources, including current forces and JIM. SDM will perform sensor data format conversions to output the data in FCS standard data formats.

Force Transformation Through the Network

The FCS network is a cohesive and seamless architecture of battle command, communications, computers and ISR connected through the SOSCOE. The network is central to three of the seven transformational KPPs — Joint Interoperability, Networked Battle Command and Networked Lethality — and supports the remaining four — Transportability, Sustainability/Reliability, Training and Survivability. The network enables the Future Force by providing the capabilities to see first, understand first, act first and finish decisively on the future battlefield.

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System-of-Systems Integration: The Most Ambitious Army Program Ever

Scott Davis and Tom Bagwell

System-of-Systems

Future Combat Systems integration as a system-of-systems (SoS) through a network environment will provide total operational capabilities not achievable by individual platforms. This SoS includes integration of 19 systems that make up the FCS Family-of-Systems (FoS); integration across the distributed system functions that include command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR); logistics and training; and integration with complementary programs such as Commanche, Warfighter Information Network-Tactical and High-Mobility Artillery Rocket System. FCS-equipped battalions will make up the unit of action (UA). Integration of these combat, combat support, sustainment and C4ISR systems into a networked SoS enables the UA to operate as a fully integrated combined arms force and will facilitate interoperability with the unit of employment (UE) and Joint, Interagency and Multinational (JIM) forces.

Unprecedented FCS network integration will allow the UA to:

- Share superior situational awareness.
- Engage the enemy at tactically significant standoff ranges.
- Mass effects at the time and place the UA commander chooses.
- Move to the most advantageous points in time and space to engage the enemy — offensively and defensively.
- Employ area force protection and avenge-kill capabilities to enhance force survivability.
- Synchronize pulsed resupply with combat operations to maintain high operational tempo.
- Conduct embedded, distributed mission training and mission rehearsal to enhance proficiency.

These capabilities can only be achieved through highly networked operations that leverage the ability of individual elements to achieve synergistic effects. While the FCS is designed to function in a highly collaborative manner as a tightly integrated SoS, it will still maintain the capability of independent action by individual units and platforms.

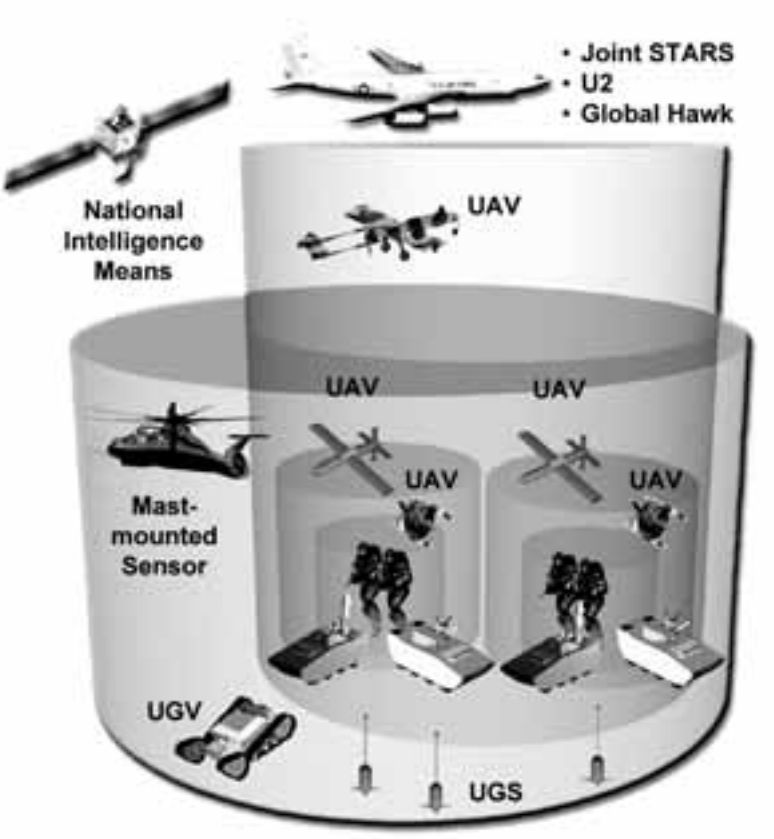
While individual systems and force elements are capable of independent action, SoS operational effectiveness is significantly enhanced by shared information, shared assets and a highly collaborative battle command environment that enables continuous collaborative planning and synchronized execution.

Systems Engineering

Traditional systems engineering (SE) is a disciplined and iterative approach using tools and processes to translate user requirements for a single weapon system into performance specifications, architectures and configurations. SE consists of three major steps — requirements analysis, functional analysis and allocation and design synthesis. It is important that the performance and functional requirements can be traced back to the users' requirements and that verification of the functions against the system design occurs as part of the iterative SE process.

SE uses a series of reviews to measure the design progress and maturity along key points in the milestone schedule. Specific entrance and exit criteria are established for each review. Some key reviews during the system development and demonstration (SDD) include the system requirements review (SRR), system functional review, preliminary design review and critical design review.

FCS uses SE to manage the program and ensure that the process discipline provides the control and traceability required to develop systems that meet users' requirements. However, FCS uses the flexibility of the DoD 5000 series to tailor the SE process to better conform to the FCS SoS approach. The SE process is being performed at the SoS level, resulting in an SoS-level specification that articulates SoS requirements and provides a top-level allocation of requirements down to the 18 individual systems that make up the FoS, which include mounted combat systems, non-line-of-sight cannons and distributed systems such as C4ISR, logistics and training.



Distributed and networked sensors will allow FCS unequaled situational awareness and enhanced survivability by avoiding enemy fires. It will also enable precision engagement and maintain contact and engagement for U.S. Forces.

The initial SRR will be conducted at the SoS level followed by individual-platform SRRs. Subsequent SE reviews will be conducted at the individual platform level and then rolled up at the SoS level. The SoS approach allows subsystem requirements and functions that cannot be performed by one system to be reallocated to another system without impacting the performance at the UA level.

FCS SoS Integration

A basic FCS program challenge is introducing a whole new way of acquiring warfighting capabilities for our soldiers. Traditionally, the Army procures a new weapon or weapon system, introduces it into the active force and lets the operational unit determine how to integrate it into its operational concepts. Then through exercises or tests and in some cases actual combat, the operational unit determines what it does for overall unit performance. With the FCS SoS approach, the Army is procuring operational capabilities designed from the start to deliver specific integrated unit performance. That is, specific integrated UA performance is being designed into the various FCS vehicles, sensors, C4ISR and training/sustainment software.

With FCS, the Army is acquiring an integrated UA with specific operational

capabilities. Thus, the FCS SoS SE activities must have an SoS focus that enables design decisions and engineering trades at the SoS level, perhaps trading individual system performance for the good of overall UA performance. The Army is most interested in how the various systems perform together at the UA level to achieve the program's key performance parameters (KPPs) articulated in the operational requirements document (ORD). The FCS KPPs are joint interoperability, networked battle command, networked lethality, transportability, sustainment and reliability, training and survivability.

> While the FCS is designed to function in a highly collaborative manner as a tightly integrated SoS, it will still maintain the capability of independent action by individual units and platforms.

The FCS SoS acquisition is not about procuring individual parts. The integrated UA is an SoS made up of many individual systems, some of which are specific to the FCS program and some that are complementary. The FCS program is procuring manned ground vehicles, unmanned air vehicles, unmanned ground vehicles and C4ISR-related equipment. This includes integrated training and supportability capabilities that address individual system or vehicle training and supportability needs and the UA's training and supportability needs as a whole. The FCS program is procuring integrated interfaces with the Army's Soldier systems, current Army forces and other existing or developing complementary programs within the Army, Joint services, interagencies and international coalition forces. It is all of these systems working together as an integrated whole that make up the UA SoS.

The complex integration task is multidimensional and must simultaneously address multiple requirements. Specific FCS systems will be procured only after four dimensions of integration are demonstrated — vertical, horizontal, performance and interoperable. The Army will actually procure individual vehicles that possess advanced *vertically* integrated lethality, sensors, C4ISR, survivability and supportability functionality. However, before the Army decides to buy any vehicles, they must demonstrate that they can work together and are *horizontally* integrated to enhance force effectiveness through networked collaboration of individual systems. Most importantly, unit-level operational testing must show that the vehicles are *performance* integrated and that they can work together to accomplish the 24 designated operational integrated processes to achieve the desired KPP thresholds and objectives. Finally, the UA must demonstrate that it is *interoperably* integrated with current Army elements as well as JIM forces.

> The Army is procuring operational capabilities designed from the start to deliver specific integrated unit performance. That is, specific integrated UA performance is being designed into the various FCS system's vehicles, sensors, C4ISR and training/sustainment software.

SE and Integration

To acquire the FCS SoS, the Army has partnered with a strong industrial team consisting of the Boeing Co. and Science Applications International Corp. (SAIC) to form the Lead Systems Integrator (LSI). Over the past 6 months, the Army and LSI team, through a series of competitive proposal actions, brought together the best of industry to help design, develop, integrate, test and deliver the various parts of the FCS SoS.

There are currently more than 20 supplier partners who will produce the integrated FCS SoS building blocks. The principle challenge today is to ensure that the specifications given to the numerous supplier partners correctly reflect the performance and integration requirements so that when the pieces come together in 2007, they can be successfully integrated against the multiple objectives discussed above. This can only be done with a focused organization, dedicated people, proven processes and robust tools that are all focused on the integrated UA SoS performance objectives.

Organization

The LSI has established an FCS-tailored organization that is designed to facilitate the FCS component acquisition. The organization's key aspect is that it operates as a true integrated product team (IPT) at every level from the program manager down to the various product acquisition teams. At each organizational level, there is a co-leader relationship consisting of an Army and LSI contractor representative from either Boeing or SAIC. IPTs are staffed with both contractor and Army personnel to help do the work and deliver the products. In IPTs where FCS products are acquired and integrated, there are representatives from the appropriate supplier partners. This IPT concept helps ensure that all stakeholders have continuous input to the design, development and integration process. In some cases, additional

specialized working groups or teams have been formed to focus on specific program aspects. The most important groups include the following:

- Senior integration management team.
- Requirements working group.
- Trade study working groups.
- Interface control working group.
- System integration working group.
- Nonadvocate review groups.

People

Both the Army and LSI contractor team have reached out broadly to get the best and brightest to support the FCS program, so the team is geographically dispersed. The staffing focus has been on centers of excellence within the two contractors, their supplier partners and within Army and DOD agencies. The LSI team is principally focused in several key centers. The program is headquartered in St. Louis, MO; and other key locations are Huntington Beach and Anaheim, CA; Seattle, WA; Houston, TX; Huntsville, AL; Orlando, FL; and Washington, DC.

Process

Key to a large program like FCS is the use of proven processes and procedures. The "best-of-breed" practices from Boeing and SAIC have been gathered to produce common best processes and procedures tailored for FCS and designed for Level 5 Capability Maturity Model (CMM) Integration. These best practices are available to the whole LSI team and to all supplier partners. However, care is being taken in the application of these processes by suppliers so that their current CMM-level certifications are not disrupted. Key processes include a:

- Risk Management Review Board.
- Configuration Control Board (CCB).
- Program CCB.
- Earned Value Management System applied at all IPTs.

The Army and LSI team, through a series of competitive proposal actions, brought together the best of industry to help design, develop, integrate, test and deliver the various parts of the FCS SoS.

Tools

A critical aspect of the integrated FCS SoS approach is a robust SoS architecture that is developed from the Army's operational requirements, the operational and organizational plan and the 24 integrated processes. A single integrated FCS SoS architecture is being developed that consists of operational, system and technical views that are modeled in Unified Modeling Language. The "FCS One-Team, One Architecture — One Single Integrated Model" slogan implies that the architecture addresses the SoS-level functionality, includes the FoS-level functionality and addresses both the physical hardware systems as well as the software systems. Single integrated FCS SoS architecture development is an iterative process designed to support all LSI and supporting supplier/partner needs.

The tools also include a full suite of government models and simulations to help analyze and assess UA performance as well as help in the integration labs. A very important tool is the LSI's Advanced Collaborative Environment (ACE), which is designed to bring all the geographically dispersed locations into a single collaborative work structure that allows everyone to work from common (configuration-controlled) databases using common tools. Key ACE tools include:

- Architectures in Rational Suite.
- Requirements in the Dynamic Object-Oriented Requirements System, a tool from Telelogic Corp.

- Government models and simulations.
- Integration labs — component development labs, C4ISR System Integration Lab (SIL), platform SILs at partner sites, SOS Integration Lab, and field tests.

The Path Forward

The challenge of implementing an SoS integration approach for FCS has been successfully met through the Army and LSI partnership. The Army and LSI senior leadership's focus on SoS engineering and integration activities in SDD's early phases ensures that the FCS program is successfully integrated with the UA, UE and JIM forces. The near-term focus is to baseline the FCS program to get the whole "One-Team" aligned to a common objective and associated roadmap. Upcoming actions include completing the Integrated Baseline Review Phase I, which will ensure that schedules are integrated horizontally and vertically. The SoS Requirements Review was scheduled for completion in December 2003 followed by the individual IPT SRRs. The One-Team will continue to leverage partner expertise in developing the SoS integration approach.

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Future Combat Systems and the New DoD 5000 Acquisition Guidance

COL Donald P. Kotchman

May 14, 2003, was a significant day for Army transformation: the Defense Acquisition Executive authorized the Future Combat Systems (FCS) program, the largest and most comprehensive development effort for the acquisition of combat capability in U.S. history. Program magnitude and challenges were daunting and the program's complexity surpassed any previous Army developmental effort. Along with tackling the program's scope, Army program managers (PMs) had to address three aspects simultaneously — keeping up with the ongoing requirements definition process revisions, an ongoing update to defense acquisition processes and implementation of a system-of-systems (SoS) management philosophy — as they prepared for a milestone decision run against unprecedented schedule goals.

Combatant commanders encounter near-term strategic capability gaps that may affect the range of land power options needed to operate in today's dynamic security environment to exercise National Command Authority. In his October 1999 presentation on Current and Future Force Capability, then Army Chief of Staff (CSA) GEN Eric K. Shinseki set the course for Army transformation when he described the capabilities that would be required of FCS as the centerpiece of the Future Force materiel and doctrinal solution. The Secretary of the Army and the CSA articulated their vision of how the Army would transform to meet 21st century demands in a white paper.

The Director of the Defense Advanced Research Projects Agency (DARPA) and the Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASAALT) executed a Memorandum of Agreement (MOA) on Feb. 28, 2000, to establish a collaborative program to develop and define an FCS design concept. Simultaneously, the U.S. Army Training and Doctrine Command (TRADOC) worked with the Army staff to construct Future Force

concepts of operation. This MOA initiated the DARPA-led Concept and Technology Development (CTD) phase of the FCS program. CTD provided for the evaluation and competitive demonstration of FCS-related technologies and helped to:

- Define and validate FCS design and operational concepts using modeling, simulation and surrogate exercises.
- Demonstrate the concept was suitable for transition to the System Development and Demonstration (SDD) phase.
- Develop selected enabling technologies for integration into FCS.

In executing the CTD strategy, DARPA used a new contracting methodology known as an other transaction agreement (OTA), which is simpler and shorter than a procurement contract. In March 2002, DARPA competed the second leg of CTD and selected a Lead Systems Integrator (LSI) to maximize the program's flexibility and to facilitate the SoS approach to developing combat capability.

Determining the Requirements

The FCS-equipped organization will be organized, manned, equipped and trained to be more strategically responsive, deployable, agile, versatile, lethal, survivable and sustainable than today's forces. The Army formed a triad consisting of the PM, TRADOC and LSI to concurrently work all aspects of requirements development from analysis of alternatives, to deriving technology requirements and, finally, balancing technical feasibility with capabilities in a time-phased or "evolutionary" approach. FCS capability requirements were derived from the top down, structured around an organization steeped in joint interdependencies, reliant upon intra- and interoperability for success and focused on achieving full-spectrum combat dominance in a significantly expanded battlespace.

Important Feedback

Timely feedback of cost, schedule and performance implications enabled the triad to develop these requirements at speed, but not in haste. Feedback further enabled the triad to formulate plans for analyses and trade studies for those requirements that would need further definition and rationale in the future. Along with the triad, many other stakeholders were encouraged to participate to eliminate future problems early in the generation of requirements, enabling the Army to use its functional expertise in all areas to develop an achievable requirements document and a plan to achieve knowledge for requirements yet unconceived.

The One-Team Approach

One-Team Workshops

Several techniques were used to lessen the complexity of the distributive work associated with defining an SoS-oriented requirements document. Requirements traceability was emphasized by using a management database as the principal tool to capture requirements. Requirements could now be managed in tabular form — for easy inventory, comparison of changes and prioritizations — with quick printing of high-quality documents. TRADOC then framed the requirements document in segments that facilitated easy visualization of the family-of-systems (FoS) in a unit of action (UA) structure, which is the basic organizational building block for the Future Force. This operational requirements document (ORD) structure relied on the base document to list primary SoS requirements, while annexes list platform and system requirements.

TRADOC conducted workshops, which included all stakeholders, to examine the integrated concepts that define the major aspects of the force. These workshops allowed for the identification of requirements at a time when all the stakeholders were present to ensure full understanding and buy-in. These same principles of teaming, concurrency and distributive collaboration will remain in place as the "One-Team" concept while Army completes the SDD in preparation for an initial production decision.

Developing the FCS Acquisition Strategy

Traditionally, the government awards a contract to a single prime contractor to procure a platform or system. The prime contractor builds in its core capabilities and subcontracts the rest of the work. The relationship between the government and its prime contractor has, more often than not, been one of "benign adversaries," a relationship requiring checks and balances to ensure that a system is delivered on time and within budget. Often, as the program moved into the field, new technologies and improvements emerged, resulting in new and lengthy procurement cycles to upgrade the contract's statement of work.

To obtain the best value for the Army, PM FCS uses the LSI as the single accountable, responsible contractor to integrate FCS on time and within budget, ultimately reducing the logistics footprint. The LSI acts on the Army's behalf to optimize FCS capability, maximize competition, ensure interoperability and maintain commonality to reduce life-cycle cost. It is the Army's intent to maintain a single LSI throughout the completion of Increment I development. The LSI is the program integrator and is an integral partner on the DARPA/Army/LSI One-Team. The LSI is responsible for providing the Army direct support in developing and analyzing requirements, developing architectures (operational, systems and technical), leveraging applicable government and commercial activities and resources, and assisting in the identification, selection and procurement of components, subsystems and systems.

FCS is the first Major Defense Acquisition Program structured under the provisions of the new (May 12, 2003) DoD 5000 acquisition guidance. The program is tailoring business strategies to contain only those process requirements that are essential and cost-effective. PM FCS is capitalizing on commercial best-business practices to improve acquisition and sustainment processes and to ensure flexibility to meet continuous concurrent user requirements development and refinement to reach objective FCS capabilities. FCS is using an evolutionary acquisition strategy to mitigate the risk associated with the program's challenging schedule and scale. The program is structured around acquiring increments of capability leading to full Future Force capability. Incremental development of an SoS allows the Army to field capabilities to warfighters faster by producing and deploying systems as their technologies mature.

Increment I will provide the initial capability to the Soldier at full operational capability to enable the UA to fight effectively according to its operational and organizational (O&O) plan. Subsequent increments will incorporate technologies that have matured since the previous increment of capability was fielded to the UA, and will further enhance the UA's ability to execute missions and respond to new threat countermeasures. The sequence of increments will lead to objective FCS full capability for the warfighter and ensures that the UA can execute its O&O plan to dominate ground combat anywhere. The ORD — now called the capabilities development document — defines objective FCS capabilities to guide program development through the life cycle from Increment I through the remaining increments, leading to objective capability.

Acquisition Streamlining Initiatives

FCS is a complex, netted FoS that will use evolutionary acquisition to field, develop and upgrade equipment throughout its life cycle. The acquisition strategy focuses on creating program increments of affordable capability on the path to full objective capability. Planning for subsequent increments is dependent on the availability of future technologies, value to the operational concept, affordability and integration considerations. "The success of the strategy depends on the consistent and continuous definition for requirements and the maturation of technologies that lead to disciplined development and production of systems that provide increasing capability towards a materiel concept," (DoD 5000 series). The FCS program has embraced the flexibility offered in the new acquisition policy in two ways.

- Office of the Secretary of Defense (OSD) management has reporting oversight at the SoS level with system management executed per best-business practices via the Army/LSI collaboration.
- OSD partnering occurs through the integrated product and process development process to maintain integrated insight to the program.

This approach is different from traditional stovepipe oversight arrangements and augments OSD's normal involvement in the DOD overarching integrated product team (IPT), integrating IPT and working IPT process.

Finally, use of an OTA allows the integration of innovative and nonconventional business practices, including Simulation and Modeling for Acquisition, Requirements and Training, among the three primary shareholders — requirements, science and technology and acquisition — thus providing unprecedented flexibility to adjust the program as it matures.

The FCS program's evolutionary acquisition strategy has allowed unprecedented progress in executing its aggressive schedule to develop, test and field an initial operational capability by the end of this decade. It will serve as a model for other acquisition programs to follow as increased attention is placed on innovative, streamlined business practices and sound systems engineering requirements definition and integration activities.

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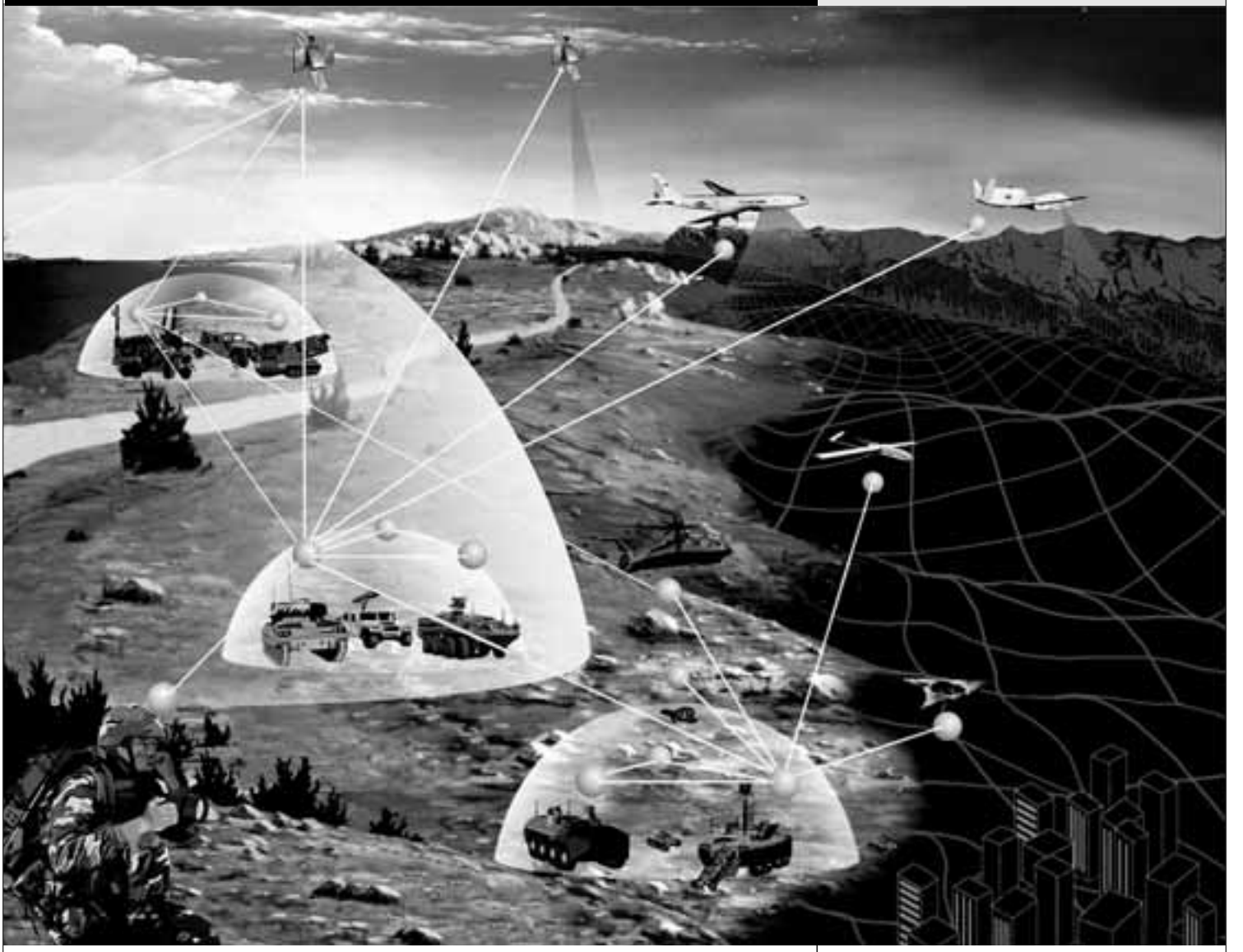
FCS-Equipped Unit of Action Complementary and Associate Programs

COL John R. Bartley

FUTURE COMBAT SYSTEMS
FCS
One Team-The Army/Defense/Industry



Future Combat Systems (FCS) mission accomplishment hinges on the ability to align the cost, schedule and performance of programs outside the control of the Program Manager (PM) FCS. Labeled Complementary and Associate Programs, they are being synchronized and tracked within both the FCS and Army, and touch both the Joint and DOD domains and the multinational arena.

Complementary and Associate Programs

Complementary (CP) and Associate Program (AP) definitions are both programmatic and organizational in nature, and have evolved over time to those contained in the Memorandum of Agreement (MOA) between the Deputy Chief of Staff, G-8, and Military Deputy (MILDEP) to the Assistant

Secretary of the Army for Acquisition, Logistics and Technology (ASAALT), signed Aug. 5 and 27, 2003. The MOA covers the Management Approach for the Unit of Action (UA) and Candidate Unit of Employment (UE) Complementary Systems for FCS Increment I.

The FCS foundation is built around the 19 Core Systems as defined in the above-referenced MOA. These 19 systems are specified in the FCS Operational Requirements Document (ORD) and include current programs that will be integrated directly into the 19 systems. PM FCS is responsible for the systems procurement and integration into FCS platforms. The UA Complementary Systems comprise those systems essential to the family-of-systems (FoS) to work together and/or to support a system-of-systems (SoS). These systems facilitate UA operation. The UE Complementary Systems are needed to operate or support an SoS at the UE. UA APs are those programs that FCS must interoperate with as detailed in the FCS ORD and command, control, communications, computers and intelligent support plan.

The FCS foundation is built around the 19 Core Systems as defined in the Memorandum of Agreement between the Deputy Chief of Staff, G-8, and Military Deputy to the Assistant Secretary of the Army for Acquisition, Logistics and Technology, signed Aug. 5 and 27, 2003.

Management Within FCS

The PM FCS has partnered with the Lead Systems Integrator (LSI), the Boeing Co. and its partner Science Applications International Corp., to integrate Complementary and Associate programs into the overall FCS program. As such, the LSI has the lead in the integration required to meet SoS specification functionality and performance. In conjunction with the LSI, the CP Integrated Product Team (IPT) plays a key role in developing the overarching integration and management approach for CPs, and for developing and implementing plans with Army and other service counterparts to identify and manage CPs. The IPT provides the communications path to define the SoS-level interface and interoperability requirements for each FCS complementary and associate system.

In those cases where an existing or development program has applicability to FCS, associate contractor agreements (ACAs) as required will be negotiated with the LSI, or a directed subcontract arrangement will be invoked under the LSI agreement. An ACA is not a purchase order, subcontract, consultant agreement, proprietary information or nondisclosure agreement. The ACA document contains all the same elements as a contract, except that the ACA does not have value, cost, price or payment terms. The value, cost, price and payment terms are addressed in the respective prime contracts.

ACAs are needed because the LSI is a contractor. An ACA will not always be required and the need may be filled with a government-to-government MOA. PM FCS set the stage for the entire MOA/ACA development process by sending a combined government and LSI team to each of the program executive officers (PEOs) and subordinate program/project managers (PMs) who own a CP and/or AP. Onsite visits were held between June and November 2003.

Draft MOAs and Subordinate MOAs (SMOAs) were developed and are now in the signature review process. These MOAs/SMOAs purpose is to establish the responsibilities and management processes between PEO Ground Combat Systems (GCS) PM FCS and the other PEOs/PMs to procure, develop, test and field an FCS FoS and a UA. The MOAs/SMOAs also provide a basis for cooperative, technical and acquisition efforts between PEO GCS PM FCS and the other PEOs/PMs.

The MOAs/SMOAs are what we are using now to facilitate this significant coordination effort. Current count within only the Army is 19 PEO-to-PEO MOAs and 44 PM-to-PM SMOAs. The Army recognized that if FCS were to be successful, a permanent process in addition to the MOAs, SMOAs and ACAs would be required.

Management Within the Army

Because of the FCS program's complexity and its interdependence on other standalone complementary and associate systems that are essential to meeting UA and UE requirements, the Army G-8 and the ASAALT MILDEP established a management and oversight process. It was documented in an MOA signed between the two in August 2003. Key duties and responsibilities for their offices include:

- Establish a series of action officer level working groups, Council of Colonels (CoC) and 2-Star General Officer Level Equipping Program Evaluation Group (PEG) Synchronization IPT to synchronize the network, survivability, lethality, sustainability and training aspects of FCS.
- Identify programmatic disconnects and funding shortfalls with complementary systems.
- Develop work-arounds to rectify

disconnects and for resources and adjustments to the FCS/UA/UE Complementary Systems list.
- Ensure program baselines for the UA and candidate UE Complementary System include FCS key programmatic events as part of their program oversight.
- Manage and track cost, schedule and performance identified in the program baselines for the UA Complementary Systems and candidate UE Complementary Systems.

The MOA also defines the support roles and responsibilities of a Synchronization IPT. The Synchronization IPT is co-chaired by the Equipping PEG co-chairs and has membership from all parts of the Army as well as the Joint and DOD Staffs. The Synchronization IPT exists to resolve issues. If the issue is within the Army's purview, the IPT will convene to map out appropriate resolution to include adjustment of other program funding, scheduling or performance requirements. The IPT then weighs the impacts of proposed alternatives and decides on a course of action (COA) — based on impacts across the Army — and informs the Army Acquisition Executive (AAE) of the preferred COA prior to implementation. If consensus cannot be reached, the issue and alternatives are taken to the AAE for disposition and resolution. When issues with CP and AP fall outside the Army's purview, sometimes a clear COA is not apparent.

Management Outside the Army

If an issue is external to the Army and cannot be solved at the PEO level, the Synchronization IPT will meet and additional members will be brought in to represent their respective services/organizations as the issue warrants. Once alternatives are assessed, the Synchronization IPT will present its recommendation to the AAE in preparation for convening an Overarching IPT (OIPT), or joint OIPT depending on the issue, for a recommended course forward. If the path forward can be effectively resolved at the OIPT level, the Defense Acquisition Executive will be notified of the decision. If consensus cannot be reached, the OIPT will recommend convening a special Defense Acquisition Board to bring the issue to closure. Challenges occur when there is no documented or scheduled process like that defined in the MOA between the Army G-8 and the MILDEP.

The Synchronization IPT exists to resolve issues. If the issue is within the Army's purview, the IPT will convene to map out appropriate resolution to include adjustment of other program funding, scheduling or performance requirements.

In the multinational arena, the intent is to leverage the Multilateral Interoperability Program (MIP). Steps have been taken to contact the MIP Heads of Delegation to notify MIP member nations that Army Battle Command Systems, specifically the Maneuver Control System, will transition to FCS over the next several years. As a current review of the MIP Statement of Intent is ongoing, introduction of FCS is a logical step in the deliberations.

The glue that holds the FCS-equipped UA together is the CPs and APs, a well-recognized fact inside and outside the Army. PM FCS, the LSI's PM office and the CP IPT have put a process and organization in place to align the cost, schedule and performance of programs outside their control. Both the process and organization will continue to evolve as the program moves forward. The PEO and PM MOAs/SMOAs are starting points for coordination, synchronization and alignment. A follow-on methodology could be a Department of the Army-level policy such as the one that has been put out on Standardization of Collaborative Environments for Weapon Systems Acquisition Programs.

The Army, in the establishment of the 2-Star General Officer Level Synchronization IPT and the documented supporting structure of action officer level working groups and CoCs, is an excellent beginning. The next step is for the Synchronization IPT to become a cross-functional, empowered and focused PEG versus just an Equipping PEG.

Outside the Army, specifically at DOD level, the process and organization needs to be quantified, similar to what the Army did in its MOA between G-8 and ASAALT. It cannot be an FCS forum, or an Army forum, because the issues go beyond both groups. Just like the Army runs the UA Synchronization IPT, DOD must do something similar.

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FCS Lead Systems Integrator Contract

Pamela Demeulenaere and Ignacio Cardenas

The Future Combat Systems (FCS) program is a networked system-of-systems (SoS) serving as a core materiel building block within the Army's unit of action (UA). The program's goals are to equip Soldiers and field UAs to accomplish the operational and organizational (O&O) plan. The FCS program is more complex and far-reaching in scope than any other major defense acquisition program in Army history. The Boeing Co. was competitively selected by the Defense Advanced Research Projects Agency (DARPA) to serve as a Lead Systems Integrator (LSI), along with its partner Science Applications International Corp. (SAIC), for the concept and technology demonstration (CTD) phase in March 2002.

This award initiated a comprehensive partnership with the government to provide advanced technologies to support enhanced warfighting capabilities and techniques, effectively expanding and evolving the Army's 21st-century missions. An other transaction agreement (OTA) was selected as the contractual vehicle, providing a wide array of flexibility to the program and its objectives. Both DARPA and the Army cooperatively managed the CTD phase.

In May 2003, the Army awarded Boeing the FCS Systems Development and Demonstration (SDD) phase. Boeing and SAIC will continue their role as the LSI. While the selection of an OTA for the CTD seemed logical in the absence of an approved operational requirements document (ORD), the selection of an OTA for the SDD phase was a much bolder move by the Army. The SDD phase extends for 103 months (through December 2011) and is valued at $14.78 billion. Key program tenets will include:

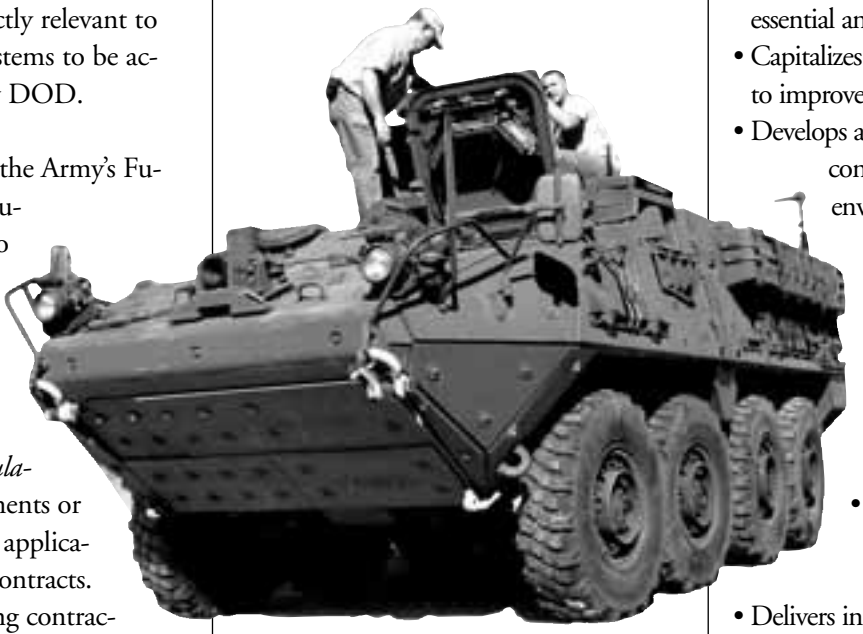
- Create opportunity for "best-of-industry" participation.
- Leverage the government technology base to the maximum extent possible.
- Associate ongoing enabling efforts with LSI-led activity.
- Provide a collaborative environment from design through life cycle.
- Provide commonality at component/subsystem level as a minimum.
- Design/plan for technology integration and insertion throughout project life cycle.
- Maintain and shape the future industrial base.
- Retain competition throughout Future Force acquisition.
- Guarantee government involvement in procurement processes.
- Ensure consistent and continuous requirements definition.
- Maintain and shape the government's acquisition community.
- Balance performance and sustainment, thereby ensuring program affordability.

Other Transaction Agreements

An OTA is the commonly used term referring to the *10 U.S.C. 2371* authority to enter into transactions other than contracts, grants or cooperative agreements. An OTA for prototype projects is an acquisition instrument authorized by *Section 845 of Public Law 103-160*, as amended, under *10 U.S.C. 2371*. Prototype projects acquired under this authority must be directly relevant to weapons or weapon systems to be acquired or developed by DOD.

FCS is the keystone of the Army's Future Force. These instruments are not subject to the federal laws and regulations governing procurement contracts. Therefore, they are not bound by the *Federal Acquisition Regulations (FAR)*, its supplements or laws that are limited in applicability to procurement contracts. OTAs are legally binding contractual agreements that provide a necessary organizational structure, serve a legal purpose and exchange of consideration and allow for innovative business arrangements based on sound business judgment and program needs.

The FCS program requires a unified effort across the Army, DARPA and industry for advancement of science, technology and engineering. The challenging schedule requires a high level of concurrency. The FCS program's key tenets dictate that innovative business arrangements must be allowed to achieve success. The schedule and funding constrain FCS to leverage the best available research and move it forward. This unprecedented effort requires a level of interaction, cooperation and collaboration that is unachievable with *FAR*-based procurement contracts. The use of an OTA in lieu of a *FAR*-based contract allows structuring to meet the program's needs and not as a one-size-fits-all. It also allows for flexible teaming arrangements, extensive government involvement and innovative provisions. The LSI concept is a unique business arrangement necessary to the FCS program's success.



Lead Systems Integrator

As the LSI, Boeing and SAIC have taken on many roles normally performed by the government as well as roles that a prime contractor would perform. The LSI's primary role is SoS integration. As the LSI, Boeing provides unbiased assessments to Army decision makers through programmatic, analytical and engineering processes. It maintains an optimal view of overall force effectiveness within the O&O plan, ORD, technology, cost and schedule constraints. The LSI provides integrated and balanced open architectures and specifications. As the Army's first large-scale SoS development and integration process across many disciplines and platforms, FCS requires a robust and dedicated organization experienced in large-scale systems integration. Boeing must enforce integrated, open architecture as a procurement agent and is responsible for successful verification and validation testing, using extensive systems integration and modeling and simulation capabilities.

Functioning as the SoS integrator and trusted industry partner, the LSI:

- Operates at the Army's direction throughout the program's life cycle.
- Tailors business strategies to only contain essential and cost-effective processes.
- Capitalizes on commercial best practices to improve acquisition and sustainment.
- Develops and maintains a government/contractor advanced collaborative environment.
  - Co-leads integrated product teams (IPTs) with the government.
  - Leads program management for industry team including cost, schedule and performance.
  - Implements program management best practices across industry team.
- Delivers integrated open architectures, specifications and interface definitions.
- Conducts SoS integration and performs system engineering.
- Develops and delivers the SoS common operating environment and network.
- Performs simulations and tests.
- Develops and demonstrates hardware, software, training and logistics.
- Provides quality assurance and configuration control.
- Maintains competitive industrial base.
- Maintains small business participation.
- Provides and maintains manufacturing facilities and manages production.
- Assures competition at component, subsystem and system level.
- Assures emphasis on commonality and design processes.
- Enhances SoS performance through continuous technology integration insertion.

FCS OTA Signing Ceremony: Shown left to right in each row are Dennis Muilenburg, Harry Hallock, Sean Garcia, Jeff Worley, Maureen S. Johnson and Pam Demeulenaere.

A key FCS program tenet is to maintain competition and create opportunities for the "best of industry" to participate. During the program's CTD phase, the LSI implemented these tenets by issuing 23 competitive solicitations to industry at large. All solicitations involved multiple contract years and millions of dollars in actual work content that would shape the FCS team. These solicitations were issued on a "best value" basis with the intent to attract the best technological approaches and the most reliable partners industry could offer. It was a remarkable feat that all solicitations were conducted simultaneously in approximately the same time it would take to conduct one source selection of this magnitude. Approximately 600 government and LSI subject matter experts were assembled to tackle this endeavor. The winning offerors selected have joined forces with the LSI to form a "One-Team" approach to FCS program challenges.

The LSI, its partners and the government have embraced the One-Team concept. This is accomplished through IPTs; co-locations at government and contractor facilities; use of an advanced collaborative environment as the single authoritative source of management, product and technology information; and program management plans that establish joint management procedures and processes.

The One-Team concept incentivizes the LSI, customer and industrial partners to share the same destiny.

A One-Team council was established along with subteams to develop strategies, approaches and processes. Subteam plans include:

- Establishing and using cost as an independent variable/life-cycle costing through an affordability process and plan.
- Establishing and using a seamless and timely earned-value management reporting system.
- Determining program metrics and reporting processes.
- Completing the program-wide definition and management reserve/ estimate-at-complete process implementation.

The LSI business arrangement is a relatively new concept and is being used on the Army's largest and most complex program. The shared destiny of the LSI, Army and industrial partners takes the IPT and the integrated product and process development management technique to the extreme. The SDD phase allows government personnel to perform scope-of-work efforts as the OTA requires. This is a unique arrangement and is being used only within the areas for which the government has the skills and experience. The government will retain its *Title 10* responsibilities for managing cost, schedule and performance, ensuring programmatic decisions are supported by analysis and compliance with OTA requirements.

Using an OTA as the contractual vehicle for the Army's FCS development has enabled it to complete and implement the program's basic tenets of attaining the best of industry, leveraging the technology base, forming a collaborative environment and having Joint IPTs. The FCS program has inherent challenges in managing such a diverse and complex program, but the program has a unique opportunity to be free ranging in selecting unconventional solutions to meet those challenges. Many aspects of this program make it stand out as one-of-a-kind, including the contracting instrument (OTA 845 for prototype projects), management type (LSI), business arrangements (industry- and government-shared destiny) and complexity (networked family-of-systems serving as a core building block within the Army's UA). The future holds the ultimate answer to the Army's fate in developing the largest and boldest renovation of its warfighting landscape.

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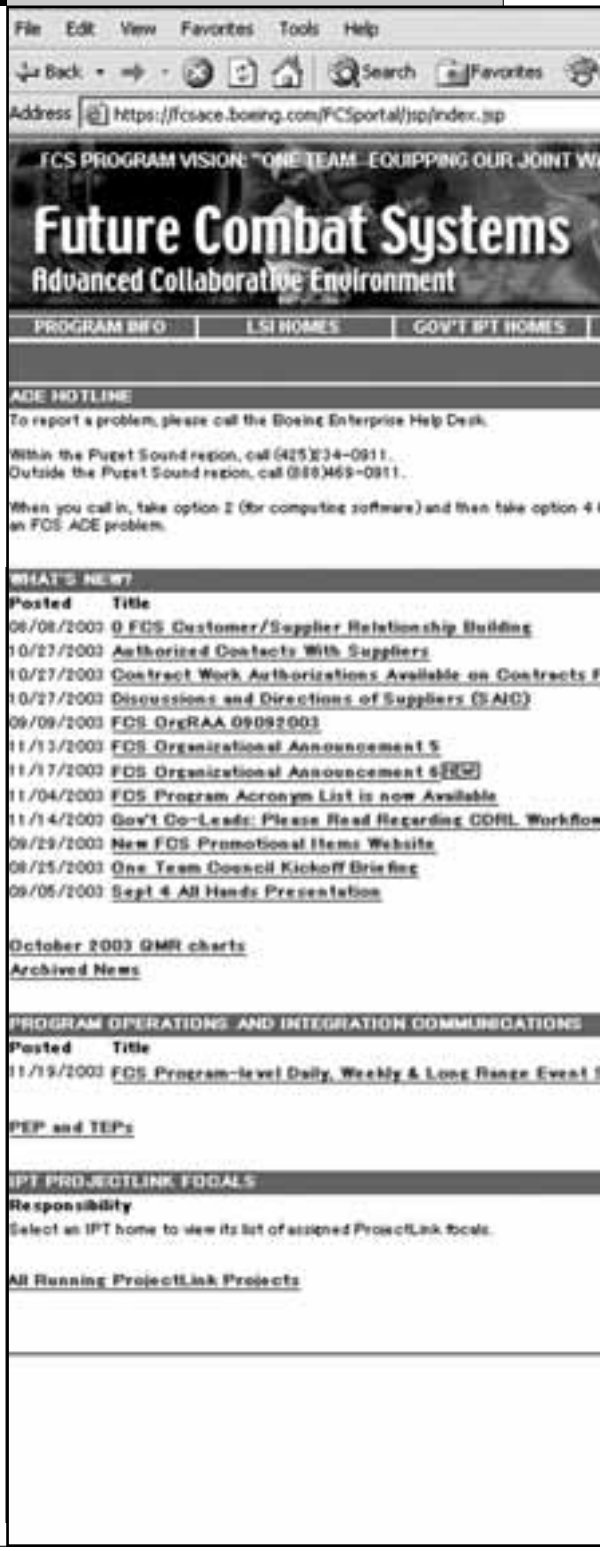
Advanced Collaborative Environment: Enabling the Future Force Unit of Action

LTC(P) Steve Bristow, William H. Dunn and
Joaquin J. Martinez de Pinillos



The Future Combat Systems (FCS) program will deliver a Future Force Unit of Action (UA) to the Army by the end of this decade. To accomplish this expansive task, the Army requires a life-cycle management system to support the FCS program. The life-cycle management system must act as a force multiplier and as a catalyst to accelerate product development. It must also support the FCS UA throughout its entire life cycle. The Advanced Collaborative Environment (ACE) is the force multiplier for the FCS program.

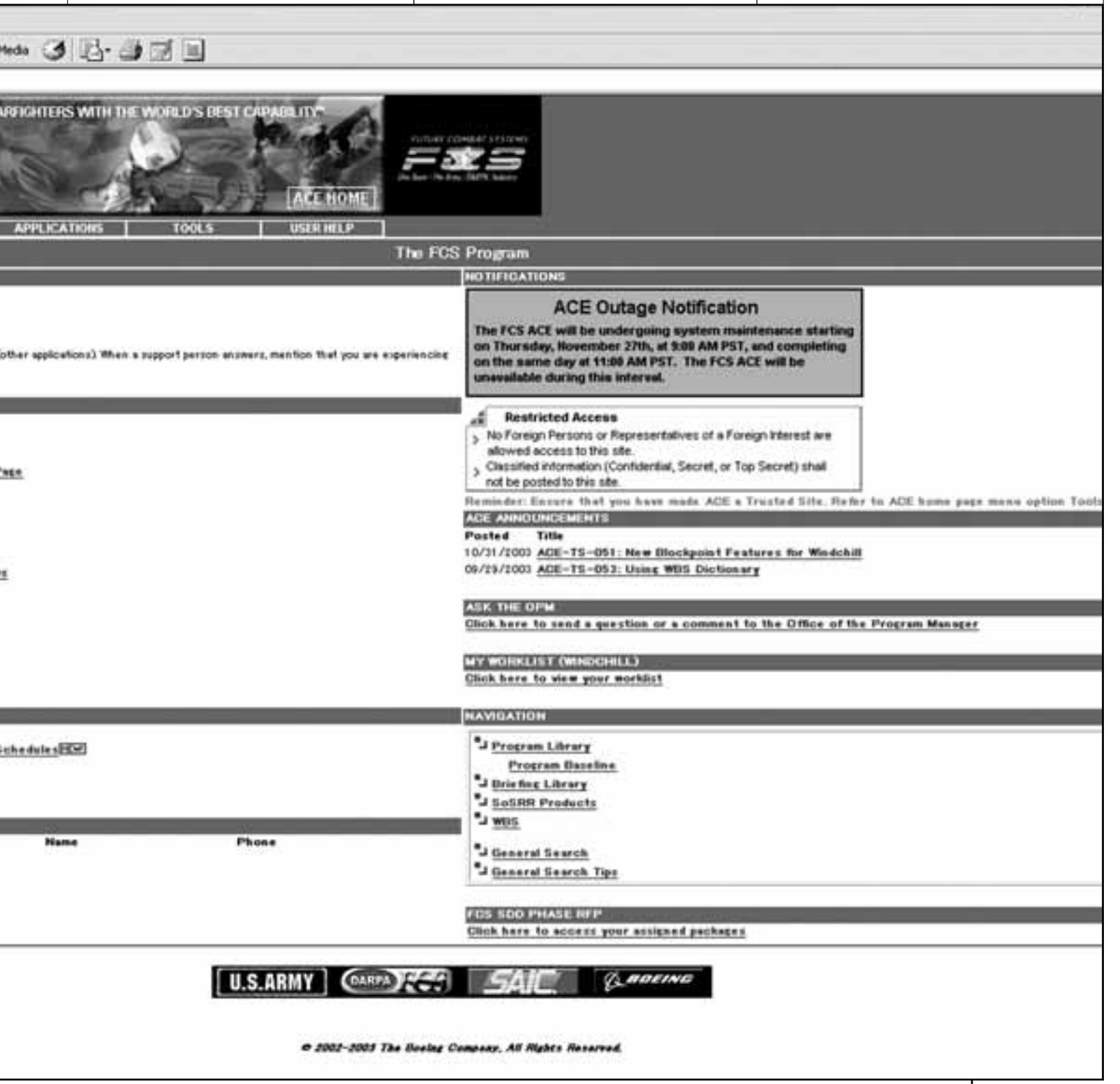
FCS ACE represents a new way of doing business within the Army acquisition community by streamlining the process of multiplatform weapon systems acquisition. Using ACE will dramatically shorten the FCS system development and demonstration phase as decision makers will have modeling and simulation, design, engineering and test data available to them before production lines ever start rolling. In addition, by applying tenets of the Army's Simulation and Modeling for Acquisition, Requirements and Training initiative, FCS ACE will provide data support to engineers who are developing realistic synthetic battlefields. These battlefields are complete with complex terrain and intelligent opposing forces, enabling Soldiers to fight tomorrow's battles today on "digital dirt." By using FCS ACE, issues will be addressed, mistakes avoided and effectiveness maximized as key participants will collaborate early and often on authoritative sources of digital product information.

Evolution

ACE evolved from the DoD Directive 5000-mandated integrated data environment (IDE) for sharing information and tracking program management data and product life-cycle data. The U.S. Army Tank-automotive and Armaments Command and National Automotive Center originally developed the ACE concept and today the Tank Automotive Research, Development and Engineering Center is involved as well. FCS ACE meets the IDE mandate and significantly surpasses the requirements for an IDE with particular enhancements for digital product data management of system-of-systems (SoS) product development and support for modeling and simulation throughout the weapon systems development life cycle.

Boeing and Science Applications International Corp., the Army's Lead Systems Integrator (LSI) for the FCS program, are delivering the ACE as an

FCS enterprise-wide, integrated information management gateway. The LSI Statement of Work (SOW) mentions FCS ACE 33 times and states that it will be used for generation and delivery of all FCS Contract Data Requirements Lists. The SOW clearly defines the capabilities that FCS ACE will deliver to the FCS program when it states: "… the FCS ACE to serve as the primary means of creating, sharing, reporting, collecting, recording, accessing and approving program information …" It also makes FCS ACE the single integrated source of FCS data, stating: "… single integrated source of management information, product information and technical data …" The SOW designates FCS ACE as the FCS program management support tool: "ACE shall be developed to serve as the primary FCS program management decision support system." The capabilities mentioned above only sample the ACE capabilities the LSI will deliver to the Army.



At its core, FCS ACE is an Internet-based, Web-centric and federated data environment for accessing, sharing, collaborating, integrating and controlling management information as well as product information and technical data defining the FCS Future Force UA. The FCS ACE home page is shown in the figure on Pages 28-29. FCS ACE consists of an integrated suite of "best-of-breed" commercial-off-the-shelf (COTS) applications. These COTS applications can be grouped into five major modules.

COTS Applications

The first module, called Program Management, provides robust tools for collaborative management of the FCS program. Here, the FCS management team can use a management tracking application to control, measure and report on program action items as well as monitor the technical performance of the FCS program. Risks are managed within the risk management tool and the management team can track FCS cost, schedule and performance through the earned value management system. All of the tools are accessible to the FCS management team 24 hours a day, 7 days a week via the Internet.

The second module, called Project Collaboration, provides users the capability to collaborate on a specific task or element, develop or review the task and then complete the task. This capability allows users to develop and share "in-work data and files" while allowing individual project managers to manage data access within the project. The Project Collaboration module has a variety of features to facilitate collaboration including discussion forums, Microsoft Project® integration, subscription, notification, action-item assignment and tracking, data iteration management and document routing.

The third module, called the Distributed Product Description (DPD), ties together UA product data. This will include requirements, specifications, modeling and simulation, design, production, test data of all FCS platforms, the network and all UA support elements. The DPD will allow collaboration and data sharing with 21 prime contracts and their associated subcontractors; 130 Army complementary programs spanning across 12 program executive offices and 44 program management offices; and various Army organizations such as Army Test and Evaluation Command facilities, research development and engineering centers and battle labs. The DPD will be the single authoritative source of FCS SoS performance data.

At its core, FCS ACE is an Internet-based, Web-centric and federated data environment for accessing, sharing, collaborating, integrating and controlling management information as well as product information and technical data defining the FCS Future Force UA.

The DPD has various Web-centric views, known as DPD lattices, and will provide automated integration processes between suppliers, Army data environments and the FCS ACE. The DPD will allow users to access all relevant FCS data no matter where it physically resides through a single Web-centric entry point within the FCS ACE. Configuration management remains under the control of the group developing the data and pointers will be created to the data within the FCS ACE. DPD references will automatically be updated whenever changes are made to the data. Simultaneously, version control and change history will be maintained.

The fourth module, called Workflow, provides the ability to automate business processes. The Workflow module allows users to configure routings and make decisions on the fly about where an object should go next. The Workflow module will also eliminate time-consuming, manual, paper-based configuration management processes. Workflows involving the DPD are key to enabling continued integration of maturing technologies as systems progress through block upgrades.

The fifth module, called Visualization, provides users the ability to view lightweight, computer-aided design (CAD) data without having a CAD system (e.g., Pro/ENGINEER® or CATIA®) installed on their workstation. This very powerful tool greatly expands the number of users who can see 3-D models of UA platforms while they are still in development. It will also allow multiple users to collaborate in real time on design drawings over the Internet and make design changes from distributed locations. Users can mark up models and save those markups into FCS ACE where the changes can be reviewed by others and used in the configuration management process.

FCS ACE Impact

Once FCS weapons systems are in production and fielded, the impact of FCS ACE will be far-reaching. FCS ACE will support reach-back training by allowing soldiers to receive and apply new tactics and techniques. Reach-back logistics will allow soldiers sustaining FCS platforms to receive updates on repair parts and maintenance

procedures. FCS ACE will provide configuration data about each platform and maintain configuration information throughout the platform's life. This allows the logistics community to generate Interactive Electronic Technical Manuals (IETM) using FCS ACE. As changes are made to FCS platforms in the field, the onboard IETM database will be updated via the FCS reach-back capability.

FCS ACE continues to mature and expand in capability and user base. Today the FCS ACE has more than:

- 3,700 users
- 600 projects
- 1,400 active workflows
- 200 gigabytes of data

FCS ACE provides the backbone of collaboration for the Army, industry and the joint community working together to produce the FCS Future Force UA. The Army has designated FCS ACE as the prototype architecture for Increment I implementation of the Army ACE because it has made such a significant investment in, and seen so much benefit from, FCS ACE. FCS ACE has already made a dramatic impact on the FCS program and will continue to be a critical tool enabling the FCS program to achieve its aggressive timelines and, more importantly, deliver enhanced combat capability to the Soldier.

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Sustainability: An Essential Combat Capability

Nancy A. Moulton

FUTURE COMBAT SYSTEMS FCS One Team-The Army/Defense/Industry

"The FCS Family-of-Systems (FoS) must maximize available combat power while achieving significant logistics footprint reductions and personnel efficiencies in the area of operations (AO) through reduced demand for maintenance and supply." This is the overarching key performance parameter (KPP) for sustainment, as documented in the Future Combat Systems (FCS) Operational Requirements Document (ORD) KPP #5.

The FCS approach to providing sustainment is summarized in the following paragraphs by discussing the four main focus areas for accomplishment that must be addressed during the system development and demonstration (SDD) phase:

- Supportability assessments
- Design for supportability
- Design the support
- Support the design

Supportability Assessments

To meet ORD requirements, three high-level assessment measures are being developed to evaluate operational effectiveness: operational availability, reduced logistics footprint, and lower life-cycle costs for the unit of action (UA). These metrics are supported by many other ORD requirements such as high reliability, increased fuel efficiency, onboard water generation, self-loading and cross-leveling of supplies under armor and a predictive logistics and medical capability. The Program Manager (PM) FCS is using the recently published DOD guide titled

Designing and Assessing Supportability in DOD Weapon Systems: A Guide to Increased Reliability and Reduced Logistics Footprint to develop an integrated approach to assessing UA supportability. An integrated modeling and simulation approach and an integrated test and evaluation methodology are being developed to ensure that a consistent supportability assessment and sustainment evaluation is performed throughout the life cycle.

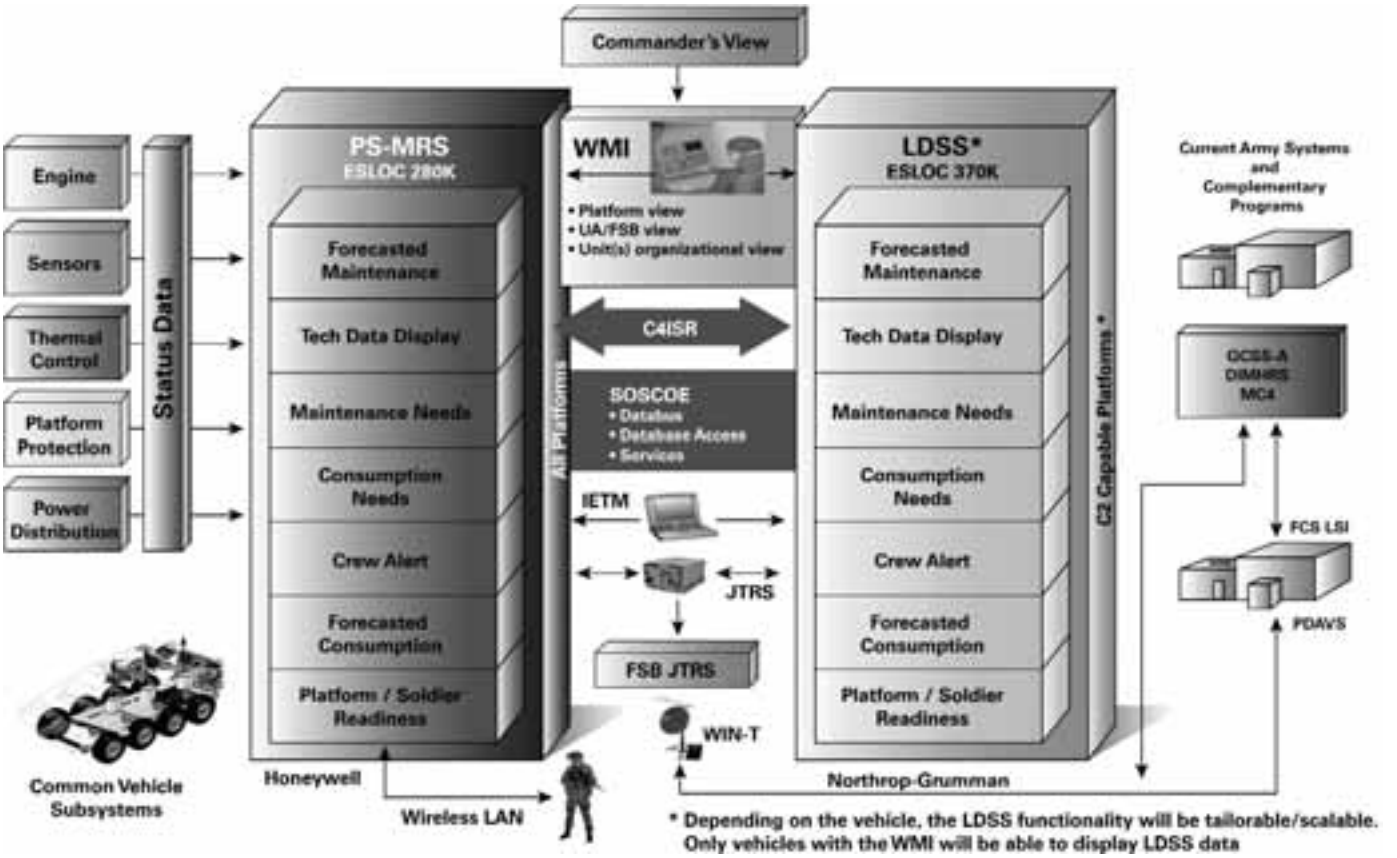
Design for Supportability

To both design supportability into FCS and to incorporate the UA support capability during the SDD phase, logistics design influence is a critical component of the systems engineering and system-of-systems (SoS) integration processes. Logistics contract requirements are structured to achieve SoS optimization at the UA level. These SoS requirements are then allocated to individual system design and, subsequently, to component/subsystem design from individual system requirements. Trade studies are performed that include an assessment of logistics impacts on operational availability, life-cycle costs, logistics footprint and deployability. The intent is for each design decision to optimize the trade between warfighting capability, availability of that capability, performance reliability, logistics footprint, life-cycle costs and affordability, schedule and risk.

> FCS is designing these and other capabilities by using the "pit-stop engineering" approach. Similar to how racing teams design efficiency into their pit stops – Army combat repair teams will be the UA pit crews.

Operational effectiveness measures will be used to ensure availability of systems (to include soldiers) to perform their missions and will be monitored through sensors and software that are integrated into platforms, equipment and the Land Warrior ensemble. Initially, availability will be measured across each battalion-size fleet of like systems. To ensure high operational availability at the SoS level (the collective battalion or brigade-size UA) there are two fundamental components required: maximize uptime and minimize downtime. FCS will maximize uptime by designing in performance characteristics such

FCS Logistics Products — PS-MRS and LDSS



as greater hardware and software reliability, maximizing commonality and increasing fuel efficiency for maximum range between refuel stops. Downtime, when it does occur, will be minimized by designing out most scheduled maintenance, constraining remaining scheduled maintenance to no less than annual time periods, constraining the need for tools and test equipment, maximizing accessibility to components requiring repairs or adjustments and eliminating complicated on-system maintenance procedures. Downtime will also be minimized by designing for two-level maintenance, the capability for the crew to do 80 percent of the on-system maintenance in a much shorter time period and through significant reductions in customer wait times for supplies and parts. FCS is designing these and other capabilities by using the "pit-stop engineering" approach. Similar to how racing teams design efficiency into their pit stops – Army combat repair teams will be the UA pit crews. Equipment will monitor the systems' condition, health and needs and notify the crew and sustainment cell at the Forward Support Battalion (FSB) of support requirements in advance of need. This allows integrated battle management and planning based largely on automatic data feeds from the platforms. Through near-real-time awareness of logistics requirements, the combat commander can plan the maneuver sustainment action into the order of march without degrading the operation.

The FCS FoS must be able to sustain itself with minimal external support. The requirement for platforms to self-load supplies, including ammunition, eliminates the need for stand-alone material handling equipment, extensive manpower requirements and long time delays while reloading. Essentially, this self-loading capability will transform the way we resupply ammunition, missiles and munitions to weapon systems. This one design feature could save billions in operations and support costs over the FCS life cycle.

We must start thinking differently about how combat power will be maintained and sustained. Iron mountains of supplies must be replaced by a lean system of strategically located, mobile and critical items that can be quickly provided where needed based on information obtained from the FCS system-of-systems common operating environment.

Design the Support

The maneuver sustainment concept described in the June 30, 2003, Operational and Organizational Plan demands much from future logistics systems. For example, higher mobility over longer distances drives the future logistics enterprise to become distribution-based versus inventory-based. To enable the transformational maneuver sustainment concept for the UA, the logistics system must also become more predictive than reactive. We must start thinking differently about how combat power will be maintained and sustained. Iron mountains of supplies must be replaced by a lean system of strategically located, mobile and critical items that can be quickly provided where needed based on information obtained from the FCS System-of-Systems Common Operating Environment (SOSCOE). FCS will be able to report supply, personnel and equipment status and predict needs before the shortages occur or before equipment goes down. In the past, an empty fuel tank did not impact the readiness report; in the UA it will. The sustainment services in the SOSCOE include two software products that will enable this new way of doing business in the UA: Platform Soldier-Mission Readiness System (PS-MRS) and the Logistics Decision Support System (LDSS). PS-MRS will feed data from the platform to the LDSS in the FSB and at the national level and provide the interface to and from the Global Combat Support System-Army (GCSS-A) for support outside the UA.

Support the Design

PM FCS is implementing a performance-based logistics (PBL) concept for FCS FoS and the UA. During SDD, the Lead Systems Integrator (LSI) will lead the effort to conduct a business case analysis to develop a best-of-breed PBL implementation plan. This plan will consider the industrial base study, FCS sustaining base study, Army Materiel Command depot and arsenal capabilities, public-private partnerships and best-of-industry practices. One constraint the team will work with is the requirement from the Army Acquisition Executive to not allow routine assignment of any contractors within the UA AO.

The PBL implementation plan will be based on a supply chain plan similar to the support enterprise model used on the Joint Strike Fighter program to validate the plan prior to implementation. Also, selected processes will be tested during the two limited user tests and the final plan will be approved at the initial production decision.

Part of the SOSCOE and logistics products development includes integration kits for complementary programs within the UA. Prototype kits will be developed and tested during SDD. The intent is to have common exportable SOSCOE capability (including logistics) that allows full integration of complementary programs and in lieu of vehicles into the UA maneuver force. Logistics command and control and integration of combat support and combat service support with combat decision making will be included.

During production and fielding, the UA will be fielded with a PBL concept. Performance-based agreements will be developed in conjunction with the user during SDD that state what the PM will deliver to the user in terms of specific metrics that may include performance, availability, reliability, footprint and life-cycle costs. The UA will have a product support integrator (PSI) who will coordinate and manage product support provided by each product support provider (PSP). PSPs will deliver operational availability within the logistical footprint and cost constraints. PSP performance will be measured and incentives awarded for meeting or exceeding goals. The PSI will enforce PSP performance. During SDD, the PSI is the LSI working with PM FCS.

In summary, the Army is transforming the way it designs and supports systems through extensive design influence in the FCS program and through designing systems that will enable embedding logistics functions in the common operating environment in the UA. At the same time, the Army is moving to a performance-based approach to provide product support to the UA. The FCS program has just begun to address the many facets of achieving ORD requirements and will need the help of the entire logistics community to achieve these objectives.

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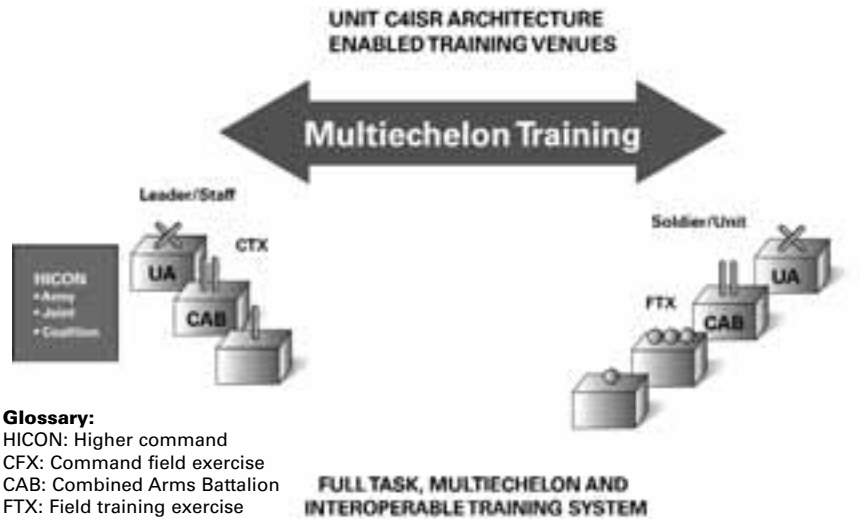
Training the Future Combat Systems

MAJ Larry S. Anderson and Jeff Simons

The key capability of the Future Combat Systems (FCS) training environment is an unprecedented embedded training (ET) capability inherent to the operational system-of-systems (SoS). This ET is derived from the FCS Mission Needs Statement that states: "Training must be inherent in FCS design to enable units to rapidly deploy without the need for system-specific training and allow individual and collective training on a digital terrain representation of the mission area."

Unprecedented in Army acquisition is the approval of training as a Key Performance Parameter (KPP). This places training equal to other mission-critical capabilities that will enable the FCS Soldier to train and fight like never before. The 2003 FCS Operational Requirements KPP states: "The FCS FoS [Family-of-Systems] must have an embedded individual and collective training capability that supports live, virtual and constructive training environments."

The requirement to host an ET capability as part of the materiel acquisition process for operational systems has been around since the late 1980s, directed by GEN Maxwell R. Thurmond, then the Commander, U.S. Army Training and Doctrine Command (TRADOC), requiring systems be developed with ET inherent to the platforms. However, achieving an ET capability necessitated that the training be developed commensurate with the operational systems. The processing



Glossary:
HICON: Higher command
CFX: Command field exercise
CAB: Combined Arms Battalion
FTX: Field training exercise

capacity and digital infrastructure made it impossible — until now. FCS now affords the Army an opportunity to achieve this unprecedented capability during the system development and demonstration phase.

ET Environment

So what is ET and why is it crucial that it become an inherent FCS program component? According to TRADOC Pamphlet 350-73, *Objective Force ET Users Functional Description (June 2003)*, ET is defined as a function hosted in hardware and/or software, integrated into the overall equipment configuration that supports training, assessment and control of exercises on the operational equipment, and when activated, starts a training session overlaid on the system's normal operational mode.

The June 2003 Operational and Organizational (O&O) Plan describes how the brigade-sized unit of action (UA) is expected to operate in 2010 through 2020. These documents provide the foundation that directs how our forces will operate in the future. Having ET in the operational platform enables our warfighters to meet operational requirements by providing the necessary flexibility and technology to train anytime, anywhere.

The training strategy outlined in the O&O identifies an ET system that executes within live, virtual and constructive environments. ET provides the means to achieve a blended capability of these traditionally independent training environments. This capability provides the UA with an increased level of competency that is adaptive and embedded within the UA. This incorporates leadership, cohesion and unit design that will help fuel the core performance of Soldiers, leaders and staffs. This ET strategy supports Soldier and leader proficiencies in tactical and technical tasks required in full-spectrum operations. The figure shows how the ET strategy will support training at all echelons.

ET is defined as a function hosted in hardware and/or software, integrated into the overall equipment configuration that supports training, assessment and control of exercises on the operational equipment, and when activated, starts a training session overlaid on the system's normal operational mode.

The FCS ET system will provide warfighters with the ability to train in the institution, at Combat Training Centers (CTCs), while at home station or deployed. The ET system is being developed as an integral part of the FCS system design and, while the FCS platforms are in training mode, will stimulate and receive information from the operational vetronics, executed through the platforms' Warrior Machine Interface and command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) architectures; and use the organic decision aides and vehicle management software.

Platform-resident simulation-based training support packages (TSPs) will provide the operator, individual, crew and combined arms unit a complete, mission-based training event. These TSPs are based on the FCS missions defined in the O&O, to include a progressive training matrix allowing for training progression. TSPs will include individual, crew and multiechelon tasks that leaders will be able to modify to fit their unit mission needs.

This capability will also allow the FCS FoS to interoperate with our current forces and their training aides and other collective training capabilities. Also, ET provides the capability of reach, allowing connectivity between the newly conceptualized Home Station Operations Center or institution and the warfighter. FCS Soldiers will be able to download required training products via the network to update their skills or to get operational-relevant information.

To achieve a training capability for the institutions, the software hosted on the operational systems will be ported to platform replicas (ranging from high-end manned modules to desktop environments) to create stand-alone trainers. This package will provide the institutions with networked reconfigurable assets (called Network Reconfigurable Full-Task Trainers) available to Soldiers prior to arriving at their assigned UA. This is necessary during the initial stages of the FCS fielding and training process because of the lack of operational platform availability.

Acquisition Strategy

A key tenet associated with the successful FCS training environment acquisition was establishing a Training Systems Integration Integrated Product Team (TSI IPT). Consistent with other elements of the Lead Systems Integrator (LSI), the TSI IPT executes the management and technical integration necessary for hosting the FCS training capability as part of the FCS operational environment. A strongly coupled government and LSI team has been forged to ensure that the ET capability for FCS becomes a reality. The Program Executive Office for Simulation, Training and Instrumentation (PEO STRI) was selected as the government co-lead to the LSI's Training IPT because of its expertise in the modeling and simulation domain and as a result of its current technical capabilities portfolio that is strategically postured to assist FCS training development.

An early question facing the TSI IPT was how to best establish the supplier base necessary to achieve the operational environment ET capability. To better ensure that the ET capability is an inherent part of the operational system, an acquisition strategy was embraced that requires training be developed commensurate with development of each FCS end item by the contracted supplier of that end item. The TSI IPT concluded that a separate host of suppliers, acting independent of the operational system development, would be hindered in their ability to introduce the developed software into the SoS. To overcome this problem, the TSI IPT established the acquisition paradigm whereby the operational end item suppliers for FCS (e.g., Manned Ground Vehicles) are accountable for achieving the training requirements for constructive, live and virtual training. Each contract let by the LSI has the training requirements inherent as part of the contract action and a separate contract line item has been established under the cognizance of the TSI IPT to control cost, schedule and performance.

This acquisition strategy has an inherent challenge which, if not explicitly addressed by other means, would be a significant hurdle — collective training. Whereas each supplier of the varying operational systems can best assess and develop individual and crew training capabilities, the ability for the multiplicity of different suppliers to achieve a common collective training capability is problematic. To address this challenge, the TSI IPT established a second key tenet. The TSI IPT will provide the suppliers (using previous government investments) the foundation of a collective training environment from which adaptations can be made. These common components form complementary programs.

Complementary Programs

A set of common components, which will build the foundation for the collective training environment, will be adapted from four key ongoing Army programs. Three of these programs, managed by PEO STRI, include the One Semi-Automated Forces (OneSAF), the Common Training Instrumentation Architecture (CTIA) and the One Tactical Engagement Simulation System (OneTESS). These programs are intended to provide the varying training enablers for the FCS ET paradigm.

The OneSAF program provides the heart of the collective training capability, establishing a foundation of training enablers (or common components) to include the scenario generation capability, computer-generated forces and after-action review. Interoperability and integration of CTIA components create the ability to execute in the live-training construct at CTC's home station and while deployed. Elements of CTIA will also round out the training enablers from a live perspective need. The OneTESS will be the objective tactical engagement capability to the live force-on-force engagement arbitration.

An additional program currently managed by TRADOC, the Army Training Information Architecture provides the means by which training management and reach to the Army Knowledge Enterprise is achieved, providing ready access to TSPs while deployed. Collectively, these programs provide the foundation of a collective training environment, overcoming the challenge inherent in multiple developers, while also significantly reducing the FCS program cost burden by taking advantage of existing investments — an estimated cost avoidance of $300 million.

The Army still has a requirement to train as it plans to fight, but with the expanded battlefield, increased operational tempo and personnel tempo, we must find better ways of "how" to train. A leader will have the ability to place warfighters in a blended live, virtual and constructive environment resident on their operational equipment. Executing a training event from a motor pool or assembly area will become commonplace in the future.

This exportability and tailorability is where the power of ET is realized as a force multiplier. ET will provide commanders with the ability to train their forces anytime and anywhere.

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Benefits and Impacts of Using Tactical Sensor Payloads

MAJ Michael K. Wegler and Michael A. Johnson

FUTURE COMBAT SYSTEMS
FCS
One Team-The Army/Defense/Industry

The U.S. Army is accelerating its effort to develop and field unmanned aerial vehicles (UAVs) at the brigade, division and corps levels. This effort will enhance the Army's capability to find, identify, attack and destroy enemy troop concentrations and simultaneously reduce U.S. force vulnerability. The synthetic aperture radar/moving target indicator (SAR/MTI) sensor payload is being developed to perform UAV reconnaissance, surveillance and target acquisition (RSTA) missions.

Product Manager Robotic and Unmanned Sensors (PM RUS), part of Project Manager Night Vision/Reconnaissance Surveillance and Target Acquisition (PM NV/RSTA) under Program Executive Officer (PEO) Intelligence, Electronic Warfare and Sensors (IEW&S), hypothesized that Army military occupational specialty (MOS) 96U, UAV operators, with minimal additional training, could effectively employ a synthetic aperture radar and moving target indicator sensor payload to perform RSTA missions. PM

TUAV Operator

RUS designed the Sensor Employment Assessment Program (SEAP) to test this hypothesis. SEAP includes an engineering test; a military demonstration, analysis and feedback (MDAF); and an operational demonstration, analysis and feedback (ODAF). The engineering test and MDAF phases were completed in April and May 2003, respectively.

Tactical UAV Radar (TUAVR), a SAR/MTI sensor payload, developed under an advanced technology demonstration program, was installed on a Hunter UAV and configured to interface with the Hunter C-Band datalink

for the SEAP. A SEAP's engineering test phase was conducted to verify software and hardware modifications before involving soldiers in the MDAF and ODAF. A separate engineering test effort was conducted to evaluate and refine the human interface design. Imagery subject matter experts and MOS 96U soldiers from Fort Huachuca, AZ, collaborated with the radar engineers from the Northrop Grumman Corp., Electronic Systems, to develop and validate appropriate functionality for the user interface and to ensure that soldiers could operate the radar system after receiving minimal training.

The SEAP's second phase — the MDAF — required soldiers to employ a SAR/MTI package to detect and classify stationary targets and detect moving targets while conducting RSTA missions in a tactical environment. The MDAF's purpose was to:

- Provide a SAR/MTI package that could be used and appraised by military users.
- Determine the SAR/MTI sensor payload's military utility while conducting RSTA missions during tactical operations.
- Assess and validate PM RUS-developed tactics, techniques and procedures (TTPs) for SAR/MTI sensor payload employment.

The MDAF was controlled from the division tactical operations center (DTOC) located in the Electronic Proving Ground Instrumented Test Range Central Control Facility at Fort Huachuca. The launch and recovery Ground Control Station (GCS) — and backup GCS — were located at Libby Army Airfield. The backup GCS was also used to control the Hunter UAV with the electro-optical and infrared (EO/IR) sensor payload onboard during cross-cueing missions. The Supportable Ground Control Station containing the Radar Ground Support Equipment (RGSE) was located in the parking lot adjacent to the DTOC.

The Hunter UAV

The scenarios developed for the MDAF assessment portrayed a threat force similar to one that might be encountered during a small-scale contingency operation. The missions the operators were required to conduct were:

- Area, route and zone reconnaissance
- Surveillance missions
- Urban area reconnaissance

The RGSE and DTOC computers were on a local area network that was configured with e-mail and a Web server. Size, activity, location, unit, time and equipment (SALUTE) reports with attached National Imagery Transmission Format imagery were e-mailed from the Mission Payload Operator (MPO) to the G2, G3 and 96D Imagery Analyst within the DTOC using the automated SALUTE report dialog boxes available with the RGSE software. The 96U indicated in the SALUTE report's equipment line whether he thought the target was a wheeled or tracked vehicle. An MOS 96D used RemoteView software to further exploit the SAR image so that 96U and 96D capabilities could be compared and assessed.

The 96U MPO was given a fragmentary order for each mission to search an area of interest and to detect and classify stationary targets and detect moving targets. This guidance was based on mission-driven intelligence preparation of the battlefield that included named areas of interest, targeted areas of interest and decision points. In one scenario, a 96U MPO operating the TUAVR detected and reported four M60 tanks and a 5-ton truck as five stationary vehicles. This same MPO then directed another MPO operating an EO/IR sensor payload onboard another Hunter UAV who was cross-cued to the location of the detections. The EO/IR MPO quickly recognized and reported the detected targets as tanks and a cargo truck. A second mission resulted in the SAR/MTI MPO detecting four stationary M577 armored personnel carriers arranged in a tactical operations center configuration. The MPO reported them as four vehicles and sent the SALUTE report to the DTOC. A 96D then used RemoteView software to further exploit the image sent by the MPO with the SALUTE report. He correctly classified the targets as four tracked vehicles.

SFC Gary Torre, a test participant, stated he believed that "the SAR/MTI payload will give battlefield commanders the additional situational awareness when the EO/IR payload is deemed usable because of weather or smoke coverage. Also, the ability to use the MTI package to cue an EO/IR payload will give the commander the ability to cover more area more swiftly than with the EO/IR solely as the only asset."

Another difficult mission was conducted in an urban environment simulation at Fort Huachuca. The MPOs were given a target list consisting of a DTOC, logistics convoy, three different motor pools, command and control aircraft, fuel point, power substation, tank platoon and command post. The MPO successfully detected and reported the DTOC, which consisted of several tents and vehicles. Then, a 96D used RemoteView software to further exploit the image sent by the MPO. He correctly located the tents and vehicles.

The MDAF provided a reliable, supportable SAR/MTI package. The MDAF demonstrated the SAR/MTI sensor payload's military utility while conducting tactical RSTA missions. The TTPs for the employment of this payload were reviewed, revised and documented. The information and lessons learned through the MDAF will influence the Army's SAR/MTI sensor payload employment for many years to come. Initial MDAF results support PM RUS's expectations that Army UAV operators — with minimal additional training — can effectively employ a SAR/MTI sensor payload to perform RSTA missions.

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FCS Unattended Ground Sensors

Edward T. Bair

FUTURE COMBAT SYSTEMS FCS One Team-The Army/Defense/Industry

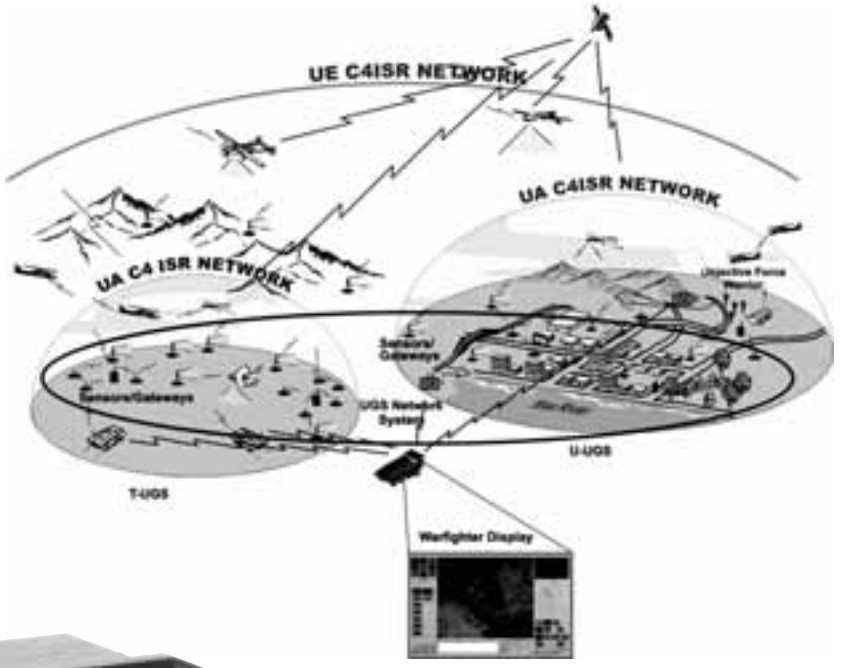
The Future Combat Systems (FCS) Unattended Ground Sensors (UGS) will provide remote sensing capabilities to enhance the Objective Force commander's intelligence picture. The remotely deployable UGS is an integral component of the FCS-layered sensor network and will provide enhanced threat warning, situational awareness (SA) and force protection in both tactical and urban environments for extended periods. The sensor family will be self-webbing, self-healing and network-capable for target detection, location, tracking and identification.

The FCS UGS program is divided into two major subgroups of sensing systems: Tactical-UGS (T-UGS), which includes Intelligence, Surveillance and Reconnaissance (ISR)-UGS and Chemical, Biological, Radiological and Nuclear (CBRN)-UGS; and Urban-UGS (U-UGS), also known as Urban Military Operations in Urban Terrain (MOUT) Advanced Sensor System. The ISR-UGS will be modular and composed of tailorable sensor groups using multiple ground-sensing technologies. A UGS field will include low-cost, expendable and multimode sensors for target detection, location and classification; and an imaging capability for target identification. A sensor field will also include a gateway node to provide sensor fusion and long-haul communications capability for transmitting target or other information to a remote operator or the common operating picture through the FCS Unit of Action (UA) Network. The UGS can be used to perform mission tasks such as perimeter defense, surveillance, target acquisition and SA, including CBRN early warning.

U-UGS will provide a leave-behind, network-enabled reporting system for SA and force protection in an urban setting, as well as residual protection for cleared areas of MOUT environments. They can be hand-employed by Soldiers or by robotic vehicles inside and outside buildings and structures as depicted in the figure on Page 40.

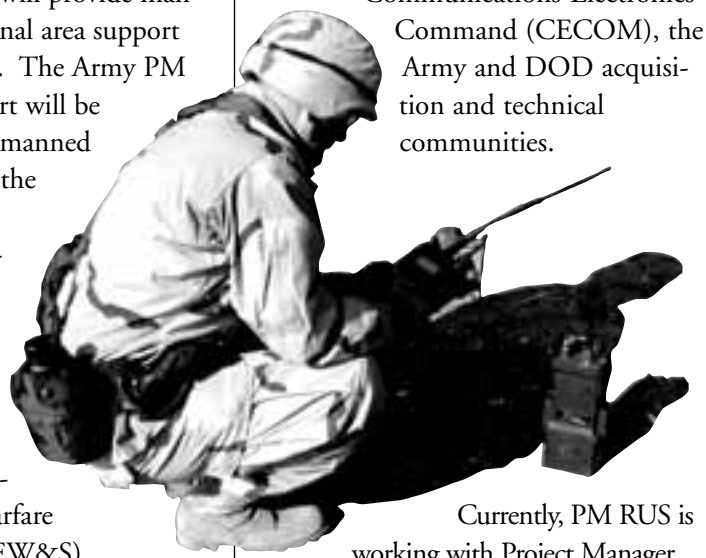
Program Management Approach

Unique among FCS core systems, the FCS-UGS program will be co-managed



by the FCS Lead Systems Integrator (LSI), the Boeing Co., and an Army product manager (PM). The LSI will perform overall program and UGS supplier contract management responsibilities, while the Army PM will provide management and functional area support personnel to the LSI. The Army PM providing this support will be PM Robotic and Unmanned Sensors (RUS) from the Project Manager for Night Vision/Reconnaissance, Surveillance and Target Acquisition (PM NV/RSTA) under the Program Executive Office for Intelligence, Electronic Warfare and Sensors (PEO IEW&S).

This program management approach will enable both the government and industry to focus on their core area expertise in a common effort to bring a vital warfighting capability to the American military. The LSI will focus on UGS supplier contract management and UGS integration into the FCS UA System-of-Systems, while PM RUS will concentrate on the program meeting other Army requirements and interfaces with other systems. PM RUS will act as the program conduit to the U.S. Army Communications-Electronics Command (CECOM), the Army and DOD acquisition and technical communities.



Currently, PM RUS is working with Project Manager Warfighter Information Network–Tactical on UGS communications requirements for the Joint Tactical Radio System Cluster 5 Small Form Factor variants. Also, in an agreement between PM NV/RSTA for UGS and PM Close Combat Systems (CCS) for the Intelligent Munitions Systems (IMS), coordinated with PM FCS Network Systems Integration and PM FCS Lethality, FCS UGS will provide the Layer I sensing capability to wake up and cue the IMS field. PM RUS is working with CCS, the LSI and the UGS supplier to ensure the IMS interface requirements are defined, documented and implemented in UGS.

There has been more than $168 million invested within the government technology base for UGS-related technologies. PM RUS will act as the agent for transferring UGS-related technologies developed as part of Science and Technology Objective programs and Advanced Concept Technology Demonstrations to the UGS program to help meet current and future requirements. In addition, PM RUS will provide the conduit for the reverse, transferring capabilities developed under FCS to satisfy UGS needs outside FCS, such as sensors for PM Force Protection Systems, other services and allies.

The FCS UGS co-management concept will bring the cooperation between the Army and the LSI under the FCS One-Team approach to a new level. The driving force in the success of this relationship will be the dedication of personnel on both sides, with the understanding that the ultimate customer is the Soldier.

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Non-Line-of-Sight Launch System

Rod Summers

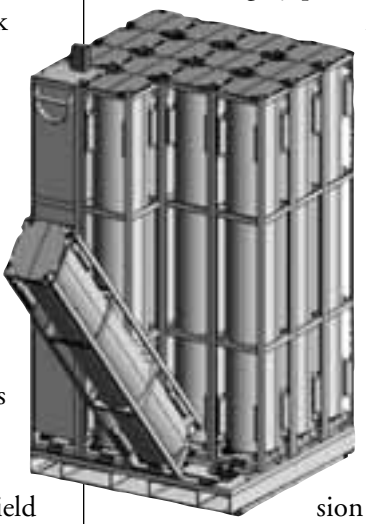
FUTURE COMBAT SYSTEMS
FCS
One Team-The Army/Defense/Industry

The Non-Line-of-Sight Launch System (NLOS-LS) provides enabling lethality for the Army's Future Combat Systems (FCS) program. The NLOS-LS, one of 19 FCS Core Systems, consists of a family of missiles and a highly deployable, platform-independent Container Launch Unit (C/LU) with self-contained tactical fire control electronics and software for remote and unmanned operations.

The NLOS-LS Increment I configuration will consist of Precision Attack Missiles (PAM) focused on defeating armored and command and control targets and Loitering Attack Missiles (LAM) focused on defeating non-armored fleeting, high-value targets as well as supporting both targeting information and battle damage assessment (BDA). Each missile will be vertically launched directly from the C/LU based on fire missions received via the FCS Unit of Action (UA) network and be capable of being updated in-flight by the network via on-board Joint Tactical Radio Set Cluster 5 radios. Vertical launch capability enhances deployability and delivers the ability to engage a wide spectrum of targets in diverse environments and terrain. Future increments may include additional missiles variants such as air defense and nonlethal missiles.

Current operational plans are to field 60 C/LUs with each of the 15 FCS UAs. Each C/LU will consist of a computer and communications system and 15 missiles (PAM and LAM). The first C/LUs will be deployed by the decade's end to meet FCS Initial Operational Capability.

PAM is a modular, multimission, guided missile with two trajectories — a direct-fire or fast-attack trajectory and a boost-glide trajectory. The missile will receive target information prior to launch and can receive and respond to target location updates during flight. The PAM will support laser-designated, laser-anointed and autonomous operation modes and will be capable of transmitting near-real-time information in the form of target imagery prior to impact. PAM is being designed to defeat heavy armored targets.



LAM will provide imagery for area search, surveillance, targeting and BDA and could serve as an airborne radio transmission platform for other system missiles, as well identifying high-payoff targets for missile attack. LAM will be capable of flying to extended ranges with significant loiter time at its maximum range. Mission data can be preprogrammed or changed in flight and imagery information can be provided to multiple common ground systems. Current target requirements for LAM are for high-fleeting, high-value targets.

C/LU serves as the basic missile shipping container and vertical launcher. It contains the PAM and LAM as well as the computer and communications system. It will accept remote commands to launch, test for availability and conduct firing operations without the use of an attendant crew. NLOS-LS is a platform-independent transported system.

This NLOS-LS technology is being developed by Lockheed Martin Missiles and Fire Control of Dallas (LMMFC-D), TX, and Raytheon Corp. of Tucson, AZ, under a Defense Advanced Research Projects Agency (DARPA) Concept Technology Demonstration contract. In September 2002, the Program Executive Office for Tactical Missiles established the NLOS-LS Task Force (TF) to manage the NLOS-LS technology's transition from DARPA to the Army and to manage the program for the Army until an NLOS-LS project office could be established. Approximately

6 months after the TF's establishment, pre-system development and demonstration (SDD) contracts were awarded to LMMFC-D and Raytheon to facilitate the transition and mitigate risk associated with the SDD contract award planned for early FY04. A project manager for NLOS-LS has been approved for FY05 and the TF will continue to manage the effort until then.

In May 2003, Lockheed Martin Corp. and the Raytheon Corp. formed Netfires Limited Liability Company (LLC) to develop the NLOS-LS. On Aug. 6, 2003, the U.S. Army Aviation and Missile Command issued a request for proposal to Netfires LLC for the NLOS-LS SDD contract. Contract award is planned for the second quarter of FY04.

ROD SUMMERS is the NLOS-LS TF Director. He has a B.S.M.E. from Auburn University and an M.S.E. from the University of Alabama, Huntsville. He is a graduate of the Advanced Program Management Course and is Level III certified in systems planning, research, development and engineering and in program management.

Ummanned Ground Vehicles

COL Terry Griffin (USMC)

FUTURE COMBAT SYSTEMS
FCS
One Team-The Army/Defense/Industry

There are three unmanned ground vehicles (UGVs) in the Future Combat Systems (FCS) program. Each UGV program is managed by an integrated process team consisting of the Lead Systems Integrator and government personnel located in Huntsville, AL. A description of each program follows.

Small Unmanned Ground Vehicle (SUGV)

The SUGV is a small, lightweight, manportable UGV capable of conducting military operations in urban terrain tunnels, sewers and caves. The SUGV could be used for reconnaissance, surveillance and application of effects, including door breach, smoke generation and delivery of concussion grenades. The SUGV's modular design allows multiple payloads to be integrated in a plug-and-play fashion. Weighing less than 30 pounds, it is capable of carrying up to 6 pounds of payload weight. Three payloads will be developed in the FCS System Development and Demonstration (SDD) phase. They include a manipulator arm, fiber-optic tether and unattended ground sensor dispenser.

The SUGV will be controlled with video feedback through an Operator Control Interface (OCI) that is being developed in cooperation with the Land Warrior Program. The FCS SUGV contractor is iRobot, located in Burlington, MA.

Multirole Utility Logistics Equipment Vehicle (MULE)

The MULE is a 2.5-ton UGV that will support dismounted operations. It consists of four major components:

- Mobility platform.
- Autonomous Navigation System (ANS). The ANS is the mission payload package that will be integrated on both the MULE and Armed Robotic Vehicle (ARV) to provide a robotic semiautonomous capability and also on the family of manned ground vehicles (MGVs) to provide a leader-follower capability.
- OCI.
- Mission equipment packages.

The MULE is sling-loadable under military rotorcraft. The MULE has three variants: transport, countermine and the ARV-Assault-Light (ARV-A-L).

The transport MULE will carry 1,900-2,400 pounds of equipment and rucksacks for dismounted infantry squads with the mobility needed to follow squads in complex terrain. The countermine MULE will provide the capability to detect, mark and neutralize anti-tank mines by integrating a mine detection mission equipment package from the Ground Standoff Mine Detection System FCS program. The ARV-A-L MULE is a mobility platform with an integrated weapons and reconnaissance, surveillance and target acquisition (RSTA) package to support the dismounted infantry's efforts to locate and destroy enemy platforms

and positions. The MULE platform's centerpiece is superior mobility built around an articulated suspension system to negotiate tough obstacles and gaps that a dismounted squad might encounter. The MULE contractor is Lockheed Martin Missiles and Fire Control, located in Grand Prairie, TX.

Don Nimblett, Lockheed Business Development, stands on a mock-up of the ARV-A-L MULE.

ARV

The ARV is a 5-ton unmanned combat vehicle consisting of four major components: the mobility platform, ANS, OCI and RSTA sensors and weapons. There are two ARV variants: ARV-RSTA and ARV-Assault. The ARV-RSTA will maximize capabilities to detect and target the enemy, and the ARV-Assault will focus on increased lethality to destroy the enemy. The ARV platforms must have the speed and mobility to support mounted forces. The ARV program will enter a 2-year systems engineering phase. During this phase, FCS will explore ways to improve the ARV's effectiveness while maintaining the vehicle's weight at 5 tons. The program will evaluate technologies that include:

- Hybrid electric drive to provide a limited silent watch capability while increasing mobility for complex obstacles.
- Active suspension and steering system that will perform well on both hard-surface roads and cross-country terrain.
- Advanced lightweight materials and construction to increase survivability.

The FCS team will work with the Defense Advanced Research Projects Agency (DARPA) initiative — the ARV Demonstrator — to take advantage of the lessons learned to integrate weapons systems and their prototype ANS developed under DARPA's PerceptOR program on the ARV Demonstrator. Upon phase completion, a decision will be made whether to spiral the ARV into SDD. The ARV contractor is United Defense Ground Systems located in Santa Clara, CA.

The SUGV is a small, lightweight, man-portable UGV that could be used for reconnaissance, surveillance and application of effects, including door breach, smoke generation and delivery of concussion grenades.

ANS

The ANS consists of core navigation sensors, perception sensors, autonomous navigation algorithms and software. The ANS will be integrated on the MULE and ARV platforms to allow them to be either teleoperated or autonomously controlled. The ANS will be integrated on MGVs to provide a leader-follower capability. The ANS program will take advantage of several past and current programs that have worked diligently to advance semiautonomous capability for unmanned platforms: DARPA's PerceptOR program, the U.S. Army Tank-automotive and Armaments Command's Robotic Follower Advanced Technology Demonstration and the Army Research Laboratory's DEMO III program. The ARV, MULE and MGV contractors will work with the ANS contractor to ensure that the ANS is properly integrated to its platform. The ANS contractor is General Dynamics Robotic Systems in Westminster, MD.

COL TERRY GRIFFIN (USMC) is the Robotic Systems Joint Project Office Program Manager located at Redstone Arsenal, AL. He has a B.S. degree in communication from Auburn University and an M.B.A. from Averette University.

Manned Ground Vehicles —

Redefining System Development

COL Donald P. Kotchman

Delivered by tactical airlift, the manned ground vehicle (MGV) fleet moves into initial position. Unit of action (UA) commanders at all levels issue orders while on the move from command and control vehicles (C2Vs), according to intelligence analysis derived from fused sensor input from the Reconnaissance and Surveillance Vehicle (R&SV) and Joint, Interagency and Multinational assets. Superior mobility and integrated fires allow the Non-Line-of-Sight Cannons (NLOS-C), mortars and the beyond-line-of-sight (BLOS) capability of the Mounted Combat System (MCS) to engage enemy targets in-depth, coordinated with other UAs, units of employment (UEs) and Joint service assets under the control of the combatant commander via an unprecedented networked lethality capability.

Having set the conditions for an overwhelming advantage, the Infantry Carrier Vehicles (ICVs) and MCSs move in to secure key objectives under the watchful eye of the R&SV and unmanned ground and air vehicles. Advanced Medical Vehicles (MVs) provide evacuation and immediate treatment capability as required during the operation.

The goal is to see first, understand first, act first and finish decisively. As envisioned in the Maneuver UA Operational and Organizational Plan, the FCS MGV family development focuses on integration of Soldiers, situational awareness, sensors, shooters, survivability and sustainment. Unlike predecessor programs, FCS manned ground system development focuses on the design of an interdependent family of vehicles, structured within the overarching UA network to maximize combined capability rather than individual system prowess. Success in this endeavor relies heavily on the coordinate contributions of many other key elements of the overall FCS program, including command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR); training; logistics and lethality efforts to achieve operational goals.

In addition to the features normally found on individual combat systems, FCS MGV development is oriented to significantly improve operational availability, reduce logistics system burden and simplify operator interfaces. This is consistent with the goal to build the system around the Soldier rather than forcing the Soldier to adapt to the system. An embedded Personnel and Materiel Readiness Monitoring System will provide commanders key health monitoring information on the status of fuel, ammunition, system

readiness and personnel health to assist in campaign planning.

Key features of the MGV family include a simplified two-level maintenance concept, onboard water generation capability, embedded training, diagnostics and prognostics and rapid resupply. Within the framework of holistically addressing interdependencies at the systems level, the FCS MGV development must pay close attention to C4ISR integration, power management, electronics architecture and data management.

As with lethality, survivability within the MGV family relies on a stepped approach focused on minimizing potential exposure to overmatching threats via situational awareness culminating in advanced active protection systems, novel active armor solutions and advanced materiel design for passive protection. This layered approach to MGV survivability is essential to achieving other mobility and transportability boundary conditions.

To achieve these goals, MGV development is segmented into two principal areas: common core systems and mission variants. The common core systems are provided to all variant development teams for integration with mission equipment packages. This common approach further helps reduce the logistics burden of the manned vehicle fleet and provides for economy of scale during the procurement phase of the program.

Common Systems

The FCS MGVs are structured around a series of 12 common systems and a series of mission modules, resulting in eight variants. The intention of the developmental effort is to optimize commonality throughout the family of vehicles where it makes sense, and to construct a deliberate decision process to determine when being common is not feasible. In most other family-of-systems programs to date, a single variant is used as the lead vehicle from which each of the remaining family of vehicles evolves. While it may appear to be subtle, the common design of this family of vehicles is not initially influenced by a dominant variant but focuses on taking a balanced approach to meeting the capabilities required by the whole family. Operational requirements documentation reinforces the approach by dividing MGV requirements into a set of common core needs such as mobility capabilities and mission-specific requirements such as indirect fire capability as in the case of the NLOS-C.

A Common Design Concept for FCS

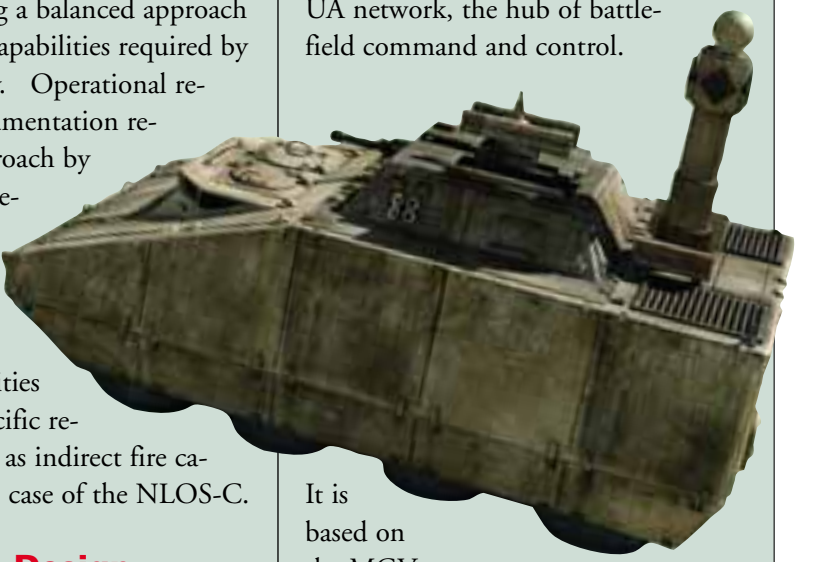
While these 12 common systems would typically be treated as standalone components, their interdependencies mandate an integrated approach for developing the common core without suboptimizing MGV variants' mission contribution at the system-of-systems (SoS) level. This led to a natural grouping of systems into certain core areas. As each variant design evolves, deviation from the influence of the common contribution to system design is by exception only.

The Variants

The FCS program defined in Increment I initial fielding consists of seven vehicle variants, each providing key enablers for execution of the UA SoS strategy. When integrated into the FCS network of sensors and communications, these network-enabled mission equipment packages based on the common mobility platform deliver the command and control, intelligence, and fire-power necessary to realize the vision of the Maneuver UA Operational and Organizational Plan.

C2V

The C2V is the central node of the UA network, the hub of battlefield command and control.



It is based on the MGV common platform. The C2V platform provides for information management of the integrated network of communications and sensor capability within the UA and provides the tools for commanders to synchronize their knowledge of combat power with the human dimension of leadership. It is located within the headquarters sections at each echelon of the UA down to the company level, and when integrated with the C4ISR suite of equipment, it provides commanders command and control on the move.

The C2V contains all the interfaces required to enable the commander to leverage the power of the C4ISR network and provides the means for leaders at all levels to achieve information

superiority and situational understanding and to establish, maintain and distribute a common operating picture fused from the friendly, enemy, civilian, weather and terrain situations while on the move. The crew uses its integrated C4ISR suite (communication, computers and sensor systems) to receive, analyze and transmit tactical information via voice, video and data inside and outside the UA. The C2V can also employ unmanned systems, such as unattended ground sensors and unmanned ground and air vehicles to enhance situational awareness throughout the UA.

ICV

The ICV delivers 9-person infantry squads to a location from which they will conduct a close assault. The ICV will effectively employ weapon systems and rapidly maneuver during blackout, day and night operations, inclement weather, and limited visibility periods. The ICV will deliver the dismounted force to the close battle and support the squad by providing self-defense and supporting fires. The ICV carries the majority of equipment freeing the individual Soldier to focus on mission. The squad will have access to Army and Joint fire delivery systems from external sources to provide extended range, networked responsive precision or volume fires on demand in support of tactical maneuvers. The ICV can move, shoot, communicate, detect threats and protect crew and critical components under most land-surface environments. Data transfer with other components of the UA permits constant update of the common operational picture and rapid identification of targets making the ICV the infantry carrier for the 21st century.

MCS

The MCS provides direct and BLOS offensive firepower capability allowing UAs to close with and destroy enemy forces in support of the operations plan. The MCS delivers precision fires at a rapid rate to destroy multiple targets at standoff ranges quickly and complements the fires of other systems in the UA. It is highly mobile and maneuvers out of contact to positions of advantage. It is capable of providing direct support to the dismounted infantry in an assault,

defeating bunkers and breaching walls during the tactical assault. The MCS also provides BLOS fires through the integrated sensor network. BLOS fires from an MCS provide in-depth destruction of point targets up to 8 kilometers away from the target. This capability significantly increases the options available to the UA commander for the destruction of point targets through the integrated fires network enhancing SoS lethality. The MCS will consist of the common MGV chassis and an autoloading line of sight and BLOS capabilities.

R&SV

The R&SV serves as a vital component of the integrated, SoS approach to development of the tactical, operational and strategic situations. R&SVs are agile, stealthy vehicles that use advanced sensors to rapidly detect, locate and discriminate multiple threats while remaining undetected themselves. These features, in conjunction with a dynamic hunter-killer capability using onboard systems and other organic UA, UE, Joint, and coalition lethal systems enable the R&SV to avoid detection, move quickly and facilitate the UA to close with and destroy enemy forces. C4ISR links facilitate critical data and information exchange with other UA, UE, Joint forces, theater and national assets.

R&SVs feature a suite of advanced sensors to detect, locate, track, classify and automatically identify targets from increased standoff ranges under all climatic conditions, day or night. Included in this suite are a mast-mounted, long-range electro-optic infrared sensor, a Prophet emitter mapping sensor for radio frequency (RF) intercept and direction finding, the Joint Service Lightweight Stand-off Chemical Agent Detector for remote chemical detection and a multifunction RF sensor. R&SVs also feature the onboard capability to conduct automatic target detection, aided target recognition and Level I sensor fusion. To further enhance the scout's capabilities, R&SVs are also equipped with unattended ground sensors, small unmanned ground vehicles with their own suite of sensors and two unmanned aerial vehicles.

NLOS-C

The NLOS-C provides unprecedented responsiveness and lethality to the UA commander. The NLOS-C provides networked, extended-range targeting and precision attack of point and area

targets in support of the UA with a suite of munitions that include special purpose capabilities. The NLOS-C provides sustained fires for close support and destructive fires for tactical standoff engagement. The system's primary purpose is to provide responsive fires in support of the FCS Combined Arms Battalions and their subordinate units in concert with line-of-sight, BLOS, NLOS, external and Joint capabilities. The system provides flexible support through its ability to change effects round-by-round and mission-by-mission. These capabilities, combined with rapid response to calls for fire and rate of fire, provide a variety of effects on demand.

The cannon will be able to move rapidly, stop quickly and deliver lethal first round effects on target in record time. The NLOS Cannon will have a multiple round-simultaneous impact (MRSI) capability. The MRSI capability, coupled with the NLOS-C's superior sustained rate of fire, will provide record effects on target from a smaller number of systems. The cannon, like all MGV variants, can rapidly rearm and refuel, and its system weight makes it uniquely deployable. Fully automated handling, loading and firing will be another centerpiece of the NLOS-C. The NLOS-C balances deployability and sustainability with responsiveness, lethality, survivability, agility and versatility.

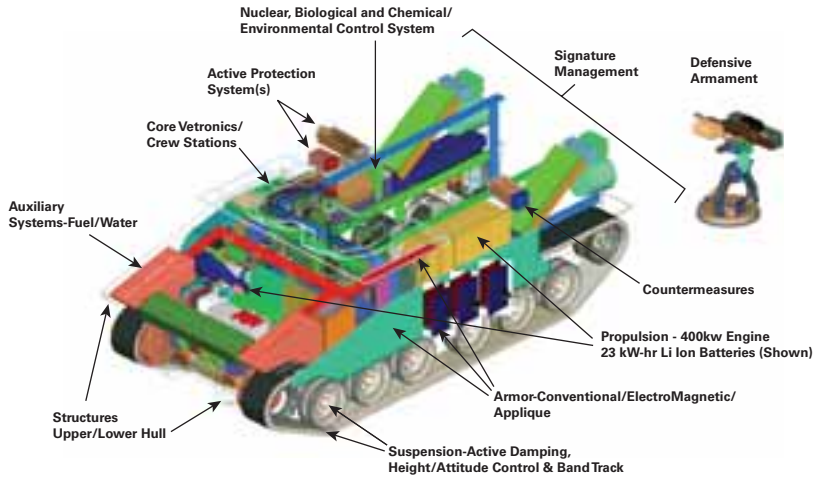
Non-Line-of-Sight Mortar (NLOS-M)

The NLOS-M provides unparalleled responsiveness and lethality to the UA commander. The mortar provides fires in close support of tactical maneuvers that include destructive fires and special purpose fires. While working as part of an NLOS-M battery, the NLOS mortar-firing Precision Guided Mortar Munitions will deliver lethal fires to destroy high payoff and most dangerous targets and provide area suppression in support of UA companies and platoons. The mortar and platoon are highly flexible and agile in establishing sensor-shooter linkages. It provides highly responsive, reliable, timely, accurate and sustained rates of fire and rates of kill with 24/7 availability in all weather and terrain conditions at extended ranges.

The NLOS-M system provides precision-guided fires to destroy, protective fires to suppress and obscure the enemy and illumination fires all in close support of UA Combined Arms Battalions maneuver units. The platoon provides responsiveness with fires on-demand to engage complex and simultaneous target sets. The C4ISR network enables the FCS NLOS-M fire control system to conduct semi- to autonomous computation of technical fire direction, automatic gun lay, preparation of the ammunition for firing and mortar round firing. Vastly improved handling, loading and firing systems will be another centerpiece of the NLOS-M. The mortar platoon will retain a dismounted 81mm mortar capability for complex terrain.

MV

The Treatment/Evacuation MV serves as the primary medical system within the UA. It will have two mission modules (evacuation and treatment). The time-sensitive nature of treating critically injured soldiers requires an immediately responsive force health protection system with an expedient field evacuation system. These functions will be accomplished by having an FCS MV-Evacuation (MV-E) vehicle, internally configured for casualty evacuation, and the MV-Treatment (MV-T) vehicle, internally configured for patient treatment, rapidly collect, stabilize



Common Systems

and transport casualties. These vehicles are designed to provide advanced trauma life support within 1 hour to critically injured soldiers. Both FCS MV mission modules will be capable of conducting medical procedures and treatments using installed networked telemedicine interfaces, Medical Communications for Combat Casualty Care and the Theater Medical Information Program. The MV-E and MV-T are integral variants of the FCS program that contribute to sustaining and generating combat power to the Future Force structure.

Demonstrating Concepts

To support the development of FCS MGV weapon systems, an FCS systems engineering tool was developed to leverage and transition technologies from the Crusader program into the FCS program. The NLOS-C System Demonstrator was built and sent to Yuma Proving Ground, AZ, to undergo firing and mobility assessments. The FCS team is using the System Demonstrator to evaluate the stability of a 155mm cannon firing from a 20-ton vehicle, demonstrate the weapon module's ability to execute rate-of-fire missions, cannon automation, gun point and control. A mobility evaluation will also be conducted on representative mobility technologies including hybrid electric drives and new band tracks representing common platform capability across all MGV platforms. FCS engineers will use collected data to correlate and improve vehicle concept models.

Another key to successful development of the MGV family is the unprecedented involvement of the warfighting community. Through the U.S. Army Training and Doctrine Command (TRADOC) Systems Manager, the FCS MGV effort relies heavily on subject matter experts to support the design decision process and the evaluation process. A full partner in MGV concept development and assessment, TRADOC plays a key role in assisting the materiel developer in achieving the MGV vision.

The MGV program is structured like no other vehicle development program from the past. The approach focuses on development of a family of vehicles that provide unmatched capability at the SoS level, sacrificing the optimization of any single platform to maximize synergy and warfighting benefit at the UA level. Heavy emphasis on logistics considerations provides significant reinforcement of the sustainment strategy and efforts to reduce the logistics footprint. In conjunction with new approaches to networked survivability and lethality, the MGV family will live up to its goal of providing the combatant commander a lighter, more lethal force able to engage decisively across the full spectrum of future conflict and focused on enabling Soldiers' capabilities.

The NLOS-C System Demonstrator fires its first round on Aug. 26, 2003, in support of firing and mobility assessments for FCS MGVs.

COL DONALD P. KOTCHMAN is the FCS Project Manager for UA Manned System's Integration. He holds a B.S. from the U.S. Military Academy, an M.S. in mechanical engineering from Rensselaer Polytechnic Institute and an M.S. in national resource strategy from National Defense University.

Unmanned Ground Vehicles

- Armed Robotic Vehicle (ARV)*
- Multirole Utility Logistics Equipment Vehicle (MULE)*
- Small Unmanned Ground Vehicle (SUGV)

* The Autonomous Navigation System (ANS) is the mission payload package that will be integrated on both the MULE and ARV to provide a robotic semiautonomous capability and on the MGVs to provide a leader-follower capability.

FCS Family-

Manned Ground Vehicles

- Infantry Carrier Vehicle (ICV)
- Command and Control Vehicle (C2V)
- Mounted Combat System (MCS)
- Reconnaissance and Surveillance Vehicle (RSV)
- Non-Line-of-Sight Cannon (NLOS-C)
- Non-Line-of-Sight Mortar (NLOS-M)
- Medical Vehicle (MV) (includes MV-Treatment and MV-Evacuation)
- FCS Maintenance and Recovery Vehicle (FMRV)

Unattended Sensors and Munitions

- Non-Line-of-Sight Launch System (NLOS-LS)
- Unattended Ground Sensor (UGS)
- Intelligent Munitions System (IMS)

Unmanned Aerial Vehicles

- Class I (Platoon)
- Class II (Company)
- Class III (Battalion)
- Class IV (Brigade)

-of-Systems

The Network

The network is the overarching system-of-systems that is the conduit of information knowledge and seamless connectivity for the entire unit of action.

Unmanned Aerial Vehicles —

Unmanned Aerial Vehicles (UAVs) are a core system in the FCS Family-of-Systems (FoS) enabling network-centric warfare and expansive knowledge-based operations throughout the unit of action (UA). The UAV systems provide reach, depth and persistence enabling the commander to integrate an aerial capability into high-risk operations beyond the tactical employment of manned assets. UAVs are especially suited for repetitive, dangerous operations or operations in potentially contaminated areas. This gives commanders the capability to employ different assets preserving the combat readiness of their manned systems.

Enabling Network-Centric Operations

COL John D. Burke

FCS UAV Roles

FCS unmanned systems serve three main purposes:

- Advanced intelligence, surveillance and reconnaissance (ISR).
- Communications relay.
- Air-ground or air-to-air cooperative engagement.

The FCS construct of network-centric systems reduces the importance of individual systems and raises the emphasis on common communications, computers, sensors, modeling/simulation, weapons, training and logistics. An individual UAV does not become an FCS Class of UAV until these common characteristics are integrated and tested in a system-of-systems environment.

In the ISR role, UAVs use a variety of sensors such as electro-optic, infrared or meteorological sampling while sending this data back to the networked system of communications and information sharing throughout the UA. The UAV sensors provide situational awareness through "eyes-on" operations, persistent observation of a target of interest or battle damage

assessment (BDA) after precision-strike operations.

The communications relay mode uses the Joint Tactical Radio System in one of its cluster configurations (Cluster 1, 4 or 5) with up to four separate channels. UAVs in this mode will use a combination of radios, data compression, networking waveforms and integrated communications systems compatible across the entire FCS FoS. In the communications-relay mode, the UAV serves the UA with real-time terrestrial communications while overcoming most terrain limitations. The UAV can be positioned to provide communications coverage as the command maneuvers or to provide an enabling capability to forward forces for shaping and deep-strike missions.

UAVs used in the air-ground and air-to-air mode demonstrate flexibility and adaptiveness beyond a single class of systems extending the reach of manned systems throughout the depth of operations. UAVs, when flown in conjunction with the Comanche helicopter, provide a one-two punch of lethal fires with a medium altitude capability for ISR or communications relay. UAVs conducting BDA missions provide a low-risk means to survey the situation, which enables the commander to determine whether or not further action is required and, if so, allows the commander to conduct a risk analysis to discern which assets should be employed against the target, given the enemy situation.

The UAV can be positioned to provide communications coverage as the command maneuvers or to provide an enabling capability to forward forces for shaping and deep-strike missions.

UAV Classes/ Acquisition Status

FCS UAVs consist of four classes as follows:

- Class I: Platoon
- Class II: Company
- Class III: Battalion
- Class IV: Brigade

The 2003 FCS source selection process conducted by the FCS Lead Systems Integrator (LSI), the Boeing Co. and its partner Science Applications International Corp., determined the only UAV selected was the FCS Class IV. The Firescout, a Class IV UAV, is a rotary-wing aircraft manufactured by Northrop Grumman in development with the U.S. Navy. The Army and Navy have entered into a Joint service partnership to cooperate on the Class IV UAV and other UAV experiences to advance the operational needs of both services. The Navy Firescout program is a key component of the Littoral Combat Ship program that will undergo initial operational test and evaluation in 2007.

UAVs provide a 21st-century capability essential to the overarching goal of a network-centric knowledge-based force.

The Army elected to defer development of a Class I UAV because the technology was not sufficiently mature to satisfy a requirement to "hover and stare." The Defense Advanced Research Projects Agency has a science and technology program supporting an advanced concept technology demonstration for U.S. Pacific Command with a vertical take-off and landing aircraft using a ducted fan technique. Should the ducted fan UAV mature, it will be inserted into FCS Increment I development.

The FCS Class II UAV was deferred in Increment I and is expected to mature and become part of FCS Increment II. The Class III UAV in Increment I was combined with the Class IV UAV during a 3rd quarter, FY03, HQDA decision review. As a result, the same UAV will be used at both the battalion and brigade levels.

UAVs will contribute immeasurably in FCS Increment I as they are employed in the UA's tactics, techniques and procedures. Integrated into the FoS through compliance with the FCS architecture, these UAVs provide a 21st-century capability essential to the overarching goal of a network-centric knowledge-based force.

COL JOHN D. BURKE is the Army Unmanned Aerial Vehicle Project Manager.

Testing the Future Force — A Transformation in Testing

Dr. C. David Brown

The test and evaluation (T&E) plan for Future Combat Systems (FCS) is unique and has four main components as follows:

- An evaluation strategy covering platform and individual systems to system-of-systems (SoS). It is based on decomposition of SoS missions to individual component capabilities and technical specifications.
- A test plan that is a highly integrated combination of modeling and simulation (M&S) and live, technical, operational and contractor and government testing.
- A highly capable and distributed SoS Integration Laboratory (SOSIL).
- All of the above are planned and will be directed and managed by a Combined Test Organization.

FCS is a family of advanced, networked air- and ground-based maneuver, maneuver support and sustainment systems. These systems are networked via a command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) architecture operating as an SoS that will network existing systems, systems already under development and new systems to meet the unit of action's (UA's) needs. The effectiveness, suitability and survivability of the FCS Family-of-Systems (FoS) and the SoS should exceed the sum of the capabilities of the individual systems. Therefore, FCS test and evaluation is based on an integrated plan that builds from individual system testing through SoS testing.

FCS operational testing will be conducted in the context of a UA operating in a field environment against a realistic OPFOR and per the O&O plan. The FCS evaluation will support the whole range of acquisition actions and decisions.

Evaluating FCS is unique because of its magnitude and scope and because it must address the capabilities of the individual FCS and the FCS FoS, as well as FCS contributions and their complementary systems to UA mission performance. In the great majority of acquisitions, the Army is only adding or replacing an individual system to an existing unit structure. In this case, the UA is being developed at the same time as its equipment. As always, FCS operational testing will be conducted in the context of a UA operating in a field environment against a realistic opposing force (OPFOR) and per the operational and organizational (O&O) plan. The FCS evaluation will support the whole range of acquisition actions and decisions.

The evaluation strategy for assessing FCS effectiveness, survivability and suitability (ESS) FoS is based on mission accomplishment. The strategy is underpinned by tracing how missions are decomposed into tasks that are enabled by capabilities that are provided by the materiel. ESS evaluation involves discerning whether the materiel is sufficient to enable completion of mission-critical tasks when set upon by elements within the operational environment such as the threat, terrain and weather. Underpinning the evaluation strategy with mission decomposition enables early detection of "gaps" in:

- FCS FoS capabilities.
- Identification of design attributes that should be sufficiently robust to enable performance in spite of a degraded state.
- Reinforcement of Manpower Personnel Integration considerations.

During the early stages of system development and demonstration (SDD), the continuous evaluation will primarily be enabled through M&S. As the program matures, these same M&S representations will be leveraged to support and interface with hardware technical and operational testing to provide data to support M&S verification and validation and to support the evaluation.

The FCS T&E plan is highly integrated in four ways. First, the FCS SoS is an integration of multiple systems. The acquisition and testing strategies are centered around the development of these individual systems and concurrent integration of them into an SoS.
The test plan is composed of seven integration and testing phases. These phases start with detailed designs and models (IP S1), through components and

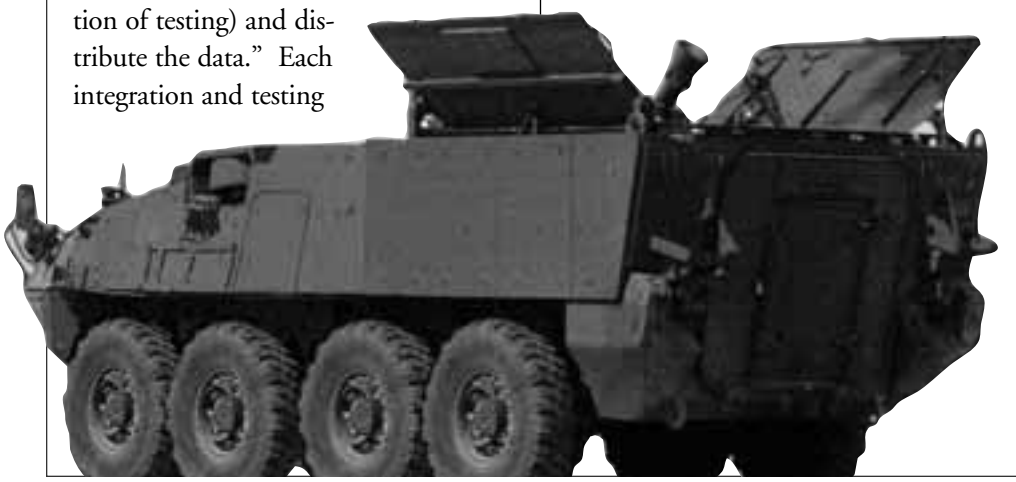
system-level models (IP S2), hardware prototypes (IP S3 and S4) and finally with production hardware (IP P1 and P2).

The second form of integration is synthetic (M&S) and live testing. A contiguous thread of M&S augmentation and support will be maintained throughout all testing. These M&S include representations of components, systems, forces (UA, unit of employment, Joint and opposing) and threats; scenario generators; environment simulators; synthetic stimuli and event controllers. These M&S will serve as input or nodes on the Systems Integration Laboratories (SILs) and SoSIL and wrap-arounds or players in Limited User Tests (LUTs), Force Development Test and Experiments (FDTEs) and the Initial Operational Test (IOT). Technical testing will use M&S to augment testing and will provide live data to support M&S verification and validation. A widely distributed synthetic environment known as the SoS Virtual Framework (SVF) will provide the SoSIL backbone to ensure that all connected simulations, models, emulations and hardware are stimulated and interact in a common environment.

The third way that FCS testing embodies integration is by integrating contractor and government testing throughout the entire acquisition. Every attempt has been made to "plan together, test once (meaning no duplication of testing) and distribute the data." Each integration and testing phase, as well as the technical field tests, involves jointly planned testing by the contractor and the government to examine SoS performance and system integration issues. An Integrated Qualification Testing (IQT) period is also planned. During this testing, system contractors will be conducting systems engineering verification testing to ensure that their designs and development prototypes meet the technical specifications.

Because this testing is often duplicative of Government Production Qualification Testing, integrated planning will ensure that this testing is conducted only once during this period. Integrated planning will also ensure that data used to verify specification compliance will feed the government's independent evaluation to support the Initial Production Decision (IPD). This same logic is used in planning an Integrated Verification Testing (IVT) of the initial hardware production as it is delivered to ensure that the manufactured hardware conforms to the accepted designs tested and evaluated during SDD.

Fourth, this test planning provides a strategy for technical and operational testing integration whenever and wherever appropriate. It is based on the assumption that Soldiers will be committed to FCS development and that a unit, when designated, becomes involved in all appropriate aspects of the combat development and acquisition processes at the appropriate time and place. This involvement includes being available to bring operational flavor to testing at appropriate opportunities and fully support the LUTs and IOT. Thus, Soldiers will conduct early user testing during the integration testing phases in the SoSIL by participating in user test (UT) scenarios that are oriented toward UA level and will eventually be accomplished in the IOT. This same integration will be accomplished as Soldiers are involved in the technical field tests and in the IQT and IVT.



Integrated testing will afford multiple opportunities to address many operational issues early and with a greater variety of environments and stimuli than the LUTs and IOT. The planned LUTs will be Army/Army Test and Evaluation Command controlled events with the primary purpose of addressing operational issues in realistic operational environments. Embedded instrumentation will capture additional technical test data, such as reliability, availability and maintainability, during all operational test events without hindering operational realism.

The testing and evaluation strategy is also based on an evolution of user and operational testing. Three LUTs will provide opportunities to test the FCS with increasing numbers of hardware prototype system assets and, finally, production hardware, in increasingly complex operational environments and scenarios that are structured toward UA employment as will eventually be executed during the IOT. The third LUT is configured to demonstrate — along with a proposed Army Certification Exercise (CERTEX) — Initial Operational Capability (IOC). An FDTE

The Stryker family of vehicles were designed to increase combatant commanders' mobility, lethality and battlefield survivability through networked battle command, long-range acquisition and targeting, and degradation of enemy detection and targeting capabilities.

is also planned following delivery of production hardware to provide an opportunity to refine and test the tactics, techniques, procedures and training prior to the IOT. Finally, the IOT is planned involving an FCS-equipped UA so as to properly represent the performance of this SoS-enabled, fully integrated unit in a selection of live operational environments and scenarios. These environments and scenarios are chosen so that they represent the most likely, and include some of the most stressful and unique missions, of those specified in the FCS O&O Plan. The IOT, along with another proposed Army CERTEX, will be used to demonstrate full operational capability (FOC) and support a full-rate production (FRP) decision. M&S will be used to expand the evaluation beyond the chosen scenarios.

The overall FCS survivability in the UA context will be a function of more than traditional ballistic and nonballistic individual platform vulnerability and susceptibility. The holistic survivability capabilities will be determined in terms of active and passive capabilities to see the enemy, maneuver out of contact and destroy the enemy at extended ranges or in close contact on our terms. The cornerstone enabling capabilities for survivability include networked battle command, integration of signature management, active and passive protection systems, Land Warrior, early and long-range acquisition and targeting, network lethality, obscurants, dash speed and degradation of enemy detection and targeting.

UA survivability is dependent on C4ISR as well as the munitions defeat mechanisms on the hardware systems. Therefore, significant information assurance and network stability, reliability and functionality testing are planned as part of the SIL and SoSIL as well as during technical field testing, LUTs, FDTE and IOT, to feed the effectiveness evaluation and survivability evaluation. The plan incorporates Title X Live Fire Test (LFT) within the survivability attachment because it contributes significantly to the ballistic vulnerability evaluation. LFT is applicable only to covered systems, which in FCS's case, are the manned ground systems. However, survivability testing and evaluation will be conducted on all systems and the SoS.

Finally, this plan has been developed by, and will be directed and managed by, a Combined Test Organization. This is an equal partnership of the FCS Program Management Office (PMO), Army Test and Evaluation Command, and Lead Systems Integrator (LSI) personnel. The organization supplants the traditional PMO test management and augments the ATEC and LSI top-level test management. Its goal is the most efficient testing through integration, combination and sharing. Integration has been described in detail previously. Test resources will be combined for time and cost efficiency and data will be shared completely. This organization will also see that developmental and operational testing are integrated as much as appropriate while still preserving the Title X specified independence. The Combined Test Organization's motto is: plan together, test once and share the data.

FCS is a cornerstone of Army transformation. It will be a unique capability that will be deployed and will function in nontraditional ways. The program management is unique because it must deliver an FoS, and an FCS-equipped unit as well. A unique T&E plan has been developed to ensure that requirements are being met as prescribed. As the Army transforms, so too must T&E.

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Intelligent Munitions System Integral to Networked Lethality

James C. Sutton

Like other outdated paradigms, the defensive, dumb, solitary killer landmine has no place in the Future Force. The Intelligent Munitions System (IMS) is an unattended munitions system providing both offensive battlespace shaping and defensive force protection capabilities for the Future Force. How? Networked lethality makes the difference. The IMS is a system of lethal and nonlethal munitions integrated with robust command and control features, communications devices and sensors and seekers that make it an integral part of the Future Combat Systems (FCS) network's core systems.

IMS provides unmanned terrain dominance, economy of force and risk mitigation for the warfighting commander. Typical missions include:

- Isolating enemy forces, objectives, and areas of decisive operations.
- Creating lucrative targets and engaging them or cueing other fires.
- Filling gaps in the noncontiguous battlespace.
- Controlling noncombatant movement with its nonlethal capabilities.

With its reduced footprint, IMS can be delivered by various means and, once on the ground, locate itself, organize all of its components and report its location to the Battle Command Mission Execution (BCME). It will be under positive control of the BCME, one of the FCS command and control applications. The munition field can be armed, turned off to allow friendly passage, then rearmed to resume its mission.

The Intelligent Munitions System is a system of lethal and nonlethal munitions integrated with robust command and control features, communications devices and sensors and seekers that make it an integral part of the Future Combat Systems (FCS) network's core systems.

This on-off-on capability allows it to be recoverable, further reducing its logistics footprint. IMS will not become a residual hazard; it will self-destruct on command or at a preset time interval. It will also be tamper resistant.

As part of FCS's networked lethality, IMS provides target engagement without latency, cues other networked munitions like the Non-Line-of-Sight Launch System (NLOS-LS), and supports situational awareness (SA). FCS unattended ground sensors (UGS) also support SA. IMS and UGS will often be employed together. Additionally, it makes good business sense to seek acquisition economies. For these reasons, development and acquisition of IMS and UGS are coordinated as described below.

The IMS program, like the other unattended munition, NLOS-LS, has a management structure tailored to its risks. IMS is managed by the Project Manager Close Combat Systems (PM CCS) under the Program Executive Officer for Ammunition. The IMS team relies on the Lead Systems Integrator to complete the physical and network integration in the FCS architecture and to ensure the network is extended to include IMS and NLOS-LS. Operating under empowering memoranda of agreement, the IMS team's primary organizational link to FCS overall program management is through the Lethality Integrated Product Team (IPT). (See "FCS-Equipped UA Complementary and Associate Programs" on Page 22 for more information.) Close and continuous contact is also maintained with the Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance IPT because of the overriding importance of networked lethality and the contribution that IMS can make to SA. Another memorandum of agreement between PM CCS and Project Manager Night Vision/Reconnaissance, Surveillance and Target Acquisition ensures the coordination of IMS and UGS programs. Within the IMS program,

daily execution of tasks is managed by a multidisciplinary IPT. In addition to the functional disciplines, technical expertise from several Army activities is included to address munitions, sensors, command and control and communications technologies.

As a risk reduction measure and to maintain competition, two best-of-industry teams are currently in an IMS competitive development phase. This phase will culminate in a down selection based in large measure on integration into the FCS Family-of-Systems. To this end, each team is maximizing modeling and simulation within its respective System Integration Laboratory. Outputs from these will feed the FCS System-of-Systems Integration Lab.

The IMS, an integral part of FCS, will be delivered by multiple means and operate across the full spectrum of operations to provide immediate engagement and unattended area denial effects — scaleable nonlethal and lethal munitions that deny enemies the use of an area.

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FCS Spiral Development and the S&T Community

George J. Mitchell

FUTURE COMBAT SYSTEMS
FCS
One Team-The Army/Defense/Industry

The Program Manager (PM) Future Combat Systems (FCS) will use spiral development to bring forward subsystems and other enabling technologies that require maturation before inserting them into the system architecture. In the FCS Acquisition Decision Memorandum (ADM), the Under Secretary of Defense for Acquisition, Technology and Logistics (USDAT&L) addresses DOD's thrust with evolutionary acquisition and its goal to shorten development time for delivery of military capability. The use of a spiral development strategy for FCS is intended to deliver to the user desired capability sooner rather than waiting for a future increment. The ADM continues by stating that the "... program must remain flexible and open to accommodate [system] trades ... with the objective of providing an effective, affordable, producible and supportable increment of military capability."

These statements from the USDAT&L are consistent with DoDI 5000.2, *Operation of the Defense Acquisition System*, which states that the goal of evolutionary acquisition (including spiral development) is to balance needs and available capability with resources. It further states that success of the strategy depends in part on the maturation of technologies.

To fold these systems into the FCS, the Program Management Office (PMO) was charged with crafting a strategy to spiral forward specific subsystems and technology opportunities into FCS Increment I. For PM FCS, the challenges associated with managing technologies and associated resources meant that the FCS architecture must be developed now to allow room for system growth and spiral insertion of the subsystems and technologies in the future. As technologies

mature, they must be developed to meet such limits as volume, weight and power and fulfill user performance requirements and Army cost targets. This effort requires continuous communication between the system designers, technology program managers and the user representatives.

Generally, the process for spiraling technology into the FCS, as described in the FCS Program Management Plan, conforms to the following steps:

- Identify potential payoff technology.
- Prepare incremental development plan for approval.
- Assess ability to incorporate with respect to technology maturity and program schedule.
- Prioritize against Army requirements.
- Resource.
- Plan production break-in point/ retrofit plan.
- Execute plan for integration.

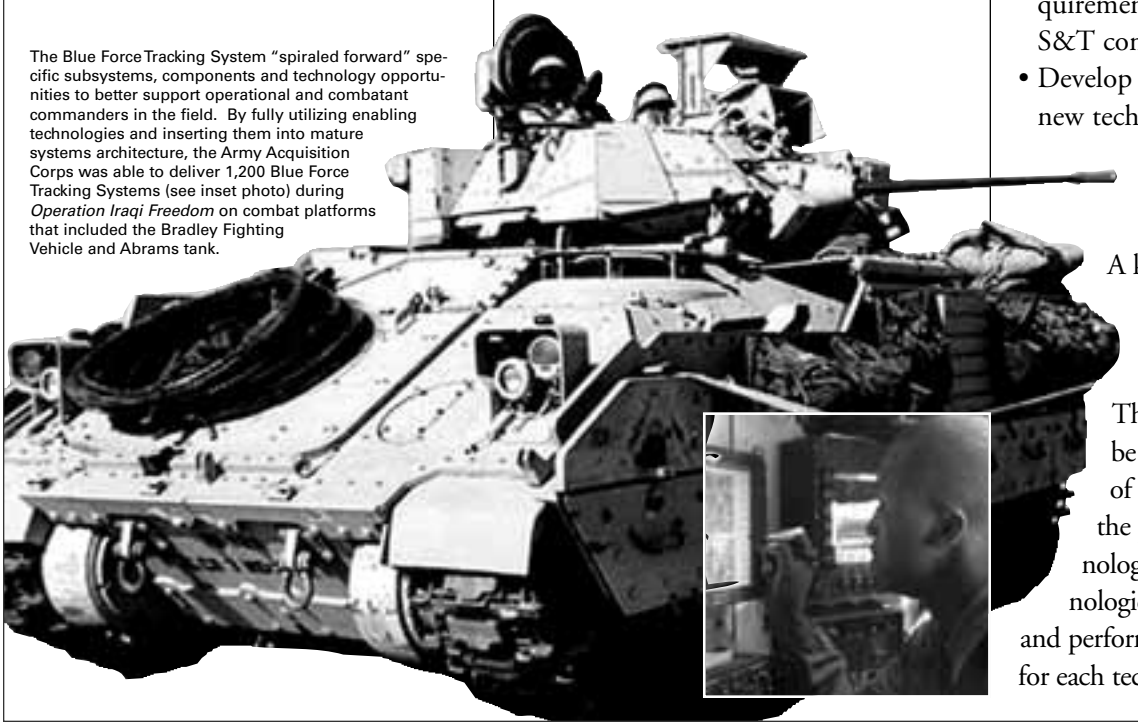
Again, not all technologies will be ready for integration when desired because of actual technical maturity and resource availability. As a result, the FCS program management team and the U.S. Army Training and Doctrine Command (TRADOC), as part of the program review process, remain open to deferring requirements to later spiral opportunities or FCS increments.

To perform the mission of managing the spiral development process, a Spiral Development and Technology Planning Integrated Product Team (IPT) was formed as the FCS program entered into system development and demonstration (SDD). This PM FCS and Lead Systems Integrator (LSI) co-chaired IPT is made up of representatives from the U.S. Army Research, Development and Engineering Command (RDECOM); the TRADOC Unit of Action Mission Battle Lab and PM FCS, with input provided by the Deputy Assistant Secretary of the Army for Research and Technology (DASAR&T), Army G-8, TRADOC Deputy Chief of Staff for Development and HQ RDECOM. The IPT also examines the possible integration of foreign-made technologies while focusing on the importance of interoperability between U.S. equipment and that of its potential allies. The responsibilities of the IPT include:

As technologies mature, they must be developed to meet such limits as volume, weight and power and fulfill user performance requirements and Army cost targets. This effort requires continuous communication between the system designers, technology program managers and the user representatives.

- Identify, evaluate, focus and recommend new technologies for insertion into FCS.
- Coordinate and support the process to identify and mature systems not currently in the FCS baseline until ready for transition.
- Coordinate the process of providing endorsements and recommendations to Army science and technology (S&T) management.
- Communicate FCS technical requirements and architectures to the S&T community.
- Develop analytical assessments of new technologies.
- Develop technology transition agreements.

A key IPT product is the program Technology Development Strategy (TDS) that is currently under development. This document — which will be modified throughout the life of the program — details how the program is divided into technology spirals, at what point technologies are planned for insertion and performance and test plan criteria for each technology spiral.



The Blue Force Tracking System "spiraled forward" specific subsystems, components and technology opportunities to better support operational and combatant commanders in the field. By fully utilizing enabling technologies and inserting them into mature systems architecture, the Army Acquisition Corps was able to deliver 1,200 Blue Force Tracking Systems (see inset photo) during *Operation Iraqi Freedom* on combat platforms that included the Bradley Fighting Vehicle and Abrams tank.

Technologies that support and provide desired FCS capabilities are pursued throughout the entire S&T community. From its beginning with technologies developed by the Defense Advanced Research Projects Agency, FCS has evolved into an Army program. FCS now relies heavily on Army S&T community efforts to bring technology to a desired maturity level for system integration. Additional technology sources include other Army and military programs, industry and academia. These S&T efforts result in both primary FCS components as well as enablers to the various program elements. Key to successful technology integration is the interaction between the S&T PM and the FCS IPT that is formalized within a technology transition agreement.

As previously stated, the technology maturity and the timing of reaching the desired technology readiness level of 6 or greater are important, and by necessity are, tied to the planned insertion point documented within the TDS. Evolving from TRADOC force operating capabilities and determined capability gaps, the S&T community creates developmental efforts and applies resources such that materiel fill to a capability gap is developed to meet desired program schedules.

> The IPT examines the possible integration of foreign-made technologies while focusing on the importance of interoperability between U.S. equipment and that of its potential allies.

An important process performed within the PMO is providing Army S&T management endorsements and recommendations to ongoing and planned research and development efforts. This process entails analysis of current and potential S&T efforts that might fulfill an FCS materiel need. This is important because FCS requires the rapid maturation and integration of selected technologies throughout its evolutionary acquisition. For each technology opportunity, PM FCS assesses FCS architecture impact and architecture integration ability and examines technology affordability. This analysis ensures that all FCS technology is mature before insertion into the design of a particular FCS increment. This analysis is provided to the S&T community in the form of recommendations and potential endorsement of the effort.

> Key to successful technology integration is the interaction between the S&T PM and the FCS IPT that is formalized within a technology transition agreement.

PM FCS recommendations and endorsements are incorporated into management forums that are run by TRADOC and DASAR&T. These forums include Warfighter Technical Councils and Army S&T Working Group reviews. These reviews ultimately solidify a funded portfolio of technology projects for each fiscal year focused on identified capability gaps in the FCS program and other Army programs.

In summary, the key to PM FCS' technology management success is application of sound principles and processes, which include:

- Sustaining a collaborative relationship with the S&T community for future FCS concepts and technologies.
- Designing technology integration points into the evolutionary acquisition strategy or as part of an increment based on business case analysis.
- Testing promising technologies in relevant environments in coordination with the Army's Battle Labs.
- Assessing and developing risk-mitigation plans for higher risk technologies.
- Assessing producibility of technologies.
- Implementing the technology through deliberate integration points.

By thoroughly integrating these principles and processes as part of the spiral development strategy, PM FCS will be able to provide effective, affordable, producible and supportable military capability to combatant commanders ensuring greater lethality, survivability and sustainability on the battlefield than ever before.

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Transitioning Technology to PM FCS

Dr. James C. Bradas, Edward Brady
and COL Herbert M. Carr (USA, Ret.)

Historically, the jump from 6.3 to 6.4 funding has been the most difficult for a new program. Numerous transition issues can contribute to this difficulty, but the maturity of technology at Milestone B (MS B) and its readiness to transition into development has frequently been a fundamental cause of cost, schedule or performance anomalies. The Technology Readiness Assessment (TRA) and its service-level feeder document, the Technical Maturity Assessment (TMA), are management tools designed to establish a new program's technical fitness prior to MS B approval and to identify high-risk critical technologies before significant developmental investment is made.

To this end, the Future Combat Systems (FCS) Increment I TMA was completed and the TRA was subsequently forwarded to, and approved by, the Office of Secretary of Defense's Director of Defense Research and Engineering. As supporting documentation for MS B, the TRA contributed to a successful milestone decision resulting in a $15 billion FCS program. The TMA was researched and completed by the FCS Science and Technology (S&T) Integrated Product Team (IPT) from April 2002 to March 2003.

> There are a few key ingredients to a successful TMA — a clear definition of CTs, a comprehensive database of source technologies and solid criteria applied as objectively as possible to assess technology maturity.

Chartered by the Deputy Assistant Secretary of the Army for Research and Technology and Program Manger (PM) FCS, the FCS S&T IPT was formed with key technical representatives from each of the major research and development centers and labs; the FCS Lead Systems Integrator (LSI); Defense Advanced Research Projects Agency; Army Materiel Systems Analysis Activity; Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology; and U.S. Army Training and Doctrine Comamnd (TRADOC), including the Unit of Action (UA) Maneuver Battle Lab (UAMBL). The IPT was co-chaired by Dr. James Bradas, Aviation and Missile Research, Development and Engineering Center (AMRDEC); and Edward Brady, Strategic Perspectives Inc. The first challenge faced by the IPT members was to answer these key questions:

- What process should be used by the IPT to evaluate FCS technologies?
- How should the critical technologies for the FCS System-of-Systems (SoS) be defined?
- What criteria/tools should be used to accurately and consistently determine technology maturity?
- What determines the technology program's readiness to transition into development?

Process

Figure 1 defines the process followed by the IPT. Early efforts focused on evaluating key technologies identified by the LSI during the proposal phase that were clearly needed to realize the UA requirements. The LSI had gone through a structured technology search and winnowing process starting with more than 3,000 technologies in May 2000 and ending with more than 700 technologies in June 2002. From these technologies, a key set of 40 and a super set of the 15 most important technologies were selected for initial IPT evaluation. The evaluation's result was to bin the technologies into Increment I or Increment II according to the technology maturity/readiness level.

Later, as the FCS Operational Requirements Document (ORD) emerged and key performance parameters (KPPs) were defined, the IPT established the critical technologies (CTs) definition. Applying that definition against available technologies produced source technologies required for Increment I FCS. The subsequent evaluation of these CTs was recorded in the TMA.

Figure 1. Technology Assessment Process

Definitions

There are a few key ingredients to a successful TMA — a clear definition of CTs, a comprehensive database of source technologies and solid criteria applied as objectively as possible to assess technology maturity. For the FCS S&T IPT, the CT definition was structured as follows:

- Technology must meet the FCS system operational requirements. If it doesn't meet the necessary criteria, UA effectiveness will be significantly degraded if technology is not available. Technology absence will result in significant impacts to the overall SoS concept.
- Technology, or its application, is either new or novel.

The CTs were generated by specifying the technology required to achieve the seven FCS KPPs. There are 31 CTs, for which there are 77 source technologies/programs. These were evaluated using several tools, primarily the technology readiness level (TRL), that apply to different aspects of technology maturity.

Tools

Although a primary technology assessment tool, the TRL, as defined in DoD 5000.2-R (for both hardware and software) is a necessary but insufficient measure of transition readiness for a technology program. These TRL definitions provide a structured standard to assess technologies. However, the IPT found that different S&T communities have different cultures and thought processes when addressing maturity of their particular type of technology, making TRL assessment standardization difficult.

> The IPT found an assessment tool that does focus on producibility issues and shows promise as a check sheet to help coordinate the transition of technologies from S&T to system design and development.

One method for increasing objectivity is to group the table definitions into a spreadsheet using common parameters that are evaluated separately. The parameters used included hardware status, integration level, test/demonstration type, simulation/modeling and environment. As an example, using the parameter "environment," "laboratory" is TRL 4 or lower, "high-fidelity laboratory" is TRL 5, "simulated operational environment" is TRL 6 and "operational environment" is TRL 7 or higher. When examined in this manner, not all aspects of a technology program will achieve the same TRL, generating a fractional but more objective overall TRL. As useful as it is, however, the TRL does not measure

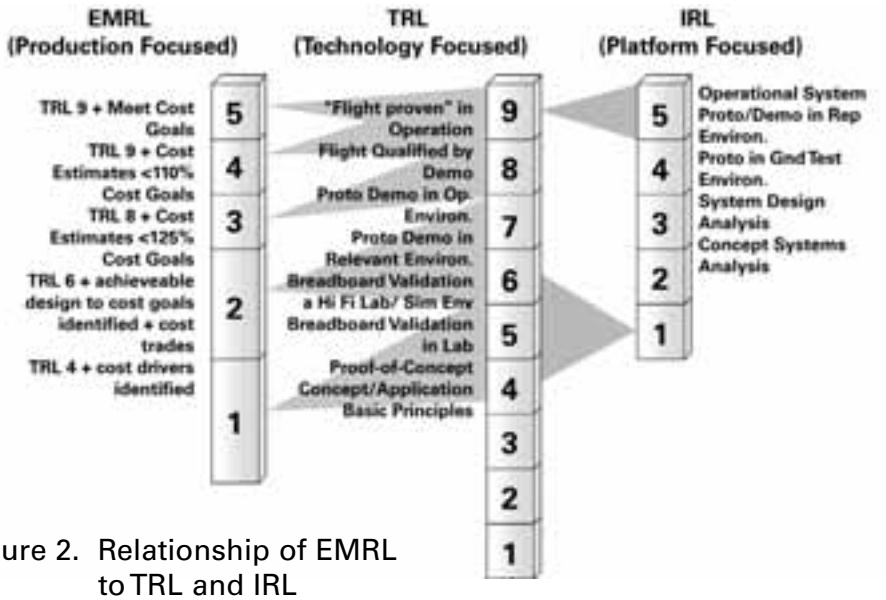

Figure 2. Relationship of EMRL to TRL and IRL

technology program integration readiness, interoperability or producibility.

The IPT found an assessment tool that does focus on producibility issues and shows promise as a check sheet to help coordinate the transition of technologies from S&T to system design and development (SDD). Known as the engineering manufacturing readiness level (EMRL), this detailed tool looks at design-to-cost, tooling and special test equipment and all aspects of design including systems engineering requirements and trade-off studies, processes, materials and facilities required. AMRDEC's Engineering Directorate at Redstone Arsenal, AL, has defined this metric tool with great precision and uses the tool to help PMs correct deficiencies in their program preparation before MS B. Designed to be used at the component level, the EMRL can also be used at the system level as an indicator of program maturity. Figure 2 depicts the relationship of the EMRL to the TRL and the integration readiness level (IRL).

The IRL has limited utility when assessing technology programs transitioning to SDD as TRL 6 corresponds to IRL 1. To achieve anything higher, the program would have to be in SDD and have completed a preliminary design review (PDR). Thus, the IPT did not attempt to establish any IRL ratings.

Technology Transition

IPT members looked at three technology transition types to better define readiness for transition into early SDD:

- An advanced technology demonstration, technology demonstration or advanced concept technology demonstration transitions directly into a specific program.
- A pre-planned product improvement.
- Technology maturation.

> Currently, technology centers produce the technology but don't necessarily focus on *transitioning* that technology to other programs.

Normally, the close association of the SDD PM required in Types 1 and 2 greatly improves the probability of good dialog and teamwork with the Science and Technology Objective Manager/Technology PM. However, few formal technology transition plans were uncovered during the IPT technology review. Technology transition coordination for Type 3 is more difficult because the SDD PM would normally be identified after the capability is put on the shelf. Here, transition would start after most of the early decisions had already been made concerning form, fit and function, thereby complicating the design, integration and test process.

It became evident during the IPT that more emphasis was needed to orient the S&T community toward transition issues to better streamline technology insertion. Currently, technology centers produce the technology but don't necessarily focus on *transitioning* that technology to other programs. Steps that could help correct this oversight include:

- Requiring early coordination between Technology PMs and SDD PMs to include collaboration on program risks, execution plans, transition plans, integration issues and test/demonstration schedules.
- Establishing formal memorandums of agreement to define responsibilities for all including the Technology PM, SDD PM, user and contractor.
- Performing detailed joint examinations of technology maturity using the aforementioned management tools to reduce the probability of expensive surprises once the program transitions into SDD.
- Blocking schedules into increments based on technology maturity and planning for insertion of less mature technology in later blocks.

A detailed "how-to" handbook to guide the Technology PM and SDD PM Team would go a long way to facilitating these goals. However, *A Manager's Guide to Technology Transition In an Evolutionary Acquisition Environment: A Contact Sport* (August 2002) is an excellent interim publication that can be used now.

The FCS S&T IPT took a detailed look at the state of technology available to realize the Army's desired future combat capabilities and recorded the CTs required and their maturity levels in the TMA. Bottom line: the necessary technology for Increment I exists and will transition, but not without risk. Transitioning that technology from the technology base into development will be a complicated but achievable task that will help transform our Army for the future. A key lesson learned by the FCS S&T IPT is that the S&T community needs to begin to pay as much attention to *transitioning* their technology as they are in making the technology work. To this end, coordination and cooperation between the Technology PM and future project/product managers, users and contractors is crucial to prepare programs for success. Excellent assessment tools are available to provide managers the metrics they need to plan and execute programs. In short, what gets measured gets done.

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RAVEN — New Gun Shakes up FCS

Dr. Eric Kathe, Henry Nagamatsu and Joseph Flaherty

FUTURE COMBAT SYSTEMS FCS One Team-The Army/Defense/Industry

Packing lots of punch in small packages is a succinct description of the armament requirements for Future Combat Systems. During the past 3 years, a new gun propulsion method has been discovered, analyzed, patented and fired that may usher in a new era of lightweight weaponry. Termed RAVEN for RArefaction waVE guN, it achieves this by decimating the core engineering challenges to lightweight gun integration — recoil and thermal management.

The RAVEN Principle

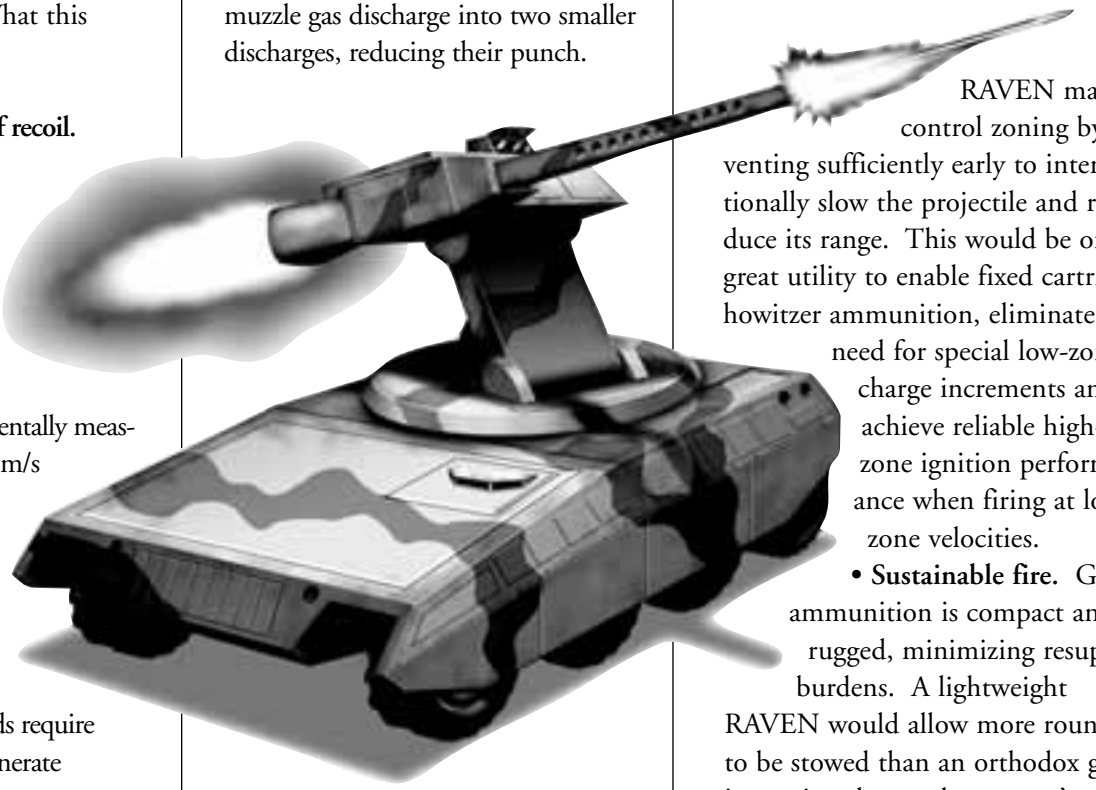
If the breech of a gun's chamber is suddenly opened while the bullet is being propelled through the bore, a delay time will occur before the pressure loss in the chamber can be communicated forward to the bullet's base. Thus, it is possible to trick the bullet into thinking it is being fired from a closed breech gun when it is not.

How RAVEN Works

When the breech is vented, the pressure in the chamber plummets. This pressure loss propagates through the

bore at the same speed that a sound wave would. This phenomenon is termed a rarefaction wave or "thinning of gases" as pressure is lost. If the venting is timed so that the bullet exits the muzzle before the bullet can "hear" the venting, no loss in muzzle velocity will occur. The gases vented from a RAVEN's breech are driven through an expansion nozzle. This nozzle cools and depressurizes the gases as they are accelerated to high rearward velocities generating thrust. This thrust dramatically reduces the recoil energy imparted to the cannon. What this achieves follows:

- **Reduction/elimination of recoil.** RAVEN firing of a tank round such as the 1,650 meters per second (m/s) M829A2 is anticipated to eliminate 95 percent of the recoil energy. More than 80 percent has been experimentally measured when firing a 1,150 m/s NATO standard 35mm Oerlikon round from a RAVEN, while 75-percent reductions are anticipated for a high-zone 686 m/s howitzer. Theoretically, faster rounds require more propellant gas to generate more thrust.
- **Double the firing rate.** Hot propellant gases heat up guns during firing. Removing these gases from the bore before the bullet exits the gun dramatically reduces barrel heating. With reduced heating, greater burst fire may be achieved and a higher firing rate sustained without overheating the barrel. RAVEN also reduces blow-down duration and recoil cycle time. Further, RAVEN has demonstrated that it can be engineered to pneumatically blow out the cartridge case, eliminating the extraction sequence for cased munitions.
- **Reduced blast.** When guns fire bullets, only about 30 percent of the energy released is imparted to the bullet. Most of the remaining energy is manifest as muzzle blast. RAVEN favorably alters this balance between bullet energy and blast energy by leveraging a large portion of the remaining energy to drive a recoil compensating jet. This reduces the energy available to generate blast and signature. Further, cooling and depressurizing the gas reduces the propensity for secondary flash. RAVEN then splits orthodox muzzle gas discharge into two smaller discharges, reducing their punch.



- **Enables lightweight cannons.** Guns remain heavy, despite advances in material technology, for two principal reasons: their thermal mass is required to manage the heat generated during burst-fire; and their inertia aids in recoil management. Lighter guns "kick" harder during firing than heavier guns. Exploratory development and firing of a 350-pound 5-inch gun for the Navy (program Fire-Box) has proven successful at a 10-fold reduction in barrel weight, but system integration is impractical. Reduction of recoil and barrel heating are the keys to enabling lightweight guns.
- **Infinite zoning.** Although RAVEN's focus has been applied to venting sufficiently late so that the bullet velocity is unaffected, advantages may be realized by venting earlier. Further reductions in recoil and barrel heating may be realized, although with some loss in muzzle velocity. Taken to a logical extreme, control of the muzzle velocity may be achieved.

RAVEN may control zoning by venting sufficiently early to intentionally slow the projectile and reduce its range. This would be of great utility to enable fixed cartridge howitzer ammunition, eliminate the need for special low-zone charge increments and achieve reliable high-zone ignition performance when firing at low-zone velocities.

- **Sustainable fire.** Gun ammunition is compact and rugged, minimizing resupply burdens. A lightweight RAVEN would allow more rounds to be stowed than an orthodox gun increasing the combat system's staying power.
- **Clean chamber.** The advantages of caseless ammunition have been appreciated for decades. The disadvantages include the tradeoff between a rugged and combustible case construction and beach closure methods that are fast and those that tolerate residue. RAVEN achieves a rearward supersonic blow-down within the chamber, entraining and flushing burning embers, firing residue and any debris present in the gun.

Implementation Challenges

Integration of RAVEN technology requires two challenges to be met — vent mechanics and gun system integration that accommodates back-blast. Many methods may be conceived to vent the chamber of a gun during the interior ballistic cycle. The most reliable approach engineered thus far has been a blow-back, bolt-operated RAVEN, inspired by guns such as the M3A1 0.45 caliber "grease gun." In this system, the breechblock is free to recoil rearward within an extended chamber. By altering the breechblock's weight and the distance required to uncork the back of the gun, vent timing may be engineered to occur when required.

Experimental testing of a 35mm RAVEN demonstrated complete vent reliability with a standard deviation in vent timing of less than 1 percent. Since the venting mechanism is directly driven by the same propellant gases that are concurrently driving the bullet down the bore, this approach is robust.

Alternative approaches include directly coupling the recoil of a light gun barrel within a mount to open the vent, balanced chamber valves and active burst disks. Nonrecoil-based approaches may be anticipated to "misfire" on rare occasion, perhaps one in 10,000 shots. For RAVENs with less than 100-percent vent reliability, the gun barrel must be free to recoil rearward within the mount. Technologies analogous to the engineering of "crumple zones" in automobiles may be applied to ameliorate these rare failures without catastrophic consequences.

More development is essential in this area to mature RAVEN into a formidable weapons platform. Analysis and experimental findings to date have not surfaced any insurmountable barriers to achieving a reliable and useful weapon system.

Virtually all armament technologies generate blast. Orthodox guns generate formidable muzzle blast. The incorporation of muzzle brakes to manage recoil redirects the muzzle "blast back" at the vehicle, generally making "hatches-open" operation impossible without violating the requirements of Military Standard 1474D, *Noise Limits for Army Materiel*. Nevertheless, orthodox gun blast always emanates from the muzzle. This is a most familiar and comfortable configuration because it allows the gun's breech to recoil within the turret. However, this comes at the price of consuming precious under armor swept volume.

External guns such as the 105mm Stryker mobile gun system and 175mm M107 gun allow for convenient and direct integration of a RAVEN. Oscillating turrets, such as the French 75mm AMX-13, also provide for convenient nozzle integration. External guns are amenable to RAVEN because they enable longer recoil strokes without costly under armor volume consumption.

Precedents for back blast abound. Firing missiles or rockets generally results in a large back-blast zone, exceeding that of prior-art recoilless rifles. Such systems have been combined with infantry since the days of the 106mm M50 Marine Ontos and continue to this day with the M3A3 Bradley Tube-launched Optically tracked Wire-guided missile and Multiple Launch Rocket System. Although it can be said RAVEN has less energy to drive blast, our understanding of this blast and means to mitigate the consequences is immature. Focus thus far has been placed on understanding and validating RAVEN's interior ballistic performance. With validation complete, focus may now be applied to design challenges.

Meeting the Objective Force's combined lethality, deployability and sustainability requirements entails revolutionary armament technology. Combined with advances in composite material technology, RAVEN promises to reduce gun system weights by factors of two or more. It will virtually eliminate recoil kick to stop shaking up our combat systems.

DR. ERIC KATHE is an Engineer at the U.S. Army Tank-automotive and Armaments Command's Armament Research, Development and Engineering Center's Benet Laboratories located at the Watervliet Arsenal, NY. He leads the future armaments concepts team and holds several patents on gun technology. He earned his Ph.D. from Rensselaer Polytechnic Institute (RPI) on the interior ballistics of guns.

HENRY NAGAMATSU is an active Professor Emeritus at RPI. He was the Hypersonic Laboratory Director at General Electric Global Research Laboratory. He earned his Ph.D. at the California Institute of Technology. He is an American Institute of Physics and American Institute of Aeronautics and Astronautics fellow.

JOSEPH FLAHERTY is the Dean of the School of Science at RPI. He is a fellow and Vice President of the U.S. Association for Computational Mechanics, and the recipient of an IBM Director's Award and an Army Service Recognition Award. He earned his Ph.D. at the Polytechnic Institute of Brooklyn.

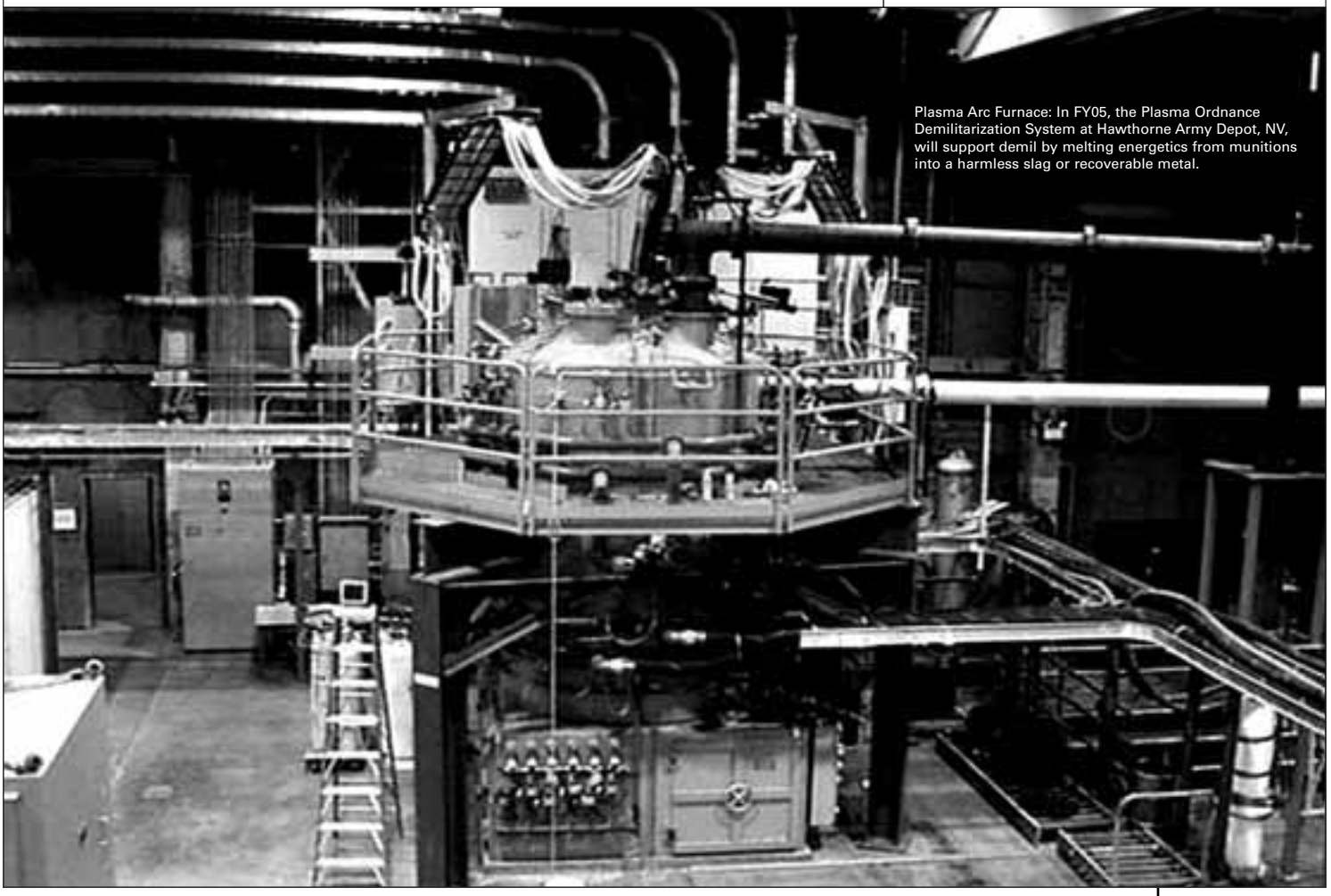
Transforming Conventional Ammunition Demil

LTC Kevin Jennings and Larry Gibbs

FUTURE COMBAT SYSTEMS
FCS
One Team-The Army/Defense/Industry

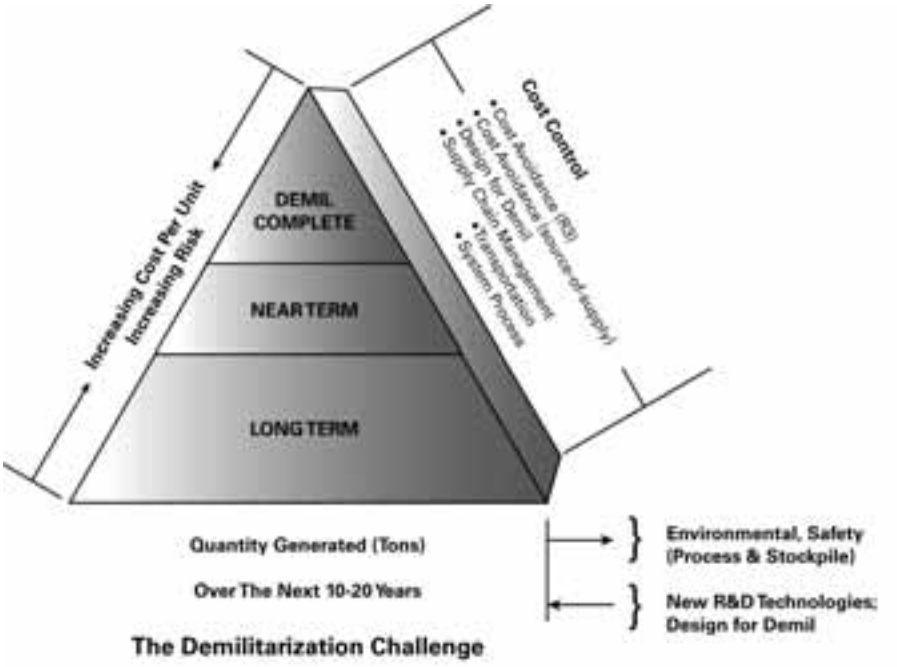
By the end of August 2003, the demilitarization (demil) stockpile stood at 367,619 tons, with a liability to the American taxpayer of more than $1.4 billion. These figures may be on the low side because they do not include Army missiles or excess ammunition in Korea, Europe and Southwest Asia. Korea's stockpile alone stands at more than 97,000 tons. Today, the demil stockpile is about 20 percent of the total DOD CONUS depot stockpile (30-percent Army), but is forecasted to leap to about 52 percent by FY09. The dramatic change is due to the projected demil of Army missiles and other service items nearing the end of their shelf life.

Since the early 1990s, DOD has grappled with how to handle the demil stockpile, which has hovered around the 400,000-ton mark for more than a decade with no apparent relief in generations of excess, unsafe, obsolete or unserviceable ammunition. During FYs 95-00, DOD funded demil an average of nearly $94.5 million annually, but the stockpile still experienced growth despite the Herculean effort to reduce tonnage. In 1996, the Army set a goal to reduce the demil stockpile to less than 100,000 tons by FY10. This goal is no longer achievable because of inadequate funding; higher



Plasma Arc Furnace: In FY05, the Plasma Ordnance Demilitarization System at Hawthorne Army Depot, NV, will support demil by melting energetics from munitions into a harmless slag or recoverable metal.

demil cost to meet mandates for environmental compliance; decreasing reliance on open burning (OB) and open detonation (OD) processes; increasing closed disposal technologies (CDT) and resource, recover and recycling (R3); and the need for more research and development (R&D) technologies to enhance existing capabilities. We are still generating more ammunition than we are destroying — a liability that hinders warfighter readiness and our environment. Although little headway has been gained with reducing the stockpile, the demil community, led by the Joint Munitions Command (JMC), can boast that it substantially reduced reliance on OB/OD from 88 percent of funds in FY92 to 78-percent (funds) reliance on CDT and R3 processes combined in FY02.



The Demilitarization Challenge

Demil challenges are considerable and illustrated in the adjacent pyramid. The complexity of the demil stockpile spans low-cost/low-risk operations at the top of the pyramid to high-cost/high-risk operations at the base. Demil will most likely experience cost growth as the "low-hanging fruit" yields to more complex munitions and demil processes not yet known. Expanding environment, health and safety requirements add to the challenges but will be offset by the transition of R&D technologies and upfront ammunition design and life-cycle management that fully considers demilitarization. Private industry will continue to participate and invest in demil execution and R&D efforts as long as financial benefits provide sufficient incentives and mitigate expected risk.

We are still generating more ammunition than we are destroying — a liability that hinders warfighter readiness and our environment.

The Army's solution to these complicated challenges and problems was to establish a Product Manager for Demilitarization (PM Demil) Office and transition demil from a logistics function to an acquisition-centric program. On Dec. 6, 2002, the Army Acquisition Executive (AAE) affirmed the need for acquisition management of the DoD conventional ammunition demil program. The genesis of PM Demil was the transfer of the DoD Single Manager for Conventional Ammunition (SMCA) Executor mission from the U.S. Army Materiel Command to the Program Executive Office for Ammunition (PEO Ammo) in April 2002. Subsequently, the AAE approved a PEO Ammo and JMC Implementation Plan to pave the way forward for transforming demil. The implementation plan provided the impetus for establishing an acquisition-managed program — PM Demil — and developing a strategic plan.

PM Demil strategic planning evolved from PEO Ammo guidance to establish a plan using the Six Sigma process concurrent with performing other transition activities. A Demil Strategic Plan Integrated Process Team (IPT) was chartered in late April 2003, which laid the foundation for a healthy and creative business enterprise focused on long-term success. Continuous coordination, cooperation and communication were of utmost importance to the process given the IPT's Joint character. In a time-constrained environment, the team had to focus on the end state. The IPT was involved in all plan aspects, including PM mission and vision, strategic goals and enabling objectives, performance measurements (metrics), process mapping, plan definition and content and other planning activity. After just 4 short months, PEO Ammo approved the plan Aug. 1, 2003. The demil mission, challenges and framework were clearly defined, laid out and accepted.

Mission

Recently, PM Demil's responsibility expanded with the addition of Army Missile Demil effective FY04 through *Program Budget Decision 123*

(November 2002). In addition, the AAE concurred with the September 2003 draft SMCA policy changes to DoD Directive 5160.65 and DoD Instruction 5160.68 directing the Army to perform and fund the demil mission for *all* conventional ammunition including military service-retained items such as guided projectiles, submunitions and torpedoes. These decisions were significant in that they consolidated the demil program and made the Army the executive agent. The demil challenges are unique in the acquisition realm and are nothing like a "normal" weapons systems program.

Demil is accomplished OCONUS and primarily at 13 Army activities including our arsenals, depots, munition centers and ammunition plants. These sites have historically relied on OB/OD and incineration destructive processes for demil, but are now moving to more environmentally friendly CDT and R3 processes as demil R&D technology programs discover alternatives to OB/OD. To complement organic operations, the Army currently relies on two prime contractors — Parsons Brinkerhoff/ NAMMO Demil LLC and General Dynamics-Ordnance and Tactical Systems Inc. These commercial partners will execute a 5-year indefinite delivery, indefinite quantity demil contract. The commercial contractors, with their subcontractors (including contracts with government activities), typically demil about 50 percent of the annual requirement.

Autoclave Meltout: An autoclave operator lowers projectiles into a pressure vessel where steam will melt out explosives that can be reclaimed.

Supercritical Water Oxidation System (SCWO): In FY06, the SCWO at McAlester Army Ammunition Plant, OK, will support demil by converting hazardous chemicals and materials into benign compounds using water at high temperatures and pressures.

Vision

PM Demil's shared, accepted vision is an important investment in creating a better future for the community and its customers — warfighters, the American people and Army leadership. The vision is customer-focused on doing what's right for the Nation by shedding light on the demil mission and creating core values and competencies for today's and tomorrow's demil goals. The vision provides a simple, compelling and powerful direction for transformation, which will, ultimately, help make the demil community more effective and efficient.

Ultimately, the vision is designed to be a seamless, effective Joint Enterprise committed to efficient reduction of the U.S. Conventional Munitions Demilitarization Stockpile that improves warfighter readiness and enhances safe operations while safeguarding the natural environment for the American people.

Conventional ammunition demil is part of an era of change in munitions life-cycle management and will evolve to face the demanding challenges of DOD 21st-century transformation. The demil community's structure, systems, practices and culture must assimilate the character of a rapidly changing environment to ensure that it can successfully achieve its mission, vision and goals. The demil community must act in unison to lead change and assure warfighters and the American people that it is proactively doing its part to improve operational readiness and effectiveness through more efficient business practices. PM Demil and the demil community must be leaders and practitioners of transformation focused on continuously improving the quality and processes of our business and service product — demilitarization.

Goals

The demil community's top priority is to reduce the demil conventional ammunition stockpile. The old goal of reducing the stockpile to fewer

than 100,000 tons by FY10 no longer applies. Today's strategy is to reduce the stockpile by the generations plus a percentage of the beginning year demil stockpile. The annual percentage is expressed as a 6-percent standard goal (adequate performance) and an 8-percent stretch goal. The stretch goal is ambitious and will be achieved by innovation and breakthrough performance, helping to more rapidly attain the goals for a manageable stockpile. Given these methodology and affordability constraints, the stockpile is projected to be about 100,000 tons by FY19 for an 8-percent goal and by FY23 for a 6-percent goal. Achieving this goal depends on the success of other strategic factors, such as Design for Demil (DFD), source-of-supply and adequate program funding.

PM Demil and the demil community must be leaders and practitioners of transformation focused on continuously improving the quality and processes of our business and service product — demilitarization.

Ammunition developers play a key role in demil's affordability by ensuring it is an integral part of the life-cycle management processes for all new and modified ammunition products. Designing for demil, like other engineering disciplines, must be balanced with performance and other "design to" requirements. With DOD guidance to avoid using OB/OD as a primary demil/disposal method and to *limit liability* because of environmental, safety and occupational health laws, DFD cannot be ignored. An IPT was formed to develop DFD tools and processes, which will substantially help reduce liability. Developing these tools will also enhance warfighter readiness via reduced life-cycle demil costs and benefits realized through improved R3, reuse and source-of-supply processes and initiatives.

Although generally viewed as a liability, the demil stockpile is an asset with respect to supporting DOD sustainment goals and operations by providing a valuable supply source for critical munitions components. The resource, recovery and reuse of certified components and energetics, such as HMX and TNT or high-value electronics or materials, have several benefits. The only way to domestically acquire TNT is through reclamation. Reuse can improve affordability, reduce dependence on foreign or alternative supply sources, avoid costs of increasingly scarce strategic materials and help to reduce the impact on the environment. Private industry partners are important to developing and marketing these sources.

The demil community must become the Nation's environmental stewards to safeguard the natural environment and protect human health.

Finally, the demil community must become the Nation's environmental stewards to safeguard the natural environment and protect human health. As we strive to implement the strategic plan, the demil community must successfully deal with the complex environmental issues. As environmental stewards, the demil community must recover, recycle and reuse munition components, energetics and designated wastes to the greatest extent possible; and minimize or eliminate pollution during demil execution operations and R&D technology projects. The demil workforce will use R&D technology to identify problems, risks and solutions that enhance the natural environment and protect our workforce and the general public. The environment will also be a driver in influencing munitions design and modification, and a factor in the selection and funding of demil R&D technology efforts.

Demil success will depend on people embracing transformation and proactively committing to doing what's right, and listening to our customers. We must also learn to foster a new business culture that makes us more effective and efficient with our competing resources and constrained funds. The demil community has accomplished much, and the strategic plan creates the glidepath forward for demilitarization and attainment of our core goals and objectives.

LTC KEVIN JENNINGS is the PM Demil, PEO Ammo, Picatinny Arsenal, NJ. He holds a B.A. in business administration from Virginia State University, an M.S. in management from the Florida Institute of Technology and is an Air Defense Artillery officer and an Army Acquisition Corps member.

LARRY GIBBS is the Deputy PM Demil. He holds a B.S. in general engineering from the U.S. Military Academy, an M.S. in management from the Florida Institute of Technology, and is an Army Acquisition Corps member.

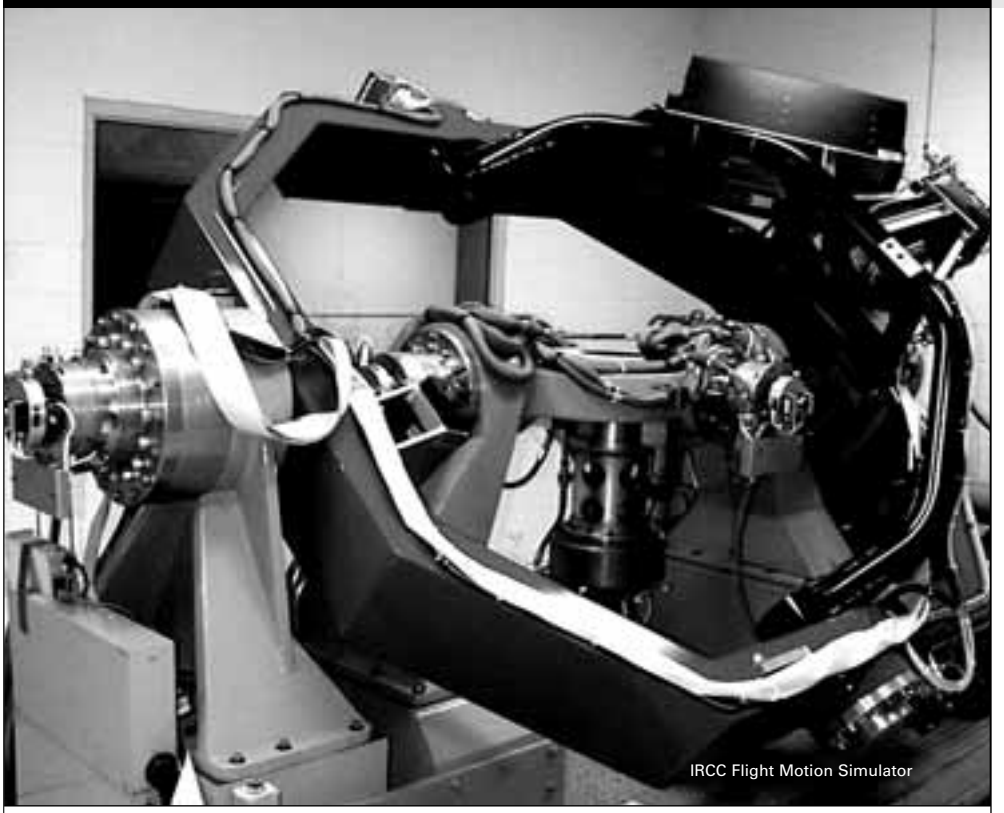
Correction

In the November-December 2003 *Army AL&T* article, "Army Venture Capital Initiative," Mr. Bruce Held was incorrectly listed as an author. We regret this error.

Inter-Range Control Center Provides Means to Orchestrate System-of-Systems Testing

Brian Simmons and Michael Cast

FUTURE COMBAT SYSTEMS
FCS
One Team-The Army/Defense/Industry



IRCC Flight Motion Simulator

The Developmental Test Command (DTC) Inter-Range Control Center (IRCC) orchestrates simultaneous test events distributed across numerous test centers. Future Combat Systems (FCS) demand this type of distributed testing because it is the only way to realistically determine how the diverse components of FCS are operating together as an interlinked system-of-systems (SoS).

The Army Test and Evaluation Command (ATEC) faces parallel challenges to those faced by our Armed Forces as it transforms to meet the current and future challenges of modern warfare and military operations other than war. These challenges include keeping pace with the fast-track acquisition of systems such as the Army's new Stryker family of combat vehicles and looking years ahead to ensure we are technologically and strategically prepared to test FCS. FCS brings three new test and evaluation challenges to the table:

- The FCS brigade-level organization's operational footprint exceeds the boundaries of any single DTC range.
- Key performance parameters dictate testing of multiple interdependent systems simultaneously across multiple ranges.
- The FCS test program requires a mix of live, virtual and constructive events.

As evidenced in Iraq and Afghanistan, today's military operations tempo underscores the Army's need for superior situational awareness. Diverse operational elements must be able to share a common picture of the battlefield situation, and the shooter must be linked by reliable technology to the decision maker. FCS's success will depend on an interlinked SoS that enables the Soldier to see first, understand first and act decisively. This must happen in the context of a Joint and Expeditionary Force environment because it is very unlikely that an FCS-equipped unit of action will be engaged in combat alone.

If testing is to reflect this reality, FCS's ground-based and aerial weapons platforms — including unmanned air and ground systems designed to provide information, detect hazards or deliver weapons — must at some point be SoS tested. This will require test events to be distributed across multiple test centers and ranges, sometimes simultaneously.

For the past several years, DTC has been acquiring the technical capabilities to enable *distributed testing*. By investing heavily in state-of-the-art Virtual Proving Ground (VPG) technologies at its centers throughout the United States, DTC developed validated models and synthetic test environments that enable realistic virtual testing. DTC also developed the capability to distribute test scenarios across multiple test sites, an essential capability for evaluating FCS's diverse components to ensure they perform to the standards under which they are designed to operate.

Situational awareness is a key element of success on the modern battlefield.

As part of this VPG program, DTC has conducted distributed testing experiments for more than 10 years. A significant finding from these experiments is the need to command, control and manage the configuration of distributed test events. To meet this exacting need, DTC developed a construct called IRCC.

Similar to the conductor of a large, complex orchestra, IRCC's role is to ensure that all the players in a distributed test receive and follow their cues, play together at the right time and tempo and produce harmonic results. While each instrument in this test "orchestra" may play from its own sheet of music, the various pieces come together as one under IRCC's direction. In a distributed test, IRCC has the ability to see the entire "score" and portray it in a way that is useful to testers, evaluators and customers.

In line with DTC's distributed testing concept, a Distributed Test Control Center (DTCC) will be established at all DTC test ranges. These DTCCs, linked together via the Defense Research and Engineering Network, will be able to support distributed test scenarios with their DTCC counterparts at other DTC test ranges. Some tests distributed across more than one test center will not require a multitude of players, nor the level of centralized command and control (C2) envisioned for IRCC. For these events, control and management can occur at the DTCC level.

Some FCS-required tests will involve most or all of DTC's test centers. The IRCC at White Sands Missile Range, NM, will play a crucial role in these test events' success. Each DTC test center has its own capabilities and instrumentation for testing FCS's diverse SoS components. By working together through the IRCC, they become more than the sum of their parts. The IRCC will facilitate complete virtual FCS battlespace replication using test assets to exercise, measure and analyze the synergies achieved through the SoS approach to testing.

The IRCC concept of operations is still taking shape through the work of an integrated process team that includes testers, evaluators and industry representatives, but the focus is on the testing needed for the FCS program's success.

Program managers plan to use a large distributed test network to link each FCS System-of-Systems Integration Laboratory (SoSIL) while working on their respective areas of FCS development. The SoSIL Virtual Framework network will provide the ability to tap into most of ATEC's test facilities, as well as battle labs, industry sites and other research and development sites as needed.

To facilitate command, control and configuration management, DTC selected White Sands Missile Range as IRCC for the DTC portion of this vast

network. White Sands was chosen largely because of its experience in managing complex missile test programs and the C2 capabilities afforded by its J.W. Cox Range Control Center. IRCC will be the point of entry for the FCS SoSIL, and SoSIL will coordinate with IRCC when test activities at DTC ranges are required.

The IRCC concept was put into action during two events at White Sands, both designed to demonstrate the Synthetic Environment Integration Testbed's (SEIT's) initial operational capability, a VPG modeling and simulation initiative. DTC's principal goal for SEIT is to develop a high-resolution representation of natural and man-made environments from physics-based modeling and simulation capabilities. The intent is to develop common and standard environment applications, which could be adapted to the test requirements of a specific system throughout its life cycle, for any system within DOD's acquisition program.

To support the August 2003 SEIT demonstration, the J.W. Cox Range Control Center served as IRCC and exercised oversight and control over a variety of events that required DTC test center participation. The large-screen central viewing station at this control center was used to monitor the demonstration events as they unfolded. Demonstration participants at White Sands and other DTC test centers were able to respond to events and provide various reports using remote role-player workstations.

The demonstration scenario involved a Blue Force whose objectives were to attack and seize an airfield at one location and an ammunition bunker at another. The scenario called for the opposing Red Force to deny access to these sites by simulating the release of chemical agents by fixed-wing aircraft that actually flew over a section of the test range. The scenario was played out over simulated topography that represented an actual 400-square kilometer section of terrain at DTC's Yuma Proving Ground in Arizona.

The demonstration included a variety of maneuvers by virtual forces, live and recorded aircraft and vehicle movements, virtual weather effects on the simulated dissemination of chemical agent, and stimulation of actual infrared and chemical/biological sensors at multiple test centers. A simulated tactical operations center at White Sands took part in the demonstration, also responding to the scenario with the aid of a remote role-player workstation.

The SEIT demonstration was the first time all DTC's test centers participated together to support a single test event simultaneously. Getting to the point where all DTC test centers could communicate with one another and play in the test scenario was a major accomplishment. It was the result of years of effort to develop common architecture, integrated information systems and common, reusable tools. This demonstration's successful execution points the way to the future, where DTC will work in partnership with other ATEC elements, the FCS Lead System Integrator (Boeing and Science Applications International Corp.), the FCS Combined Test Organization, the FCS Program Manager and other interested parties in this critical test program.

For more information about IRCC, contact Rick Cozby at (410) 278-1474, DSN 298-1474 or send e-mail to **cozbyr@dtc.army.mil**.

More information about DTC's VPG initiatives is also available at **http://vpg.dtc.army.mil**.

Systems that provide situational awareness will have to be tested as they are designed to be used, requiring simultaneous tests at multiple sites.

BRIAN SIMMONS is the Technical Director at DTC. He has a B.S. degree in physical science from the University of Maryland and an M.S. degree in numerical science from Johns Hopkins University. He is a Harvard University Senior Executive Fellow, a U.S. Army War College graduate and an Army Acquisition Corps member.

MICHAEL CAST is DTC's Public Affairs Specialist. He is a former Army photojournalist and Keith L. Ware award winner. He has a B.A. in journalism from Arizona State University.

New Military Deputy LTG Joseph L. Yakovac Jr. Plans to Put People First

Meg Williams

The Acquisition, Logistics and Technology (AL&T) Workforce welcomes new Military Deputy (MILDEP) to the Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASAALT) LTG Joseph L. Yakovac Jr., who assumed duties Nov. 18, 2003.

LTG Yakovac brings extensive program and leadership experience to his new assignment. He has held every traditional developmental position from platoon leader through battalion commander as well as critical acquisition positions thereafter. His extensive mechanized infantry troop experience provides a depth of knowledge that few Army Acquisition Corps (AAC) officers have, which will undoubtedly benefit the AL&T Workforce and the Army as it continues to transform.

> The Army Acquisition community must be interdependent. How you structure, and how you encourage people to think of interdependency, is really the key to our future as acquisition professionals.

Yakovac's most recent assignments previous to his posting as the Program Executive Officer (PEO) for Ground Combat Systems in 2000 were as Deputy for Systems Acquisition, U.S. Army Tank-automotive and Armaments Command (TACOM) and as Assistant Deputy for Systems Management and Horizontal Technology Integration, Office of the ASAALT. As a colonel, he fulfilled critical duties as the Project Manager (PM) for the Bradley Fighting Vehicle System and Deputy Commander for Acquisition, both at TACOM.

He holds a B.S. degree from the U.S. Military Academy and an M.S. degree in mechanical engineering from the University of Colorado. Additionally, Yakovac is a graduate of the Army Command and General Staff College, the Defense Systems Management College and the Industrial College of the Armed Forces. He earned the Expert Infantry Badge, Ranger Tab, Parachutist Badge, the Legion of Merit and seven awards of the Army Meritorious Service Medal.

The following interview, conducted Dec. 22, 2003, touches on Yakovac's (Y3's) personal leadership philosophy and his strategic direction for the immediate future. Key excerpts of that interview are below. This interview is the first in a series of planned MILDEP articles and updates.

AL&T: *We heard your motto is people, programs and processes. With the Army at war you will most likely emphasize Soldiers and the people who support them. How can the Army Acquisition Corps and more specifically, the Acquisition Support Center, best support the Army's ongoing war effort?*

Y3: What I really want to look at in my first year — if I emphasize nothing else in terms of priorities — is the "people" aspect of acquisition. I have been frustrated in the last 5 or 6 years that we let the personnel management system manage our people. I want to get "people" back in "personnel management." We should encourage officers to become their own career managers. I think they'll provide a clear voice to our younger civilians. That being said, I know there are a lot of rules and regulations and I think within the confines of these regulations there is also room to maneuver.

AL&T: *How can the Acquisition Support Center help you?*

Y3: The Acquisition Support Center (ASC) is already helping me. For me to execute my priorities, I have to ask the ASC staff — if I have a short timeline, which one of these priorities is possible to

tackle? Some of my priorities may not be doable, but I can put things in place that over time could become reality.
Like anything else, you have to have some actionable short-term goals that you can meet to show people that, in fact, you're serious about it. So in the short term, I've already put changes in place that have gotten people's attention. For example, I announced I would no longer senior rate O6-level project managers. The reason I did that was very specific. Again, it was to put "people" back into personnel management. I think we evolved to a rating scheme that was more focused on careers than people. People can debate this with me, but that's the reason I did it.

That's the short-term type of items I'm going to continue to work with ASC to see what I can do based on what makes sense for our people. Then there are some longer-term issues that I'll grapple with to make people part of the decision process. To effect change in a bureaucracy — rather than get a consensus — you've got to use your gut instinct to make decisions. And you won't please everybody. You have to almost be a benevolent dictator. Because if you wait for consensus, you'll never get the consensus you seek, and before long you'll be gone [on to another assignment]. I've been an acquisition professional since 1991. I feel that I have gained a significant amount of knowledge and insight into the acquisition business. Therefore, if I make a change, there is some underlying basis for it and I don't have to ask for consensus. There are some issues where I will ask my people. By and large, you've got to do some things right away that say you're serious about change, or change will never happen in this business.

My focus will be on "people" for the first year. Obviously my day-to-day duties will require me to get into programs and budgets and all the normal acquisition issues and AL&T Workforce initiatives. Every day I've got to do something useful as it pertains to people.

Programs are not as important to me — individually — as the idea of what our future requirements will be as an acquisition community to effectively manage those programs. I came into this business where most, if not all, programs were islands unto themselves. During my tenure at TACOM, if you walked into a PM shop, everything you wanted to know about that PM shop was there. That PM shop was primarily focused on a commodity in a certain functional area. Rarely did we go outside that boundary. My best example of how this thinking has changed is to look at information technology and what it's done for us. Back then, when a piece of equipment was added to your system — for example a radio — all you had to do was maintain a space for it, provide power to it and add an antenna mount. That was your interface. Simple. Give me the specifications and I'll build it for you.

Look at what's required today in terms of a weapons platform with the requirement of a shared common operating picture of passing information. Today, the person who manages the tank has to interface outside of his community and really work hard to make sure that his program supports other programs and they support him. That takes integrated training. There are a lot of things today that force our community to be much more interdependent. A Joint Force must be interdependent. The Army Acquisition community must be interdependent. How you structure, and how you encourage people to think of interdependency, is really the key to our future as acquisition professionals. The programs, per se, as they exist in the budget are not as important to me in the near term as communicating to people who come to me for decisions or send me documents for decision or approval, that I look at them from an interdependency standpoint. I must instill a culture that will encourage people to work together across the various domains.

We have created a program that is beginning to do just that — Stryker, where we have become interdependent. Take Future Combat Systems (FCS) for example. That whole program is based on the idea of interdependency and sharing domain expertise — not growing your own independent domain expertise. It's a completely different construct that we're working toward. And that's the focus I will continue to foster. I don't want to have to worry that PM "X" is talking to PM "Y." It needs to become instilled in the entire AL&T Workforce that we have to work together. That whole idea of interdependency goes beyond programs to partners.

This is not all-inclusive. Everything we do from the beginning of a program until we put it away somehow requires that the following three contracting entities be part of our team: The Army Materiel Command (AMC), Army Test and Evaluation Command (ATEC) and Defense Contract Management Agency (DCMA). Whether your program is in development when you're talking about working with the new R&D [Research and Development] Command or if it's putting together a program with the involvement of ATEC — it comes back to the fact that you can't survive by yourself. You need the expertise and the support of those three interdependent agencies as a minimum, outside of your PM shop or outside of your program. What I

plan to do every day is enforce program interdependency — that's what's important to me.

Along with that, there's one thing that I don't want to hear. If somebody comes to me and complains because they have a log [logistics] problem and they're not the life-cycle manager, I won't accept that. Logistics must be their partner in life-cycle management. And ultimately, their success is dependent upon how they interface and work with AMC.

Rather than complaining about something, go do something about it. From the beginning of the time that you're a sustaining PM and you work in a program and part of your program doesn't include your supporting AMC MSC [major subordinate commands] or whatever piece it takes — you're remiss. If you look at ATEC as only a tester who's going to grade your paper, you're wrong. They, too, are part of the partnership.

From the beginning of your program through the end, ATEC is an important enabler and integrator for you. They don't just sit on the side of the road as you drive by waiting to give you a thumbs-up or down. You partner with them from the beginning of the process and you understand that they have a role to play, a legal role, and they have a job to do as well.

Do not talk about the "testers." The testers are all of us. If you come to me and blame something on the "testers," I contend that you haven't worked with them. If you have a deficiency in test — whether it be developmental testing or operational testing — and you blame it on somebody other than yourself, you're wrong. You need to work the testing portion of the program just like cost and schedule, because testing ensures our programs provide Soldiers the best equipment in the world.

> So if you're in a position where you have to make a hard decision, and you're at a point where somebody asks you whether your program should be terminated, your answer should never be based on what's good for us — "us" being the workforce, "us" being the command where we're located, "us" being the acquisition community. The answer should always be "It's good for Soldiers."

AL&T: *The Army Chief of Staff has 16 Focus Areas. Have you received any direction from him or the Vice Chief of Staff on how the AL&T Workforce can best support Army Transformation?*

Y3: I think we were a bit proactive. I don't know if anybody knows this but back in the October-November timeframe, Mr. [Claude M.] Bolton called a special ASARC [Army Systems Acquisition Review Council/Committee]. It was announced as an FCS ASARC. What it really turned into was our opportunity to explain to the Army Staff what we thought these Focus Areas mean to the acquisition community. The point we tried to make is that Focus Areas are DOTLMSPF [doctrine, organization, training, leader development, materiel, soldiers, personnel and facilities]. People get too focused on the role of "M," materiel, because "M" is where the money is. You can't get to the "M" unless you look across the entire spectrum. Because "M" means you have to go after dollars. There may be a cheaper way to meet a Focus Area to look after how we manage people. We made a case that before people start looking at these Focus Areas demanding materiel solutions, we should look at it more broadly in terms of what capabilities these Focus Areas require. Some of the Focus Areas don't touch us at all. But we are participants in those Focus Areas where there is discussion that would impact materiel. We're players and we have different people playing, like representitives from PEOs, from the tech base, from Washington, DC, and elsewhere. Throughout the process, the U.S. Army Training and Doctrine Command [TRADOC] is taking the lead in most of the Focus Areas that would affect materiel and we are interfacing with them to make it happen. But specific guidance, no, but understanding where the Army's going and at least our concern that in some areas people were too quick to look at the "M" solution even though we're "M." Yes, we would have welcomed the opportunity to excel. Remember, "M" carries a bill. And maybe that's not what you want to do. There are other ways to get after it.

You will see some impacts in the spring when most of the Focus Areas are due out. Right now, we want to be a participant. We want to influence, and we want to put our thoughts on the table so we're not just given something to execute. That's where we are right now.

AL&T: *You have got a unique background. You were a battalion commander who came in as an acquisition assistant program manager. You became a PM and then a PEO. How do you think that these skills are going to benefit you as the MILDEP?*

Y3: I'm unique only because I existed before 1991 when the old program

would allow us to dual track. And I was fortunate that I had some jobs that enabled me to do both. I think officers gain critical field experience between the 7th and 8th year of service. It's the troop-leading experience, the leadership aspect of it — not the technical aspect of it — that's necessary. You can be the most technically qualified person in the world and have the most technically challenging program, but my experience tells me that programs are successful because of quality DOD civilian and military personnel who are properly trained and led. People want decisiveness, they want things that you get from the diversity of experiences many of us have had — from leading Soldiers. That experience is one aspect of what I bring to the MILDEP position.

> When you see a program you are working with become successful, I think that makes all the hard work and personal sacrifice worth it and you can proudly say "I made a difference in the life of a Soldier."

Another important point is, at the end of the day, no matter what we think our purpose is, the only thing that matters is that we deliver capabilities to Soldiers. So if you're in a position where you have to make a hard decision, and you're at a point where somebody asks you whether your program should be terminated, your answer should never be based on what's good for us — "us" being the workforce, "us" being the command where we're located, "us" being the acquisition community. The answer should always be "It's good for Soldiers."

Sometimes we get too hung up on "our" program. It's not "our" program, it's the Army's program, and it exists only because the Army said at some point in time it wanted the provided capability. Things change all the time and, ultimately, we have to remember that if we didn't have Soldiers, we wouldn't have a need for acquisition. Nothing else matters in terms of why we exist. I think you can see the pride of ownership, the esprit, that a lot of our organizations have, when you turn on the TV at night and see equipment they provided that gives Soldiers the capability to fight and win on a very complex battlefield. Sometimes programs take a long time to mature, but when you see something happening with Soldiers, when you see a program you are working become successful, I think that makes all the hard work and personal sacrifice worth it and you can proudly say "I made a difference in the life of a Soldier." It's not so much about what rank you are or how much money you make. It's more about being able to go back at the end of the day and say "I had a hand in giving Soldiers a capability and they're much better off than they would be without it."

MEG WILLIAMS is a Senior Editor/Writer and provides contract support to the Acquisition Support Center through BRTRC's Technology Marketing Group. She has a B.A. from the University of Michigan and an M.S. in marketing communications from Johns Hopkins University.

Ballard Promoted to Senior Executive Service

Tina Ballard, Deputy Assistant Secretary of the Army (Policy and Procurement), was promoted to the Senior Executive Service in a ceremony at the Pentagon Jan. 12, 2004. Assistant Secretary of the Army for Acquisition, Logistics and Technology Claude M. Bolton Jr. presided over the promotion ceremony.

Water Immersion Lab Measures Responses to Heat and Cold

If the 14-foot depth of the Water Immersion Laboratory tank at the U.S. Army Research Institute of Environmental Medicine (USARIEM) seems excessive, there's a good reason for it.

Vincent Forte, a research biologist at USARIEM, asks PVT2 Sacorah Tillman, a human research volunteer, to rate his exertion and thermal sensation while walking on the Water Immersion Facility treadmill in cold water.

"Visitors are always surprised at how deep it is, but once (the water) gets to temperature, we can keep it at that temperature within a few tenths of a degree," said John Castellani, a research physiologist in USARIEM's Thermal and Mountain Medicine Division. "That's the benefit of a deep tank."

Researchers at USARIEM, located at the U.S. Army Soldier Systems Center in Natick, MA, have been using the laboratory to evaluate human responses to cold or hot environments for a variety of studies since the USARIEM building was constructed in 1968. Renovated in 2000, the lab's premier feature is its 10-foot by 10-foot stainless steel tank filled with 10,000 gallons of chlorinated water. Besides water depth, the facility is unusual for its ability to test humans exercising on a single underwater walking treadmill or with two cycle ergometers while sitting on accompanying bolted-down stainless steel chairs.

Each type of exercise machine is independently operated and raised or lowered on separate platforms into water with an operational temperature range of 41-122 degrees F, although the majority of human exposures in test protocols range from 59-104 degrees F. Each cycle ergometer has a moveable plate system to adjust to individual leg length, and resistance is adjusted by attaching or removing fins to the wheel. Human research volunteers are connected to a data acquisition system — a computer nearby on a platform that surrounds the tank — to measure and record physiological status.

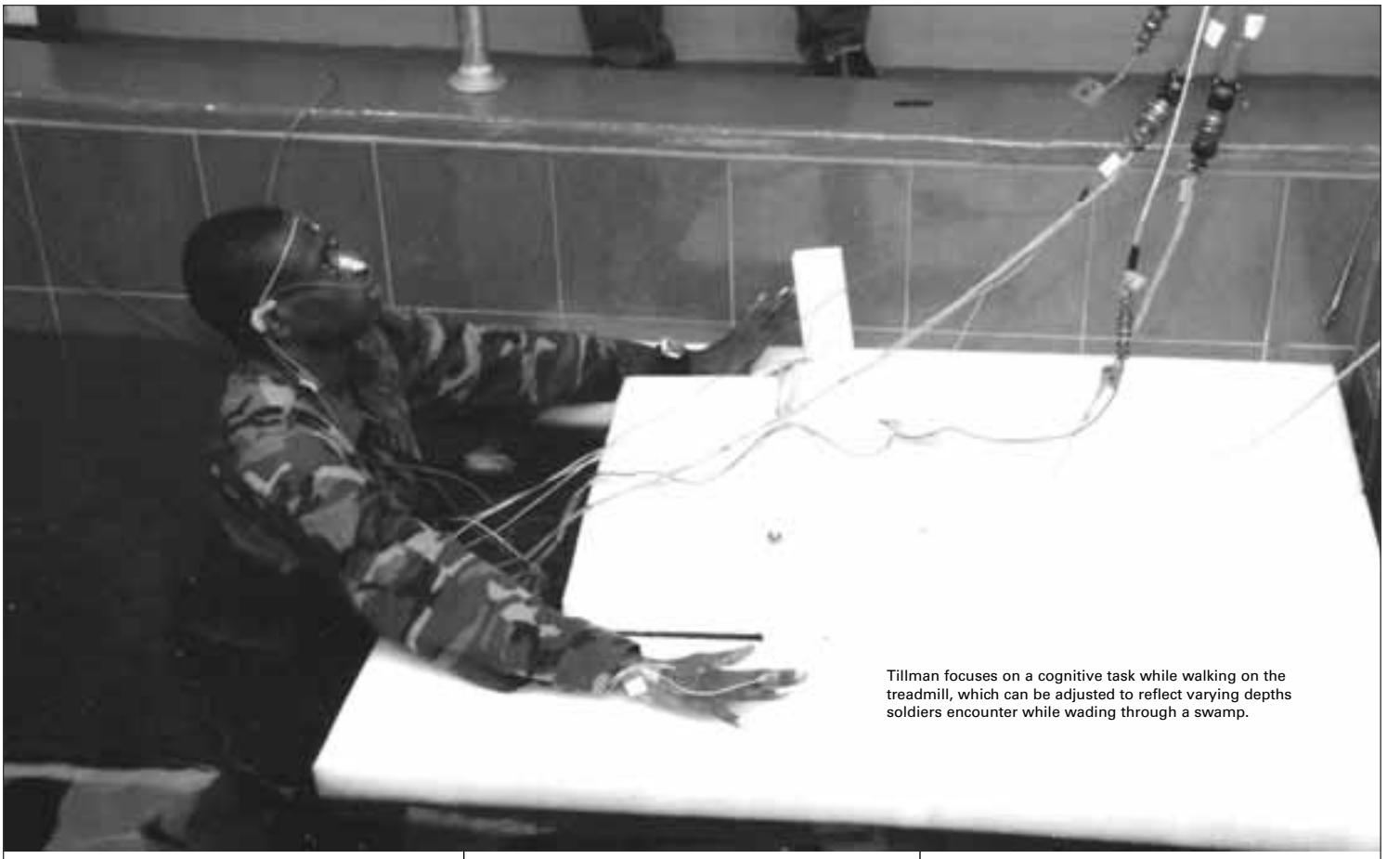
Work in the facility has been wide-ranging. The lab helped validate the core body temperature pill against conventional methods of measuring body temperature. Sometimes the exercise equipment is untouched, as with one nutrition study where the human research subjects sat still in the water. Nearly 5 years ago, a commercial hot tub was acquired as a re-warming pool to help test subjects raise their body temperature quickly after soaking in chilly water, and the cold is what research has focused on in recent years.

"We're interested in how hypothermia affects humans," Castellani said. "This facility works out well because it gives you a great place to re-create a cold or cold-wet environment."

> Water takes away heat 25 times faster than air, which makes it easier for researchers to reduce core body temperature without risking a cold injury that could occur in an air chamber.

Water takes away heat 25 times faster than air, which makes it easier for researchers to reduce core body temperature without risking a cold injury that could occur in an air chamber, he said. Motivation in studying hypothermia was spurred after four Army Rangers died while going through Ranger school at Eglin Air Force Base, FL, in 1995. Scientists used the water immersion lab along with the climatic chambers to pursue research on how cooling affects performance.

A repeated immersion study in 1996-1997 simulated what happens when a



Tillman focuses on a cognitive task while walking on the treadmill, which can be adjusted to reflect varying depths soldiers encounter while wading through a swamp.

soldier enters the water for 2 hours at a time and then emerges, three times per day. By the second and third immersion, researchers learned that body temperatures decreased because the test subjects couldn't shiver as well.

Researchers also used the facility in studies to learn if exercise fatigue causes thermoregulatory fatigue. Human research volunteers exercised or remained motionless in the water, which was then followed by cold air exposure. Those exercising and fatigued had a lower body temperature because they could not keep their body heat in as well.

"The idea is to feed data into our cold temperature models. We're trying to add fatigue factors into the existing model, which is now good, but we're building on it," Castellani said.

Ultimately, the idea is to be able to predict under what conditions a soldier declines in performance and may become a casualty, giving troops the information to make the right decisions and avoid harm.

The treadmill, a relatively new addition, is helpful because it can simulate wading in a swamp, which is more realistic than the cycle, said Castellani. Researchers can vary the treadmill speed, water temperature and, by raising or lowing the platform, vary the water depth to test responses at different points along the body.

A study that began in 2003 looks at how long people can stay in water at different depths and temperatures. The study will take hypothermic human research volunteers into a cold chamber to test their cognitive and physical performance through a series of Special Operations Command tests.

"We don't have much information on this at the temperatures and depths we're looking at," Castellani said. "We've been able to understand that stressors soldiers undergo cause a degradation on thermal regulation. That information will help us design better physiological models."

Ultimately, the idea is to be able to predict under what conditions a soldier declines in performance and may become a casualty, he said, giving troops the information to make the right decisions and avoid harm.

For more information on the U.S. Army Soldier Systems Center, go to **http://www.natick.army.mil**. For more information on USARIEM, go to **http://www.usariem.army.mil**.

From the Acquisition Support Center Director

We begin 2004 by welcoming LTG Joseph L. Yakovac Jr. to his new post as our Military Deputy (MILDEP) to the Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASAALT) and Director, Acquisition Career Management. I encourage you to read *Army AL&T's* interview with LTG Yakovac on Page 74 of this issue. He is a former Program Executive Officer (PEO) and Deputy for Systems Management and Horizontal Technology Integration at ASAALT who also brings experience as a former Commander, 2nd Battalion, 12th Infantry, 4th Infantry Division, Fort Carson, CO.

LTG Yakovac has promised to make himself available to the Acquisition, Logistics and Technology (AL&T) Workforce. His number one priority is to put "people" back into "personnel management." LTG Yakovac's focus will be on people and career development for both civilian and military personnel. And he's already "walking the walk and talking the talk." One of his first changes is to no longer rate senior O6-level project managers (PMs) or acquisition commanders. We can all expect to have eye-to-eye contact with those who senior rate us. The Acquisition Support Center (ASC), in coordination with our PEOs, is already implementing the MILDEP's revised rating guidance on colonel-level PMs and acquisition commanders. He also wants our officers to pursue "Diversity of Experience" and not stove-piped professional development.

We have established a task force to study a regionalization concept for assignments at the captain and major levels to support the MILDEP's request for officer diversity of experience. ASC has also initiated an Army Acquisition Corps (AAC) Transformation Plan as part of our ongoing Campaign Plan to further address the AAC's future and its evolving mission in support of the Future Force. The Transformation Plan is focused on embedding the AAC as an Army core capability, doctrinally integrating the AAC with the rest of the Army, leveraging strategic partnerships across the Logistics Enterprise and institutionalizing AAC roles within the Joint warfighting community. The AAC Transformation Plan is a nested fit with the Army's overall transformation as spelled out in the Army Chief of Staff's Transformation Roadmap 2004. ASC looks forward to supporting LTG Yakovac and his initiatives to take us to the next level.

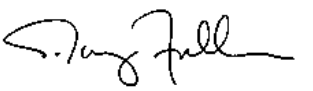
Here's a quick update for your planning calendars. The 2004 Acquisition Senior Leaders' Conference will be held Aug. 9-12, 2004, in Louisville, KY. The theme for this "by invitation only" conference is: *Supporting the Fight, Improving the Force, Building the Future.* More information will be posted to the ASC Web site as details become available, so check our home page frequently.

Speaking of conferences, if you're planning to attend the 2004 Association of the United States Army Winter Symposium and Exhibition in Fort Lauderdale, FL, March 3-5, stop by ASC's booth. As always, we will promote acquisition good news stories and explain how ASC is supporting the AL&T Workforce and Army Transformation. For the latest on conference and convention information, visit the ASC Web site at **http://asc.army.mil/public/news/events**.

I'd also like to call your attention to a career development opportunity on Page 94. There are 1-year developmental assignments available for DA employees at the GS-12 level in the Contracting and Acquisition Career Program (CP-14). The Contracting Career Program Office funds travel and temporary duty costs. This program provides tremendous opportunities for you to advance your acquisition career.

Army Chief of Staff GEN Peter J. Schoomaker has promoted 16 immediate Focus Areas that the Army needs to embrace. All of ASC's actions in 2004 will directly support these Focus Areas and the evolving Army Transformation to a campaign-quality Army with a Joint and Expeditionary mindset.

In December, I gave all ASC military, civilian and contract employees a copy of Army Values to review and put into practice. Please take a few minutes to review the seven Army Values at **http://asc.army.mil/armyvalues/**. I ask that you embody Army Values in all that you do as dedicated Army personnel and encourage other readers to do so as well because these Values are universal to public service. Remember, it's up to you to make a difference every day.



COL Mary Fuller
Director
Acquisition Support Center

AHRC Notes

FY03 Major Promotion Board Results

The FY03 Major Promotion Board results were released on Sept. 4, 2003. This article will analyze the board results.

Overall Acquisition Corps Results

Board members reviewed the files of 133 Army Acquisition Corps (AAC) officers in the primary zone (PZ) of consideration for promotion. From this population, the board selected 120 officers. The resulting PZ selection rate of 96 percent is a 2.0 percent increase over last year. The Army's competitive category PZ selection was 93.8 percent. There were 28 AAC officers considered for above-the-zone (AZ) promotion and the board selected 20. The AAC selection rate for AZ is 71.4 percent. The Army's competitive category AZ selection was also 71.4 percent. In addition, two AAC officers were selected below the zone.

What was the trend for those selected?

Again we are seeing that the selection to major is a reflection of how well an officer performed in his or her basic branch assignments. Most AAC officers have few, if any, Officer Evaluation Reports (OERs) from acquisition assignments when the Major Promotion Board meets.

The *most important* discriminator continues to be company command OERs. Board members appear to use command reports as the measure of an officer's ability to succeed as a major. The senior rater's narrative must quantify an officer's performance when their profile did not support an *above center-of-mass* (i.e., top five percent, number three out of 10). Additionally, senior rater narratives that focus on an officer's potential (i.e., promote below the zone, send to Command and General Staff College, ready for battalion XO/S3 now) were generally more effective than OERs that focused on what the officer accomplished. Officers with overall center-of-mass *files* and "top block center-of-mass" command OERs were at risk for promotion. The OER clearly communicates the senior rater assessment on which officers they place above center-of-mass.

The message is clear — seek company command, do well and maintain high-level performance on all other assignments.

Congratulations to the following officers selected for promotion:

Aiken, Terry J.
Allison, Randy S.
Anderson, Joseph S.
Ansley, Steven R. Jr.
Atkins, Thomas J.
Badar, Patrick J.
Bailey, Curtiss M. Jr.
Bates, Archie P. III
Beall, Scott T.
Besaw, Craig S.
Betts, Eric S.
Blaney, Jeffrey D.
Brumlow, David G.
Buck, John M.
Burris, Joshua R.
Cahill, Michael S.
Calvaresi, Chad A.
Carrera, Daniel S.
Carter, Don C.
Charles, Melody J.
Clark, Philip R.
Cline, Todd C.
Collier, Tijuana D.
Conroy, Michael P.
Cotto-Arroyo, Luis
Craft, Paul G.
Crawford, Jacob E. III
Crawford, Leo R. Jr.
Crespo, Luis
Crosby, Troy W.
Cummings, Kenneth F.
Cunningham, Craig H.
Dean, Glenn A. III
Dellert, Gregg M.
Dills, Jack E.
Dooley, Matthew R.
Duchemin, Edgar R.
Durant, Jon R.
Erickson, Patrick R.
Ford, Christopher M.
Franklin, Francene M.
Gamel, Dannell T.
Gentry, Todd M.
Giese, Joseph H.
Gray, Michael G.
Gruchacz, Brian J.
Guffy, Kent G.
Hall, Lamont J.
Hanson, Michael G.
Henderson, Roger G.
Hernandez, Delisa L.
Hoecherl, Joseph A.
Hofmann, Daniel M.
Hollister, Carl J.
Hopkins, Paul T. Jr.
Huff, Tom T.
Irvine, Marguerite D.
Jackson, Shannon C.
Jacobson, Kathleen J.
Jenkins, Shawn T.
Johnson, Ellsworth K.
Jury, Matthew A.
Klopotoski, Dean T.
Lackovic, Christopher J.
LaFontaine, David R.
Larkin, Kevin L.
Lowrey, Douglas S.*
Lozano, Francisco J.
Lucas, Shawn P.
Lucius, Tommie J.
Lundy, Jacques S.
Mayo, Louis D.
Mazure, Paul D.
McGowan, Dennis M.
McLinnaham, James O.
Mendoza, Wendell L.
Mills, James C.
Morgan, Keith S.
Morris, Kenneth L.
Nerdig, Daniel A.
Nerenberg, Steven L.
Newson, Marcellus J.
Nicholson, Jennifer A.
Olmstead, Michael G.
Panozzo, Paul R.
Patterson, Neil P.
Pearson, Mollie A.
Pettengill, Edmund K.
Phillips, Bryan K.
Phillips, Jeffery E.*
Phillips, Lewis H.
Powers, Arthur B.
Price, Paul E.
Qualls, Teddy D.

Ramos, Robert
Ransom, Wilton
Redfield, Richard M.
Rivera, Erwin
Ross, Pete A.
Royse, Lynda R.
Rupkalvis, Gregory M.
Ryan, Thomas J.
Scott, Stanley
Scuteri, Michael F.
Shepard, Jason K.
Simpson, Jeffrey S.
Smith, Robert S.
Snodgrass, William J. Jr.
Stehle, Brian C.
Stewart, Donald G.
Stiner, Mark T.
Stone, Jeffery C.
Stringer, David B.
Sublett, Charles E.
Talbot, Mark E.
Terry, Ingrid M.
Varnadore, Marcus L.
Wallace, Eugene F.
Warnick, David A.
Washington, Crystal M.
Webber, David E.
Zachary, Bernard Jr.

* Denotes below the zone

WORTH READING

Command in War

Martin van Creveld
Harvard University Press, Cambridge, MA, 1985

Reviewed by Geoffrey French, a Counterintelligence Analyst with General Dynamics and former Logistics Specialist for the U.S. Marine Corps Reserve.

The role of the commander in war is paramount, yet there is no military in the world that has reduced command to a science, knowing what to do and say at critical times. Many books have been written on the intangible qualities for leadership and vision, and others have looked at the qualities of great military commanders from history. Modern military leadership, however, is not built around personalities — it is built on systems of command. Martin van Creveld — a military historian who has long been a resource for the U.S. Army, Navy, and Air Force — examines command structure and staff development in *Command in War*.

As in any military history survey, *Command in War* breaks down events into coherent time periods. Whereas van Creveld used four categories to describe the effects technology has had on war, he uses more to describe the evolution of command. The first, referred to as the "Stone Age of Command," is the era where the commander was present with his troops, fighting with them and exercising tactical control over a relatively small number of men in a small geographic area. The second era was ushered in by Napoleon, and van Creveld devotes a chapter entirely to him, because the revolutionary aspect of Napoleonic warfare is directly related to command — not technology. This is remarkable in and of itself. Napoleon developed the system of command idea where independent corps were given general orders and operated for significant time periods without orders. This system, and Napoleon's genius, gave the French armies an enormous advantage over their enemies, with no superiority in weapons, transportation or communications.

Van Creveld then moves to the formalization of the general staff in Prussia. Prussian changes to Napoleon's idea improved the structure and consistency of staff command and further decentralized control to the lower-level commanders. Command now took place from the rear, but retained flexibility in the field. Although many nations copied this concept, all — including the Germans — drew incorrect lessons, viewing war and battle as the careful unfolding of meticulous plans, as exemplified in World War I. Obviously, staffs (and plans) created under this concept failed when faced with the uncertainty inherent in war.

The following chapter deals with mobile warfare, where van Creveld briefly discusses models from World War II that allowed junior officers great independence and freedom to address tactical needs innovatively. In more detail, he discusses 1967 and 1973 Israeli Defense Forces operations, juxtaposing the flexibility of the command system in the former with the rigidity in the latter. In this chapter, and in the final one that looks at the U.S. command system employed in Vietnam from 1963 to 1968, van Creveld looks at two modern systems that stifled initiative and centralized control, with poor effects. In both cases, the choice at the highest level to retain control was reflected in the lower levels as well, leading to a system where decisions were made without the proper information and where coordination was difficult at best.

Like all of van Creveld's works, *Command in War* is well-structured. In each chapter, he discusses the political and technological developments that brought about change and the command structures of the period. Although the author touches on many systems to provide examples and illustrate points, he focuses on one system and one significant campaign that typifies each period. Finally, he reviews the strengths and weaknesses of the systems and compares them to others.

Van Creveld gives the reader a thorough, but concise, examination of the historical trends in command, tracing the balance of centralization and decentralization through time. As with other books he has written, van Creveld avoids generalizations and impressions about a battle or an era and instead works with facts, from which he pulls conclusions. And as with his other books, van Creveld delivers a work that is both profound and easily understood.

Blood & Oil: Inside the Shah's Iran

Manucher Farmanfarmaian and Roxane Farmanfarmaian
Random House Inc., New York, 1997

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

On the inside jacket of *Blood & Oil*, is this comment on the book by Fouad Ajami, Director of Middle East Studies, Johns Hopkins University: "A luminous memoir of Iran before the deluge, a book of stunning beauty about an irretrievably lost world. One of the best accounts of the cultural and political life of modern Iran, it is exquisite and intimate rendered with artistry and detail." It would be difficult to surpass this appraisal of *Blood & Oil*, but it is important to cite some specifics.

As stated in the book title, the author, whose daughter is co-author, was a member of the Persian royal family. The author and his family members held the highest governmental and industrial (petroleum) positions within Persia (now Iran). When the author was a young boy, his father had eight wives. Each wife had her own house in a rather large compound, and each wife had many children. With this number of brothers and sisters and numerous uncles on both sides of his family, the reports of both good and bad encounters with relatives were very believable. The book's use of the word "blood" refers to both the supportive and sometimes not so supportive ties of relatives as well as the significance of being part of a large family with great political and cultural influence. At times, the author's family was in favor with the government. At other critical times, the family was not. Because of his family's changing views, the author's memoirs include many ups and downs related directly to his blood relatives. These incidents included granting favors, awarding positions of power, removal from positions of power, punishments, assistance in escaping punishment and, finally, expatriation. The significance of the "blood" portion of the title is simply that political power and the Persian culture rested highly on family, tribes and religion. The author's version of how the Shah of Iran obtained power, maintained his position and finally lost power is based on how the Shah treated his nation's many different factions. One item of special interest was the author's opinion that the Shah did not show sufficient respect for key local leaders.

This book gives an extremely interesting version of the rise of oil's importance in the world economy, the development of oil fields in the Middle East and the creation of the Organization of Petroleum Exporting Countries (OPEC). The author states that the real turning point in oil's importance was the British Admiralty's decision to convert their coal-burning ships to oil-burning ships. This decision involved evaluating factors such as relative efficiency of propulsion systems, remaining competitive with foreign navies, conversion costs and, of most importance to subsequent history, source of oil supplies. British exploration and discovery of oil in Persia created the necessity for the British to cultivate support within Persia. The British exerted decades-long influence on the Persian government to develop oil agreements, which led to the British Petroleum Co. The author states that because oil production was controlled in most nations by foreign interests, the producing countries did not receive a fair share of the revenue. This arrangement began to change when U.S. companies began offering higher shares to Venezuela. Through his contacts in Venezuela, the author was able to assist in conducting meetings, which eventually resulted in OPEC's establishment. The author instructs how oil was produced, worker conditions and how negotiations were conducted. All of this provides good insight into relations between oil-producing nations and OPEC patrons.

Blood & Oil provides an unusual perspective of the importance of family and family groupings in the Middle East's struggle to achieve and maintain power. Because this perspective is from the eyes of a Persian with historical family roots, the customs and rituals that seem strange to Western eyes are seen as a way of doing business. There is no apology for using family influence — that is just the way it works. As for the oil portion, the author provides firsthand reporting, again from the perspective of a Middle Eastern executive, on the relations between the Middle East and the rest of the world.

Blood & Oil relates many good stories that apply to our understanding of the Middle East. One of the nagging questions for the reader is: If the British Admiralty had foreseen

the current problems in the Middle East, would they have converted from coal-burning ships much later? A lesson for today's reader is that there can be far-reaching and unknown effects from the introduction of new technology in developing nations and world regions.

NEWS BRIEFS

Army Fields New 80-Passenger "Troop Hauler"

A new Army system for transporting soldiers to and from training sites was developed and placed in the field last year. The new system, called the "Troop Hauler," is replacing the outdated vehicles formerly used to transport troops to training sites.

Development of the new transportation system was a coordinated effort by the U.S. Army Training and Doctrine Command, the U.S. Army Tank-automotive and Armaments Command (TACOM) and the General Services Administration. The system, a nontactical vehicle, is managed by TACOM's Materiel Support Group. Lifeline Shelter Systems of Columbus, OH, built the vehicles.

The system consists of an 80-passenger semitrailer van and a truck tractor. The unit has rucksack storage space, air conditioning and heating, a two-way communication system between the truck driver and the drill instructor in the van, egress windows, interior lighting, escape hatches in the roof and several other key safety features.

When developing the new transportation system, both safety and durability were priorities. Safe troop movement was a top priority as well as a necessity. The new system will eliminate using outdated vehicles or commercial buses that are not really suited for moving troops and their equipment. In the past, transporting 80 troops would have required using two 44-passenger buses. Some of the troop haulers are now being used 24/7 to more safely and economically move troops from one site to another.

New troop haulers were fielded at Fort Leonard Wood, MO; Fort Sill, OK; and Fort Benning, GA. Fort Leonard Wood received the prototype model in June 2001. Since then, and after a few modifications, 10 additional units were fielded. The feedback regarding troop-hauler performance is that it outperforms anything previously used to transport troops. System performance on rough installation roads or on highways at top speeds of 65 mph has been effective and problem-free.

The Army plans to procure and field additional units in FY04.

The preceding article was submitted by Rosalie Velthoven, a Materiel Support Group member who is a Level III certified Weapon System Manager.

Heaping on Heat

Heating tents safely, effectively and efficiently is now much simpler thanks to the Family of Space Heaters (FOSH) developed by Product Manager Force Sustainment Systems located at the U.S. Army Soldier Systems Center, Natick, MA.

FOSH uses the latest advances in combustion, power-generation and microprocessor technology to provide comfort and protection for soldiers, supplies and equipment in tents during field cold-weather operations. It replaces the old World War II-era M-1941 "pot belly" and M-1950 "Yukon" heaters and eliminates the serious operational deficiencies and safety hazards associated with these antiquated systems.

While many seemingly attractive commercial space heaters are available in today's marketplace, they are unacceptable from a safety, performance and economic perspective. Military units are urged to replace their stock of these heaters with standard vented military heaters. Commercial unvented kerosene or propane-fueled heaters that release exhaust directly into the living space present a serious risk of injury or death to soldiers and should never be used.

Kerosene heaters "are intrinsically dangerous and should not be used in field environments," according to the U.S. Army Center for Health Promotion and Preventative Medicine. Army Regulation 420-90, *Fire and Emergency Services*, restricts the use of unvented space heaters in living quarters or enclosed locations where soldiers sleep, and the U.S Army Safety Center also advises commanders not to allow soldiers to use these heaters where they work or sleep.

Besides safety hazards, commercial heaters do not meet military requirements that FOSH satisfies. Some of FOSH's key capabilities include:

- Operates without electrical power.
- Operates using multifuels such as diesel, JP-8, JP-5, kerosene, wood or coal.
- Efficient, clean-burning combustion requiring little maintenance.
- Operates in temperatures down to -60 degrees F.
- Self-contained, lightweight, portable, rugged and simple to operate.
- Vents exhaust outside the tent.
- Meets heating requirements for all standard military tentage.

FOSH consists of the space heater small (SHS), space heater medium (SHM) or H45, space heater Arctic (SHA) and space heater convective (SHC). The SHM, SHA and SHS are nonpowered radiant heaters that operate inside the tent, and the SHC is a self-powered convective heater that operates outside the tent. The thermoelectric fan is a FOSH accessory used with the SHM and SHA heaters to circulate heated air inside the tent.

The SHM, SHA and SHS heat through radiation and natural convection. They use a newly developed vaporizing burner tube technology that overcomes major combustion and safety problems plaguing the nonpowered heater industry during the past 50 years. In the old heaters, fuel would pool in the bottom of the burner to be vaporized and burned. If fuel entered faster than it could be vaporized, the burner would flood and the operator would end up with a "runaway" heater.

The patented burner design vaporizes all fuel within the confines of a tube and eliminates the pooling of raw fuel during operation and the possibility of flooding the pot. It also provides a multistage liquid-to-vapor combustion process that results in much cleaner, more efficient combustion requiring much less burner maintenance.

A patented multifuel control valve is incorporated into each heater. This valve compensates for dissimilar fuel viscosities and maintains a consistent flow rate among the various types of liquid fuels and temperatures encountered in field operations. The addition of a sight glass also allows the operator to view the flame and heater operation without the need to open the lid.

The SHC is the most advanced of the four heaters. It is a self-powered, thermoelectric heater that provides forced hot-air circulation without external power normally supplied by a field generator. The SHC generates its own electrical power, without any moving parts, through thermoelectric modules located in the combustion chamber that convert waste heat into electricity. The internal generation of electrical power gives the SHC the extra capabilities of single-switch operation, completely automatic safety and temperature controls, operation without the need for a fire guard and significantly higher combustion efficiencies — all without an external power supply. To troubleshoot, the SHC comes equipped with a remote intelligent control box that tells the operator when there's a problem and how to fix it. All fielded FOSH units are available through the Defense Supply Center Philadelphia.

For more information about FOSH or the Soldier Systems Center, go to **http://www.natick.army.mil**.

PM DMS Receives Defense Acquisition Executive Recognition

A team from the Product Manager Defense Message System-Army (PM DMS-A) received the Defense Acquisition Executive Certificate of Achievement (DAE) — the highest acquisition award presented to Army organizations — during the Acquisition Senior Leaders' Conference in Seattle, WA, Aug. 14, 2003.

Assistant Secretary of the Army for Acquisition, Logistics and Technology Claude M. Bolton Jr. presented the certificate to Cathy Doolos, former PM DMS-A, who is currently the Deputy Project Manager Enterprise Infostructure, Program Executive Office for Enterprise Information Systems (PEO EIS). The PM DMS-A reports to the Project Manager Enterprise Infostructure.

The PM DMS-A team received the certificate in the Program Management category for the radical redesign of the

The PM DMS-TMS team shown from left to right: Bill Stapleton, LTC Paul Haffey, Cathy Doolos and MAJ Pedro Passapera. (Photo by Bob Fowler)

Army's Tactical Message System (TMS), taking it from concept through test in just 6 months and saving the Army more than $85 million in life-cycle costs as TMS gets fielded throughout the Army.

According to MAJ Pedro Passapera, PM DMS-A's Assistant PM-Tactical, the redesign was indeed radical, trimming the system from nearly 7,200 pounds of equipment in 9 transit cases — including extensive cabling "the size of a tree trunk" and complex servers and routers — down to a simple design that weighs 240 pounds and employs only 3 ruggedized laptops as servers and one router — all contained in 3 transit cases.

"Before, we had to modify a High Mobility Multipurpose Wheeled Vehicle (HMMWV) to transport the TMS," said Passapera. "We went from a lot of nice-to-have equipment down to the essential equipment that was really needed to get the mission done."

According to Bill Stapleton, PM DMS-A Technical Management Division Chief, the redesign was the latest in an ongoing product improvement process that began when TMS was a prototype in the early 1990s and weighed in at a whopping 16,380 pounds.

"Soldiers can unload the new TMS from a HMMWV and have it up and running in less than 30 minutes," said Stapleton. With TMS, he said, the Army can extend the same DMS services used in garrison, including e-mail-based writer-to-reader messaging based on Public Key Infrastructure signed and encrypted message technology, to deployed units. "TMS provides that seamless integration," said Stapleton.

Passapera added that the TMS program's success was achieved as a result of the teamwork between PM DMS-A and its Army and industry partners — the U.S. Army Information Systems Engineering Command/Information Assurance Security and Engineering Directorate, the U.S. Army Signal Center, Vitronics, Maddentech, Electronic Warfare Associates, Titan and Data Systems Analysts. "They have all provided great support and contributed to the team effort," said Passapera.

Other Army teams that received the DAE Certificate of Achievement were the Product Management Office for Telecommunications Systems of PEO EIS, which received two certificates. They received one for greatly contributing to the successful restoration of the Pentagon information technology infrastructure in the aftermath of 9-11 and the other in the Program Management category. The M45 Chemical Biological Mask Team of the Joint Program Executive Office, Chemical and Biological Defense, was recognized in the Program Management category for incorporating new technologies to improve the mask and reduce life-cycle costs by more than $2.6 million. The Armament Retooling and Manufacturing Support team was recognized in the Industrial Property Management category for employing innovative acquisition reform policies to save the Army approximately $40 million by attracting commercial tenants into Army Acquisition Plants, lowering facilities' disposal costs, creating and sustaining more than 3,000 jobs and providing approximately $395 million in economic impact to local communities.

Natick Offers Local High School Students Better Summer Jobs

The Science and Engineering Apprentice Program (SEAP) is a DOD-sponsored program designed to provide local area high school students the opportunity to gain valuable experience and exposure to scientific research and engineering. SEAP allows students to work with a senior scientist or engineer who acts as a mentor for eight continuous weeks during the summer. Each apprentice completes a science or engineering project under the mentor's direction. Students are then required to submit a research paper to The George Washington University based on their experience in the program.

The Soldier System Center, Natick, MA, has been participating in this program for 13 years. SEAP is a contractual program administered by The George Washington University. Each student receives a stipend in the amount of $1,450.

In 2003, Natick had eight new students and two returning students from the previous year. Over the years, many students who have participated developed long-term mentoring

relationships with scientists that still exist today. Another important SEAP program benefit is that two students have been offered permanent federal employment.

Christopher Black, a sophomore attending Dover-Sherborn High School, was one of the 10 who participated in the program last summer. He evaluated the effectiveness of cooling the Small Tactical Airbeam Tent (STAT) with a Field Deployable Environmental Control Unit, under the mentorship of Claudia Quigley, a mechanical engineer in the Collective Protection Directorate. He also examined the effect of the STAT liner and plenum on heating, ventilation and air conditioning (HVAC) efficiency. Black's observations and recommendations will be used to help improve HVAC performance and to optimize the plenum airflow efficiency. In addition to completing his research project, Black designed and installed a mounting assembly for a solar-powered fan in the STAT.

"Chris provided valuable insight on how to improve the plenum design in the STAT and was a welcome addition to our team for the summer," noted Quigley. "Chris's enthusiasm was contagious. I highly recommend participation in the SEAP for students interested in the sciences or engineering."

Fan Improves Heater Performance and Tent Comfort

At first glance, the self-powered Thermoelectric Fan used with the Army's Family of Space Heaters may appear to be a high-priced air mover. However, when used with non-electric space heaters, the fan/tent heater combination is the most inexpensive option available to Army units for temporary space heating, costing several thousand dollars less than electric-powered forced hot air systems.

The fan was conceived and developed by the Product Manager Force Sustainment Systems Shelters Team at the U.S. Army Soldier Systems Center, Natick, MA, as an important accessory to space heaters that operate on liquid or solid fuel. Manufactured by Aspen Systems Inc., Marlborough, MA, for uninsulated structures such as tents and barracks, the fan ensures that heated air is circulated downward creating even heat distribution within the structure.

Testing conducted in the Soldier Systems Center arctic chamber at minus 60 degrees F showed that the fan can increase the temperature 1 foot off the floor by more than 20 degrees F. This is important because soldiers sleep on or near the floor, and the most difficult parts to keep warm are the feet.

"With the fan, we can have the stove barely on and it will warm you throughout the tent, whereas before you had to be right on the stove to stay warm, and your backside was still cold," said SSG Chris Harder at Fort Gordon, GA. "I wish I had these in my unit over in Korea. It would make a huge change in wintertime comfort."

When placed on a heater surface, the self-powered fan converts a small amount of heat energy directly into electricity to drive the fan's impeller. It improves the heater's performance by creating warmth throughout a larger area with the same fuel consumption, or it can heat the same area with less fuel. Reduced fuel consumption, primarily JP-8 or diesel, is an important advantage because fuel must be transported along with the field unit, costing the Army as much as $12-$20 per gallon.

"Logistic fuel is considerably more important than ammunition at every point along the battlefield except at the leading edge of the fighting, and even there fuel is more valued from time-to-time," explained GEN Paul J. Kern, U.S. Army Materiel Command Commander, speaking at the Society of Automotive Engineers World Congress in March 2003.

Fuel use is critical to the Army because fueling stations are often remote in combat zones. In cold climates, the Army has estimated that a single fan can save as much as 320 gallons of heating oil in one heating season. Actual results depend on the local climate and annual "degree-days," which is the difference between 65 degrees F and the day's average temperature.

Since the fan's introduction in 2000, the Defense Logistics Agency (DLA) has received orders for more than 6,000 fans. Units can purchase the fan, currently priced at $590, through the DLA Web site at **www.dscp.dla.mil** or order it through the MILSTRIP system.

For more information about the Soldier Systems Center, go to **http://www.natick.army.mil**.

Did You Know?

Did you know that the U.S. Army Acquisition Support Center has a new Web site address that is more recognizable and user-friendly? **Check it out at http://asc.army.mil.**

New Fibers Could Lighten Body Armor

Two new fibers are vying to replace the respected but heavier Kevlar, the staple of body armor for decades, as the Army strives to enhance mobility by reducing Soldier loads.

Body armor is one of the more riveting individual equipment successes, especially from the ongoing conflicts in Afghanistan and Iraq, with reports of dozens of saved lives directly attributed to the bullet and shrapnel-halting ability of the helmet, flexible vest and rigid chest plate worn by troops.

However, body armor ranks with water, ammunition and weapons as the heaviest items worn or carried by troops, according to engineers on the Ballistics Technology Team at the U.S. Army Soldier Systems Center in Natick, MA. "The Army is putting the best available materials into Soldiers' armor," said Philip Cunniff, a research mechanical engineer. "Part of our work in the Ballistics Technology Team is to develop new materials and techniques to lighten the load of those armor systems."

Body armor technology has advanced in the past century to protect the head and torso against high-velocity handgun bullets and fragmenting munitions, such as those from artillery shells, mortar shells, mines and grenades. Lightweight small-arms protection is also available for the torso.

The nylon "flak" vest for ground troops and steel helmet from the 1960s were replaced by Kevlar vests and helmets during the 1980s in a product called Personnel Armor System, Ground Troops (PASGT). Performance increased with PASGT, but weight remained about the same, according to Cunniff.

The next major change was in the 1990s with an improved version of Kevlar that helped lighten the vest by 25 percent and increased ballistic protection.

The Ballistic Technology Team's objective is to reduce the weight again by 25-30 percent, without losing performance. Zylon and M5 fibers show potential in meeting or exceeding that goal. Zylon, a commercially available fiber first developed by the Air Force in the 1980s and now produced in Japan, turned in a solid performance in testing, said Cunniff. A prototype helmet made last year with Zylon was developed as part of the Human Systems Defense Technology Objective for Ballistic Protection for Improved Survivability. The Zylon helmet weighs 1.79 pounds vs. 3 pounds for the PASGT at the same protection levels. Cunniff said two possible roadblocks with Zylon are environmental degradation and the law requiring certain military products to be manufactured in the United States with domestic materials. Zylon has shown to break down with exposure to light, high heat and humidity, but there may be solutions to these problems, Cunniff said.

An alternative material to Zylon is M5, an ultra-high performance fiber developed by Magellan Systems International in Bethesda, MD. According to Cunniff's mathematical model for impact performance estimation based on the mechanical properties of armor materials, M5 appeared to provide exceptional impact performance. The model indicated that M5 could cut weight by at least 35 percent compared to currently available fragmentation armor at the same protection level. So far, the ballistic impact test results with a limited, relatively low-strength sample of M5 are glowing.

"We shot it, and it came out better than we expected," Cunniff said. "We found there was something wrong with the model; we underpredicted the performance of the material. Of everything we looked at, it looks like M5 will be a really big improvement in reducing the weight of armor." Another feature of M5 fiber is excellent thermal and flame protection. Besides helmets, fragmentation vests and composites for use in conjunction with ceramic materials for small arms protective plates, M5 fiber could also be used for structural composites for vehicles and aircraft.

"The military market for ballistic material is cyclic," Cunniff said. "The beauty of this fiber is that it should have a lot of other markets when Army demand falls. We're hoping it becomes cost-competitive to Kevlar."

The plan is to acquire sufficient quantities of M5 fiber by next fall to make a prototype helmet, vest and small-arms protective plate. "Then we can find out how well high-strength M5 performs and find out what kind of armor we can develop for Objective Force Warrior and the Army," Cunniff said.

Air Force's Scott Becomes DCMA Director

U.S. Air Force BG Darryl A. Scott has been selected as Director, Defense Contract Management Agency (DCMA), succeeding Army BG Edward M. Harrington, who retired after 33 years of distinguished military service.

As DCMA Director, Scott is the senior contract manager responsible for ensuring that DOD acquisition programs, supplies and services are delivered on time, within cost and at acceptable levels of performance. This involves management of 360,000 prime contracts with current work valued at $900 billion.

"I plan to build on DCMA's outstanding record of first-rate customer service, improved business processes and excellent performance from its 10,000 personnel," Scott said. "My job will be to ensure that our nation's warfighters get the very best weapons, components and spare parts; that the taxpayers get the most for their investment and that our DCMA teammates are empowered to perform to the maximum of their abilities."

Scott's most recent assignment was as the Vice Commander, Warner Robins Air Logistics Center, Air Force Material Command, Robins Air Force Base (AFB), GA, the largest single-site industrial complex in Georgia.

Scott also served as the Deputy Assistant Secretary for Contracting, Office of the Assistant Secretary of the Air Force for Acquisition in the Pentagon.

Scott holds a master's degree in logistics management, with distinction from the Air Force Institute of Technology Graduate School of Systems and Logistics, Wright-Patterson AFB, OH. He is a distinguished graduate of the Air Command and Staff College, Maxwell AFB, GA, and a distinguished graduate of the Industrial College of the Armed Forces, Fort McNair, Washington, DC.

ASC's MAJ Michelle Nassar Awarded the Bronze Star Medal

MAJ Michelle Nassar was recently awarded the Bronze Star Medal for exceptionally meritorious achievement while serving as the Headquarters Commandant for the Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASAALT) Southwest Asia Operations Center under the Army Materiel Command during *Operation Iraqi Freedom*. Nassar distinguished herself through exceptional leadership in providing superior administrative and logistics support for nearly 500 military, Department of the Army civilian and contractor personnel.

COL Mary Fuller, Director, U.S. Army Acquisition Support Center (ASC), presents the Bronze Star Medal to MAJ Michelle Nassar, ASC Operations Officer, for exceptionally meritorious achievement while assigned to the ASAALT Southwest Asia Operations Center during *Operation Iraqi Freedom*.

Nassar became the common voice that the acquisition community relied on to operate in theater. She specifically coordinated the efforts of 12 different program executive offices (PEOs) responsible for developing and fielding all of the Army's equipment and systems to include vehicles, helicopters, ammunition, command and control (C2) systems, intelligence systems, robotics, unmanned aerial vehicles, information systems and numerous other critical systems that deployed forces needed daily. Nassar established support operations for this body of forces that allowed them to operate quickly and efficiently. She was directly responsible for coordinating with the ASAALT Staff at Camp Doha and various PEOs in accounting for contractors on the battlefield and assuring that all assigned personnel had the correct tactical equipment, shots, passports, visas, clothing and supplies to survive in the harsh desert environment.

Nassar also consolidated numerous technical and administrative data for official reports that were passed back to the Army Staff (ARSTAFF) and Army Chief of Staff. She quickly assimilated data and passed on issues that needed immediate reconciliation. Nassar's direct coordination with the ARSTAFF ensured critical supplies and equipment were delivered to the Coalition Forces Land Component Command (CFLCC) throughout the area of operations. She was the direct liaison between the Army G-6 Information Office and the CFLCC G-6 and G-3 offices to coordinate all elements of hardware and software interfaces and contractor support to the Command Centers at Camp Doha and Camp Arifjan.

Nassar also worked with security and networking personnel to install the satellite hub providing situational awareness (SA) data and C2 information to the combatant commanders. She

was directly responsible for establishing funding accounts at Camp Doha and then personally wrote numerous contracts to maintain the Special Projects Office/ASAALT facilities on Avenue M. She also contracted for several work sites at outlying camps to facilitate the installation of Blue Force Tracking to enhance battlefield SA. Nassar deployed into Iraq to ensure critical parts and equipment were promptly received by the command as it began fielding Blue Force Tracking. Her support to combatant commanders was immeasurable and was key to the organization's success and the Soldiers who relied on the products and services Nassar delivered.

CONFERENCES

TACOM/Industry Logistics Symposium

The 13th annual U.S. Army Tank-automotive and Armaments (TACOM)/Industry Logistics Symposium will be held March 16-18, 2004, at the Hyatt Regency hotel in Dearborn, MI. This logistics symposium brings together government and industry personnel to discuss issues and concerns relevant to the constant changes in the logistics environment. The symposium will offer formal presentations, workshops, exhibits, demonstrations and open discussions and will emphasize how logistics contributes to transforming the Armed Forces. Symposium speakers will discuss logistics transformation, lean logistics, recapitalization and Army transformation. Speakers will also discuss the impact of logistics on Homeland Defense, U.S. Joint Forces in combat, technology development, logistics support to *Operation Iraqi Freedom*, Future Combat Systems, sense-and-respond logistics and resetting the Army structure back to pre-war conditions. For additional information on the symposium, contact Cherice Carter, TACOM Symposium Chairperson, at (586) 574-4175, or go to the National Defense Industrial Association (NDIA) Web site at **http://www.ndia.org**.

TARDEC to Host Ground Vehicle Survivability Symposium

The 15th Annual Ground Vehicle Survivability Symposium (GVSS) will be held March 29-April 1, 2004, at the Naval Postgraduate School, Monterey, CA. The symposium is being held under the auspices and sponsorship of the Survivability Technology Area, U.S. Army Tank Automotive and Armaments Command Research, Development and Engineering Center (TARDEC). The GVSS is held annually to provide a forum to discuss, exchange and debate accomplishments, discoveries and issues in all ground vehicle survivability areas.

This year's symposium will provide a setting to discuss the implications of survivability technology focusing primarily on the Unit of Action Future Combat Systems and lessons learned in Iraq. The conference is classified up to and including SECRET U.S. ONLY. For more information, contact Joe Moravec, Booz Allen Hamilton, at (586) 978-3106.

5th Joint Service Chemical and Biological Decontamination Conference

The Joint Program Manager for Decontamination and the Defense Threat Reduction Agency are hosting the 5th Joint Service Chemical and Biological Decontamination Conference (DECON 2004) May 17-20, 2004, at the Westin Innisbrook Golf Resort, Palm Harbor, FL. The conference provides a forum for dialogue between civil and federal government, industry, academia, foreign representatives and first responders on critical decontamination issues on the battlefield, at fixed sites and in our communities.

Conference attendance is open to all members of the scientific and industrial decontamination community. Attendees can register online at **https://www.enstg.com/Signup**. Enter the Conference Code: 5TH23624.

For more information on DECON 2004, contact the conference coordinator by phone at (410) 612-8247 or by e-mail at **bilotto_deborah@bah.com**.

CONTRACTING COMMUNITY HIGHLIGHTS

This issue's column focuses on developing our future Army leaders for tomorrow's challenges. As leaders, we must take an active role in developing and preparing a whole new generation to lead the Army's workforce into the 21st century. In October 2003, I welcomed six Department of the Army (DA) interns in the 1102 contracting career program from the Army Field Support Command (AFSC) (formerly the Joint Munitions Command). These interns were hired under the Outstanding Scholars Program for the 2-year DA intern program.

To further develop their leadership skills, the interns participated in the New Leader Program offered by the U.S. Department of Agriculture Graduate School. Through this program, interns must complete a 30-day developmental assignment outside the scope of their current positions. Our interns chose to perform their 30-day assignments at various DA locations, including the Office of the Assistant Secretary of the Army for Installations and Engineering, Office of the Deputy Assistant Secretary of the Army for Policy and Procurement (DASA(P&P)), Army Materiel Command (AMC), Coalition Provisional Authority (CPA) (Rear Support Office) and Defense Contracting Command-Washington (DCC-W).

A principle goal was to provide opportunities that were career broadening, educational and diverse. In keeping with that goal, developmental assignments for these interns were multifaceted. They gained experience in the various Army offices and had an opportunity to see day-to-day activities on Capitol Hill such as Senate and Congressional Hearings and Supreme Court sessions. Some interns met Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASAALT) Claude M. Bolton Jr. and attended one of his staff meetings with the Deputy Assistant Secretaries (DASs). The exposure and insight gained through these collective experiences will be instrumental for the interns to choose potential career paths and set achievable goals.

The senior staff members who volunteered as mentors were key to internship success. A special thanks to Dr. Angela Billups, Emily Clarke, Scott Crosson, Carol Doell, Linda Fowlkes, Perry Hicks, Bill Mysliwiec and Sandy Rittenhouse, who put forth the extra effort to help develop the Army's future contracting leaders.

I am pleased to introduce interns — Keith Bakewell, Emily Guy, Brett Luchsinger, Bryan Luchsinger, Jessica McMillin and Rachel Phelps. Here are highlights from their experience "in their own words."

Keith Bakewell. "I spent my 30 days working for Emily Clarke, Office of the DASA(P&P) at HQDA. The most beneficial part of my training was the opportunity to meet with personnel from numerous Army organizations and learn what they do. I met with representatives from the Army Contracting Agency, Military Traffic Management Command, AMC and the Defense Acquisition Regulation (DAR) Council. I especially enjoyed meeting with DASA(P&P) Tina Ballard and the ASAALT and attending one of his DAS staff meetings. It was beneficial to meet with and observe the higher echelon of our organization, and it gave me a better perspective of how I fit into the organization as a contract specialist at Rock Island Arsenal, IL. This is an experience I would recommend to every intern who aspires to progress in his or her career."

Emily Guy. "I spent my 30 days working at DCC-W as a procurement analyst. One of my most rewarding experiences was attending informal small business capability statement briefings with contractors. As face-to-face market research, it was neat to see the different contractors express interest in government work and market their companies. Another experience that was very rewarding was attending the DCC-W customer and contractor forums. Director of Contracting Dr. Angela Billups held these forums to find out how DCC-W is doing and what they must do to improve service. I thought going straight to the source was a good way of getting this direct information. It was a means for DCC-W, the customer and the contractor to meet and discuss their business. These forums are very informative and were a nice demonstration of a leader taking active steps to improve the office. I gained a wealth of information and knowledge and would definitely recommend that other interns take advantage of this opportunity."

Brett Luchsinger. "I spent my 30 days working in the Army's Residential Communities Initiative Office, which is dedicated to building quality residential communities for Soldiers and their families. Some highlights included the day on the Hill attending Senate hearings and meeting with Rep. Jim Nussel, my Congressman from Iowa, and Illinois Rep. Lane Evans. I also attended oral presentations of a Step Two award of a Community Development and Management Plan. I worked acquisition and source selection plans for various locations in addition to working with Source Selection Evaluation Boards. I have gained a lot more external awareness of what is really going on in Army procurement."

Bryan Luchsinger. "My experience highlights included working in the CPA Office, which assists in restoring the stability of Iraq and its economy by means of infrastructure, reconstruction and development. I also felt that shadowing LTC Kelvin Wood, DASA(P&P) Executive Officer, was very beneficial to me. Seeing the personnel he dealt with on a day-to-day basis was quite informative in connection with my job at AFSC.

Another highlight of my 30-day experience was the day I spent on the Hill. I got to tour the Capitol, which is an amazing place — especially when you consider the people and history there — and I attended interesting Senate hearings and Supreme Court sessions. Another memorable experience was meeting with Rep. Jim Nussel, my Congressman from Iowa, and Illinois Rep. Lane Evans. Lastly, one of the most important highlights was sitting in with the DASA(P&P) in one of the ASAALT's DAS staff meetings. The ability to see the big picture must happen in every organization because there is always more than one perspective out there. I would definitely recommend this experience to other interns."

Jessica McMillin. "I completed my developmental assignment at AMC's Command Contracting Office. While there, my focus area was the Contract Processes Division. My most interesting experience was learning about the DAR Council and the process for making changes to the *Federal Acquisition Regulations (FAR)* or *Defense Federal Acquisition Regulation Supplement (DFARS)*. I participated in a Cost Accounting Standards (CAS) Committee meeting where public comments to the proposed *Federal Acquisition Regulation (FAR) Part 30-Cost Accounting Standards Administration* rewrite were addressed and a recommendation to the CAS Board was prepared on accounting for Employee Stock Ownership Plans. I also learned about streamlining efforts to reduce the *DFARS* by 40 percent and to reorganize the current 28 *FAR* committees into 5 teams. I also benefited from briefings by Ronald Poussard, Office of the Secretary of Defense's Deputy Director for the DAR Directorate, and Angelena Moy, Office of the Defense Procurement and Acquisition Policy (DPAP), which demonstrated efforts to allow seamless access to the Web-based *DFARS* by relocating the procedures and guidance. I would recommend this experience and similar developmental assignments or exchanges to others who want to learn more about their organization at any and all levels."

A trip to Capitol Hill was a highlight of the interns' developmental assignments. Pictured from left to right in front of the U.S. Capitol are: Bryan Luchsinger, Keith Bakewell, Emily Guy, Jessica McMillin, Rachel Phelps and Brett Luchsinger.

Rachel Phelps. "I spent my 30 days at AMC's Office of Small and Disadvantaged Business Utilization (SADBU). I have seen a much broader picture of the Army as a whole and the different opportunities available within the government. Working at AMC provided me exposure to the headquarters environment, along with a broader view of how AFSC and other major subordinate commands fit in. We met with Ronald Poussard and other deputy directors under the direction of Deidre Lee, DPAP Office. I also attended the 7th Annual Army Small Business Conference and learned more about how small businesses partner with the Army. This assignment has been a great opportunity for me, and I would definitely recommend that other interns obtain similar rotations outside their commands."

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

Contracting Successes

AMCOM's Apache Sensors Contracting Team. The Apache Sensors contracting team (Contracting Officer Stephen Bradford and Contract Specialist Mitchell Shelton) are recognized for awarding the Apache Program Office's first International Cooperative Development contract with the United Kingdom. On Aug. 20, 2003, the firm-fixed price contract was awarded to Lockheed Martin Systems Integration-Owego to provide Enhanced User Data Module Programming Capability for the Apache helicopter's AN/APR-48A Radar Frequency Interferometer System. The team used acquisition reform initiatives, including Alpha contracting, the integrated product team approach and performance-based payments.

Army Contracting Agency (ACA's) Information Technology, E-Commerce and Commercial Contracting Center (ITEC4). ACA is recognized for establishing the Army's ITEC4 in FY03. In its first year of operation, ITEC4 provided the Army with a

AFSC's Steve Herman and Rosemary Hensley were recognized for awarding an urgent requirement contract to support munitions movement in support of *Operation Iraqi Freedom*.

plethora of information technology (IT) to support its mission requirements. IT support includes enterprise software agreements, telephone operation and maintenance services, wireless services, enterprise hardware solutions and support services and support of *Operations Noble Eagle* and *Enduring Freedom*.

Army Field Support Command (AFSC) (formerly Joint Munitions Command). Steve Herman and Rosemary Hensley are recognized for awarding an urgent requirement within 17 days for the movement of munitions from various CONUS locations. They issued a FedBizOpps solicitation April 25, 2003, and closed it May 2, 2003. The offers were quickly evaluated and the contract was awarded May 8, 2003. These professionals demonstrated the ability to quickly support customer needs by aggressively pursuing an innovative acquisition approach that was the best fit.

TACOM's Bradley Systems Acquisition Team. The Bradley Systems Acquisition Team at the U.S. Army Tank-automotive and Armaments Command (TACOM) teamed with Finance and Accounting and United Defense, Limited Partnership (UDLP) on an innovative approach to close out old contracts.

Contracting personnel supporting CPA efforts in Baghdad are ready for the cafeteria's Thanksgiving dinner. Shown left to right are: Barbara Heald, Frank Sharsel, Chris Vuxton, Patty Logsdon, COL Anthony Bell, MAJ Sharon Orlando, Dennis Longo and Interpreter Wahab.

The Enhanced Multiple Contract Negotiated Final Closeout (EMCNFC) process is a dedicated and efficient way to close out performance-complete contracts. This closeout effort allows the amounts owed by the government to be offset by amounts owed to the government by UDLP. This arrangement allows the contracts and corresponding debt or obligation to offset each other and results in no money changing hands. EMCNFC Phase 1 resulted in an offset total of $8.4 million. On July 2, 2003, the Business Initiative Council reviewed this initiative and approved the above approach.

Hurricane Isabel strikes Fort Monroe, VA, leaving heavy damage in its wake.

ACA Northern Regional Contracting Center (NRCC), Fort Eustis, VA. NRCC Fort Eustis is recognized for its efforts in supporting Fort Monroe, VA, after it was severely damaged by Hurricane Isabel in September 2003. Fort Monroe sustained extensive flooding, power outages and structural damage to every building on post. NRCC Commander LTC Fred Roitz implemented the center's contingency plan and established the NRCC operations center at Fort Eustis. The center was manned by MAJ John Dove, Terry Hyatt-Amabile, Patrick Hogston and Lance Beuschel, of NRCC's Installation Division, with their respective team members providing direct acquisition support. They procured emergency supplies and services and determined construction requirements, while also successfully completing FY03 year-end requirements. Approximately 80 procurement actions were processed with an estimated $10.1 million value for FY03 Hurricane Isabel relief efforts. In FY04, NRCC is processing approximately $5 million in contracts to support Hurricane Isabel relief efforts.

ACA Northern Region Headquarters. In the aftermath of Hurricane Isabel, several ACA Northern Region HQ personnel distinguished themselves in supporting flood-ravaged customers. Doug Packard and Ed Cooke were recognized for relocating the Principal Assistant Responsible for Contracting function to NRCC Fort Eustis to ensure that FY03 year-end customer support was provided in spite of Hurricane Isabel. Special thanks

are extended to Roger Ash and Tom Sumpter for manning the Installation Operations Center at Fort Monroe in the aftermath of the hurricane. Also, kudos to Barb Harmon, Jean Melson and Kit Lindfors for their above-and-beyond efforts supporting critical year-end responsibilities immediately following the hurricane in spite of the substantial personal property damage each of them endured.

Corps of Engineers (COE) Fort Worth, TX, District. The COE Fort Worth District is recognized for using the first reverse auction process for services under the Free Markets contracts. They successfully awarded 16 janitorial contracts for the Navy, Air Force, Army and Marine Corps. This resulted in a savings of 33 percent (or $619,264) for the government during a 5-year period.

COE New England District. The COE New England District is recognized for its efforts in providing more than 2 million gallons of bottled water procured and distributed to about 40 staging, distribution and storage areas in the aftermath of Hurricane Isabel. The COE needed to provide 24-hour-per-day efforts to meet the critical need for emergency drinking water throughout the Commonwealth of Virginia. The COE and the contractor, Lipsey Mountain Spring Water Inc., demonstrated professionalism and teamwork in completing this very successful water distribution humanitarian mission.

Anniston Army Depot's Sandra Turner was selected as AMC's Small Business Specialist of the Year.

Anniston Army Depot, AL, Awarded Small Business Award. Sandra Turner, Procurement Analyst and Small Business Specialist at Anniston Army Depot, was selected as the FY02 Army Materiel Command (AMC) Small Business Specialist of the Year. Turner has served as the Anniston Army Depot Small Business Specialist for the past 8 years. Her award confirms Anniston's history of meeting and exceeding socioeconomic targets and for providing exceptional customer service through the Small Business Administration Program. She was presented this award at the 7th Annual Army Small Business Conference held in Tyson's Corner, VA, in November 2003.

Defense Contracting Command-Washington (DCC-W) Provides Contracting Support for the Coalition Provisional Authority (CPA). DCC-W Contracting and the Office of the Administrative Assistant to the Secretary of the Army, Office of the Chief Attorney, teamed to send contracting support to Iraq in November 2003. The trip included site visits to radio and television stations north and south of Baghdad and culminated in a pre-proposal conference in Amman, Jordan, attracting contractors from around the world. DCC-W will provide acquisition support for the multimillion dollar requirement to provide radio, television and print media components to both the Iraqi people and the CPA.

Looking for Career Broadening Opportunities? Then Look No More!

The Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology is offering a 1-year developmental assignment for all DA employees at the GS-12 level (or Acquisition Demonstration broadband equivalent) in the Contracting and Acquisition Career Program (CP-14). The Contracting Career Program Office funds travel and temporary duty costs.

For details see the Oct. 31, 2003, memorandum entitled *FY2004/2005 Competitive Professional Development (CPD) Announcement for the Contracting and Acquisition Career Program (CP-14) (Updated)*. The memorandum is located online at **http://asc.army.mil/docs/programs/cp/FY04CPDAnnouncement.doc**.

Currently, the ASAALT has a developmental employee who would be happy to share her experience with you. For additional information, contact Linda Fowlkes at **linda.fowlkes@saalt.army.mil**.

U.S. Army Materiel Command Moves to Fort Belvoir, VA

In another example of the reverberations from September 11, 2001, the U.S. Army Materiel Command (AMC) has moved its headquarters, under the command of GEN Paul J. Kern, from Alexandria, VA, to Fort Belvoir, VA. HQ AMC, the only 4-star command previously not housed on a military post, had been at 5001 Eisenhower Avenue in Alexandria for the past 30 years. AMC held a Lights On Ceremony Jan. 23 to celebrate its official new temporary headquarters.

"We're excited about this move for AMC and the Army," said Kern. "It is a great honor for us to be on an Army installation."

Kern welcomed several visiting dignitaries and special guests, including CPL Joseph Hudson, SSGT Tarik Jackson and SPC Patrick Miller from the 507th Maintenance Co. Miller was awarded a Silver Star for his heroic actions during a March 23, 2003, attack on a 507th Maintenance convoy in the city of An Nasiriyah during *Operation Iraqi Freedom*.

During the attack, Miller was in the rear of a convoy that received fire from both sides. He and four other personnel became separated from the convoy and Miller returned fire on the enemy. At one point, he manually fed rounds into his weapon's chamber to protect two wounded comrades. He dismounted his vehicle and fired on a mortar position. Miller's captors found the radio frequencies he had written on pieces of paper inside his helmet and they questioned him about these numbers repeatedly. Thinking on his feet, Miller said the numbers were prices for water pumps. Disgusted, his captors threw the frequencies and his helmet into the fire.

AMC recognized Miller's courageous acts by naming its new state-of-the-art operations center the "Miller Operations Center." Miller thanked Kern and AMC for supporting him and his comrades while they were captives and when they returned to the United States. He asked that everyone remember the Soldiers still overseas and his friends who sacrificed their lives during the fight.

"I am extremely proud of this young man and his fellow Soldiers," Kern told those assembled. "As the Army's largest logistics organization, AMC is proud to name its new operations center in honor of this brave logistics Soldier so that we are always reminded of the serious work we support. SPC Miller stands here, the recipient of a Silver Star, Purple Heart Medal and Prisoner of War Medal, as a reminder to all logisticians today that first and foremost, we have to know how to fight as Soldiers."

Kern also praised the Program Executive Office Enterprise Information Systems (PEO EIS) for its expertise in handling the information technology aspect of the Miller Operations Center.

"The AMC move was very challenging because of the number of people needing to relocate, the quick turnaround time, the importance of the customer (AMC) and the subsequent wet weather," said Kevin Carroll, PEO EIS. "PEO EIS turned to Project Manager Defense Communications and Army Transmission Systems of Fort Monmouth, NJ, to control the project because of its excellent reputation for building and upgrading command centers. Led by Jerry Murphy, the team — which included the U.S. Army Communications-Electronics Command/Information Systems Engineering Command and Sytek — overcame all obstacles to deliver a first-class building, including a comprehensive information technology infrastructure, on time and within budget."

SSGT Tarik Jackson, CPL Joseph Hudson, GEN Paul J. Kern and SPC Patrick Miller stand beside the new AMC Miller Operations Center, named in honor of SPC Miller in recognition of his courageous actions during *Operation Iraqi Freedom*. (Photo by SGT Scott Meinhardt)

Because this is a temporary move, the new AMC complex is built from manufactured, modular buildings that have all the attributes of constructed buildings and are also mobile and reusable.

"This is the largest single site of a modular project in the United States," explained Mike Bowers, President of Comark Building Systems. Digging on the building site began April 25, 2003, and AMC employees, including the AMC Office of Command Contracting, moved in November 2003.

The challenges faced by everyone involved in the planning, building and subsequent move of employees was put in perspective by Kern.

"The reason we're here today — the only reason we're here — is to support our Armed Forces wherever they are," Kern emphasized. "Our mission is to provide acquisition support and logistics to Soldiers, other members of the Armed Forces, allies and to America."

Contingency Contracting Operations — Achieving Better Results

CDR E. Cory Yoder

Nearly everyone agrees that soldiers, airmen and sailors in current contingency operations are putting forth tremendous effort to achieve positive results. Nonetheless, our efforts in Iraq, Afghanistan and other contingency operation environments in

the last few years have been subject to close scrutiny and critique. Is it possible for the military to achieve better results? By better planning and coordination, tactical, operational and theater commanders can achieve better results.

Contingency Operations

A contingency is an event that requires deployment of military forces in response to natural disasters, terrorist or subversive activities, collapse of law and order, political instability or other military operations. Contingencies, by nature, require plans for rapid response and procedures to ensure the safety and readiness of personnel, installations and equipment. There are three types of "disasters" to which the international community, including the military, may be called to respond: natural disasters, technological disasters and complex humanitarian emergencies. According to the United Nations Department of Humanitarian Affairs, complex humanitarian emergencies are defined as "a humanitarian crisis in a country or region where there is total or considerable breakdown of authority resulting from internal and/or external conflict which requires an additional response that goes beyond the mandate or capacity of any single agency."

Contingencies may exist across the full spectrum of war and during military operations other than war. These include, but are not limited to, major theater wars, small-scale contingencies, domestic and international disaster relief operations, peacekeeping operations, nation building, stability operations and other humanitarian operations.

Contingency Contract Environments

Contingency contracting environments may be classified as either mature or immature. Mature environments have sophisticated infrastructures capable of supporting and sustaining operations. Generally, mature environments have host-nation support agreements; financial systems able to support complex transactions; transportation networks; and business capacity, capability and willingness of participants. Immature environments have little to no supporting infrastructure as indicated above. Immature environments may require grooming to bring the infrastructure to desired operational standards or work-arounds, such as bringing a capability into theater, to leverage capabilities.

In most contingencies where military force is required, the "complex humanitarian emergencies" are in immature environments. Most often, a breakdown of leadership and social order *negatively* impact host-nation capabilities, financial systems, transportation systems, business capacity, capability and willingness of potential participants. By nature, these immature environments present unique business and socioeconomic dynamics. Underground networks for food, shelter, safety and security, and a loss of traditional motivators to which many domestic businesses are accustomed, are just some of the potential challenges. Lack of cohesive planning can also exacerbate problems and degrade mission effectiveness.

Multifaceted Operations

Within the contingent environment, several key functions may be accomplished. Among prominent functions are diplomatic negotiations, humanitarian relief, refugee support, economic restoration, security and deweaponization, democratization and provision of essential services for food, shelter, safety, security and medical needs.

Numerous organizations actually perform these missions and include the military, nongovernmental organizations (NGOs) and private volunteer organizations (PVOs). The difference between NGOs and PVOs is that NGOs are defined by the International Red Cross as nongovernmental, both national and international, constituted apart from the government in which they are formed. PVOs are defined by the U.S. Agency for International Development as tax-exempt, nonprofit organizations working toward international development, and which received some portion of annual funding from the private sector. Generally speaking, most nations prefer the Red Cross definition and the NGO designator for defining both NGOs and PVOs.

Contingency Contracting Officer (CCO) Employment Models

Most CCOs deployed fill one of three hierarchical employment models. The most basic and simplistic model is the "ordering officer" model. This is the most rudimentary of contracting support and includes such functions as placing orders against existing theater contracts. By nature, this requires little interactive engagement in the environment and is best suited for warranted junior officers and enlisted personnel. The next higher-level model is the "leveraging contracting officer." This level includes the basic functions of the ordering officer model, but includes leveraging the capacities and capabilities of local and regional economies in the contingent theater. As such, there may be a reduced need for organic service and materiel support. The practitioner in the leveraging model clearly will be engaged in interfacing with local and regional businesses, creating business processes and potentially coordinating with higher military, NGO/PVO and political organizations. With this in mind, only higher-level and more qualified and capable practitioners should perform in the leverage model. This model's shortfall is that CCO operations may or may not be integrated with the broader goals of national and theater objectives. Worst case, some of the tactical execution may actually be counter to those higher-level goals.

The highest-level model is the "integrated planner and executor CCO (IPE CCO)." This model takes the leveraging contracting officer function one giant step forward. In this model, well-educated and qualified CCOs are integrated into the operational planning phases of contingencies, often before actual troop deployment, then make the transition to operations. An IPE CCO hallmark is that contingency contracting operations may be planned and subsequently executed to meet national strategic and theater objectives. Additionally, NGOs and PVOs, which, in many cases, are essential to overall efficiency, effectiveness and ultimate success of operations, can be integrated into contingency operation planning and execution. While this integration requirement may seem painfully obvious, the integrated planning and execution among warfighters, CCOs and NGOs/PVOs does not occur on a regular and recurring basis.

Better Planning and Coordination

Recently, there have been several calls for better planning and coordination. However, none of these calls specifically focus on the inherent link required between warfighters, CCOs and NGOs/PVOs. For example, *Presidential Decision Directive 56 (PDD-56), Managing Complex Contingency Operations*, issued by former President William J. Clinton, calls for the integration of planning and execution among agencies called to perform contingencies. However, *PDD-56* was flawed because it does not specifically apply to combat operations. In reality, most contingencies where military CCOs may be deployed are, in fact, part of combat operations or military operations adjunct to combat.

Integrated Planner and Executor CCO Model

I propose that the IPE CCO be used in a broader planning and execution environment. The CCO, with higher-level certification, education and experience, could be integrated within J-4 and J-5 Logistics and Planning/Operations and Exercise organization structure. Concurrently, operational planners can leverage integration of all theater players, including military, NGOs/PVOs and contractors, to achieve harmony between National Security Strategy, Combatant Commander (COCOM) and significant NGO/PVO objectives, through integrated planning and exercising and, ultimately, execution. This integrative planning, exercising and execution may help in eliminating competing and often conflicting participant demands, closely marry acquisition support with stated objectives, allow for the creation of robust contingency contract support plans and integrate such plans into broader operational plans in support of theater operations.

Moving From Theory to Practice

All organizations will benefit from integrating contingency contracting planning and execution with broader operational and theater planning. The IPE CCO model has distinct benefits and unique challenges. COCOMs are generally interested in getting into theater, accomplishing the mission and getting their troops back out. The premise is that without integration, they are not effectively or efficiently using all players and assets capable of providing leverage for their mission achievement. Clearly, they can benefit from integration.

The J-4 and J-5 staffs, which have traditionally focused on "logistics" rather than integrative contracting and logistics, can better achieve logistical support through integration of all theater assets, including contingency contracting.

Ultimately, personnel planners and assigners have a stake in the model. The IPE CCO inherently demands highly educated and experienced personnel to effectively integrate into the higher-level planning organizations. The IPE CCO could benefit from master's-level education in at least one specialty, such as contracting, and concurrently with Joint Professional Military Education Phase I and II, and associated master's education. This qualification level is not for everyone and would have a decided impact on the personnel pipeline.

Clearly, NGOs and PVOs would benefit from the IPE CCO model. These organizations could develop a better understanding and dialog with their military counterparts, something that is now lacking. NGOs and PVOs are sensitive and dedicated to maintaining a perception and, often, the reality of being wholly detached from a particular government or military. Any close association could damage their "neutrality" and adversely affect their ability to deliver services and supplies during actual contingency operations. However, they are often inescapably dependent on the military to provide the secure framework, logistics support and contracting to conduct their business. Meshing, or creating harmony of operations, may be a better moniker than integration. Nonetheless, national strategic objectives, theater and operational objectives of both the military and NGOs/PVOs requires coordination to achieve maximum synergies and the desired efficiencies and effectiveness to meet the collective end-state. Using CCOs to create better planning and integrated operations will result in resources and materiel being where it is needed when it is needed most.

***CDR E. CORY YODER**, U.S. Navy, is a Lecturer and Academic Associate (Program Manager) for two graduate master's programs at the Graduate School of Business and Public Policy at the Naval Postgraduate School. He has an M.S. in management from the Naval Postgraduate School and an M.A. in national security and strategic studies from the Naval War College.*

Vuxton Joins Coalition Provisional Authority Contracting Activity Iraq

Chris Vuxton is the PARC for the CPA Contracting Activity Iraq.

Army Acquisition Corps (AAC) member Chris Vuxton, a 2003 Industrial College of the Armed Forces graduate, has been assigned to the Coalition Provisional Authority (CPA) Contracting Activity Iraq, as the first CPA Principle Assistant Responsible for Contracting (PARC). Given a week's notice, Vuxton departed the Army Contracting Agency in August 2003 and reported to Baghdad where he oversees a joint contracting effort that includes Army, Navy, Air Force and DOD civilian contracting officers.

The CPA Contracting Activity Iraq is charged with contracting for goods and services for the United States and Coalition Forces using money appropriated by U.S. Congress and coalition governments and is responsible for all CPA reconstruction contracting throughout Iraq. CPA contracting officers are found in four Iraqi regions: Baghdad, Mosul, Al Hillah and Al Basrah.

Contracting projects vary from training and equipping the restructured Iraqi Police Force to repairing and renovating more than 40 schools in the Al Basara area alone. Rebuilding a 30- to 40-year-old electrical generation and distribution infrastructure keeps three contracting officers occupied full time as well as a large group of technical experts from all over the world.

The immediacy of this assignment means that Vuxton and his staff work 15-hour days, 7 days a week. The central office is located within the CPA Compound in Baghdad in an area called the "Green Zone." The area has been a continued target of terrorist activity and is surrounded by troops, cement walls, razor wire and armored vehicles. As the Green Zone area was reduced to allow Iraqis access to more of their capital city, it became the target of nearly nightly rocket and mortar fire.

There are three Iraqi employees working in Vuxton's office. "All told me the same thing when I asked if they had ever been in this building before the war," he said. "They told me they would have been shot if they even walked or drove past it. The extent of Saddam Hussein's brutality was beyond words."

Vuxton praised the daily bravery and dedication of the young men and women in uniform who have secured Iraq from a brutal regime and continue to place themselves in harm's way to accomplish their mission and pave the way for democracy to become reality in Iraq. "These are the heroes who make it possible for those of us with sore knees and bad eyes to come here and do our jobs," Vuxton stated.

The AAC salutes Chris Vuxton and all our brave military and civilian personnel who are rising to the challenge and going where they are needed to get the job done!

ITES FA-1 Contracts Awarded

In September 2003, the Information Technology E-Commerce and Commercial Contracting Center (ITEC4), in conjunction with the Army Small Computer Program under the Program Executive Office for Enterprise Information Systems, the Army Chief Information Officer (G6) and Network Enterprise Technology Command, awarded four commercial item, indefinite delivery, indefinite quantity contracts for the Information Technology Enterprise Solutions (ITES), Functional Area 1 (FA-1), Enterprise Hardware Solutions (EHS). The contracts were awarded to Dell Computer Corp. of Round Rock, Texas; GTSI Corp., a small business from Chantilly, VA; Hewlett-Packard Co. of Gaithersburg, MD; and Lockheed Martin Integrated Systems of Bethesda, MD. Contract performance commenced Oct. 1, 2003, for a 3-year base period (including a 60-day phase-in), with two 2-year option periods. The contract maximum for each individual contract is $500 million. This figure represents a combined maximum for all ITES FA-1 awards. Stated otherwise, ordering under all four ITES contract awards is subject, collectively, to $500 million total. The contracts were awarded for the contract minimum of $10,000.

The purpose of ITES FA-1-EHS is to support the Army enterprise infrastructure and infostructure goals with information technology (IT) equipment (commercial servers, workstations, managed platforms, storage systems, network equipment and related products) and related services (installation, equipment maintenance, site survey, system configuration

and integration, image loading, data migration, asset tracking and, potentially, legacy equipment maintenance).

On May 2, 2003, ITEC4 issued the Request for Proposal on the Army Single Face to Industry and Federal Business Opportunities Web sites. The acquisition was conducted under performance-based principles, where the offerors were required to explain their approaches to meeting the following eight Army goals as identified in the Statement of Objectives.

- Support and partner on the Army's e-commerce system (i.e., IT Marketplace Direct).
- Support the Army's data requirements and emerging asset management through electronic interface.
- Provide compliant, state-of-the-market, sustainable and supportable enterprise solutions.
- Seek ways to achieve customer satisfaction.
- Ensure affordable, best-value, best-pricing solutions.
- Establish a partner-focused working relationship with Army customers across the Army enterprise and within the DOD integration framework.
- Effectively use subcontractors and teaming partners, including small and disadvantaged businesses.
- Assist the Army through best commercial practices in the migration to enterprise resource planning.

ITES FA-2 Contracts Awarded

In October 2003, the Information Technology E-Commerce and Commercial Contracting Center (ITEC4), in conjunction with the Army Small Computer Program under the Program Executive Office for Enterprise Information Systems, the Army Chief Information Officer (G6) and Network Enterprise Technology Command, awarded five indefinite delivery, indefinite quantity contracts for the Information Technology Enterprise Solutions (ITES), Functional Area 2 (FA-2), Enterprise Mission Support Services Solutions (EMS3). The contracts were awarded to Northrop Grumman Information Technology of McLean, VA; IBM Corp. of Bethesda, MD; Lockheed Martin Integrated Systems of Bethesda, MD; and two small businesses — QSS Inc. of Lanham, MD; and NCI Information Systems of McLean, VA. Contract performance covers a 3-year base period (including a 60-day phase-in), with two 2-year option periods. The contract maximum for each individual contract is $500 million. This figure represents a combined maximum for all ITES FA-2 awards. Stated otherwise, ordering under all five ITES contract awards is subject, collectively, to $500 million total. The contracts were awarded for the contract minimum of $10,000.

The purpose of ITES-EMS3 is to support the Army enterprise infrastructure and infostructure goals with information technology (IT) services and solutions. IT solutions will be acquired by issuing individual task orders that will identify specific, detailed requirements. It is anticipated that the services required will fall under the following task areas: program management, enterprise IT policy and planning, enterprise design, integration and consolidation, information assurance, business process reengineering, requirements analysis, market research and prototyping, information and knowledge engineering, development of software interfaces and software configuration, product integration, test and evaluation, seat management, asset management and technology insertion. Additionally, a full range of services will be needed to analyze requirements, develop and implement recommended solutions, and operate and maintain legacy, ITES, or other products. ITES-EMS3 contemplates services-based solutions under which contractors may be required to provide a full range of IT equipment necessary to implement solutions. ITES-EMS3 contractors are expected to use ITES-Enterprise Hardware Solutions (EHS) (FA-1) contractors as preferred supply sources.

On May 2, 2003, ITEC4 issued the Request for Proposal on the Army Single Face to Industry and Federal Business Opportunities Web sites. The acquisition was conducted under performance-based principles, where the offerors were required to explain their approaches to meeting the following eight Army goals as identified in the Statement of Objectives.

- Support and partner on the Army's e-commerce system (i.e., IT Marketplace Direct).
- Support Army data requirements and emerging asset management through electronic interface.
- Provide compliant, state-of-the-market, sustainable and supportable enterprise solutions.
- Seek ways to achieve customer satisfaction.
- Ensure affordable, best-value, best-pricing solutions.
- Establish a partner-focused working relationship with Army customers across the Army enterprise and within DOD integration framework.
- Effectively use subcontractors and teaming partners, including small and disadvantaged businesses.
- Assist the Army through best commercial practices in the migration to enterprise resource planning.

ARMY AL&T Writers Guidelines

http://asc.army.mil/

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Purpose

To instruct members of the acquisition, logistics and technology (AL&T) community about relevant processes, procedures, techniques and management philosophy and to disseminate other information pertinent to the professional development of the Army AL&T Workforce.

Subject Matter

Subjects may include, but are not restricted to, professional development of the Army's AL&T Workforce, AL&T program accomplishments, technology developments, policy guidance and acquisition excellence. Acronyms used in manuscripts, photos, illustrations and captions must be kept to a minimum and must be defined on first reference. **Articles submitted to *Army AL&T* will not be accepted if they have been scheduled for publication in other magazines.**

Article Length

Articles should be approximately 8 double-spaced typed pages, using a 20-line page, and must not exceed 1,600 words. **Articles exceeding 1,600 words will not be accepted.** Do not submit articles in a layout format or that contain footnotes, endnotes or acknowledgement lists of individuals.

Photos and Illustrations

A maximum of 3 photos or illustrations, or a combination of both, may accompany each article **in files separate from the manuscript.** Artwork must be accessible for editing and not embedded in the manuscript. Photos may be black and white or color. **Illustrations must be black and white and must not contain any shading, screens or tints. All electronic files of photos must have a minimum 300-dpi resolution (JPEG or TIFF). If they do not meet this requirement, glossy prints of all photos must be submitted via U.S. mail, FedEx, etc.** Photos and illustrations will not be returned unless requested.

Biographical Sketch

Include a short biographical sketch of the author/s that includes current position, educational background, acquisition certifications and AAC membership if applicable.

Clearance

All articles must be cleared by the author's security/OPSEC office and public affairs office prior to submission. The cover letter accompanying the article must state that these clearances have been obtained and that the article has command approval for open publication.

Individuals submitting articles that report Army cost savings must be prepared to provide detailed documentation upon request that verifies the cost savings and their reinvestment. Organizations should be prepared to defend these monies if higher headquarters has a higher priority for them. All articles are cleared by the Acquisition Support Center Director.

Submission Dates

Issue	Author's Deadline
January-February	15 October
March-April	15 December
May-June	15 February
July-August	15 April
September-October	15 June
November-December	15 August

Submission Procedures

Article manuscripts (in MS Word) and illustrations/photos (300-dpi JPEG or TIFF) may be submitted via e-mail to **army.alt.magazine@asc.belvoir.army.mil**, or via U.S. mail to the address in the first paragraph at the top of this page. All submissions must include the author's mailing address and office phone number (DSN and commercial).

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1. Publication Title	2. Publication Number	3. Filing Date
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a. Total Number of Copies (Net press run)	37,630	37,836
b. Paid and/or Requested Circulation (1) Paid/Requested Outside-County Mail Subscriptions Stated on Form 3541. (Include advertiser's proof and exchange copies)	341	341
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16. Publication of Statement of Ownership
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17. Signature and Title of Editor, Publisher, Business Manager, or Owner: Michael L. Boddie, Editor-in-Chief, Army ALAT magazine — Date: 5 Jan 04

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