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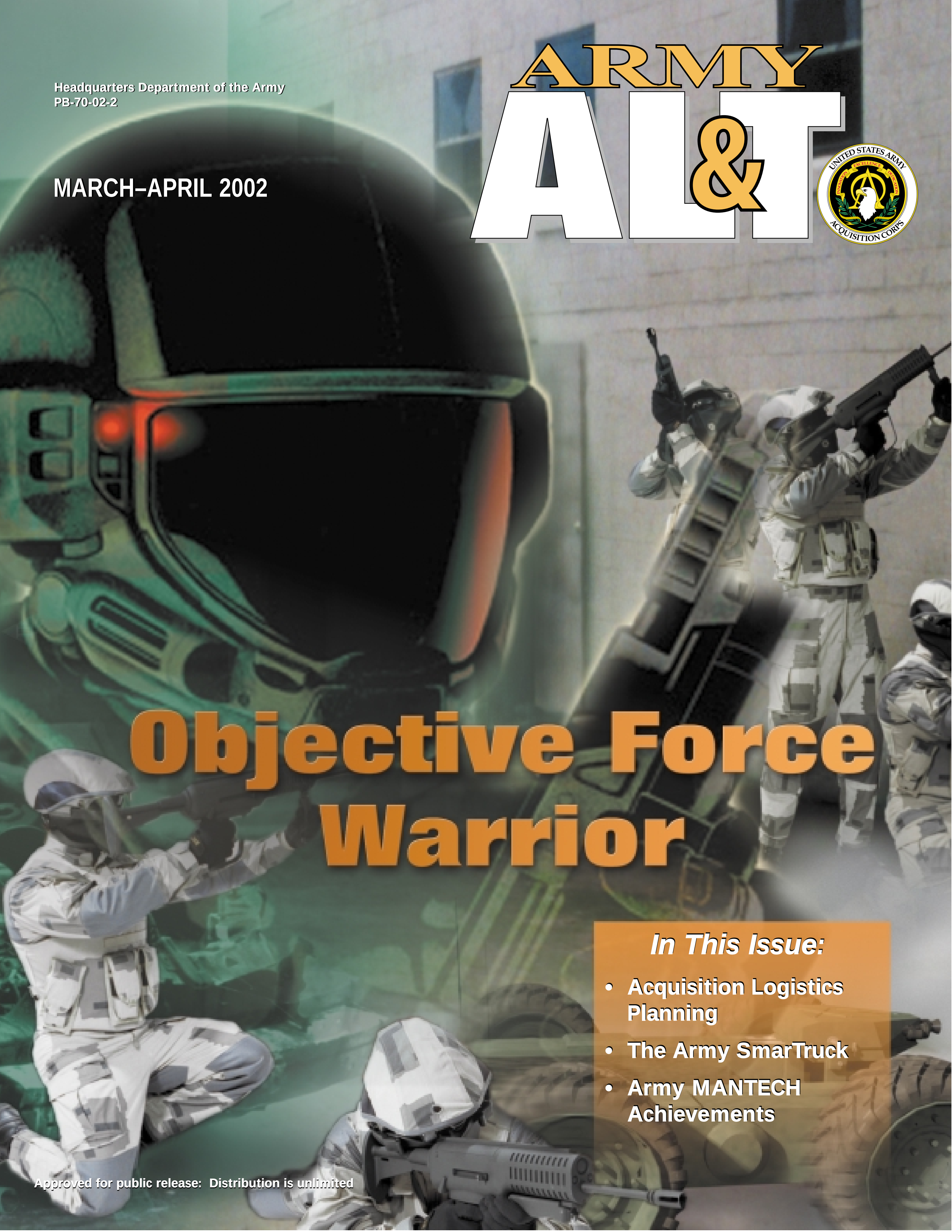

Objective Force Warrior

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FROM THE ARMY ACQUISITION EXECUTIVE

Objective Force Warrior

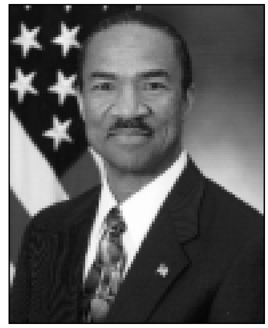
The recent attacks on our homeland and the operations that followed confirm our earlier decision to accelerate the Army's transformation to the Objective Force and provide new urgency to our work. The Army is committed to fielding the Objective Force in this decade. Army science and technology (S&T) is clearly focused on a new generation of land-combat systems, the Future Combat Systems (FCS). FCS is envisioned as a networked "system-of-systems," including manned and unmanned platforms that will be capable of conducting direct and indirect fires, air defense, reconnaissance, surveillance and target acquisition, and battle command and communications—all at operational tempos that will surpass even the war-winning capabilities in today's force.

The Army leadership recognized at the start of FCS that the Objective Force also needed a special focus on technology for the soldier who must walk the enemy's ground before any battle is finished decisively. This vision has now crystallized into an S&T program that we call the Objective Force Warrior, a new leap forward that extends the advances of the Army's current Land Warrior acquisition program for the light forces infantryman. Land Warrior will bring revolutionary information dominance, situational awareness, and weapon systems to the individual soldier. For example, every soldier will see on his display where his comrades are, will know instantly about the location of enemies, and will have a "911" capability to let people know if he is in trouble.

Still, our imaginations permit us to define even more revolutionary capabilities. Imagine, if you will, a squad of Objective Force Warriors on duty in a foreign land sometime in the period 2010-2015. They were deployed in one day, just a few hours before. They are already prepared to engage in the full spectrum of operations, from peacekeeping to high-intensity combat, because their embedded training systems and individual access to all-source worldwide intelligence allow them to start training for their missions in detail the minute they receive the deployment order in the states. On the ground, assuming their basic peacekeeping mission to separate warring local factions, they distribute miniature sensor systems to supplement national assets and unmanned air vehicle reconnaissance systems, confer with local leaders using automatic voice translation systems, and develop a thoroughly detailed knowledge of the area and its dangers.

Early in the mission, the situation gets ugly. Citizens of one side are incited to riot against the Americans, bearing pipes and pitchforks against the peacekeepers. But advanced sensors give ample warning of the unruly crowd's approach, allowing the Americans to take strong positions, increase their protective posture with automatic face shield deployment, filter system activation, and an exoskeleton force enhancement system. Issuing warnings to the crowd in the local language through their automatic translation systems, the Americans bear up for minutes with restraint under a hail of rocks, bottles, and sticks, then decide to deploy tear gas to disperse the crowd.

As the crowd runs for air, the soldiers' advanced sensors detect a new, much more dangerous threat—snipers taking aim at them from a hill several hundred yards away. Instantly, the soldiers' chameleon-like uniforms



allow them to "cloak" into near invisibility, assuming the colors and patterns of the nearby terrain. Quickly checking their rules of engagement, the soldiers direct precision, high-explosive projectiles at the snipers from their personal weapons, killing them, but not before one of the Americans is hit by a rifle bullet. His protective suit stops the bullet, reducing what would otherwise have been a killing penetration to a blunt trauma injury. Then the suit's medical status sensors and self-medicating systems go to work, responding automatically to his wounds, reporting the impact to the chain of command, and applying pressure to affected areas.

As the squad leader checks the wounded soldier's status, the threat ratchets up yet again. Sensors detect an armor/infantry platoon-sized force approaching in battle formation. The squad deploys its organic, unmanned hovering air vehicle, takes the measure of the attack, and launches loitering attack missiles to destroy the threat, all in a matter of minutes. But one enemy vehicle survives. As the squad calls up its robotic follower missile launcher, the enemy vehicle scores a lucky hit, putting the launcher out of action. In a do-or-die play, this last vehicle is destroyed by the wounded soldier who, sustained by his protective suit, is able to fire the remaining precision-fire missile lying near him. As the day closes, the squad leader speaks to the wounded soldier's mother thousands of miles away, assuring her that he is fine and will be home soon.

Some of these scenarios were explored in an innovative video presentation created recently by the Army's Institute for Creative Technologies under the direction of Dr. A. Michael Andrews II, Deputy Assistant Secretary of the Army for Research and Technology and the Army's Chief Scientist. This whole will be much more than the sum of its parts. These technologies in turn will further enable us to implement change across our Doctrine, Training, Leader Development, Organization, Materiel and Soldiers (DTLOMS). DTLOMS will accept these new capabilities to bring another revolution in the way we fight. And not just the way Americans fight. In Afghanistan and other operations, we see the tremendous advantages of fighting as part of an international coalition. Clearly, sharing technology with our allies will enhance our overall effectiveness. Conversely, we will take special care with industrial security, anti-access systems, and other technologies to ensure that our adversaries do not gain access to this or comparable technology.

Like many products of Army S&T in the past, the technologies we've discussed will find application here at home among those who have challenging, dangerous professions including police, fire, medical responders, and emergency service workers. The sensors, protective systems, and lethal and nonlethal weapons advanced under the Objective Force Warrior Program will help firemen find children in burning homes, protect police on the streets, provide unimagined lifesaving information to paramedics responding to accident scenes, and more.

Most important, the Objective Force Warrior is not a fixed objective. Rather, it will be an evolutionary process, evolving and improving for years and decades into the future, incorporating advancements that we can't foresee even today.

That's our vision for the light forces soldier of the future—the Objective Force Warrior. I'm glad to report to you that the S&T community is organized, empowered, and motivated to take us there.

Claude M. Bolton Jr.

March-April 2002; PB 70-02-2

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FEATURES

DEPARTMENTS

COVER

The Objective Force Warrior initiative is expected to provide revolutionary capabilities for the future dismounted warfighter. (Graphic art for the cover provided by Steve Smith, Natick Soldier Center.)

A VISION FOR THE OBJECTIVE FORCE WARRIOR

Dr. A. Michael Andrews II, Dr. Pamela Beatrice, Philip Brandler, and Roy Cooper

Introduction

Today's fully equipped warrior is too "heavy," and his lethality, power, survivability, mobility, and situational awareness are too limited to ensure overmatching capability in the warfighting environments anticipated during the next 20 years. To ensure that the Army remains "persuasive in peace and invincible in war," we must do more for our dismounted warrior. The Objective Force Warrior (OFW) is the answer.

The Objective Force Warrior is a bold initiative to provide a revolutionary capability for the dismounted warrior of the future. The impetus for this initiative is multifaceted:

• "Light forces must be more lethal, survivable and tactically mobile"—*Chief of Staff of the Army intent statement of June 1999*;

• "Soldiers—not equipment—are the centerpiece of our formation"—*The Army vision*;

• Mounted-enabled by dismounted and dismounted-enabled by mounted—*Unit of Action operations described in the Mission Need Statement for Future Combat Systems (FCS)*;

• "Provide enhancement to enable soldiers to conduct dismounted maneuver with load bearing equipment and load not to exceed 40 pounds"—*Statement of Required Capabilities, FCS*; and

• Operations in Afghanistan demonstrate the importance of the warfighter on the ground.

The dismounted warrior is a primary element in the Army's nonnegotiable contract with the American people to protect our Nation's interests. These interests may range from peacekeeping, to support and stability operations, to full-scale war. Therefore, the equipment and supplies worn, carried, or consumed by the dismounted warrior are a key Army priority.

A View Of The OFW

The future OFW will fight as a team with unparalleled capabilities. To achieve overwhelming overmatch, the OFW must apply a new fighting paradigm—see first, understand first, act first, and finish decisively.

• *See First*. The OFW must first see the enemy by detecting, identifying, and tracking him.

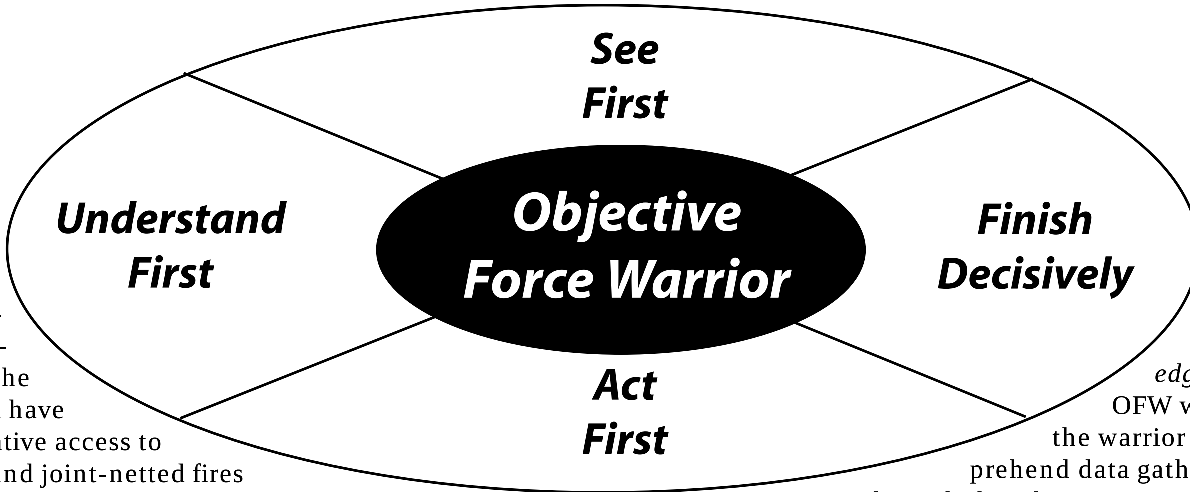
• *Understand First*. With a common operating picture of the battlefield enabled by seeing first, the OFW will have an unprecedented capability to understand what the enemy is doing and better anticipate his actions.

• *Act First*. Seeing and understanding first will give the OFW the situational dominance necessary to act first—to engage at times, places, and with methods of his own choosing. This will allow informed decisionmaking at the lowest levels, yielding an operational tempo able to operate inside the opponent's decision cycle.

• *Finish Decisively*. Enabled by the ability to see first, understand first, and act first, the OFW will apply enhanced agility and overwhelming lethality to destroy the enemy's ability to fight.

The OFW vision requires a "system-of-systems" approach integrating lethality; command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR); survivability; agility; and sustainment. The OFW must employ state-of-the-art solutions rigorously integrated through sophisticated system architecture. Aggressive application of analysis and modeling and simulation will be required to support the system-of-systems trades necessary to ensure optimal OFW performance at minimal weight, cost, and delay. Additionally, the OFW will use open system architecture to allow continuous incorporation of new technologies. This approach will ensure our dismounted warriors have the latest capabilities integrated into their systems and are not waiting on the integration of multiple improvements via a block upgrade.

Our future OFW will not fight with yesterday's technologies against an enemy capable of applying the



latest commercial capabilities. The OFW will have collaborative access to organic and joint-netted fires providing line-of-sight and beyond-line-of-sight fires on the move. The OFW will have access to a common operating picture of the battlefield through a combined sensor and robust communication system that also provides collaborative planning and rehearsal capabilities. The OFW will be capable of operating for 72 hours without resupply with connectivity to FCS. The OFW will also enjoy unprecedented survivability, enabled not only by better situational understanding, but also by an integrated combat suit that provides full-spectrum protection.

Technology Options

The leap-ahead capabilities anticipated for the OFW will be enabled through technology developments in five primary focus areas: lethality, survivability, knowledge, agility, and sustainment. Examples of technology opportunities in these areas follow.

Lethality. The OFW must provide individuals the capability to detect, identify, and kill targets throughout the full spectrum of military operations under all operational environments. To achieve this will require development of systems to allow access and application of the lethal assets from within the squad and higher echelons, a family of lightweight direct and indirect fire soldier weapons, and nonlethal capabilities.

Survivability. The future dismounted warrior will be exposed to threats intended to create casualties or significantly reduce performance. These threats will be from ballistic, blast, directed energy, fire/incendiary, chemical/biological, nuclear, physiological, environmental, and vibration/impact sources. In response to these threats, the OFW must provide effective protection under all battlefield conditions and the ability to see the enemy first, avoid exposure, and mitigate consequences. Key technology elements are as follows:

• Advanced sensors will allow the OFW to see the enemy first across a full spectrum of battlefield environments with emphasis on urban terrains.

• A lightweight soldier suit will integrate signature management, chemical and biological weapon protection, advanced lightweight armor, physiological monitoring, and casualty care. The Institute for Soldier Nanotechnologies is a major Army initiative for achieving this capability.

• A personal thermal management system (microclimate conditioning) will allow operation in all environmental conditions.

Knowledge. The OFW will enable the warrior to comprehend data gathered through the Objective Force C4ISR system and quickly evaluate possible actions and their outcome. Specifically, the OFW will have a nearly complete picture of the battlefield and the tools to rapidly exchange critical information across the full spectrum of military operations. The information-enabled warrior requires on-demand connectivity and decisionmaking capability. Key technology elements are as follows:

• Miniaturized, rugged, networked squad radio;

• Data visualization tools;

• Systems for near real-time soldier information processing systems; and

• Advanced decisionmaking tools and software "intelligent agents."

Agility. The OFW must have unprecedented agility with enhanced human performance. A specific goal is to reduce the weight carried by the dismounted warrior to 40 pounds or less. Key technology elements include the following:

• Approaches to offload, lighten, and assist the warrior to include leverage of the Defense Advanced Research Projects Agency's (DARPA's) exoskeleton program and semi-autonomous robotic mules;

• Warfighting simulations and virtual prototypes of warrior systems;

• Enhanced warrior performance through human modeling and pharmacological advances; and

• Embedded and small-unit leader training capabilities.

Sustainment. Both the physical and mental health of the OFW are important in addition to an autonomous ability to sustain the individual warrior across the spectrum of battlefield conditions. Specifically, the OFW must provide for 72-hour organic sustainment capability supplemented by an emergency resupply system. Key technology elements include:

• Compact soldier high-power systems through leveraging of DARPA's Palm Power Program,

• Water generation and purification methods, and

• Novel materiel delivery systems to provide never-late, warrior-specific resupply.

Strategy

The warfighter is central to the Objective Force, and the transition of OFW technologies and capabilities requires integration with FCS. To coordinate with FCS milestones, the OFW effort will be pursued in two separate science and technology (S&T) phases, the first occurring from FY02 through FY06 and the second from FY07 to FY11.

The FY02-06 phase will be pursued through the execution of two parallel program elements. The first will be a system-of-systems concept design of the OFW using up to two lead system integrators. This program element will evolve through a concept exploration phase to preliminary system design, and then to system prototyping and demonstration. The second program element will be the pursuit of high-risk, high-payoff technologies and component development. Both program elements will be initiated in FY02 and continue until transition to system development and demonstration (SDD) activities in 2006. These activities will likely be followed by low-rate initial production and fielding beginning in the 2010 period. This schedule aligns OFW production with FCS Block I production.

The second phase of the OFW Program begins in 2007 with a planned transition to SDD in 2011. This phase will integrate and demonstrate technologies that are currently in the early stages of research (for example, exoskeleton and microclimate-conditioning technologies) and require further development to determine their potential contribution to the OFW. The Phase II schedule is structured to coincide with that of the FCS block upgrade.

Conclusion

Nearly 85 percent of all U.S. casualties in World War II, in Korea, and in Vietnam were inflicted on our dismounted warriors. The Army's S&T community, through development of the OFW, fully expects a different result on future battlefields. That result will be an unfair fight that significantly favors the U.S. Army warrior.

Note*: The Institute for Creative Technologies, in collaboration with the Office of the Deputy Assistant Secretary of the Army for Research and Technology, has produced a digital video disk (DVD) to dramatize a visionary concept for a revolutionary approach to the Objective Force Warrior. The DVD depicts a series of dismounted warrior vignettes set in the 2015 timeframe and illustrates leap-ahead warfighting capabilities that may be in the realm of possibility. Information about the DVD can be obtained by contacting* ***ofwvideo@saalt.army.mil****.*

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DEVELOPING THE SOLDIER SYSTEMS ARCHITECTURE

COL Theodore Johnson

Army transformation, incorporating revolutionary employment concepts and cutting-edge technology, creates significant challenges not only for program managers who support it, but also for those who must meet today's user requirements. Project Manager (PM), Soldier Systems employs the "soldier-as-a-system" concept, along with a soldier systems architecture, to address current requirements and establish a strong foundation for transformation to the Objective Force.

The soldier systems architecture is a framework that considers required functions, establishes system modularity, and specifies internal and external interfaces among system modules that are integrated into a variety of platforms to satisfy the soldiers' needs. This architecture relies on commonality—for functions, modular components, and module interfaces—that applies to a series of warrior (soldier) platforms. For example, instead of producing a component uniquely designed for the infantry rifleman, we develop modules applicable to all types of infantry that can also be used for armor, artillery, aviation, support services, and joint Service requirements.

The obvious benefits are reduced cycle time to field new platforms through commonality and reuse, improved sustainment, and cost savings resulting from much larger production quantities. However, the soldier systems architecture helps us do more. For example, by using modular components, incorporating new commercial technology, and developing products via transformation-related research and development (R&D), we can more economically produce multiple platforms. This can be accomplished in parallel fielding events synchronized with the Army's Unit Set Fielding Plan.

User Involvement

User-needs generation is the initial step for developing the soldier systems architecture. For example, users are currently developing requirements in other combat domains including armor, aircraft, special operations, medicine, combat engineering, and artillery. Support-type requirements are also being developed for platforms in areas such as maintenance and logistics.

The soldier-as-a-system concept applies to user requirements as well. PM, Soldier Systems has been working with the U.S. Army Infantry Center as the lead proponent to coordinate the requirements definition process. The idea, illustrated in Figure 1, is that

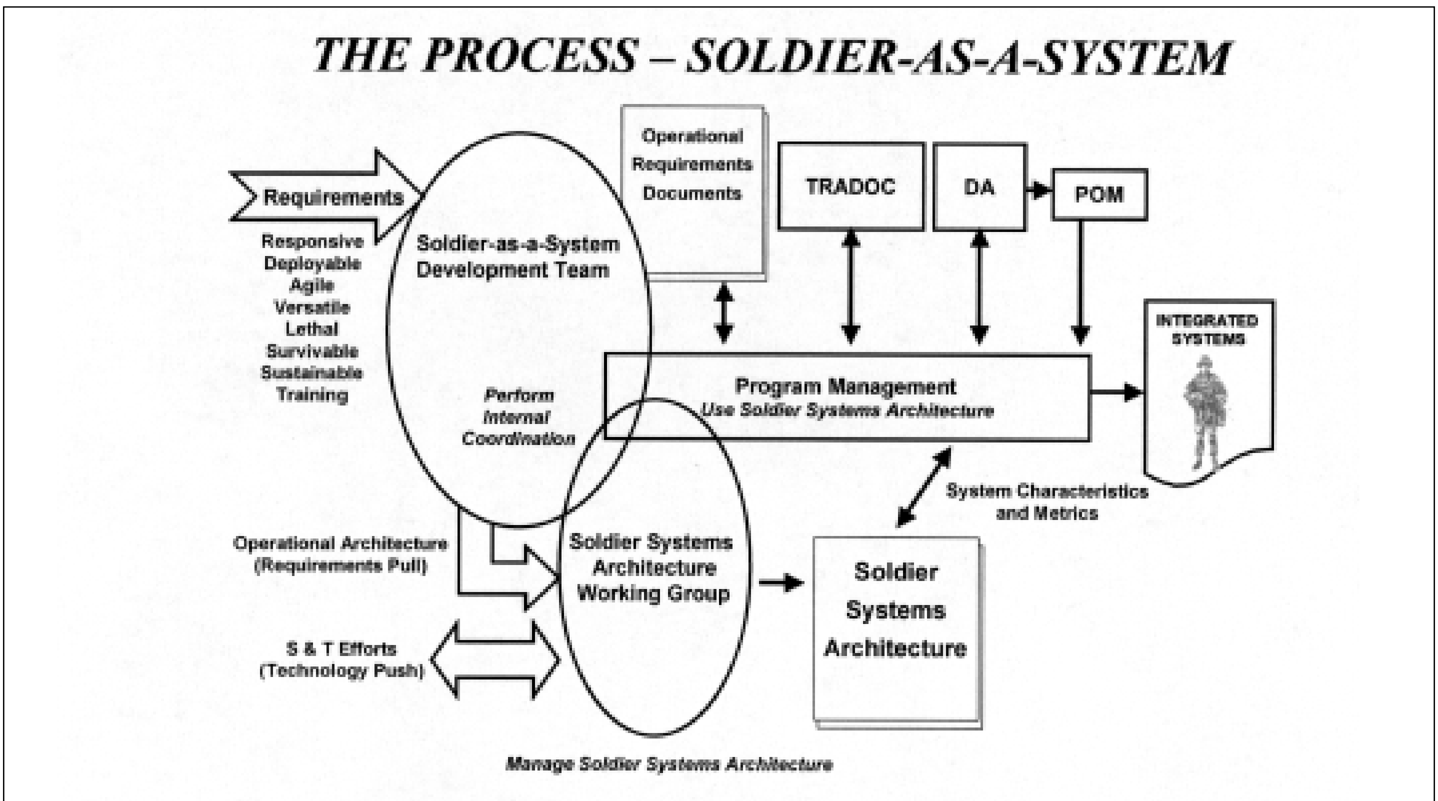

Figure 1.

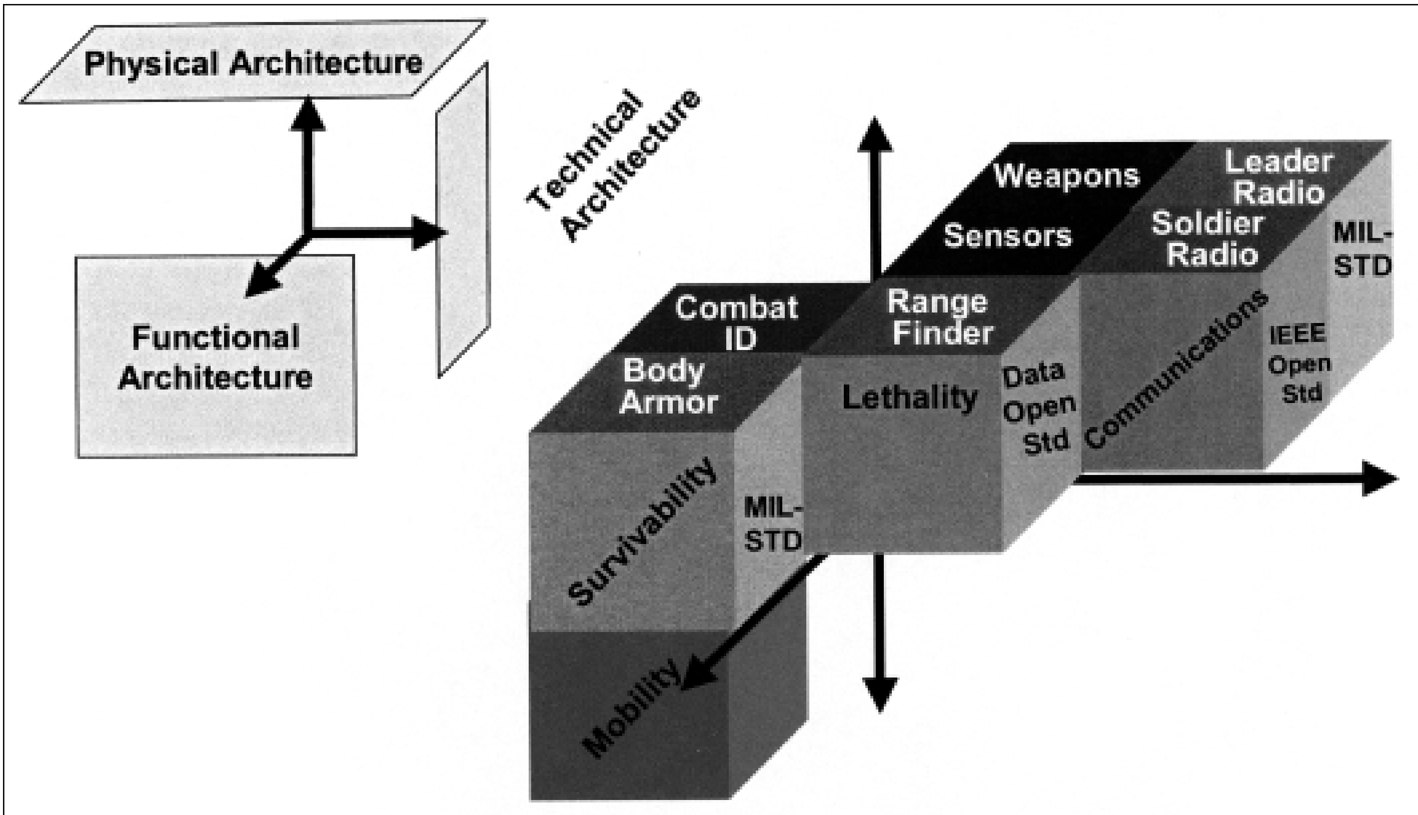

Figure 2.

materiel solution requirements can be handled much more efficiently when the users consider a core set of functions that are satisfied by modules currently in the soldier systems architecture. New capabilities build upon the basic functions, meaning development and production are only needed for the "delta" requirements. New solutions, in turn, update the architecture, providing an expanded basis for other platforms and subsequent systems.

The Soldier Systems Architecture Working Group interacts with the user community to establish and maintain the soldier systems architecture. The working group also provides a link to the R&D community to incorporate new technology developments into the architecture. The products of this process are the operational requirements document and the soldier systems architecture. Both will be used by the acquisition community when a new warrior platform is approved and funded.

Architectural Approach

The expandable soldier systems architecture facilitates plug-and-play functionality for sensors, weapons, electronics, and soldier equipment. It is the foundation for all warrior platform designs to satisfy a wide variety of soldier requirements. The architecture framework evolves more slowly than the solutions and the technology associated with individual modules. The framework includes open systems interfaces—widely available and consensus-based interface standards. Existing government items and legacy components use adapters to fit into the architecture when needed.

By concentrating on a modular architecture framework, the Army will develop warrior platforms that take advantage of future technology such as faster, low-power computer chips; improved materials; and new ballistic protection. Through close coordination with the R&D community and continuous market analysis of commercial technologies, we plan to leverage change as it occurs.

Soldier Systems Architecture

The soldier systems architecture of functions, modules, and interfaces is best viewed as a multidimensional figure. A portion is illustrated in Figure 2.

The user needs—functional architecture—are on the front face of each cube. The physical architecture—system modularity—can be related to each element of the functional architecture and is shown on the top of each cube. Corresponding technical architecture interfaces, on the right side of the cube, apply to every module. The horizontal plane forms the physical architecture, while the other two planes define the functional and technical architectures. The total three-dimensional representation is a soldier systems architecture that meets user requirements, incorporates modularity, and defines all interfaces.

The functional architecture identifies the requirements derived from the user. Managing a set of functions and their modular solutions allows us to minimize stovepiped development efforts for multiple systems, reduce procurement time through module reuse, and maintain common sustainment concepts.

The physical architecture includes all hardware and software components. The work breakdown structure captures physical architecture decisions. It defines the subsystems and major components that relate to user requirements in the functional architecture. Software modularity, part of this process, directly affects the complexity of future modifications and the software portability to multiple platforms. Logistics concepts, use of existing government or commercial items, and potential for reuse all affect module-partitioning decisions.

The technical architecture addresses interoperability among different platforms and systems. The joint technical architecture (JTA) and the JTA-Army (JTA-A) define a required set of interface standards and development guidelines for joint and Army programs that electronically produce, use, or exchange information.

The soldier systems technical architecture defines interfaces, both external and internal, that connect the system, subsystem modules, and in some cases, the internal components. The JTA provides choices for human-to-computer, data transfer, information processing, and information security activities. The soldier systems architecture takes these into account, but goes beyond information exchange. We are concerned with issues such as the following:

• Module interfaces on the soldier's load-carrying equipment,
• Sensor mounts on weapons,
• User interface controls,
• Common connectors,
• Standardized menu screens, and
• Adapters for legacy components and external systems.

We know that requirements will continue to evolve and expand. The soldier systems architecture is fundamental to implementing a responsive and effective acquisition process that must solve today's needs, but is flexible enough to cope with the future.

Architecture Coordination

We are employing the soldier systems architecture for warrior platforms now in development. The technical architecture interfaces form the framework and are key to the plug-and-play system evolution. Because other Army and government agencies develop equipment that is part of the physical architecture, coordination with these agencies and suppliers is important. For example, PM, Night Vision/Reconnaissance Surveillance and Target Acquisition continually develops new sensors with the potential for use on warrior platforms. If we intend to incorporate new night vision sensors, the plug-and-play concept only works when interfaces are consistent with the technical architecture. We cannot operate in a vacuum, but must be proactive, working with warrior platform users, government development agencies, and commercial suppliers.

Evolving Architecture

PM, Soldier Systems is now coordinating the technical architecture elements with interested Army and other government agencies. When the work is complete, we plan to update the soldier systems annex in the JTA-Army. The soldier systems architecture will eventually be fully coordinated and documented, but it will never be finished. We recognize that change will always be a factor. The functional architecture evolves each time there is a newly identified user requirement or new warrior platform. This drives re-evaluation of the physical architecture. Physical architecture changes, along with advances in technology and marketplace developments, will require us to re-examine the technical architecture in the future.

On the requirements side, PM, Soldier Systems and the Army Infantry Center are presenting a roadshow for users and developers. This explains the rationale and benefits for upfront requirements coordination and use of the architecture as a foundation for future platforms.

We know that requirements will continue to evolve and expand. The soldier systems architecture is fundamental to implementing a responsive and effective acquisition process that must solve today's needs, but is flexible enough to cope with the future. We expect that the interfaces will have much longer life spans than the materials, processes, and designs of system modules. However, the soldier systems architecture is not static, and the interactive user-developer management process will guide changes with time. This will help us define and develop new warrior platforms for the Interim Brigade Combat Teams and, ultimately, the Objective Force.

COL THEODORE "TED" JOHNSON is the PM, Soldier Systems. He has a B.A. in psychology, an M.S. in international relations, and an M.S. in national resource strategy. He is also a distinguished graduate of the Industrial College of the Armed Forces.

OBJECTIVE FORCE WARRIOR: NEW WAYS TO TRAIN

Dr. Scott E. Graham and Dr. Jean L. Dyer

Introduction

The Objective Force Warrior (OFW) will integrate advancing technologies to enhance the effectiveness of soldiers and small units. The potential of these technologies will only be realized, however, when soldiers, leaders, and units are trained to optimize the capabilities of the new technologies. This article describes Army research, plans, and training guidelines designed to solve the training challenges associated with emerging Objective Force technologies.

Technology Implications

Consider the capabilities and conditions that define the training challenges for Objective Force soldiers and small units. Objective Force soldiers will deploy almost anywhere in the world on very short notice. Increasingly, they will fight in urban and restricted terrains. Compressed timetables and rapidly changing rules of engagement will be the norm. Objective Force units will operate a mix of Legacy, Interim, and Objective Force systems. They must defeat mixes of conventional, unconventional, or nonstate enemy forces and execute stable support operations. To further complicate operations, most missions will be under national and international scrutiny.

The futuristic array of capabilities is considerable. Small-unit communication systems will allow soldiers to condense information from many sources including their immediate environment. New navigation and night vision capabilities will permit greater mobility. Integrated physiological sensors in advanced combat uniforms will provide continuous monitoring of soldier health status and will permit remote medical triage of battlefield casualties. Small units will use organic air and ground robotic capabilities, including scouts and load carriers.

Advanced weapons will permit small units to engage the enemy faster, in greater numbers, and with more focused devastation. New capabilities will allow soldiers to attack close or distant targets from concealed or even remote positions. Soldiers may also use an array of nonlethal capabilities. They will have a greater variety of tools than ever before. They must develop competence and confidence in using the new tools under stress, understand how all the tools interact, and be able to continue the mission when the tools fail. There will be many training challenges.

Future Training Requirements

New technologies will produce obvious and some not-so-obvious demands for more effective and efficient training. Training will increasingly focus on the use of information systems and will, therefore, emphasize cognitive skills in conjunction with psychomotor skills. At all levels, soldiers and leaders must be trained to operate sophisticated information systems. More important, they must be trained to make rapid, accurate decisions with enormous implications on mission success.

Training Guidelines

In recent years, Army science and technology training research taught us much about what we must do to train soldiers to operate complex systems, but significant challenges remain. They include how best to tailor training to OFW technologies, operational conditions, and new training environments. Some specific training guidelines follow.

• *Develop tailorable training.* The goal of training should be to raise the level of proficiency of all soldiers. "One size fits all" training is essentially suboptimal. To maximize efficiency, training should be individually tailored to the knowledge and skill levels of the training population.

• *Ensure soldiers have the prerequisite knowledge and skills.* Increasingly, all soldiers will require basic computer skills. Recently, 36 percent of enlisted personnel in infantry courses rated themselves as computer "novices." OFW-enabled soldiers must master skills that are not taught until the advanced noncommissioned officer level.

• *Develop tools to help leaders train*. Effective trainers must not only be able to use a system, they must be skilled at training. Trainers must be able to diagnose underlying causes of poor performance of both soldiers and equipment. This is difficult with complex systems, especially with an increase in the number of tools and subsystems. For example, while recent advancements such as the thermal weapon sight and aiming light provide extraordinary capabilities, they dramatically increase the number of factors that can cause a soldier to miss a target.

• *Apply demonstrated principles in cognitive skills training.* Research by the U.S. Army Research Institute (ARI), among others, identified effective techniques for training cognitive skills, including learner control, hierarchical sequencing, and the use of advanced organizers.

• *Provide effective, efficient performance feedback*. Performance assessment and feedback mechanisms underpin effective training. Training exercises, especially large collective exercises, provide an experience rather than actual training for small units. Collective live-fire training should account for detailed measures of target hits and task performance. Digital systems should provide new capabilities to permit combat trainers to see how soldiers and leaders are using new technological systems.

• *Develop new "building-block" approaches for collective skills.* New technologies require new strategies to systematically move soldiers through training of individual skills, to buddy team (pairs), to fire team, to squad. More than ever, the risk of an individual-to-collective training gap is likely. Individual soldiers, or staff elements, may be proficient with a particular system in isolation, but increasingly less effective when other systems are incorporated.

• *Develop training exercises that demonstrate and stress full-system capabilities and limitations.* Soldiers and units must be trained to understand the capabilities and limitations of all of the subsystems and their interrelationships. Soldiers not adequately exposed to all system features are unlikely to use the system well. Collective exercises can be carefully constructed to encourage and reward individuals using optimal combinations of subsystems.

• *Understand the difference between basic proficiency and full mastery.* Developing soldiers and units to fully exploit the technological capabilities of new systems takes time. "Go/no go" standards are generally not appropriate for cognitive tasks. The Army has trained high-performing teams for its warfighting experiments but at an extraordinary cost of resources and stabilization. Moreover, it is increasingly difficult to estimate training resource requirements for new systems. Minimal proficiency may require 8 hours where mastery-level skills needed to exploit technology may require 120 hours.

• *Emphasize training basics.* Practice, practice, practice—with feedback—under increasingly difficult conditions, to include replication of stresses from the expected battlefield.

Training Environments

When people think of training technologies, many focus on the hardware and software of training systems. While these are important, effective training is largely a function of training content, instructional design, and feedback. The following are some considerations for OFW training environments.

• *Embedded training.* The lure of embedded training is great. The logic is that if you have a digital system, you should easily be able to use the system's processing capacity in training. In practice, it is never that simple. Embedded training adds to the complexity of a system, increases system usage and subsequent maintenance, and may not always be available for training (e.g., when locked up in an arms room). Many individuals have advocated the cost-effectiveness of embedded training for some time, but few detailed studies fully validate the approach. Moreover, significant training research challenges remain about what to train and how best to build in sound instructional features. Embedded training, at least in the near term, will more easily address individual and procedural tasks than collective and cognitive tasks. One key to the success of embedded systems will be how well they can incorporate automated performance assessment and feedback.

• *Virtual environments.* Immersive training technologies for dismounted small-unit leaders and soldiers continue to become less expensive and more realistic. Simulating dismounted soldiers walking, talking, and using hand-and-arm signals remains considerably more difficult than simulating mechanized forces. However, progress is being made. In the near term, virtual environments will be most appropriate for training leader skills (e.g., training Objective Force platoon and squad leaders supported by computer-generated forces). The fact that there are 243 rifle squads in a typical infantry division demands that cost-effectiveness and ease of access be fundamental considerations in the development of small-unit virtual environments.

• *Distributed/Web-based training.* Certainly multimedia instruction and Web-based training will play important roles in soldier and small-unit training. Advances in authoring tools, instructional management systems, gaming technologies, and the use of sharable content objects are making quality training development easier and potentially less expensive. The challenge remains in developing scenarios that train more advanced thinking skills. There remains an overarching issue of how to incorporate intelligent feedback, especially for training cognitive skills.

• *Field training.* While each of the mentioned training environments will play a useful and vital role, field training will remain essential. Given the lethality and complexity of systems using emerging OFW technologies, new field training approaches must ensure that all individual-to-collective capabilities can be trained across the full spectrum of operations. This is no simple task. In particular, there is a need for improved performance assessment to help optimize the work of observers and controllers.

Field Trials

Historically, the development of new training approaches and new tactics and fighting techniques has lagged behind the development and fielding of new systems. As a result, the full value of new systems rarely is realized early on. To help the OFW effort avoid that problem, ARI, in conjunction with the U.S. Army Simulation, Training, and Instrumentation Command, plans to develop prototype training methods in parallel with other OFW developments. The new and alternative training methods would be compared and evaluated in a series of field trials using prototype tactics and techniques.

A field-trials approach can provide a highly flexible laboratory for evaluation of alternative training approaches and emerging technologies. The trials will be designed to explore what is possible, practical, and likely. The new training approaches and prototypical fighting techniques will be passed to Army training, combat, doctrine, and materiel developers.

Conclusion

If we are to transform the Army during this decade, we will need validated training approaches that accompany, not trail, the implementation of new warfighting technologies and the tactics they will bring. The training trials would provide an essential link in the path to Army transformation.

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LIFESAVING ADVANCES IN COMBAT CASUALTY CARE

MAJ Robert M. Wildzunas

Introduction

Combat casualty care (CCC) is constrained by logistics, manpower, and the hostile operational environment. Although 70 percent of combat casualty wounds are not life-threatening, most will require medical intervention because even small wounds on the battlefield can degrade a soldier's operational effectiveness. Without proper initial treatment, infection can make seemingly minor wounds fatal. Also, the treatment of more serious battlefield casualties is exacerbated by long evacuation times. This requires battlefield medics and physicians to stabilize patients for extended periods. Because approximately 90 percent of all battlefield deaths occur within the first 30 minutes after an individual is wounded, the ability to rapidly locate, diagnose, and render appropriate initial treatment is vital to reversing the historical outcome of battlefield injuries. The need to optimize such care in the austere far-forward environment with a reduced logistics footprint is the cornerstone around which CCC is built.

The Objective Force and Army transformation are radical changes with a goal of a more responsive, deployable, agile, versatile, lethal, survivable, and sustainable force that will be capable of responding to missions across the full spectrum of conflict. Challenges initiated from Objective Force operational concepts will require revolutionary thinking and products unparalleled in the civilian emergency medical community. The expeditious deployment, wide area coverage, and planned initial independence of Objective Force operations will likely reduce or prevent the availability of prepositioned military hospitals and nonorganic evacuation assets. This situation places even greater emphasis on the medic's ability to perform far-forward stabilization and care of wounded soldiers. But, medical modernization in support of the Army transformation is more than just improving the standard of care. It is the examination of future warfare and new medical operational concepts made possible by advanced technology. As always, the soldier is our primary focus.

Operational Capabilities

With this in mind, we must consider what operational challenges future medical units will face and how medical requirements will be integrated into the Future Combat Systems (FCS). The medical version of the FCS will replace the M577A2 Battalion Aid Station and the M113/A2/A3 Armored Ambulance as the ground medical evacuation and treatment platform. The medical version is envisioned to be precisely the same as the FCS with the exception of mission-unique equipment added following production of the vehicle. A common-chassis approach will reduce the logistical footprint by eliminating separate repair parts and maintenance while FCS significantly enable mobility, survivability, and connectivity to the digitized force. The evacuation module of the medical version will have the capability to carry ambulatory patients and a crew of three in a climate-controlled environment. Essential medical equipment will include onboard oxygen, a litter, a vital signs monitor, and suction capability. The treatment module will allow a protected workspace for the treatment of casualties and provide enough interior workspace to conduct advanced trauma management on one patient while another is prepared for treatment.

Other medical FCS capabilities will help lower the killed-in-action rate, reduce morbidity from wounds, reduce the forward-medical footprint, and increase operational flexibility. These benefits will result from developments such as advanced blood products and volume replacement fluids, new methods to stabilize and treat combat-related trauma, and applications of new drugs to prevent secondary damage to tissues and organs. Also, casualty care and decision-support programs will be enhanced by advances in medical information technology, new noninvasive methods to assess patient status, advanced artificial intelligence software for triage and treatment, new methods to train medics and surgeons, and new ways to apply medical data.

Medical Advances

Developments such as telemedicine for casualty assessment and medical decision support will allow for a broader range of medical skills in the field, better allocation of limited medical assets, reduced need for evacuation, and a faster return to duty. New virtual-reality technologies will enhance diagnosis as well as medical treatment procedures and will enable combat lifesavers, medics, and physicians to develop and maintain critical medical skills during peacetime. Telesurgery with advanced haptics (simulating the touch and feel of the human body) will eventually allow surgeons far removed from the battlefield to perform FCS-based surgery through the use of robotic devices and robotic manipulation.

Robotics, however, will not totally eliminate first responders from the loop. Thus, Warrior Medic is planned as the medical version of the Land Warrior System. Sensor suites will detect wounding events and immediately relay physiological information on each wounded soldier to the medic's computer. Software will allow the medic to instantly obtain the wounded soldier's distance, magnetic compass heading, and vital signs. Artificial intelligence algorithms will perform triage on the casualty and monitor the patient remotely while decision-assist algorithms integrate sensor data into optimal treatment or resuscitation strategies.

After detecting an injury, the medic's first concern for the patient usually is to stop the bleeding. Thus, CCC technologies that focus on methods to stop massive or continuous internal and extremity bleeding are being developed. Technologies include recombinant synthesis and enhancement of natural clotting agents as well as synthesis of artificial clotting agents. One such agent, the fibrin hemostatic bandage, has shown to reduce blood loss by as much as 85 percent in cases of severe bleeding. Other hemostatic technologies include recombinant injectable clotting agents, the one-handed tourniquet, foams and gels (or other formulations that can be used on noncompressible hemorrhages), and high-intensity-focused ultrasound for internal hemorrhages. Such advanced hemostatic products represent a major advance in the ability of combat medics to control bleeding on the battlefield and will, undoubtedly, reduce soldier mortality. Additionally, they may significantly decrease the need for blood on the battlefield.

Notwithstanding advances in hemostasis, current red blood cell products require freezing, thawing, refrigeration, and cross-typing and have a shelf life of only 6 weeks. Longer red blood cell storage of 10-12 weeks will improve medical logistics in the field as well as increase emergency blood supplies at home for disaster relief. Beyond the limitations of shelf life, numerous units are lost annually because of storage bag breakage and embrittlement. Improved blood storage bags are being developed to reduce breakage rates. But even if units do survive transhipment intact, thawing rates preclude the immediate availability of units. New fully automated blood processing systems will thaw a unit of blood in 35 minutes. Other new devices will allow medics to quickly detect infected blood and disinfect it, thus allowing safe transfusions directly from one soldier to another when blood supplies are depleted.

Another CCC emphasis is on low-volume resuscitation strategies and optimized resuscitation fluids to prevent cardiac arrest and rebleeding, and to maintain viability of vital organs. This is critical if evacuation times are greatly prolonged. New resuscitation fluids will augment oxygen-carrying capacities and support cellular function and organ viability during shock. These fluids and/or adjunct drug therapies will extend the duration of shock tolerance for longer periods of time to accommodate delayed evacuation times to reach surgery and resuscitative care. Additionally, while still considered at or near the frontier of development, oxygen-bearing blood substitutes will one day replace the need for red blood cells on the battlefield and the collateral requirements for freezing, thawing, refrigeration, and cross-typing.

Neuroprotection initiatives aim to develop improved technologies to manage head trauma and decrease the medical footprint. This includes advanced, noninvasive sensors and equipment for determining the severity of both closed and penetrating wounds to the head. Also, under development specifically for use by nonphysician first responders is a simple five-point clinical neurological examination that can identify patients suffering from traumatic brain injury. This initiative will also provide the medic with biologics and pharmaceuticals to increase survival by reducing secondary effects of trauma. Such strategies will significantly improve initial diagnosis and the prognosis for functional recovery of the soldier following traumatic brain and spinal cord injuries.

Finally, once stabilized, casualties will need to be cleared from the battlefield. Future patient holding and transport litters must interface seamlessly with the FCS evacuation and treatment vehicles. The need to evacuate patients and treat them en route—up to and including possible surgery—implies the need for highly capable, compact, transportable, individualized medical care. Another new development, the Personal Information Carrier (PIC), will allow a soldier's medical record and treatment history to be downloaded anywhere on the battlefield. The PIC is compatible with all types of computer hardware; it securely stores text, voice, video, and digital data; its memory cells do not require batteries; and its design allows the system to evolve with technology. The Critical Care System for Trauma and Transport (C-STAT) is a patient transport litter that incorporates capabilities normally found only in an intensive care ward (such as ventilation, suction, defibrilation, intravenous/drug infusion, and oxygen) into a unit that is 1 foot deep and as long and wide as the standard NATO litter. The mini-STAT is a preplanned improvement to reduce size, weight, and power demands associated with the C-STAT with little or no loss in capability. Eventually, a future generation transport litter, the transportable patient pod, will allow patients to be sustained autonomously while awaiting evacuation to definitive medical care facilities, while controlled hypothermia and metabolic downregulation will delay cell death and offset costs associated with delayed evacuation.

Conclusion

Clearly, emerging CCC technologies will help overcome battlefield medical limitations by providing biologics, pharmaceuticals, and devices that enhance the capability to effectively treat casualties as close to the geographic location and time of injury as possible. Individually, these technologies will, without a doubt, improve medical capabilities in the future. Together—as a "system-of-medical-systems"—coupled with the FCS initiatives, these technologies will greatly enhance the Army's Objective Force capability to deliver immediate, far-forward, and en route care for soldiers sustaining life-threatening injuries on the battlefield.

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MANAGING A MILITARY PROGRAM LIKE A COMMERCIAL COMPANY

COL Theodore Johnson
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Introduction

Prior to reinventing itself, the Land Warrior (LW) Program was a nonsoldier-ready, nonfunctional, and expensive program that was the subject of General Accounting Office (GAO) criticism. The program became a success, however, by using commercial business practices; partnering with industry; using an open architecture with commercial off-the-shelf (COTS) technology and components; and using a product version-based, phased-development approach. This change in business and contract philosophy contributed to the program's success by yielding significant results in cost savings, schedule risk reduction, and technology improvements. Simultaneously, there was an increase in the program's support and visibility within the Department of the Army, DOD, and Congress.

The LW is the first-generation modular, integrated fighting system for infantry soldiers that combines and incorporates sensors; computers; lasers; geographic location; and radios with a soldier's mission equipment. This helps to achieve the Army Chief of Staff's vision of enhancing individual soldier lethality, survivability, mobility, and situational awareness as a holistic integrated system. The systems approach optimizes and integrates these capabilities without adding to the soldier's combat load or logistical footprint.

History

The LW Program originated from a typical cost-plus contract because of technical challenges and risks. The system built under this contract failed many of its May 1998 technical and performance tests, was too heavy and bulky, hindered soldier performance, and was too expensive.

New Business Strategy

In November 1998, the LW Team implemented a new acquisition and business strategy and philosophy to transition the LW system to a COTS and government off-the-shelf (GOTS) open architecture. This was achieved using hardware, software, and interfaces that take advantage of the commercial and consumer marketplace with innovative companies. Understanding that commercial contractors are structured to provide products economically, the LW Team sought to produce a Land Warrior system similar to the way Dell Computer Corp. produces its computer systems for the consumer marketplace.

The LW Team changed the traditional contract relationship in which the prime contractor is typically the administrator, developer, technical integrator, and producer. Many companies, both with and without government experience, were invited to submit two-page performance statements to demonstrate their products and areas of expertise. The team assessed each company based on its demonstrated flexibility and innovation. In addition, the government verified they had a viable path to the future and could tap the competitive commercial marketplace. After companies were selected, a "consortium" was created as a closely integrated team with fixed-price deliverables.

During Alpha-type contract discussions, minimal resources were allocated for overhead costs—with a focus on product development—thus ensuring a thin management layer with two-way visibility between the consortium and the government. One contractor was designated the manager to act as the administrator and banker, and another was designated as the technical lead and integrator. The remaining contractors were to compete and produce components or subsystems (through fixed-price contracts) from commercial marketplace resources.

This new approach, coupled with the contract price structure, eliminated conflicts of interests and encouraged contractors to seek innovative technologies outside their companies for use in the LW system. The approach also allowed each innovative company to focus on its own area of expertise without having to create huge administrative structures.

The LW Team leveraged a product version-based development approach using short duration, fixed-price phases, with known exit criteria for each phase. The intent was to limit cost growth and provide a more accurate picture of progress. Continuous assessments were conducted using this new approach. Changes in the LW system were allowed only at the end of each phase to better anticipate, evaluate, control, and track changes; ensure changes were better matched to actual program challenges; and eliminate cost increases associated with typical cost-plus contracts. This approach produces interim product versions that are built toward the final product with each successive version adding increased functionality, reliability, durability, and producibility. Furthermore, innovative technology can be evaluated off-line for insertion between each phase and version without hindering the success of each phase. The product version model uses short, basic phases.

This process resembles the commercial business model and version-based market, similar to those of Microsoft or Intel. Changes are allowed only at the appropriate time to provide measurable checkpoints and traceable costs. During LW development, a clear definition of each phase end state was established to shorten the time between requirement definition and measurement. This allowed the commercial business model to evolve with shared risk, while controlling the impact of learning, reducing the motivation for changes, and providing an incentive to deliver more products on time and within cost projections.

This phased approach closed the requirements and production gap as well as the risk and cost growth gap, while allowing a mix of COTS (computer and software) and GOTS (Integrated Helmet and Display System/Position Navigation System) solutions. Savings in development time and costs were achieved by staying within target bands during the phased spiral development process while simultaneously reviewing requirements and technologies. This approach also produced a spiral development effort where potential technology changes were assessed and refined at the end of each phase.

Changes and versions yielded a better convergence of technology with user requirements. This effort focused on technology leveraged from first applying technologies from off-the-shelf sources followed by development of technologies for the LW system. Because of an open architecture, this approach reduced any conflict of interest arising from building proprietary components typically associated with cost-plus contracts. This required close involvement between the LW Team and the consortium, with the government staying technically involved. User involvement was expected and encouraged, providing valuable input through user trials and juries directly connected to the development process. Consistent government involvement also allowed more control of intellectual property and rights issues as technology was introduced into the LW system.

How Well We Did

The new LW acquisition philosophy was tested and demonstrated when the team participated in the September 2000 Joint Contingency Force-Advanced Warfighting Experiment (JCF-AWE) at Fort Polk, LA. Although the new philosophy was still in the research and development phase, the LW Team demonstrated that it, along with strong industry partnering, contributed to successful fielding of 55 operational LW systems in less than 9 months. These efforts also led to other significant achievements as follows:

- The team received the 1999 Army Manpower and Personnel Integration Achievement Award for significantly improving the LW's weight, bulk, and soldier interface.
- The Department of the Army nominated the LW Program as a finalist for the DOD David Packard Award for Acquisition Excellence for 2000.
- The Department of the Army's Office of the Deputy Chief of Staff for Logistics selected the LW Integrated Logistics Support (ILS) Team as the winner of the 2000 ILS Achievement Award for ILS management.
- The LW Team received the Army Soldier Biological and Chemical Command Team of the Year Award for 2000.
- The Department of the Army designated the LW as one of seven programs on the Legislative Priority List that is critical to Army transformation success.
- Twelve military-unique and proprietary subsystems and components were transitioned to COTS.
- A commercial computer motherboard could be procured from any of 12 sources for about $440 vice the $32,000 for a military-unique proprietary motherboard.
- Commercial cables could be procured for about $65 as opposed to more than $5,000.
- The weight of the LW system was reduced by 8 pounds and the logistical footprint was reduced by

The commercial and consumer marketplaces tap the natural competitive pressures to bring in new and innovative technology at a lower cost. The government acquisition process must continue to adapt and transition toward a commercial- and consumer-based approach—the rewards are great.

consolidating 16 previously carried batteries into a 4-battery integrated system

• The LW was integrated with GOTS open architecture (Army standard load carriage, MOdular Lightweight Load-carrying Equipment).

• The "would cost" unit cost was reduced from more than $102,000 to $30,000.

Where We Are Now

The LW Program evolved from a failing program that was the subject of GAO criticism in November 1998 to a successful program that is now supported by Army leadership. The LW Team now does business using several acquisition reform initiatives in addition to those already discussed. These initiatives include the following:

• Using only performance specifications based on commercial practices.

• Using a test and evaluation integrated product team (IPT) to successfully streamline the testing and safety release process to meet a tight schedule.

• Using interactive Web-based LW IPT sites and an integrated data environment to permit the sharing of program information electronically with all participants.

• Using disciplined cost estimating and modeling to control and reduce program costs.

Lessons Learned

A basic premise of the Dell business model is that when given standards and standard interfaces, systems integration becomes easy with plug-and-play components available from multiple sources. This new philosophy allowed the LW Team to develop the following lessons learned.

• Seek out and use small innovative companies (they don't read the *Commerce Business Daily*) rather than the typical large Defense contractors.

• Eliminate large organizational structures and focus on the product.

• Develop products in terms of versions and use a phased approach to overcome immature and unknown requirements. This will help control changes that typically facilitate cost growth and will aid in the ability to progressively increase and measure functionality, durability, reliability, and producibility.

• Understand that commercial and consumer companies obtain their incentive and rewards by leveraging off-the-shelf technologies first and developing technology second.

• Implement a commercial industry to commercial industry relationship, thus eliminating conflicts of interest and overcoming the cost-plus contract math that encourages changes and keeps products in-house with proprietary solutions.

• Work in totally integrated teams to ensure vertical and horizontal visibility of all partners and efforts.

Conclusion

The commercial and consumer marketplaces tap the natural competitive pressures to bring in new and innovative technology at a lower cost. The government acquisition process must continue to adapt and transition toward a commercial- and consumer-based approach—the rewards are great. We must think, act, and develop cultures to match and link to commercial consumer enterprises.

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INSTITUTE FOR SOLDIER NANOTECHNOLOGIES

William M. Mullins

Introduction

How can the Army science and technology (S&T) community help achieve the revolutionary capabilities envisioned for the soldier of the Objective Force? What if it were possible to develop compact soldier-system power sources with increased energy and power densities using technology based on nanostructured electrodes or novel fuel preprocessors? What if enhanced displays, antennas, and sensors providing improved communications and enhanced security could be designed through the use of nanoscale devices? What if novel materials could be engineered to allow the integration of sensors and electronics that allow active camouflage and self-repairing equipment? To address these questions and other potential applications of nanotechnology, the Army Research Office (ARO) sponsored a workshop in February 2001. Workshop participants concluded that nanotechnology has the potential to dramatically impact all aspects of soldier equipment and apparel, not only those areas mentioned above. In addition, it was resolved that the establishment of a center for nanotechnology focused on soldier systems would provide synergistic benefits to accelerate nanotechnology research and development.

To realize the promise that nanotechnology holds for improving the survivability of the soldier, the Assistant Secretary of the Army for Acquisition, Logistics and Technology asked ARO to create a University Affiliated Research Center (UARC) entitled the Institute for Soldier Nanotechnologies (ISN). The ISN will be the first DOD research facility committed to both basic and applied research in nanoscience and nanotechnology, with a focus on transition opportunities for soldier technology. The emphasis on the development of soldier system technology will also facilitate the integration of the warfighter with the Future Combat Systems (FCS) and the Objective Force.

Background

On Dec. 29, 1959, Nobel Prize-winning physicist Richard Feynman spoke at the annual meeting of the American Physical Society. The title of his address was “There’s Plenty of Room at the Bottom.” His premise was that the principles of physics do not speak against the possibility of maneuvering things atom by atom. Feynman further discussed the challenges and implications of manipulating and controlling things at the atomic scale. His speech laid the intellectual foundation for what is known as nanoscience or nanotechnology (where nano refers to nanometers or 10^{-9} meters). Specifically, nanotechnology refers to the ability to engineer devices or structures that have at least one dimension of 100 nanometers (0.1μm) or less, and assemble these into useful macroscopic systems. (For purposes of reference, a human hair is approximately 50,000 nanometers in width.) The advantages this offers are that different functionalities can be built into a material, and combinations of properties can be achieved that have never before been possible.

Recent advances in the field suggest that nanotechnology can provide a wide array of new materials and systems with enhanced capabilities. One example is nanoclay-filled polymers, which have demonstrated unique hardness, strength, and chemical impermeability that makes them potentially useful for visor and windscreen applications. The Army is currently investigating these materials for transparent armor, while the Air Force is looking into possible canopy applications. Another example is the photonic band-gap materials, which can effectively block light of a single wavelength while being otherwise transparent. These materials have obvious potential as protection from laser dazzling or laser blinding. A third example is the blending of nanomaterials with biotechnology, which has produced a number of interesting applications in biological and chemical agent detection. Advances such as these indicate that it may be possible to provide the soldier with radical new capabilities without incurring significant weight or volume penalties.

Objective

The purpose of this research center of excellence is to develop unclassified nanometer-scale S&T solutions for the soldier. A single university will host this center, which will emphasize revolutionary materials research focused on advancing soldier protection and survivability. The ISN will serve as the Army’s focal point for basic research into nanotechnology for application to the future soldier. Further, the ISN will be expected to serve as an Army corps of technical expertise, providing nanotechnology-related basic research and technical support to Army intramural and extramural applied research and development projects for advanced and enabling technologies required by both the soldier and soldier support systems. The ISN will perform cooperative research with industry; the Army Research Laboratory; the Army's Natick Soldier Center; and other Army research, development and engineering centers to transition new technologies from the laboratory to new products for the soldier and to spin-off commercial applications.

The research will emphasize integration of a wide range of functions, including multithreat protection against ballistics, sensory attack, and chemical and biological agents; climate control through possible development of chameleon-like garments that insulate and respond to cold and hot temperatures; biomedical monitoring; and load management. The objective is to enable a revolutionary advance in soldier survivability through the development of novel materials for integration into the Objective Force Warrior system. To be effective, the research solutions must be compatible with a variety of complicating factors, including soldier mission requirements, limited energy resources, communication needs, and requirements for ruggedization to perform in extremes of temperature, humidity, storage, damage, and soilage.

A major goal of the ISN is to create an expansive array of nanotechnology-based innovations in a variety of survivability-related areas that will be harvested by the industrial partners for future Army application. To facilitate this, the ISN will aggressively garner industrial participation. The interrelationship between university innovation and industrial integration will be constantly evolving, driven by opportunities arising from cutting-edge research and responding to changing Army requirements. The ISN's management must provide a flexible means for managing the industrial participation and adapting to change while maintaining focus on the core goals of the ISN. A criterion for selection will be a comprehensive and compelling plan for creating innovation and managing technology transition from the laboratory to practical innovative applications.

Solicitation And Schedule

The university host will be selected through a limited competition with the intention of creating a unique national asset for conducting revolutionary materials research. The Army will invest more than $10 million annually in the ISN. The university host will provide a dedicated facility for this UARC and, along with its industrial partners, will commit significant infrastructure, resources, and personnel to complement the government's investment. The university will create cooperative partnerships with industry that will ensure that the technical innovations emerging from the research will transition rapidly into militarily relevant applications and result in producible technologies. Partnerships with industry are expected to be a key factor in the success of the ISN. Industry partners are expected to place personnel at the ISN, to bear the cost of their onsite personnel, and to co-invest in the development and/or operation of the ISN.

The initial announcement and a draft of the Broad Agency Announcement (BAA) were published in the second half of 2001. In addition, several advertisements have been placed in technical journals and trade magazines. Several news articles have also appeared during this time period, bringing more attention to the pending solicitation. A Web site (**http://www.aro.army.mil/soldiernano/index.html**) was set up to serve as a single source for current information about the solicitation and to post answers to frequently asked questions about the ISN and the Army's intentions.

In mid-August 2001, a series of meetings were held to announce the Army's intention to establish the ISN, to answer questions about the draft solicitation, and to hear concerns from potential bidders on the scope and requirements. A number of universities have expressed interest in hosting the institute, and the Army expects to receive between 30 and 40 proposals for consideration.

The final version of the ISN BAA was approved and officially posted Oct. 15, 2001, with a proposal deadline of Jan. 3, 2002. Evaluation of proposals began in early January and will result in a source-selection authority decision in March 2002. Once the Director of Defense Research and Engineering approves the UARC core competencies statement, a contract will be awarded. This is expected to occur in June 2002.

Conclusion

Modern warfare is placing new demands on the soldier for rapid response and flexibility. The Army recognizes this new reality and is evolving to meet it. The immediate goals are manifested in the FCS and the Objective Force Warrior Program. Future research programs that seek to integrate functionality to enhance the soldier's survivability, mobility, flexibility, and lethality will complement these goals. The Army's Institute for Soldier Nanotechnologies will work to develop new technologies that improve this integration and help soldiers of the future better operate in their battlespace.

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FUTURE LETHALITY FOR THE DISMOUNTED WARRIOR

Vernon E. Shisler

Introduction

The future dismounted warrior will be equipped with new and more sophisticated equipment and will have at his disposal a variety of new lethal mechanisms that will assist him in seeking out and destroying the enemy. For example, squad leaders will have a far broader view of their immediate battlefield. Remote and local networked sensors will provide the entire squad with increased situational awareness to include the locations of threat and friendly targets. Decision aids will enable squad leaders to better plan and accomplish their missions.

Networked fire control within the squad will allow for the handoff of targets to the best shooter with the best weapon. Several members of the squad will be equipped with significantly more lethal precision airbursting munitions weapons, and the remainder of the squad will have significantly lighter weight weapons than they have today. In addition, individual soldiers will have the ability to call and direct fire from remote weapon platforms or from robot vehicles.

Current Lethality

The current lethality for a light infantry squad is represented by the M16A2 rifle for the fire team leaders and riflemen, the shorter M4 carbine for the squad leader, the M249 Squad Automatic Weapon for the automatic riflemen, and the M16/M203 grenade launcher for the grenadiers. Performance of these systems is limited to the warrior's ability to point and aim the weapons. Soldiers become quite proficient with these weapons rather quickly. However, in times of stress, when there are multiple targets exposed for short amounts of time and targets that are moving and life-threatening, weapons are often point-fired and not aim-fired. Under these conditions, a soldier's hit performance is significantly reduced. In addition, because of the nature of conflict, many threat targets go unseen and undetected.

The current fielding of thermal weapon sights and heads-up displays will provide the increased capability of engaging targets remotely without exposing oneself, as well as through obscurants and at night. The future dismounted warrior is expected to possess many additional capabilities that will make him far more lethal and survivable.

Information Technology

Dismounted warriors, along with the rest of the force, will benefit from the information age. Target-relevant information from various sources will be available at the squad level. Fused image sensors; auto trackers; multi-functional, steerable laser range finders and transmitters; acoustic recognition sensors; and combat identification sensors will be networked to supplement the individual soldier's current visual target detection with automated detection and target state sensing. Detected targets will be analyzed and cued for priority either by range, motion type, or other attributes. In addition, future dismounted warriors will be networked, providing greater flexibility and multiple alternatives to accomplish lethal missions. Distributed firing will also allow any warrior in the squad to engage a preferred target. This will also provide the ability to mass-fire against key targets.

Networked fire control will also allow indirect or non-line-of-sight target engagement. This can be either from an improved grenade launcher or from a remote platform. Firing can be in the form of range and azimuth furnished from an individual warrior's location, grid coordinates, or an actual aiming reticle provided from the distributed network. A future grenade launcher will be able to engage line-of-sight and non-line-of-sight targets to a range up to 500 meters. The future dismounted warrior will also have the ability to directly control and fire weapons on remote unmanned robotic platforms to provide a non-line-of-sight capability to a range beyond 500 meters.

Situational Awareness

The dismounted soldier must keep his eyes on the battlefield to maintain awareness of his environment. He loses this awareness whenever he is required to look at something else or perform another task such as aiming and firing his weapon. The future warrior will be able to fire the weapon without bringing it to his shoulder to aim. An off-weapon aiming device will project an aiming reticle in the soldier's natural field-of-view periphery through a head-mounted visor. This is similar to the displays seen by fighter pilots. Speed and quickness of firing result from the soldier not having to take his eyes off the target to engage. As he brings his weapon to bear, he will see the aiming reticle in his normal field of view. He simply needs to get the aimpoint on the target and pull the trigger, thus maintaining full awareness of the battlefield.

Ammunition resupply will be provided by robotic vehicles, perhaps the same vehicles that provide remote-weapon capability. Real-time ammunition consumption will be monitored with warnings provided to the soldier at low-ammunition thresholds. Leaders will receive automated reports and be able to summon automated resupply, thus reducing the soldier's load and allowing him to carry the right amount of ammunition and call for resupply prior to actual need.

Increased Lethality

Increased lethality will be possible by integrating technology into the

***Figure 1**.*
Objective Individual Combat Weapon

individual soldier's weapon. Through the use of laser range finders, ballistic computers, and miniature electronic fuzes, the soldier will be able to precisely place and explode a fragmenting warhead at or near the target. The ability to direct-fire airbursting munitions to a target not only increases the warrior's lethality or probability of incapacitating the target, it also gives him the ability to defeat individual solder targets that are in defilade or behind obstacles and not posing an immediate threat. This capability will be provided by the Objective Individual Combat Weapon (OICW) (Figure 1), which will fire 20mm-high explosive munitions capable of airbursting to a range up to 1,000 meters. However, this significant increase in capability comes at the expense of weight and cost. These weapon systems will therefore be limited to a few individuals in the squad.

Lighter Weight

The remaining individual warriors will also be equipped with new weapons. The main new feature of these weapons is their significantly reduced weight. These weapons will be of a simple design and made of nearly 100-percent composite lightweight material. They will fire plastic-cased or caseless ammunition that is up to 50-percent lighter than today's brass-cased ammunition. The legacy M4 Carbine weighs 7.4 pounds fully loaded. The new system will weigh approximately 5 pounds and may look similar to Figure 2.

Likewise, the fully loaded M249 Squad Automatic Weapon weighs 23.3 pounds. A new, high-rate-of-fire weapon with the same number of lightweight rounds of ammunition could weigh 14 pounds. A new composite grenade launcher to replace the M203 would fire the same 20mm round of ammunition as the OICW. Without the sophisticated fire control of the OICW, the high-explosive round would function in the point-detonate mode as does the current M203 round. Six 30-round magazines currently carried by the soldier weigh 6 pounds. The same number of rounds of lightweight ammunition with equivalent performance could weigh only 4 pounds. The new lightweight round of ammunition will also be used for the bullet-launching portion of the OICW to further reduce its weight. To keep the weapon as light as possible, all aiming devices and displays will be kept off the weapon as much as possible. This also improves battlefield awareness.

***Figure 2**.*
New, lightweight weapon

Future Warrior Squad

The future warrior squad will be equipped with an entirely new suite of weapon systems and a networked connectivity that does not exist today. The future warrior squad will carry only two rounds of ammunition as it does today. Its weapons suite will include a family of significantly lighter weapons capable of firing a lightweight round of ammunition and the highly lethal, more capable airbursting OICW with its 20mm high-explosive ammunition. For example, the squad leader could be equipped with the lightweight weapon and the grenadiers with the lightweight weapon with the new 20mm attachment. The automatic riflemen will carry a high volume of the fire version of the lightweight weapon, and the highly capable OICW would go to the team leaders and riflemen.

Conclusion

The future warrior squad may look like the current light infantry squad, but new weapon systems and individual warriors will be linked in a network not available today. Improved target detection, situational awareness, and decision aides, along with the networked, more lethal and lightweight weapons, will make the future warrior squad a lethal, highly maneuverable team without equal. However, if all the new sophisticated systems fail and batteries die, the projection of lethality when the trigger is pulled must remain.

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INSTITUTE FOR CREATIVE TECHNOLOGIES GENESIS

Dr. Michael R. Macedonia, Richard D. Lindheim, and Dr. William R. Swartout

Introduction

The computer and Internet revolutions have substantially changed the direction of entertainment from delivery in a mass medium such as television to a mass customized experience via the Web and personal computers. However, the art of entertainment still requires stories, characters, and direction to make the experience meaningful and enjoyable. The U.S. Army faces the same challenge of adapting to the changes brought about through the mass marketing of supercomputing via platforms such as Sony PlayStation 2, Microsoft Xbox, and low-cost 3-D graphics.

There is also an urgent requirement for representing the human dimensions of war and conflict to provide training for the difficult decisionmaking problems our soldiers must face. Our experiences in Kosovo, Bosnia, and Afghanistan have shown that we need troop leaders who can handle the dilemmas posed by ethnic and social strife.

To provide such expertise, we must develop interface technologies such as natural-dialogue systems and intelligent agents that can simulate real-world problems. A 1997 study initiated by Anita Jones, then Director of Defense Research and Engineering, documented this need. Early in 1999, the Army leadership recognized a need for a major transformation of our forces to overcome the limitations of our current simulation technologies. Effecting this transformation requires developing new training and simulation systems to deal with future conflicts that leverage the capabilities of both the entertainment industry and academia.

The U.S. Army and DOD selected the University of Southern California (USC) as a strategic partner in the development of the Institute for Creative Technologies (ICT) because of USC's unique confluence of scientific capabilities and entertainment-industry relationships, which the Army deemed necessary for simulation leadership.

Prime Objective

The prime objective, as reaffirmed by Dr. A. Michael Andrews II, Deputy Assistant Secretary of the Army for Research and Technology and Chief Scientist of the Army, is to build a special partnership with the entertainment industry and academia.

Some of USC's unique qualifications arise from its location in Los Angeles, CA, hub of both the entertainment and aerospace industries. USC's qualifications further arise from its standing as a leading private research university and from the capabilities and stature of its component units and the working relationships they have developed with industry. For example, USC's top-ranked School of Cinema-Television grew side-by-side with the entertainment industry and continues to maintain close ties with it.

Under the auspices of the U.S. Army Simulation, Training and Instrumentation Command (STRICOM), USC established the ICT to develop the art and technology for providing synthetic experiences so compelling that participants react as if the simulations are real. In other words, ICT will provide verisimilitude—the quality or state of appearing to be true to synthetic experiences. The remainder of this article addresses one of these experiences—the Mission Rehearsal Exercise (MRE).

Mission Rehearsal Exercise

The MRE seeks to create a virtual-reality training environment in which soldiers will confront dilemmas that force them to make decisions in real time under stressful and conflicting circumstances. By allowing soldiers to see the consequences of their actions and decisionmaking skills in a simulator, the Army expects to better prepare its troops for dealing with similar dilemmas in the real world.

Since the end of the Cold War, the need for this kind of training has grown more acute because the variety of U.S. military operations has expanded enormously. In addition to conventional combat operations, U.S. military personnel frequently undertake a broad spectrum of missions that include peacekeeping operations, disaster-relief efforts, and noncombatant evacuations. Because these actions may require troops to deploy to virtually any location across the globe, providing advance training tailored to a wide variety of specific situations presents a daunting challenge.

Technical And Creative Team

Building the MRE system required assembling a diverse group of individuals and organizations with a broad range of talents. On the technical side, artificial intelligence researchers from USC/Information Sciences Institute (ISI) and USC/ICT created the automated reasoning and emotion modeling technology for the virtual humans. Audio researchers from USC's Integrated Media Systems Center created the immersive sound system and mixed and synchronized the effects and background sounds. Researchers from USC/ISI worked with AT&T's Next-Gen TTS (text to speech) speech synthesis system to create the most natural-sounding output. Finally, programmers and system developers experienced in creating real-time graphics tweaked the graphics system to provide acceptable performance.

To create the content for the MRE system, we needed an art director to design the environment's overall look; actors to serve as models for the virtual humans; and artists to model the animated characters, buildings, and environmental details.

Entertainment Industry

As the MRE development team worked on conceptualizing the MRE simulation, a core divergence emerged as to how the Army, computer scientists, and entertainment people viewed the project. The entertainment people usually took an approach diametrically opposed to that of established scientific and military procedures. This is because entertainment people who work on simulations focus on the project's concept, theme, and story, shaping these elements to create the simulation's desired impact.

The Army's concept of story, however, differs considerably from that of the entertainment industry. What the Army considers a story, Hollywood labels an event list. A sequence of events does not itself create a story; a story requires linking events in a way that builds to a dramatic climax.

To date, simulations have, at best, made rudimentary use of character despite the critical importance that entertainment veterans place on this component. Yet any simulation for training people to work with one another in decisionmaking tasks must, by definition, place a premium on realistically depicting how individuals—even simulated ones—react to each other. Given the technical challenges involved and the high priority placed on implementing the capability, integrating character into the MRE simulation proved to be the project team's most difficult task.

The MRE Story

In the MRE, we seek Hollywood's influence most strongly in the rich story structure that guides, but does not completely determine, how our simulation unfolds. A good story sequences events so that emotions and tensions build and ebb. Plot twists and surprises maintain interest and involvement. The MRE uses story structure to build toward the dilemmas the trainee must resolve, offering different paths through the structure to reflect the different options the trainee can choose, thereby making it possible to see vividly the consequences of each decision.

For example, in our demonstration, the computer generates all the scenario's characters except for the trainee, a young first lieutenant. The first lieutenant has been instructed to rendezvous with his troops at a staging point before proceeding to help quell civil unrest occurring in a small town. The action unfolds as follows:

Surprise. When the first lieutenant arrives at the staging area, his platoon sergeant informs him that one of his High Mobility Multipurpose Wheeled Vehicles has collided with a local civilian car. The first lieutenant sees a small boy on the ground, seriously injured, the boy's frantic mother kneeling beside him.

Dilemma. Should the first lieutenant continue with his mission or stop, render aid, and arrange for a medical evacuation (MEDEVAC)?

Complication. A TV cameraman shows up and starts filming. Any mistake the first lieutenant makes could appear on the international news.

Complication. If the first lieutenant decides to arrange for a MEDEVAC via helicopter, the MRE may challenge him by relaying a radio call from troops already in town that reports intensifying unrest, shots fired, and a request for assistance.

Dilemma. Should the first lieutenant split his forces, sending some ahead while keeping others behind to help with the MEDEVAC, or should he keep his unit intact?

When confronted with these choices, the trainee may receive assistance from the virtual platoon sergeant. Because sergeants usually possess substantially more field experience than new first lieutenants, the Army teaches its entry-level officers to listen to the advice their sergeants offer. The virtual sergeant thus embodies Army doctrine and coaches the first lieutenant toward the most appropriate course of action.

Technology Goals

When we began developing the MRE system, we knew we would need to push the technology's boundaries in several areas to attain the kind of compelling, immersive experience we desired. Although we sought to achieve advances in particular areas, we also recognized that much of the experience's immersiveness would come from combining components that had thus far never been integrated. Further, we felt that integrating these components would grant us a better understanding of the technology and how the basic research should proceed in individual areas.

Thus, we wanted to make the MRE system fully integrated as early as possible while continuing to enhance the capabilities of some components. These concurrent goals presented a dilemma: You can't integrate components still in development. We resolved this dilemma by adopting a hybrid approach to system development. This allowed us to create an integrated system that used rudimentary versions of some capabilities, which acted as placeholders until more sophisticated capabilities became available.

Taking a hybrid approach also allowed us to introduce new technologies where they would make the most difference, while saving us effort in areas where simple techniques would suffice. Hybrid solutions also let us create a complete mission rehearsal scenario so that we could assess how it works as a whole, without having to solve all the subproblems in the most general way. We expect to incrementally improve the MRE system over time by replacing simple solutions for control, speech, and sound with more sophisticated techniques as our research in these areas progresses.

Note: Portions of this article were reprinted from "Forging a New Simulation Technology at the ICT," from the January 2001 issue of COMPUTER magazine.

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POWER FOR THE DISMOUNTED SOLDIER

Dr. Richard J. Paur and
Dr. Thomas L. Doligalski

Introduction

The dismounted soldier needs a power source that is safe, small enough not to interfere with the soldier's actions, light enough to be a manageable burden, affordable, and reliable. It must provide sufficient energy for the soldier's needs and not become a liability because of thermal, acoustic, or other signatures.

This article outlines basic issues relative to soldier power and tries to assess how well a number of technologies under consideration by the power community might contribute to providing soldiers with the power needed. To provide a useful basis for considering soldier power sources, researchers assume the average power required by soldiers is 20 watts. Scaling the systems described up or down by a factor of two or so is not likely to present major difficulties. The 20-watt estimate for power is somewhat lower than power requirements used in a Land Warrior demonstration held in 2000 and somewhat higher than projected values for later versions of Land Warrior.

Power generation is the conversion of some stored form of energy, the fuel, to the desired form of energy (typically electrical power). At the most basic level, the choices of the starting form of the energy are chemical (fuels or batteries), radiant (solar or beamed energy), or nuclear.

Solar Energy

Solar energy is rather diffuse, so the solar collector must be inconveniently large to collect sufficient solar energy to power a soldier. To collect the 240 watt-hours required for a day's energy, a 10-percent-efficient (typical of current flexible photovoltaic collectors) solar collector (spread out in bright sunlight for 6 hours) must be about 0.4 m^2 or about 16 by 40 inches. The collector must be kept nearly perpendicular to the sun's incoming rays; therefore, the soldier would have some difficulty maneuvering and keeping a low visual profile. Other forms of beamed energy have comparable difficulties.

Nuclear Energy

Nuclear energy is noteworthy because it can be stored at energy densities more than 1,000 times greater than that of chemical fuels such as diesel fuel. However, society's concerns with scattering nuclear material over a battlefield make use of nuclear power sources very unpopular. Technically, a large problem with nuclear sources is that they tend to operate continuously regardless of whether the power generated is needed. Therefore, nuclear sources of high power tend to have short shelf lives, and sources of acceptable shelf life cannot be tuned to deliver high power. Despite these shortcomings, the very high energy density of nuclear sources suggests that some resources should be spent tracking developments that might make them more useful to the military.

Chemical Sources

The most practical sources of energy for the soldier are chemical sources. These typically belong in one of two classes: fuels that react with oxygen from the air, and electrochemical batteries that contain all of the reactants within the battery. These fuels may react with oxygen to produce electricity directly (as in fuel cells); may be burned to generate heat for engines, thermoelectrics, or similar systems; or may be processed to other types of fuels (hydrogen) before being used to generate power. One advantage of these liquid fuels is the relatively high energy density—hydrocarbon fuels produce about 10 kilowatt-hours of energy per kilogram of fuel when reacted with oxygen from the air. A significant disadvantage, however, is the requirement for air. A battery can produce only 1 to 2 percent as much energy as an equal weight of fuel. However, batteries are self-contained and the energy produced is electricity, thus the typically inefficient steps of converting the energy of the fuel/oxygen reaction to electricity can be avoided.

Batteries

The most common portable power sources are batteries. Modern primary (disposable) batteries can provide roughly 300 watt-hours per kilogram of battery weight. Secondary (rechargeable) batteries generally store about one-half the energy of an equal size primary. Furthermore, secondary batteries are not 100-percent efficient. Therefore, more than 120 watt-hours of charging energy may be required to get 100 watt-hours out of the rechargeable battery.

Batteries are the power sources of choice when the mission energy requirement is small enough that a reasonably light load of rechargeable batteries can supply the mission. At somewhat higher energy requirements, primary batteries are excellent technical choices, but are often very expensive solutions with costs in the range of $1,000 per kilowatt-hour. Although batteries are incrementally improved with each passing year, battery chemistry comes from a limited range of materials, and energy gains—while maintaining safety—are very difficult. Modern military batteries contain more than 200 watt-hours of energy compared with 260 watt-hours in a standard M61 hand grenade.

Rechargeable batteries can provide roughly one-half the energy of primary batteries on a weight basis. They provide a more economical power source when recharging is not too difficult or dangerous and are a useful source of energy for many training missions. However, recharging under battlefield conditions requires personnel to man the charging stations and transport relatively low-energy density batteries between the troops and the chargers. Models of the cost of operation seldom take all realistic variables into account.

Fueled Systems

Fueled systems are of great interest because the energy of reaction of many fuels is large compared to the energy that can be stored in a battery. This difference is primarily because the heaviest reactant, oxygen, is taken from the air during use and does not have to be carried. This weight advantage must be traded against the serious disadvantage of using systems that need air to function. Fueled systems also tend to have some acoustic signatures and greater thermal signatures than batteries. To take advantage of the high energy density of the various fuels, the energy conversion device must be very light. (See accompanying chart for representative fuels and energy content.)

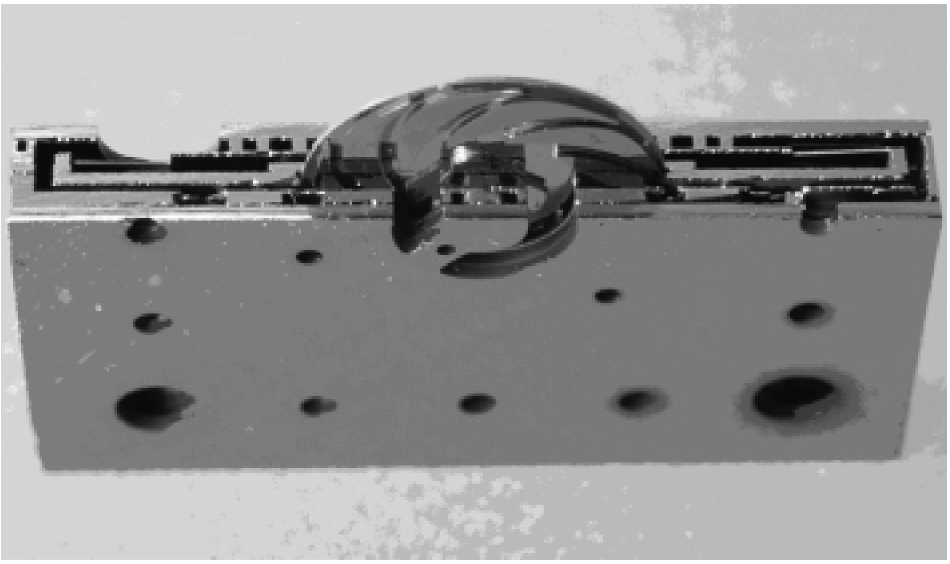
Fuel Cells

Fuel cells have recently received a great deal of attention, both in the media and in the technical community. Fuel cells are devices that convert the energy of the fuel/oxygen reaction directly to electricity by channeling some of the electrons that move during chemical reactions through the electrical load before allowing them to move to the reaction products. The simplest fuel cells are hydrogen/air fuel cells (HAFCs), which have reached a high state of development because of their use in space missions during the last three decades.

SPECIFIC ENERGY OF VARIOUS CHEMICAL SYSTEMS IN WATT-HOURS/KILOGRAM

Source	Specific Energy (Theoretical)	Specific Energy (Practical)
Steel springs	0.25	0.15
Rechargeable batteries		35-200
Primary battery—Li/SO_2	1,400	175
Primary battery—Li/$SOCl_2$	1,400	300
Zinc air		300-400
TNT	1,400	N/A
Methanol*	6,200	1,500-3,100
Ammonia*	8,900	1,000-4,000
Diesel (JP-8 is similar*)	13,200	1,320-5,000
Hydrogen*	33,000	1,000-17,000
Nuclear	2,800,000	190,000

*Data is for energy of combustion in air



Cross section of a microturbine: The device is 3.7mm thick by 21mm long.

The primary drawback to HAFCs is that they need hydrogen as the fuel. Although hydrogen is an excellent fuel in many respects and has a very high energy density on a weight basis, it is difficult to store. Even liquid hydrogen contains only about one-half as much hydrogen per liter as does a hydrocarbon fuel such as diesel fuel. Hydrogen must be kept extremely cold to remain liquid, and large quantities of liquid hydrogen are relatively less safe than fuels such as diesel fuel.

Processing (reforming) hydrocarbon fuels to produce hydrogen can be accomplished during a reasonable range of conditions, but sulfur and other materials that make up logistics fuels present a challenge that cannot be adequately handled today. Another form of fuel cells, solid oxide fuel cells (SOFCs), avoid some of the fuel processing difficulties by operating at a high temperature and being relatively tolerant of impurities in the fuel stream. One trade-off is a much slower startup time. SOFCs are much less a mature technology than HAFCs, and no good examples of soldier-size units exist.

One approach to minimizing fuel processing is to use direct oxidation fuel cells such as units that convert methanol to electricity, water, and carbon dioxide at modest temperatures of about 70 C. Current units are about twice as heavy and bulky as HAFCs, but the fuel supply, liquid methanol, is relatively compact.

Other Sources

A fairly recent approach to small power sources, the microturbine, has gained considerable attention. These devices are very small turbo machines operating at more than 1 million revolutions per minute. Complete power systems have not yet been fabricated, and issues such as cost, longevity, and signature will remain open questions for several more years. The devices appear to be very lightweight energy converters, but the early units are not expected to be very efficient and will require a significant amount of fuel.

Another recent approach to soldier power is alkali thermal-to-electric conversion (AMTEC). This technology uses a heat source (a JP-8 fueled burner is one possible source) to ionize a small amount of sodium metal. The resulting ions and electrons can be used as a power source prior to recombining them at the lower temperature end of the device. These devices have demonstrated 18-percent thermal-to-electric conversion and are likely to provide overall efficiencies of fuel to electricity ranging from 15 to 20 percent. With innovative approaches to lowering the weight of the systems, the energy density may be a factor of 3 to 5 better than primary batteries when sized for a 72-hour mission.

Conclusion

In addition to the power sources addressed in this article, a variety of other soldier-size power sources are being studied. It is likely that in the next 3 to 5 years, small hybrid-power sources that use a battery for startup, are air-independent, stealthy, and have a fueled system to keep the battery charged, will provide soldiers with more electrical energy per unit weight than current batteries. Fortunately, there is a sizable commercial market for similar sized power sources to provide the volume required to keep the units affordable.

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ARMY MANTECH COMMUNITY RECOGNIZED AT DEFENSE MANUFACTURING CONFERENCE 2001

Joseph E. Flesch and
Dr. Robert S. Rohde

Introduction

The Army manufacturing technology community was twice recognized for outstanding achievements late last year at the annual Defense Manufacturing Conference 2001 (DMC 2001) in Las Vegas, NV. Hosted by the Department of the Army, the conference drew more than 900 leaders from government, industry, and academia. The purpose was to address critical DOD manufacturing and sustainment initiatives. For the second consecutive year, the Army received the Defense Manufacturing Technology Achievement Award. In addition, it shared an R&D 100 Award presented by *R&D Magazine*.

Defense Manufacturing Technology Achievement Award

The Director of Defense Research and Engineering and the Joint Defense Manufacturing Technology Panel (JDMTP) sponsor the annual Defense Manufacturing Technology Achievement Award, which was established in 1999. The purpose of this award is to recognize and honor the individuals most responsible for outstanding technical accomplishments in achieving the vision of the DOD Manufacturing Technology (MANTECH) Program. That vision is to "Realize a responsive, world-class manufacturing capability to affordably meet the warfighters' needs throughout the defense system life cycle."

2001 Defense Manufacturing Technology Achievement Award. *Dr. A. Michael Andrews II (far left), Deputy Assistant Secretary of the Army for Research and Technology, OASAALT; and Dr. Ronald M. Sega (far right), Director of Defense Research and Engineering; flank award recipients (from left to right) Ron Fielding (accepting the award for Robert Monks, Simula Safety Systems Inc.); Richard Palicka, CERCOM Inc.; and James Mackiewicz and Janice Knowlton, U.S. Army Natick Soldier Center.*

Criteria

This award is made to the individual or small group from the government and/or private sector most responsible for a specific innovative manufacturing technology achievement that has had a significant impact on one or more of the following: rapid transition of Defense-essential or Defense-unique technologies, affordability, cycle time, readiness, quality, and/or decoupling cost from volume.

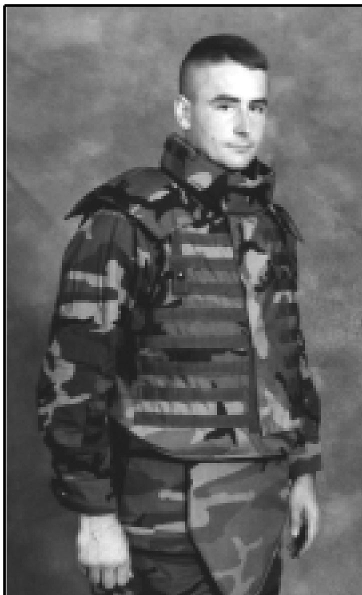
Nominations

Manufacturing technology projects that were considered for the 2001 Defense Manufacturing Technology Achievement Award were completed and/or demonstrated in FYs 00 or 01 and were funded through the DOD MANTECH Program.

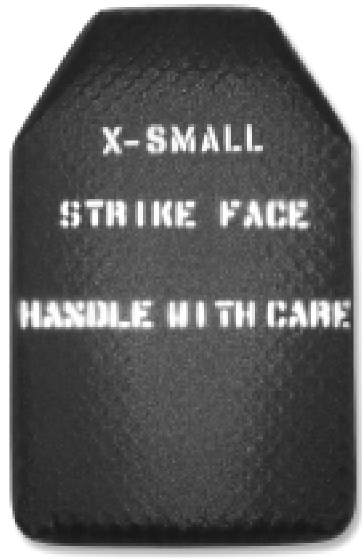
The JDMTP subpanels made nominations. The selection committee consisted of the four JDMTP subpanel heads, the Office of the Deputy Under Secretary of Defense for Science and Technology ex-officio member of the JDMTP, and senior Service and Defense Logistics Agency representatives.

Recipient

Selected from among six nominees, the winner of the Defense Manufacturing Achievement Award was a team headed by the Natick Soldier Center, Natick, MA. The team was cited for its Enhanced Manufacturing Processes for Body Armor Materials project. Award recipients were James



Interceptor jacket



Siliconized silicon carbide final assembled plate

2001 Defense MANTECH Achievement Award Recipient: Army MANTECH Enhanced Manufacturing Processes For Body Armor Materials

Mackiewicz and Janice Knowlton, U.S. Army Natick Soldier Center; Robert Monks, Simula Safety Systems Inc., Phoenix, AZ; and Richard Palicka, CERCOM Inc., Vista, CA. Dr. Ronald M. Sega, Director of Defense Research and Engineering, stated, "Thanks to the dedicated and outstanding efforts of the award-winning team, the soldiers and Marines who may be in harm's way participating in Operation Enduring Freedom will be wearing the best ballistic protection available in the world today."

R&D 100 Award. *Shown left to right are award recipients Stanley P. Kopacz, U.S. Army Tank-automotive and Armaments Command; Walter N. Roy, U.S. Army Research Laboratory; Carol Gardinier, Program Manager for MANTECH, HQ, AMC; Dr. Robert S. Rohde, Deputy Director for Laboratory Management, Office of the Deputy Assistant Secretary of the Army for Research and Technology, OASAALT; and Harvey Pollicove, Director of COM. Dr. A. Michael Andrews II, Deputy Assistant Secretary of the Army for Research and Technology, OASAALT, is shown far right. (Award recipients Don Golini, President of QED Technologies, and Robert T. Volz, U.S. Army Tank-automotive and Armaments Command, are not pictured.)*

The current interceptor body armor jacket can stop 9mm handgun bullets. Now, because of the work of this team and the success of this MANTECH project, two highly effective, lightweight ceramic armor materials have been developed that vastly enhance the interceptor's capabilities. Siliconized silicon carbide and boron carbide plates that can stop rifle or machine-gun fire, which was not possible with this jacket in the past, are now available to insert in the jacket's pockets. Simula Safety Systems Inc., with a production capacity of 5,000 plates per month, has already delivered 45,000 of its siliconized silicon carbide plates and is under contract to deliver 140,000 more. Twelve thousand CERCOM boron carbide plates have also been fielded. The new armor plates are 55 percent lighter than traditional body armor and cost approximately 60 percent less than the high-performance armor plates that were available at the start of this project.

It is also noteworthy that this project uses not only Army MANTECH money but also significant funding contributions from Army and Marine Corps program offices and private industry.

R&D 100 Awards

The R&D 100 Awards, which were established in 1963, are considered the most prestigious honor in applied research. Winners are selected by the editors of *R&D Magazine*, based on the votes and comments of a panel of outside judges chosen from among professional consultants, university faculty, and industrial researchers with superior expertise and experience. The goal is to pick the 100 most technologically significant new products from among the entries.

Criteria

Products considered for the R&D 100 Award must have been available for sale or licensing during the calendar year preceding the judging. The key criterion is technological significance. This can basically be defined as improvements resulting from major technological breakthroughs. The judges look for "leapfrog" gains in

MRF is a revolutionary process. Its extreme accuracy and computer-controlled stability allow the fabrication and polishing of exceptionally precise spherical, aspheric, and nontraditional free-form optical shapes.

performance, not routine or expected incremental improvements.

Army MANTECH Program Selected

During DMC 2001, the Army MANTECH Program was recognized as co-winner of an R&D 100 Award. The other recipients are the Army Center for Optics Manufacturing (COM) at the University of Rochester, and QED Technologies, LLC, a COM spinoff company headquartered in Rochester, NY. The individuals recognized were Don Golini, President of QED Technologies; Harvey Pollicove, Director of COM; Dr. Robert S. Rohde, Deputy Director for Laboratory Management, Office of the Deputy Assistant Secretary of the Army for Research and Technology, Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology (OASAALT); Carol Gardinier, Program Manager for MANTECH, Headquarters, U.S. Army Materiel Command (HQ, AMC); Walter N. Roy, U.S. Army Research Laboratory; and Stanley P. Kopacz and Robert T. Volz, U.S. Army Tank-automotive and Armaments Command.

This award-winning DOD-university-industry team developed and improved a revolutionary manufacturing technology that advanced optics polishing from an art to a science. The Army COM, supported by Army MANTECH efforts, has been very successful in commercializing deterministic processing for optics manufacturing through the advent of the Q22 system built by QED Technologies, LLC.

The team developed the technology to use the unique properties of magnetorheological fluids to form a point polishing source with a constant removal rate. The computer-controlled deterministic optical finishing technology, magnetorheological finishing (MRF), makes possible an affordable manufacturing process for producing the high-precision optics that are required to enhance the target acquisition, identification, surveillance, and communication capabilities of today's and tomorrow's warfighters and their weapon systems.

MRF is a revolutionary process. Its extreme accuracy and computer-controlled stability allow the fabrication and polishing of exceptionally precise spherical, aspheric, and nontraditional free-form optical shapes. Its technology enables improvements for all optical and electro-optical systems and has application in both military and commercial arenas. MRF will enable new technologies and special-use optical products that are being developed for miniaturized opto-electromechanical systems, megapixal recording devices, optical communications, computer storage, and integrated circuit fabrication.

The Q22 MRF system is commercially available and has received industry acclaim. Every manufacturer of photolithographic optics and several major precision optic shops in the United States have already installed multiple Q22 MRF systems to produce ultrahigh precision spheres and aspheres 24 hours a day. The bottom line is that this technology is implemented on the factory floor.

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DR. ROBERT S. ROHDE is Deputy Director for Laboratory Management in the Office of the Deputy Assistant Secretary of the Army for Research and Technology, OASAALT and oversees the Army MANTECH Program.

GET SMART IN ACQUISITION LOGISTICS PLANNING

Bernard C. Price

Introduction

An Army concept known as Simulation and Modeling for Acquisition, Requirements and Training (SMART) is improving the implementation of acquisition policy and collaboration across a variety of Army communities. SMART can help achieve greater operational readiness by reducing life cycle costs (LCCs) and fielding systems more quickly.

This article covers five models that improve acquisition logistics policy implementation and collaboration to achieve SMART readiness and total ownership cost (TOC) goals. Any U.S. government agency or its contractors may use these models. Three of the five models are Army standard models. The other two, developed by the Army Communications-Electronics Command (CECOM), are stand-alone tools that also link to the Army standard models. Each of the five models is identified in Table 1 and is further described in the following paragraphs.

ASOAR

The Achieving a System Operational Availability Requirement (ASOAR) model is a tool for early-on analysis of reliability, availability, and maintainability (RAM) and supportability. The ASOAR model optimally allocates a system operational readiness rate requirement to determine the operational availability (Ao) goals for each end item being separately acquired. ASOAR end item Ao outputs can be used as Ao goal inputs for supportability optimization models when data for items within an end item become available. The ASOAR model uses a top-down analytical approach requiring only system- and end-item-level inputs. The ASOAR model helps to derive and generate system RAM requirements that support the user's readiness objectives early in the acquisition cycle. The model also permits early-on RAM and supportability trade-off analyses for "system-of-systems" situations. When equipment availability is considered, ASOAR results can be used with performance simulations to determine system effectiveness. The ASOAR model can be obtained from the CECOM Deputy Chief of Staff for Operations and Plans (DCSOPS) Systems Analysis Division. The Systems Analysis Division will also perform analyses for government agencies and provide a help desk for all ASOAR users.

SESAME

The Selected Essential-Item Stock for Availability Method (SESAME) model is the Army standard initial provisioning model that optimizes the mix and placement of spares to achieve an end item Ao requirement or the maximum Ao for a dollar goal input. Essentially, the readiness goal is achieved at a minimum cost or the maximum amount of readiness is bought for an initial provisioning budget. To use SESAME, the maintenance concept for each essential item must be known or proposed. SESAME can also be used in an evaluation mode to estimate the Ao being proposed or experienced. This Ao is based on the proposed sparing of items, their demand rate, and logistics response times associated with their support concept. The Assistant Secretary of the Army for Acquisition, Logistics and Technology strongly encourages using SESAME to determine initial spares requirements. The SESAME model and training can be obtained from the Army Materiel Command's (AMC's) Army Materiel Systems Analysis Activity.

COMPASS

The Computerized Optimization Model for Predicting and Analyzing Support Structures (COMPASS) is the Army standard level of repair analysis (LORA) model that optimizes

Table 1.
Linked/Integrated Army Models

Acronym	Model Name	Type
ASOAR	Achieving a System Operational Availability Requirement	Readiness
SESAME	Selected Essential-Item Stock for Availability Method	Readiness
COMPASS	Computerized Optimization Model for Predicting and Analyzing Support Structures	Readiness and Cost
ACEIT	Automated Cost Estimating Integrated Tools	Cost
LCET	Logistics Cost Estimating Tool	Cost

Table 2.
When Ao Optimization Models Can Be Used

	RAM REQUIREMENTS EVALUATION	SOURCE SELECTION EVAL WITH LRU DATA	SUPPORTABILITY OPT PRIOR TO FIELDING	EQUIPMENT TEST & EVALUATION
ASOAR	✔		✓	
SESAME - EVALUATION MODE		✔		✔
SESAME - OPTIMIZATION MODE		✓	✔	
COMPASS - EVALUATION MODE		✔		
COMPASS - OPTIMIZATION MODE		✓	✔	

✔ - Applicable Tool ✓ - Supplemental Tool

maintenance concepts to achieve an end item Ao at the least total cost. A LORA determines where each item is cost-effectively repaired. SESAME algorithms are embedded in COMPASS to simultaneously optimize maintenance and supply support. Thus, COMPASS enables supportability optimization prior to fielding. COMPASS can also be used as a source of repair analysis (SORA) model. A SORA model determines how each item is cost-effectively repaired. Therefore, COMPASS can be used to compare the total costs associated with government depot repair versus contractor depot maintenance in achieving the same Ao goal. Of course, such a best-value analysis would apply to noncore depot work.

COMPASS was designed to determine steady-state, full-deployment LORA and SORA decisions by comparing the net present-value logistics cost estimates that vary by maintenance policy. COMPASS requires information about the line replaceable units (LRUs) used to restore the end item and higher failure rate shop replaceable units (SRUs) used to repair LRUs. Thus, it has the fidelity to permit a RAM analysis of the detailed design to show life-cycle support cost impacts associated with each item modeled in the equipment. Support costs associated with design improvements can be compared to the baseline design to assess the improvement's potential to reduce life-cycle support costs. This helps supportability analysis to become an integral part of systems engineering. The COMPASS model and training can be obtained from the AMC Logistics Support Activity.

ACEIT

The Automated Cost Estimating Integrated Tools (ACEIT) model is an Army standard for LCC estimating. ACEIT is an automated architecture and framework that integrates several software products to be used for cost estimating. ACEIT integrates cost-estimating functions and allows the cost analyst to tailor data for the project. The tool is often used to generate program office estimates and LCC estimates for project managers. The precision of the estimates is dependent on the cost-estimating relationships or methodology of other models and data used to feed ACEIT. With regard to all costs except logistics, past usage of ACEIT tends to provide credible acquisition cost estimates. The ACEIT model and training can be obtained from the Army Cost and Economic Analysis Center.

LCET

The Logistics Cost Estimating Tool (LCET) is a user-friendly model that estimates all time-phased logistics costs associated with equipment readiness, use, and support. LCET consists of two modules: Time-Phased COMPASS and the Logistics Cost Spreadsheet. The Logistics Cost Spreadsheet may be used in conjunction with Time-Phased COMPASS or by itself. Using it in conjunction with Time-Phased COMPASS requires more detailed data, but this combination provides a more credible cost estimate than using it as a stand-alone tool. The data file of a selected COMPASS run may be imported to LCET and the time phasing of support costs computed. LCET also computes the worth of a warranty to automatically adjust the time-phased COMPASS results. The logistics costs not covered by COMPASS can be computed using the LCET spreadsheet. All the logistics cost results in LCET can be electronically copied into ACEIT. Therefore, LCET improves the estimation of logistics costs and can supplement ACEIT to provide more credible life-cycle logistics cost estimates. The CECOM DCSOPS Systems Analysis Division provides the model and a help desk for all LCET users.

Operational Readiness

Table 2 depicts when to use models that optimize supportability to Ao requirements or goals. ASOAR can be used early enough in the acquisition cycle to evaluate RAM and supportability requirements. ASOAR analyzes the mission reliability aspect of RAM, while COMPASS and SESAME analyze the logistics reliability aspect of item demand rates requiring equipment support. If maintenance policies for LRUs and high failure rate SRUs are proposed, COMPASS can be used in source selection evaluations to determine RAM-related support costs. Additionally, if LRU sparing is proposed, SESAME can be used to evaluate the Ao proposed in source-selection evaluations. COMPASS and/or SESAME are highly recommended to determine optimum maintenance or supply concepts prior to equipment fielding. If SESAME is used to initially provision LRUs, the model can later be used to quickly evaluate the end item's Ao based on the reliability determined from equipment test or experienced data.

LCC

All of the models support early, informed decisionmaking across the domains of many different communities to help provide collaborative analyses. Used together in an integrated manner, COMPASS, LCET, and ACEIT are useful for estimating equipment LCC by significantly improving the fidelity and credibility of logistics cost estimates in LCC estimates. Models that improve LCC estimating aid in the analysis and management of TOCs, leading the way to TOC reduction. The rigorous computation of yearly logistics costs in LCET enables more accurate computing of system TOC when used with ACEIT.

The integration of COMPASS, LCET, and ACEIT provides a structured approach to optimize supportability and compute LCC concurrently. COMPASS optimizes among viable support concepts to achieve an inputted Ao goal. It determines the least cost initial provisioning associated with each potential maintenance concept. COMPASS also optimizes among maintenance trade-offs to determine whether it is more cost-effective to use 2-level, 3-level, or 4-level maintenance support; return LRUs or SRUs to depot for repair; use organic or contractor depot repair; and throw away or repair items. The Time-Phased COMPASS module in the LCET can be used to compute RAM and maintenance-related costs on an annual basis. The LCET spreadsheet also estimates the other logistics costs not covered by COMPASS. ACEIT becomes a much better LCC estimating tool when LCET results are electronically copied into it. This also helps to improve the modeling of trade-offs to LCC. Applying the integrated models truly helps to make supportability equal to cost, schedule, and performance when acquiring equipment.

Conclusion

SMART improves collaboration and achieves more operational readiness for less LCC by using modeling and simulation during equipment development. The Army models described in this article already exist and have an excellent potential to accomplish some of the SMART objectives. DOD and Army acquisition policies encourage use of these linked or integrated models, but they are seldom applied today. To better accomplish SMART objectives and implement acquisition logistics policies, individuals need more training to improve awareness and promote culture changes. To significantly improve model usage and collaboration, all Army communities need to accept and use Ao more as a user requirement. Identifying Ao as a key performance parameter in requirements documents will promote increased usage of supportability optimization models. Additionally, if contractor logistics support (CLS) is going to be used extensively, Ao may be evaluated in CLS buys because the contractor's designed reliability and maintainability, proposed sparing, and logistics response times are driving the end item's Ao prior to fielding and readiness after fielding. Another key to significantly improve model usage and collaboration is to start optimizing supportability in LCC evaluations. Applying these linked acquisition logistics models will lead to reduced TOCs in achieving readiness requirements. When less money is spent to achieve system effectiveness, additional dollars are available to purchase more equipment or to buy increased performance, which in turn improves operational effectiveness.

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THE ARMY'S SmarTruck: A TRUE TECHNOLOGY DEMONSTRATOR

GerMaine P. Fuller

Introduction

One of the Army's latest inventions, SmarTruck, is a concept vehicle designed to provide the Army a commercial vehicle platform to test, integrate, and showcase cutting-edge, dual-use automotive technologies. SmarTruck allows the Army to investigate the latest in wireless communications, situational awareness, and soldier safety technology for potential insertion into its lightweight tactical wheeled vehicle (TWV) fleet.

The idea for SmarTruck originated in response to Army Chief of Staff GEN Eric K. Shinseki's vision for the Army of the future: "Soldiers on Point for the Nation . . . Persuasive in Peace, Invincible in War," with the goals to become more "Responsive, Deployable, Agile, Versatile, Lethal, Survivable and Sustainable." Army transformation represents the actions that must occur for the Army to accomplish Shinseki's goals. To do this, the Army must change the way it currently thinks, trains, and fights. This change must also be reflected in its vehicle fleet. The Army needs to develop strategies to modernize and equip its light TWV fleet with dual-use technology and also devise vehicles that are capable of plug-and-play functionality.

As Shinseki's Army transformation plan began to take shape, military strategists questioned how they would put his vision into action. Specifically, they were seeking a truck that was lighter, faster, and safer, while also being affordable.

The U.S. Army Tank-automotive and Armaments Command's (TACOM's) National Automotive Center (NAC) took the initiative to support Shinseki's transformation goals and prove that specific commercial technologies, which met military mission requirements, could be integrated on a single testbed. They took an innovative approach by brainstorming ideas about futuristic vehicle weaponry systems.

After NAC personnel gathered ideas, they assembled a team of commercial partners, including Delphi Automotive Systems, Integrated Concepts and Research Corp., and MSX International, with whom they could share both state-of-the-art technology and the costs of developing the SmarTruck. Through this cost-sharing approach, NAC produced a state-of-the-art concept vehicle, which uses commercially available off-the-shelf products, within 7 months from inception to completion. In addition, SmarTruck can be quickly repaired with minimal cost because it is built on a standard Ford F-350 platform. SmarTruck could have been built on any commercial platform that fit the specifications, i.e., Dodge or General Motors; however, the team chose Ford.

What Is SmarTruck?

SmarTruck is the Army's newest technology demonstrator, equipped with the latest in automotive assets and nonlethal weaponry. The engineers at NAC modified a standard Ford extended crew cab F-350 measuring 8 feet (including mirrors) by 6 feet by 22 feet and weighing 10,000 pounds. They added 1,000 pounds to the standard chassis, lowered the body by 2 feet, outfitted everything but the floorboards with Armormax (a Kevlar-like ballistic cover), and added 1-inch-thick bulletproof glass (3-A rated) to the front, back, and side windows. On the doors, the engineers provided additional protection by installing a 3-A rated ballistic covering for protection against small arms such as .44- and .357-caliber Magnums, 9mm handguns, and M-16s. The cost of armoring the entire demonstration vehicle would have been prohibitively expensive.

The truck seats four—a driver and three crewmembers. The seats in the back of the vehicle slide to allow the user greater access to three flat-screen panel displays and a joystick control, which operate the onboard countermeasures and weapons station. User identity is confirmed using a biometric fingerprint identification device. Once access is granted, the user can deploy the onboard countermeasures (dazzling lights; high-voltage door handles; and oil slick, smoke screen, pepper spray, and tack dispensers) and the night vision system. At the touch of a button, pepper spray can be dispensed from the top of the vehicle to disorient rioters at a distance of up to 12 feet. High-voltage door handles delivering 110 volts/30 amps, enough voltage to temporarily stun an intruder or thwart would-be attackers, can also be activated from the same flat-screen panel.

The smoke screen, which pumps smoke out of the vehicle's exhaust pipe, obscures pursuers' vision, as do the dazzling lights mounted on the front and rear bumpers. The lights

SmarTruck PC/custom dash

SmarTruck exterior

temporarily disorient enemies so that they cannot look directly at the vehicle or pursue it. The front lights can pan and tilt 90 degrees, giving the user additional effectiveness. When activated, oil from the truck's reservoir is released through a pipe with several small holes in it, causing pursuers to lose control of their vehicle. Should the pursuers evade the oil slick, the SmarTruck can dispense 30 to 35 2-inch tacks, which always hit the ground with one sharp point in the upright position, immediately blowing out the tires of the pursuing vehicle. Run-flat tires on the SmarTruck ensure that the user can complete his or her mission in the event of a flat.

Some of the other capabilities of the SmarTruck include the following:

• *Bomb detection system*. An array of sensors placed around the vehicle detect any disturbances in the magnetic field. Should any disturbances occur, the LED blinks, warning the driver of danger.

• *Vehicle PC*. A ruggedized onboard event recorder, much like the black box of an airplane, can be attached to cameras that record outside via the weapons control station.

• *Truck PC*. SmarTruck uses a touch screen monitor to display National Imagery and Mapping Agency maps. It also displays vehicle-to-vehicle and vehicle-to-base e-mail communications and load-management status via satellite.

• *ECLIPSE Commander*. This replaces the existing radio on the dashboard and provides limited Global Positioning System (GPS) capability to guide the driver to new locations and pinpoint selected destinations. The radio, cell phone, and power door locks can be controlled via voice activation.

SmarTruck Objectives

Engineers at NAC thought long and hard about what the SmarTruck could be and do. The SmarTruck Program supports the Army's transformation goal for the next generation of military vehicles as well as the 21st Century Truck Initiative. (See article on Page 23 of the September/October 2000 issue of *Army AL&T* magazine.) The SmarTruck testbed was designed to show that the technology exists today to give soldiers the ability to employ nonlethal weapons to defend themselves within the confines of the rules of engagement for peacekeeping operations. Some Army missions today are peacekeeping and policing activities. The SmarTruck was also designed to give the soldier the ability to control a situation using nonlethal measures, coupled with the ability to use deadly force in case the situation escalates.

Some of the other objectives for the initial SmarTruck Program include the following:

• Integrate and demonstrate a hybrid-electric drivetrain for improved fuel economy in the long range;

• Increase voice-activation capabilities within the vehicle;

• Develop and evaluate a satellite-linked data acquisition system and flight recorder box for improved soldier safety;

• Lower maintenance, operating, and support costs using onboard computers for improved and faster diagnostics and service;

• Demonstrate multiple databus network on military trucks;

• Reduce cost-of-vehicle upgrades by embracing plug-and-play commercial off-the-shelf technology; and

• Share the cost of research and development with private industry.

Why SmarTruck?

SmarTruck can potentially be deployed on peacekeeping missions, be used to transport and protect America's dignitaries in times of unrest, or help thwart terrorist attacks on our foreign embassies or here at home. It can also be used to perform policing duties, as the Army is increasingly deployed in urban environments. Because of its resemblance to a sport utility vehicle (SUV), the SmarTruck does not draw attention to itself and can be used for such assignments as transporting diplomats, members of Congress, or the president in motorcades. A long list of agencies—the Drug Enforcement Administration, the U.S. Border Patrol, the Federal Bureau of Investigation, the U.S. Marshals Service, U.S. Army Special Operations, the New York Port Authority, the Secret Service, and local sheriff departments—have already expressed interest in a vehicle like the SmarTruck.

The SmarTruck is not yet being produced. It is considered to be a technology demonstrator, one that can be customized for the needs of the agencies listed above or other interested parties.

Partnering Produces Results

By partnering with leaders in the automotive industry, using readily available commercial products and a commercial platform, the military considerably reduces the cost of producing and maintaining the SmarTruck. According to Paul F. Skalny, Associate Director of the NAC, "It makes sense to share the task of introducing technologies that consumers want and that our soldiers need. By working together, we can get the job done better, faster, and cheaper. Everyone wins." The automotive companies are just as excited about the partnership and the opportunity to showcase new technologies and see how they hold up under demanding test conditions. Delphi Automotive Systems is using the SmarTruck as a testbed for its QUADRASTEER four-wheel steering system, which grants full-size vehicles greater maneuverability at low speeds and improved stability and handling at higher speeds. Larry Tomczak, Director of Engineering at Delphi's Saginaw Steering Systems Division, says, "The key attribute [of participating in the SmarTruck Program] is being able to evaluate QUADRASTEER. We can get a better assessment on how the vehicle can be exposed. It's a chance to learn about how well our technology works."

SmarTruck II

NAC engineers and their partners have begun planning the second iteration of the SmarTruck concept vehicle. The next SmarTruck will be combined with the NAC's COMBATT (COMmercially BAsed Tactical Truck), which leverages commercial technology to fulfill military mission needs. Vehicles that are currently part of the COMBATT Program have shown that using this approach results in better off-road mobility and payload capacity. An added benefit is being able to provide continuous improvement via automotive technology developed by the private sector at no cost to the Army.

The COMBATT Program has proven that economies of scale and commercial state-of-the-art technology result in lower operating and support costs. The future SmarTruck will integrate COMBATT and SmarTruck technologies and be designed with an urban environment in mind. The platform for the next iteration vehicle has not yet been chosen. However, the vehicle will not be camouflaged like the current COMBATT vehicles; instead it will look more like an SUV.

Future Capabilities

The future SmarTruck will include multidatabus electrical architecture (J-1850, IDB-CAN, J-1939, MOST, and wireless); an alternative propulsion system (most likely hybrid electric); voice activation; and robotic reconnaissance capabilities. Upgrading to multidatabus capabilities means that the standard vehicle original equipment manufacturer's databus will be combined with a fiber-optic databus, giving the SmarTruck multimedia capabilities.

SmarTruck passengers will be able to view electronic repair, operator, and parts manuals. Depending on the system chosen, the alternative hybrid-electric propulsion system, in addition to allowing the vehicle to operate in stealth mode, will enable the vehicle to reach a speed of 100 kilometers per hour in less than 7 seconds. By adding a state-of-the-art voice activation system, the user will be able to vocally control the nonlethal countermeasures, the GPS system, and the communication systems. The future iteration of the SmarTruck will have robotic reconnaissance capability, which will allow the user to deploy a robot from beneath the vehicle to investigate a potentially dangerous situation from a remote location. Other additions to the next iteration SmarTruck include the following:

- QUADRASTEER by Delphi, a steering system that uses all four wheels to steer. It gives the truck increased maneuverability and the ability to make extremely sharp turns.
- A central tire inflation system, which allows vehicles to move over all types of terrain with ease, thus improving mobility, traction, and comfort.
- A nuclear, biological and chemical detection system.
- A collision warning system that alerts drivers about impending danger.
- A fingerprint identification system for entry to the vehicle.

Soldiers traveling through enemy territory in the SmarTruck will have enough technology to protect themselves, disorient the enemy, and complete their mission. What will the NAC engineers think of next?

GERMAINE P. FULLER, SmarTruck Program Manager, has been employed by TACOM for 12 years, the last 3 years at NAC. Fuller has a B.S. in electrical engineering from Lawrence Technological University in Southfield, MI, and an M.S. in technical management from Embry Riddle Aeronautical University in Daytona Beach, FL.

JOINT DISTRIBUTED VIRTUAL COMBAT RANGE

MAJ Raymond D. Pickering

Introduction

Recent combat actions, most notably Operation Allied Force, showed pronounced shortcomings in Army and Air Force joint training and interoperability. The Kosovo/Operation Allied Force After Action Review noted that Operation Allied Force validated the need for joint, integrated training and underscored the criticality of interoperability training. In fact, this need is clearly evident in the Joint Surveillance Target Attack Radar System (JSTARS) Program. Although the Army and Air Force have solved many JSTARS training and interoperability issues, difficulties still remain, especially for the Common Ground Station (CGS). Realizing this, a team of government and industry experts developed the Joint Distributed Virtual Combat Range (JD-VCR). This virtual battlefield lays the foundation for solving joint training, testing, and mission-rehearsal issues for the CGS and future network-centric warfare systems.

Why A Virtual Range?

The CGS comprises a "system-of-systems" using a number of joint sensors and communication links. The primary sensor is provided by the JSTARS—an Air Force operated asset that gives the joint task force commander a wide area surveillance capability. Joint warfighters from regiment and brigade up through theater rely on the CGS to support their diverse targeting and combat information needs. CGS crews need frequent opportunities to work with joint staffs and full sensor arrays to maintain their skills. Opportunities to do this are limited because of the lack of appropriate-size ranges, transportation dollars, and operational and personnel tempos.

Training

The primary reason for a JD-VCR is the lack of live and simulated exercises that address joint interoperability training at the tactical level, specifically at the division level and below. The U.S. Joint Forces Command (JFCOM) recognized this deficiency in its *Final Report on the Training Center for Joint Interoperability (JI) Study*. The report states, " . . . only a few selected units get the opportunity to conduct joint interoperability training; when they do, it is not enough to advance beyond the 'crawl' stage."

At the simplest level of joint interoperability, CGS crews have difficulty sustaining skills that enable them to maintain linkage with the JSTARS aircraft. This is attributable to the lack of training opportunities. For example, high-density E-8C flight sites such as Fort Bragg are only able to link with the JSTARS aircraft about

The primary reason for a Joint Distributed Virtual Combat Range is the lack of live and simulated exercises that address joint interoperability training at the tactical level, specifically at the division level and below.

At its end state, the Joint Distributed Virtual Combat Range will enable CGS crews and warfighting staffs to hone joint interoperability skills, rehearse complex military operations, and train in realistic combat environments without leaving their home stations.

three times a month for about an hour each time. In addition, low-density flight sites may only be available once a quarter or less. During these training opportunities, the JSTARS radar is normally looking at civilian traffic on local highways, providing little or no tactical training value for intelligence analysts and targeting staffs. Commanders find it difficult to quantify this type of ad hoc training using the Army's formal teaching process of "tasks, conditions, and standards." More complex levels of training are offered during National Training Center rotations and at warfighter exercises, but these occur only once every 2 years. What CGS crews and their warfighting staffs need are monthly opportunities to work with JSTARS and other members of the joint "kill chain."

Testing

Operational testing requirements for systems-of-systems like the CGS mirror those of joint interoperability training. The JFCOM report states, "The testing and evaluation community has requirements similar to those of the training community in the areas of simulation, network infrastructure, and data collection, and the need for operational forces to validate capabilities and systems as would be employed in joint interoperability training exercises." Like the training community, the CGS operational test community faces the same hurdles.

Mission Rehearsal

CGS mission rehearsal in support of real-world operations also suffers from the inability to synchronize garrison forces from dispersed locations. The JFCOM echoes this point for many systems-of-systems, " . . . in many cases the only opportunity to train the joint force is between the time the joint force is activated and when it must engage the enemy in battle!" This situation will rarely result in a properly rehearsed joint operation.

JD-VCR

With the concerns of training, testing, and mission rehearsal in mind, the components of the JD-VCR began to take shape in concept and scope. The first component is the virtual battlespace or "hub." The hub must meet the operational needs for all of the Services. In addition, it must meet the fidelity of the entire customer base, most specifically the stringent requirements of the test and evaluation community. Finally, the hub must be affordable and supportable.

At first, the modeling and simulation (M&S) team sought to build a virtual battlespace from scratch. Initial cost estimates looked unaffordable until the CGS M&S team discovered the Theater Aerospace Command and Control Simulation Facility (TACCSF) at Kirtland AFB, NM. This high-tech, $250 billion facility quickly became the top choice for the joint hub. The new Air Force Chief of Staff recently designated TACCSF as the joint distributed training hub for the Air Force. This facility already has an integrated network of simulators, a robust infrastructure, and expertise in place for distributive simulation training. TACCSF currently maintains a close working relationship with the 93rd Air Control Wing (JSTARS) and conducts quarterly exercises called "Desert Pivots" or "Virtual Flags." The Desert Pivot exercises focus on battle management and work every piece of the air component kill chain from target detection, to target attack, to battle damage assessment. While TACCSF primarily supports Air Force needs, it eagerly supports expansion into the joint arena. According to LTC James "Boomer" Henry, TACCSF Director, "The ground and air components have to learn to work together, and we think that this is the perfect venue to do that."

To fulfill the role envisioned by the CGS M&S team, TACCSF agreed to have the Army integrate some of its own simulation and digital communication capabilities into the TACCSF federation. These include FIRESIM (Indirect Fire Support Simulator), a dismounted version of the CGS called the Joint Service Work Station, an All Source Analysis System (ASAS), and an Advanced Field Artillery Tactical Data System (AFATDS). In addition, the TACCSF supports establishment of a permanent Army presence within its facility. This Army cell will bring the ground component to the fight during the quarterly Desert Pivot exercises. It will also manage the monthly, distributed training events (3-5 per month) that run on the virtual combat range.

Having identified the hub, the team then shifted its attention to putting together the network that would tie the hub to the player units around the world. The team anticipated that this could be the costliest piece of the virtual combat range, and might in fact be cost prohibitive. Fortunately, the CGS M&S team discovered that the National Guard

Bureau (NGB) already has a network in place and is willing to share it. The NGB calls this the Distributive Training Technology Project or "GuardNET XXI."

GuardNET XXI is an existing network of T-1 lines and DC-3 circuits that provide integrated voice, video, and data products to all 50 states and 4 U.S. territories. The network supports hundreds of high-tech digital classrooms where soldiers train. Fortunately for the CGS M&S team, most of these classrooms are in close proximity to Active duty CGS garrisons. The partnering of GuardNET XXI with the JD-VCR also helps solve Army National Guard (ARNG) training issues. If joint interoperability training is difficult for the Active duty force, it is exponentially more difficult for the 15 ARNG units that are scheduled to receive CGSs beginning in FY02. The NGB agreed to allow the CGS M&S team to use its GuardNET XXI as long as the JD-VCR accommodates the unique training needs of the ARNG.

The final piece for the CGS M&S team to put in place was the outstation locations or "Warrior World." The team's intent here is to set up an infrastructure that allows the CGSs and their staffs to roll-up and plug right into the virtual combat range. The CGS M&S team also needed to make the sensor and communications linkages as real as possible because link maintenance is one of the identified training deficiencies.

Instead of injecting simulated E-8C radar data directly into each CGS, this information is broadcast over an emulator that physically replicates the data link on the aircraft. Each CGS will receive JSTARS information via its actual ground data terminal. Unmanned aerial vehicle (UAV) telemetry and video information is brought into the CGS via a MetaVR simulator that replicates the UAV Ground Control Station (GCS). When the actual Tactical UAV GCS becomes available, it will be able to easily integrate into the virtual battlespace because MetaVR is built into its software. The CGSs will receive intelligence broadcast services via the Commander's Tactical Terminal or Joint Tactical Terminal via the actual links using a training format. Outstation CGSs will be able to link with ASAS and AFATDS terminals locally or with these systems at the TACCSF via GuardNET XXI. The M&S team plans to have nearly 40 outstations plugged into the VCR.

Evolutionary Approach

Using quarterly Desert Pivot exercises as "waypoints," the CGS M&S team is taking an evolutionary approach to building the VCR. The intent is to use the quarterly Desert Pivot exercises to incrementally grow the JD-VCR. At each step, the customer base of trainers, testers, and mission planners will be able to assess the performance of the range to support their specific areas of interest.

The crawl phase (concept viability) of the JD-VCR occurred in April 2001. During a Desert Pivot exercise, five CGSs from the U.S. Army Intelligence Center and School at Fort Huachuca, AZ, participated in a southwest Asia scenario. The Fort Huachuca CGSs interoperated with a simulated E-8C aircraft manned by a real JSTARS aircrew at Kirtland AFB. The CGSs also received UAV telemetry/imagery from the Army's Hunter UAV and used their voice communications over the network.

By the time this article is published, the team will have completed the "walk" stage (GuardNET XXI viability) at Desert Pivot 01-4 in September 2001. The CGS from the Army's newest unit, the Interim Brigade Combat Team (IBCT) at Fort Lewis, WA, will join the JD-VCR by linking into GuardNET XXI. As such, the IBCT will monitor JSTARS and UAV operations from its Fort Lewis location. In addition, the Army's Intelligence Center will establish a digital tactical operations center to support its CGS and its schoolhouse. The M&S team will also equip the TACCSF with an AFATDS system to test the digital messaging capability of the JD-VCR.

The CGS M&S Team plans to reach the "run" stage in the summer of 2002 to include the ARNG during another Desert Pivot exercise. The team hopes to be executing all or portions of the CGS's follow-on test and evaluation on the JD-VCR in the first quarter of 2004. The CGS team also envisions that the JD-VCR will evolve beyond just the CGS. In fact, the JD-VCR has the potential to become a fundamental component in the development, testing, and training of the Distributive Common Ground System-Army (DCGS-A).

The New Vision

At its end state, the JD-VCR will enable CGS crews and warfighting staffs to hone joint interoperability skills, rehearse complex military operations, and train in realistic combat environments without leaving their home stations. The JD-VCR will also provide the test and evaluation community a cost-effective venue and tools to assess systems-of-systems like the CGS and the future DCGS-A.

MAJ RAYMOND D. PICKERING was the Modeling and Simulation Team Chief at PM, CGS when he wrote this article. He is presently enrolled in the Command and General Staff Officers Course and the Acquisition Graduate Degree Program at Fort Leavenworth, KS. He is a graduate of New Mexico State University.

Managing Risk . . .

THE ABERDEEN CHEMICAL AGENT DISPOSAL FACILITY

Robert J. Cavallo and G. Thomas Howard

Introduction

In October 1998, a team was established to design, construct, operate, and—ultimately—close the Aberdeen Chemical Agent Disposal Facility (ABCDF) at Aberdeen Proving Ground (APG), MD. This $616 million ABCDF pilot plant will dispose of the mustard agent (HD) currently stored at the Edgewood area of APG. Overseen by the Program Manager for Chemical Demilitarization, the ABCDF is a prototypical research, development, test and evaluation (RDT&E) project that will use hydrolysis and biotreatment for HD destruction.

Risk management is critical to the success of any RDT&E project or program. In the case of the ABCDF project, the Army and its systems contractor, Bechtel National Inc.-Aberdeen, are identifying challenges to the project that may arise from federal and state regulators, community scrutiny, design issues, construction and operational needs, budgets, and schedules. To assist in the identification, evaluation, and management of probable risks, the ABCDF project team developed a management tool, the risk list, in conjunction with the project's Earned Value Management System, while revising its estimate at completion (EAC). The project team spent 1 year assembling a detailed bottoms-up cost estimate for the revised EAC. The resulting risk list allows project managers to document, evaluate, prioritize, and manage major risks, thus avoiding or minimizing impacts to cost and schedule.

This article highlights how ABCDF project managers are using the risk list and how its implementation benefits the project.

Defining The Risk List

Developed in 1999, the risk list is a detailed spreadsheet of actual, probable, or potential risks that are prioritized, evaluated, and rated for management action and follow-up. The list includes any risk that the ABCDF project team deems significant in answering three basic questions: What is the likelihood that a particular event will happen? If the event does happen, what will be the magnitude of its impact? Are we able to mitigate the risk now?

Soliciting input from all the project team members helped the team to create an initial list of risk items that could impact the ABCDF project. The team identified major assumptions regarding cost (e.g., staffing ramp-up/levels), schedule (e.g., construction and operation timelines), and those items perceived to be vulnerable to certain risks (e.g., hiring required staff). A risk inventory (accompanying chart) and the *ABCDF Work Breakdown Structure Dictionary* were used to identify other applicable risks.

Risk-List Advantages

The primary benefit of using the risk list is that major risks are identified before they occur, thus allowing management to develop mitigating actions in a timely manner.

Secondary benefits include more effective partnering and team building by Army and Bechtel-Aberdeen personnel and the historical documentation generated while addressing potential risks. In addition, the historical documentation can be used as a reference tool for other demilitarization projects. The risk list also meets requirements of DoD Directive 5000.1, *The Defense Acquisition System*, which instructs program managers to use risk management tools and continually assess program risks.

However, the overall benefits to the project are cost and schedule savings. For example, the ABCDF project team made aggressive assumptions when preparing the project's EAC timeline, which must be properly managed to prevent cost overruns. One of these assumptions included scheduling less than 4 months of lead time for new personnel to obtain clearances to work on the chemical demilitarization program (the typical lead time could be more than 12 months). Because the time for employee clearances was identified as a potential cost and schedule risk, the project team is managing this risk and avoiding a cost increase of more than $6 million.

Generating Risk Ratings

In April 2000, the risk-list rating system was revised to help focus ABCDF's resources on the most critical issues. The risk-list format allows the user to enter issues or events and their associated risks and document the basis for the risk assessment and any associated risk-mitigation action plans. The scales and level of detail selected for the risk factors were based on the project team's assessment of the degree of accuracy that realistically could be applied to most risk items.

Each risk item is assigned a probability (P), an impact to performance (I) (i.e., cost and schedule), and an urgency factor (U). The risk rating (RR) is determined by multiplying these three factors (P x I x U = RR) and then ranking the risk item relative to all other risk items. The probability factor is based on a scale of one through three. One is low (less than 25 percent probability of occurrence); two represents medium (25-75 percent probability of occurrence); and three means high (greater than 75 percent probability of occurrence). The impact to performance factor scale also uses the one through three rating format. However, for use on other projects, the rating scale should be project-specific and adjusted to measure risk impacts to the project's expected total cost and schedule. For example, the risk of a 1-day schedule delay during the course of a 1-week project will register a higher

Typical Sources Of Risk

External	Internal	Technical
Personnel	*Technical*	Operational Environment
Data	Maturity	System Environment
Supplier Viability	Changing Requirements	Environmental Impact
Regulations	Design Errors	Software Language
Political Actions	*Schedule*	Configuration Management
Environmental	Unrealistic Requirements	Parts Quality
Transportation	Incomplete Identification of Tasks	Design Errors
	Cost	External/Internal Interfaces
	Design and Configuration	Maintenance
	Competitive Environment	

rating than a 1-week delay on a 5-year project.

The urgency factor is configured on a slightly different scale of 0.1 to 1.0 and estimated to the nearest 0.1. It is an estimate of the need to address a risk item based on the project's status and the team's ability to reduce the probability or impact. A rating of 0.1 to 0.3 is low and does not warrant immediate attention. A 0.4 to 0.7 rating is considered medium, which means there is a reasonable need for mitigating the risk factor in question. A rating of 0.8 to 1.0 is high and indicates that mitigation steps must be taken immediately. Once the risk ratings are calculated, they are ranked from highest to lowest. However, the risk list is a living document, and risk ratings can move up or down based on changing conditions. The list also can be sorted in a number of ways such as by probability, impact, and urgency.

Risk-List Administration

Co-chairpersons (one Army and one system contractor representative) are selected by senior members of the ABCDF project team to oversee the risk list. They maintain the list, periodically assess risk items, and request and compile updates. In addition, the co-chairpersons assign risk-item lead personnel (subject to managerial approval), normalize data as appropriate, schedule and lead the risk-list meetings, and communicate key risk items and responsibilities.

Any ABCDF project member or stakeholder may recommend risk items be added to the list or provide input on existing items via the risk-list co-chairpersons. Once a risk item is identified, a minimum of two leads—one Army and one system contractor representative—are assigned to monitor the risk item. The lead personnel are also responsible for documenting and maintaining the risk item(s) on "backup" sheets, which typically include a risk-item description, potential impact (general description), risk-factor ratings (P, I, and U), the basis for the risk-factor ratings, proposed action plan, and a history documenting all activities associated with the item.

Lead personnel must reach concurrence with their co-leads on risk-item documentation. Individual risk-item backup sheets are then compiled to formulate the risk list. The co-chairpersons review the risk list to ensure uniformity in scoring and risk rating before the list is reviewed and used by project team members. If an identified risk item does not require further action, it is archived for future reference.

Working groups meet periodically to ensure that the risk list is current and that action plans for identified risks are appropriate and progressing. During these reviews, risk items that have been mitigated or are no longer valid are archived to ensure that a history is maintained. Risk items that have received a high ranking are discussed at the system contractor's weekly staff meeting and at the Army and system contractor operations/management integrated product team meetings.

The project team also hosts biweekly Risk List Working Group meetings in addition to formal quarterly reviews and updates of all risk-list items.

Conclusion

The risk list aids ABCDF project managers in evaluating and quantifying risk, which is not an exact science. However, being able to reasonably assess a project's risks regardless of its life span or budget is critical to the success of that endeavor. On any project, the first step is to decide what type of risk management tool will be used and immediately implement it to assess and manage potential risks.

ABCDF's management team embraced risk when it decided to make a series of assumptions; weigh them against external, internal, and technical variables; and assign levels of probable impact to the project. All of this is done to identify issues and scenarios to ensure the successful conclusion of the ABCDF project. The effective partnering and teamwork by the Army and its systems contractor in the mitigating potential risks is an added benefit.

Managing risk for the ABCDF is proving to be a valuable tool in the safe and cost-effective disposal of Edgewood's mustard agent stockpile.

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NAC's GROUND VEHICLE OCCUPANT PROTECTION GUIDE

Michael L. Gedeon

The National Automotive Center (NAC) at the U.S. Army Tank-automotive and Armaments Command's Tank Automotive Research, Development and Engineering Center (TACOM-TARDEC), Warren, MI, has developed a software tool that provides much of the information needed to design occupant safety into vehicles. The *Occupant Crash Protection Development Guide for Ground Vehicles* is a multimedia tool that can educate beginners in the many facets of occupant protection or assist technical experts in developing new systems.

The Army's ground vehicle fleet needs the best possible occupant crash protection to prevent injuries to our soldiers. This requires upfront knowledge and planning prior to development. Determining the causes of injuries, developing system requirements, and extensive test and evaluation are essential to the initial phase of an occupant protection program. Engineers and managers must have access to information resources on occupant crash protection systems. Engineering and biomechanic topics that must be considered and used include mechanism of impact injuries; injury thresholds; existing and emerging crash protection technology; principles of occupant crash protection; lessons learned from previously developed systems; existing applicable standards; and test, simulation, and analysis methods.

The *Occupant Crash Protection Development Guide for Ground Vehicles* consolidates and organizes this resource information into an interactive, Web-compatible CD-ROM. The task-oriented organization of the CD, coupled with the multimedia format, maximizes comprehension of occupant crash protection concepts for diverse audiences. Additionally, the guide's use of visual aids effectively conveys the information. Internet compatibility allows the guide to be updated and provides users direct access to other Internet resources through integrated hyperlinks. Further, the electronic guide can be navigated through the use of hyperlinks, find features, and bookmarks.

The occupant crash protection guide provides essential vehicle occupant safety information for Army program managers, acquisition managers, developers of operational requirements, system safety engineers, project engineers, and others who are responsible for preparing the detailed occupant protection specifications for wheeled ground vehicles.

The guide runs on Microsoft Windows 95, NT 4.0, or more current operating systems. It uses the client's Internet browser to display text, charts, and video and audio files to assist them in understanding issues related to ground vehicle occupant protection.

The guide contains safety information from several major sources including the Federal Motor Vehicle Safety Standards, the Society of Automotive Engineers, the U.S. Army Safety Standards, and the U.S. Army Crash Survival Design Guide.

To accommodate the needs of individual users, the guide presents the principles of occupant crash protection in three levels of increasing intensity. The Overview is an executive summary; the Tutorial discusses the significant elements in the development process; and the Handbook provides detailed information about the design, development, test, and evaluation of occupant protection systems. The Handbook further explains the principles of occupant crash protection, human injury tolerance, crash test methodology, data analysis, and crash protection technology.

Another key feature of the guide is the Toolbox, which contains several analytical tools to assist users with analysis of test data and injury assessment. The Toolbox is comprised of software to calculate potential for spinal and head injury, to calculate and plot a crash pulse, and to calculate major body dimensions; a knowledge base to understand human tolerance to acceleration; and hyperlinks to government and commercial Web sites.

The final section of the guide is Resources. This section contains hyperlinks to Web sites of various government and industry offices that are involved in occupant crash safety including Army, Navy, and Air Force safety centers; the Insurance Institute for Highway Safety; the Human Factors and Ergonomics Society; and the Society of Automotive Engineers.

The best way for the Army to meet its goal of reducing the number of crash related fatalities 50 percent by 2010 is by improving in-cab occupant crash protection, installing crash avoidance systems, and improving driver education programs. The *Occupant Crash Protection Development Guide for Ground Vehicles* provides the information and tools needed to assist management in making choices that will achieve the optimal occupant crash protection for ground vehicles. Use of this interactive computer-based guide can lead to enhanced protection of our soldiers and provide increased potential for success of their missions.

Note: To order the Occupant Crash Protection Development Guide for Ground Vehicles, send an e-mail with your business address, phone number, and the number of CDs required to ***nac@tacom.army.mil***.

MICHAEL L. GEDEON is the Project Manager for NAC's Army Vehicle Intelligence and Safety Program. He has a B.S. degree in mechanical engineering from Wayne State University, is a member of the Society of Automotive Engineers, and has 20 years experience in Army ground vehicle research and development.

Putting Safety First . . .

CHEM DEMIL FACILITY HAS ACCIDENT-FREE DECADE

Kenneth W. Findley

Introduction

The term "lost-time accident" refers to a job-related injury or illness that results in an employee being unable to work. In August 2001, the Chemical Demilitarization Training Facility (CDTF), a five-building complex located in the Edgewood Area of Aberdeen Proving Ground, MD, commemorated 10 years without a lost-time accident. The CDTF serves as a hands-on, agent-free training facility for personnel who operate and maintain the U.S. chemical weapons stockpile disposal facilities. The CDTF is a unique facility dedicated to training the workforce for the disposal program.

In 1985, Congress directed DOD to safely dispose of its chemical weapons stockpile. The Secretary of the Army announced that disposal facilities would be established under the administration of the Program Manager for Chemical Demilitarization's (PM, CD's) newly formed Chemical Stockpile Disposal Project on Johnston Island, 825 miles southwest of Hawaii, and at eight other sites across the country. Shortly thereafter, PM, CD identified the need to construct a dedicated training complex that would provide programmatic training support to personnel who would operate and maintain the disposal facilities.

In 1989, General Physics Corp. (GP), based in Columbia, MD, was awarded the initial contract to construct the CDTF. GP not only built the $17 million complex but also developed the CDTF's training program to include the use of disposal facility equipment such as rocket shear and multipurpose demilitarization machines.

This article describes the successful safety, training, and management practices that have allowed the CDTF to achieve its zero-accident record.

Safety As A Priority

Ten years without a lost-time accident is an accomplishment in any industry. The CDTF credits its Occupational Safety and Health Administration Voluntary Protection Program (VPP) for its successful accident-free record. The VPP is the underlying structure of the CDTF's safety program, which consists of but is not limited to the following elements:

- Involving top management in the structure and operation of the program,
- Inspecting sites regularly for safety and health,
- Investigating accidents and "near-miss" incidents,
- Identifying all hazards by conducting baseline work-site surveys,
- Analyzing injury and illness trends, and
- Training to ensure that all employees understand the hazards to which they may be exposed to prevent harm to themselves and others.

The Project Manager for Chemical Stockpile Disposal (PM, CSD) assigns responsibilities for all aspects of the program so that managers, supervisors, and employees know what is expected of them. This helps create an atmosphere where all workers are accountable for upholding safety requirements and ensuring that their teammates adhere to them.

CDTF Training

Since its inception, the CDTF has conducted more than 5,600 classes and trained more than 28,000 employees from various chemical demilitarization program areas. The training facility was also the first organization to systemize the multipurpose demilitarization, projectile/mortar disassembly and mine disassembly machines, and bulk drain station. Test plans and control codes from the CDTF were used to support the disposal startup efforts at the Tooele Chemical Agent Disposal Facility (TOCDF) in Tooele, UT, and the Johnston Atoll Chemical Agent Disposal System in the Pacific.

System Simulator Upgrade

The CDTF training program also makes use of a process control system simulator (PCSS), which GP recently upgraded at the request of

PM, CSD. The new PCSS consists of six operator control stations and one instructor station. Each station operates as an Ethernet LAN running on a Windows NT server. Each of the six operator control stations consists of a single PC and two monitors. The instructor station allows the user to insert faults and monitor and control each of the six control station simulations concurrently.

The GP CDTF Simulation Group headed the design and implementation of the upgraded PCSS. Required software licenses and hardware were identified and purchased and process software was developed to function with the LAN-based PCSS. Other product designs and implementations included systemization, product documentation and training material design and development, and advanced training system and equipment fault scenario development. The improved PCSS serves several functions within the chemical stockpile disposal training program. For example, in addition to evaluating hazardous waste incinerator operators, it provides:

• Initial skill and knowledge training for hazardous waste incinerator operators,
• Control room team skill training, and
• Self-paced practice in relevant job skills.

The system upgrade has also allowed a larger number of students to concurrently operate independent copies of the equipment or system, increasing the time students can spend performing and practicing all of the required skills and techniques. For example, individual trainee performance and practice time increased from 8 to 32 hours per course.

GP's PCSS hardware and software upgrade is a cost-effective expansion of CDTF's training simulator capabilities. The PCSS is in full operation at the CDTF and at the TOCDF. At the time this article was submitted for publication, the system was being installed at the Umatilla Chemical Agent Disposal Facility, Hermiston, OR, and the Anniston Chemical Agent Disposal Facility, Anniston, AL. The PCSS is also scheduled to be installed at the Pine Bluff Chemical Agent Disposal Facility, Pine Bluff, AK.

Curriculum

Along with simulator training, the CDTF offers 2,000 hours of curriculum ranging from basic introductory courses such as toxic area training to highly specialized workshops and emergency response training. For example, toxic area training provides students with the knowledge and skills needed to work with chemical agents. Consisting of 8 hours of classroom instruction followed by 40 hours of hands-on practical exercises, toxic area training includes instruction in emergency response procedures and the proper use of protective clothing and decontamination equipment. Practical exercises are also conducted in a nontoxic environment and are designed to build employee confidence in his or her ability to work safely in a hazardous environment.

After individuals successfully complete training at the CDTF, they are considered qualified to perform their assigned duties at their respective chemical disposal facilities. Upon returning to their facility, the former CDTF students receive further classroom and on-the-job training. Individuals must successfully complete all training and evaluations before being certified by the chemical demilitarization facility systems contractor.

Managing For Success

The systems contractor for training, GP, currently administers the CDTF. GP is responsible for providing programmatic skills and training on common and demilitarization-unique equipment and systems. The company oversees a team of professionals responsible for safety, quality assurance and control, project support, instructional systems, training operations, and engineering. This team specifically does the following:

• Analyzes the work to be performed at the various disposal sites and determines necessary training,
• Recommends training materials to be developed,
• Updates and maintains the integrity of the training,
• Achieves the highest level of cost-effective CDTF availability, and
• Provides public affairs support.

Conclusion

CDTF personnel have successfully shown that when maintaining and operating a chemical disposal facility, there is no room for error. This dedication to preserving the safety and health of the public has earned the CDTF its zero-accident record.

"I am proud of and impressed by the CDTF's accomplishments over the past 10 years," said James Bacon, Program Manager for Chemical Demilitarization. "It has provided PM, CD with a dedicated, well-trained workforce that is aware of its importance to the success of our disposal program."

KENNETH W. FINDLEY is the CDTF Contracting Officer's Representative and the Site Project Manager for the Project Manager for the Chemical Stockpile Disposal Operations Division. He received his bachelor's degree in engineering from the U.S. Naval Academy and a master's in industrial relations from West Virginia University.

FROM THE DIRECTOR ACQUISITION SUPPORT CENTER

Many of you have read COL Richard P. De Fatta's article in the January-February 2002 issue of *Army AL&T* magazine outlining the impact of the HQDA reorganization on operations in the Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology. As part of this reorganization, the Acquisition Career Management Office (ACMO) and the Army Acquisition Executive Support Agency (AAESA) have been consolidated to form the Acquisition Support Center (ASC). As the new director of the ASC, I am pleased to work with dedicated professionals under this combined management structure.

The 21st century has dawned as a period of unprecedented change and challenge. What worked only a few years ago is no longer effective as we shift into an electronic world where new organizational logic is required. Reorganization not only involves change, it enables revitalization that will allow us to act more efficiently and responsively without sacrificing operational effectiveness. While the ASC combines related functions and transitions to a new organizational structure, the key element remains people: the people who are part of this organization, and the people we serve—acquisition professionals—and, ultimately, soldiers in the field.

To better serve acquisition workforce members, especially during this reorganization period, *Army AL&T* magazine will continue to publish responses to some of the most frequently asked questions submitted to the ASC. Your comments are welcome, and your suggestions for improving our operations are important to us.

I also want to congratulate the 28 Materiel Acquisition Management Course graduates (Page 43), the newly accessed AAC members (Pages 43-44), and the Command and Staff College selectees (Page 45).

I look forward to working with all of you.

COL Mary Fuller
Director
Acquisition Support Center

Ask The Acquisition Support Center

I applied to the Acquisition Tuition Assistance Program (ATAP) Board last October, but I did not receive tuition assistance. I updated my Acquisition Career Record Brief (ACRB) before I applied and thought I had a good application. Why wasn't I selected?

Feedback from the board indicated that some ACRBs were not updated correctly. Remember, ACRBs must be updated through your Acquisition Career Manager (ACM). In addition, ACRBs forwarded to the board must have the Army Acquisition Corps (AAC) watermark. Many were turned in without complete information. A complete ACRB provides board members a good feel for who you are and what you have accomplished.

Another problem was that many applicants who requested funding for a degree appeared to have little or no Defense Acquisition University training and/or certification. The AAC encourages a balance of education, training, and experience. Certification in your career field at the level required by your present position should be obtained before seeking education and training beyond that which is required for certification.

Many applicants appeared to have the required training, experience, and education for certification, but no certification was listed. Remember, certification is not automatic once you have met the requirements. Further, many applicants requested funding for a full degree when 24 semester hours of business would have been more appropriate.

Although the ATAP application form provides space for supervisor comments, this section was left blank on several applications. Supervisor comments are valuable to board members, and you should use every tool available to help your application stand out. Additionally, several applications did not contain a Senior Rater Potential Evaluation, which is required for all GS-13s and above (or equivalent personnel demonstration broadband levels). Don't forget this!

To ensure that your application receives favorable consideration, review the ATAP policy, procedures, and application form at ***http://dacm.rdaisa.army.mil*** *prior to applying. We also recommend that ACRBs and application packages be reviewed by your ACM prior to submittal. A list of ACMs is available at the above Web site.*

I became a member of the Army Acquisition Corps as an Army Reserve lieutenant colonel/O-5 several years ago. I am now in the retired Reserve. In addition, I was selected in 2001 as a member of the Navy Acquisition Corps as a GS-1102-13. I decided to accept a GS-1102-12 with save-pay to join the Army civilian

team and leave the Navy. Is my membership still valid from when I was selected as an Army Reserve officer, or does my Navy membership transfer even though I am now a GS-12 vice a GS-13? I am also Defense Acquisition Workforce Improvement Act Level III certified.

Actually, either way works. The Services have an agreement to recognize each other's certification without further qualification, thus your Navy certification automatically applies to the Army. Regardless, your original Army membership is also good. Technically, AAC members are GS-13 and above (or equivalent personnel demonstration broadband level); however, we don't remove members who take a voluntary downgrade, so you are still good.

One of the requirements for membership in the Army Acquisition Corps is 4 years of acquisition experience in DOD or in a comparable position in industry or government. Do you have a written definition of what qualifies as acquisition experience?

Acquisition experience is experience gained while assigned to an acquisition position, to include intern, exchange, education, training with industry, and other acquisition developmental assignments. This includes experience in DOD acquisition positions and in comparable positions outside DOD. In reality, the position code identifies a particular position as acquisition (e.g., contracting, program management, quality assurance, or industrial engineering). For the academic community, it would include experience as an instructor in the areas of contracting, procurement, program management, etc.

Tuition Assistance Program

The Acquisition Tuition Assistance Program (ATAP) assists civilian acquisition workforce members in obtaining undergraduate and graduate degrees and/or the business hours required for Army Acquisition Corps (AAC) membership. Acceptance into the program is through a competitive board process. Applicants apply by submitting the required documents and identifying the opportunity being sought.

The last ATAP board for FY02 is scheduled for June 2002. Look for the ATAP announcement in early April on the AAC home page (**http://dacm.rdaisa.army.mil**). Applications will be accepted until May 31, 2002.

Don't wait! If you are interested in this opportunity, contact your Acquisition Career Manager to update your Acquisition Career Record Brief and to get help putting your packet together.

Certification Requirements

The 2002 Defense Acquisition University (DAU) Catalog includes changes to certification requirements mandated by the Defense Acquisition Workforce Improvement Act. Available on the DAU Web site at **http://www.dau.mil**, the catalog should be used by individuals seeking certification. In particular, they should review certification requirements for their career field and determine if minimum education, experience, and training requirements have been met. Once applicants feel they have met the 2002 requirements, or if questions arise, they should contact their Acquisition Career Manager (ACM) to continue the certification process. Contact information for ACMs is on the Army Acquisition Corps home page at **http://dacm.rdaisa.army.mil**.

AAC Regional Training Program

The Acquisition Support Center (ASC) supports training opportunities for the Acquisition and Technology Workforce as an essential part of career development. As such, the ASC has established the Army Acquisition Corps Regional Training Program. This program provides leadership and career-broadening opportunities locally, which are unique to the needs of the region. Each fiscal year, the ASC centrally funds courses that meet acquisition leadership competencies. The FY02 Regional Training Program has been approved, and classes in the areas of leadership, team building, communication and presentation skills, conflict management, and personal career goals are available within the regions. For further information, contact your regional Acquisition Career Manager.

AETE Catalog Available

The 2002 Acquisition Education, Training and Experience (AETE) Catalog is available on the Army Acquisition Corps home page at **http://dacm.rdaisa.army.mil**. The AETE Catalog is an important reference tool for career development information and outlines all available training, education, and experience opportunities.

CDG Program Proves Successful

Since its inception in 1997, the Competitive Development Group (CDG) Program has been heralded as the premier leadership development program in the Army Acquisition Corps. This 3-year program is comprised of competitively selected GS-12s and GS-13s (or equivalent personnel demonstration broadband level) who are provided the education, training, and experience necessary to assume key leadership positions within the Department of the Army. Of those who have completed the program, 78 percent have been promoted, many before they graduated. In fact, 56 percent of civilian CDG members from year group 2001 have been promoted already, and they're not even halfway through the program.

If you want a challenging, career-broadening opportunity with exciting developmental assignments and promotion potential, apply for the CDG Program today. Details can be found at **http://dacm.rdaisa.army.mil**. Point of contact at the Acquisition Support Center is Maria Holmes at (703) 604-7113 or **Maria.Holmes@saalt.army.mil**. Good luck!

28 Graduate From MAM Course

On Nov. 30, 2001, 28 students graduated from the Materiel Acquisition Management (MAM) Course, Class 02-001, at the Army Logistics Management College, Fort Lee, VA. One international officer from the Philippine Air Force attended the class. CPT William Pearson received the Distinguished Graduate Award.

The 7-week MAM Course provides a broad perspective of the materiel acquisition process and its implementation and includes a discussion of national policies and objectives that shape the process. Areas of coverage include acquisition concepts and policies, research and development, test and evaluation, financial and cost management, acquisition logistics, force integration, production management, risk assessment, and contract management. Emphasis is on developing midlevel professionals to effectively manage the acquisition process. Graduates are awarded equivalency with two Defense Acquisition University courses, ACQ 101 and ACQ 201.

Research and development, program management, testing, contracting, requirements generation, logistics, and production management are some of the materiel acquisition work assignments offered to MAM Course graduates.

The names of the graduates and their academic honors follow.

Graduates	Academic Honors
Britt, Arthur CPT	
Calhoun, John CPT	Honor Graduate
Cash, Jonathan CPT	
Clark, Philip CPT	Honor Graduate
Cude, Craig CPT	
Debany, Richard CPT	
Evans, Anthony MAJ	
Everton, Michael CPT	Honor Graduate
Hall, Roy MAJ	
Hanner, Frank CPT	
Hearon, Robert CPT	
Hight, William MAJ	
Holmes, Angela CPT	
Johnson, Kenny CPT	
Lagala, Ronilo MAJ	
Mose, Edward CW3	
Odum, Marcus CPT	
Pearson, William CPT	Distinguished Graduate
Ransom, Audrey CPT	
Ransom, Wilton CPT	
Rew, Scott CPT	Commandant's List
Scott, Lance MAJ	Honor Graduate
Smart, Peter MAJ	
Smith, Keith CPT	
Snodgrass, William CPT	
Teran, Dora CPT	
Verser, Garrett CPT	
Watts, Robert CPT	

PERSCOM Notes . . .

Acquisition Candidate Accession Board Results

The annual U.S. Total Army Personnel Command (PERSCOM) Acquisition Candidate Accession Board (PACAB) convened Oct. 29, 2001, to select officers for accession into the Army Acquisition Corps (AAC). The PACAB reviewed the records of 209 officers requesting consideration for AAC membership. Below is the list of 132 officers from year groups 90-95 who were approved for accession. These officers are now controlled as Functional Area 51 (Acquisition Corps) and are managed by PERSCOM's Acquisition Management Branch.

NAME	YEAR GROUP	BRANCH
Aarsen, Thomas H.	1995	IN
Akindayomi, Adejuwon N.	1994	AG
Alessio, Paul E.	1995	OD
Anderson, Henry L.	1992	IN
Armenta, Lewis R.	1995	AR
Atkinson, Charles W.	1994	AR
Ayala, Alejandro	1994	TC
Badar, Patrick J.	1993	AV
Bails, Joseph W.	1995	CM
Baker, Patrick J.	1995	MP
Ballenger, Thomas M. III	1995	AV
Bates, Archie P. III	1993	TC
Bergantz, Eric A.	1995	AV
Bledsoe, Elizabeth E.	1992	SC
Bolshazy, Michael S.	1994	OD
Booker, Ronnell	1995	QM
Bowler, Matthew R.	1995	FA
Bowser, Charles W.	1994	IN
Bridges, Frank D.	1994	AR
Brown, Christopher L.	1992	AV
Brumlow, David G.	1993	CM
Bushnell, James A.	1995	OD
Byers, David B.	1992	AR
Calvaresi, Chad A.	1993	IN
Cheney, David R. II	1994	AV
Church, Robert B.	1995	AD
Clark, Nicole N.	1995	QM
Clements, Andrew	1990	IN
Clift, James L.	1995	AD
Cooper, John M.	1996	TC
Crawford, Jacob E. III	1993	AG

Crawford, Leo R. Jr.	1992	IN
Crosby, Troy W.	1993	QM
Cunningham, Craig H.	1993	IN
Daniel, Dexter C.	1993	MI
Davis, Gary J. II	1994	EN
Davis, Joseph M.	1995	OD
Dolan, Brian J.	1995	TC
Domke, Timothy	1994	IN
Drazenovich, John A.	1995	OD
Dudley, Jeffrey J.	1994	AV
Ellison, Kevin L.	1992	FA
Evans, Jeffrey G.	1992	AV
Fagan, Joseph E.	1995	AR
Feathers, Robert S.	1995	FA
Fegley, Eric B.	1995	IN
Feuerborn, Thomas A.	1992	AV
Fowler, Jonathan L.B.	1992	AR
Francis, Sabrina E.	1991	CM
Gaddy, Roland M. Jr.	1992	IN
Gambles, Kenneth L.	1992	AR
Gastan, Gregory J.	1994	AR
Gayle, O'Neil A.	1994	AD
Gearhart, Timothy M.	1994	OD
Gosline, Edward C. III	1995	QM
Greer, Joel M.	1995	OD
Grimes, Rudolph C.	1995	AR
Grizio, Vincent	1994	IN
Gruchacz, Brian J.	1993	MI
Hamann, Scott A.	1991	MI
Harris, Richard L. Jr.	1994	FA
Henrie, Mark E.	1992	SC
Hill, Kim Melisia	1994	OD
Hoecherl, Joseph A.	1993	AV
Hollister, Carl J.	1992	IN
Hughes, Anthony V.	1995	EN
Hyman, Terry C.	1994	MI
Hynes, Cheryl L.	1994	SC
Irvine, Marguerite D.	1993	AG
Jackson, Johnny M.	1992	AR
Johnson, Jeffrey H.	1992	AV
Jones, Ernest C.	1992	AD
Kemmer, Joseph T. Jr.	1995	FA
Kim, Glenn T.	1995	SC
Law, Robert N.	1992	AD
Lindsey, John D.	1995	SF
Lorenz, Matthew C.	1994	AV
Magras, Patrick G.L.	1990	AV
Mann, Justin L.	1995	AR
Manning, Christopher P.	1995	SC
Marsh, Adrian A.	1994	EN
Martin, Reginald G.	1995	AD
McCurty, Michael J.	1994	QM
McNair, Fritzgerald F.	1992	SC
McWhorter, Rodney S.	1994	IN
Messina, Christopher G.	1995	SC
Middleton, Robert E.	1992	OD
Mikesh, Robert J. Jr.	1995	AV
Murray, Robert C.	1995	QM
Nerenberg, Steven L.	1993	IN
Neumann, Joseph A.	1994	TC
Oelschig, Carl S.	1995	QM
Ollison, Sheila M.	1995	AD
Orwig, Brian K.	1994	AV
Pack, Arthur A.	1995	IN
Patterson, Neil P.	1993	FA
Peacock, Ossie L. Jr.	1994	AV
Pearman, William F.	1992	AD
Pennington, Stephanie T.	1995	SC
Phillips, Bryan K.	1993	AV
Phillips, David C.	1995	AV
Poppenberger, Ross C.	1994	EN
Powell, Michael T.	1994	OD
Powers, Arthur B.	1993	SC
Price, Freddie B.	1995	MI
Prowell, Kerry S.	1995	SC
Ralston, Robert	1994	MP
Roa, Alvaro F.	1995	AV
Roberson, Rochelle C.	1991	OD
Roberts, Joseph W.	1993	IN
Rupkalvis, Gregory M.	1993	OD
Ryba, Bruce A.	1992	FA
Sanders, Larry G.	1994	EN
Scuteri, Michael F.	1993	AG
Shanhols, Connie E.	1995	OD
Shea, Thomas E.W.	1992	SF
Sheehan, Mark A.	1994	MP
Sibaja, Rosiher A.	1993	SC
Singleton, Keith L.	1994	IN
Sloane, Michael E.	1992	QM
Smith, Joey R. Jr.	1994	FA
Snyder, Kent M.	1994	SC
St. Clair, Thane C.	1995	AR
Taylor, Michael R.	1994	IN
Terry, Ingrid M.	1992	SC
Thomas, Robert J.	1992	AR
Thornton, Anthony M.	1994	MP
Torres, Enrique P.	1995	IN
Verdicchio, Joseph S.	1995	QM
Viera, Michael A.	1993	IN
Williams, Michael T.	1990	IN
Zahuranic, Michael R.	1995	QM

FY01 Acquisition Corps Resident Command And Staff College Officer Selection Results

The FY01 Command and Staff College (CSC) Selection Board results for academic year (AY) 02/03 were released Dec. 13, 2001. Sixty-seven Army Acquisition Corps (AAC) officers from year groups (YGs) 90 and 91 were selected for resident attendance, and 69 AAC officers from YGs other than 91 were revalidated.

Under the two-look system, 50 percent of each YG is selected to attend the resident CSC. Thirty percent of YG91 was selected by the FY01 board. The remaining 20 percent of YG91 will be selected by the FY02 board.

Allocation of seats for AY 02/03 has not been finalized, but the U.S. Total Army Personnel Command's Acquisition Management Branch anticipates approximately 69 seats against the total population of 136 selectees, including deferments from other YGs. At the time this article was written, slating decisions were expected to be finalized around mid-January 2002.

Congratulations to the following officers selected for AY 02/03 CSC resident attendance.

Bailey, George D. Jr.
Bailey, Michelle M.
Bamburg, James A.
Barrie, Robert L. Jr.
Bruce, Jeffrey A.
Cash, Jonathan G.
Chambers, Floyd
Cote, Courtney P.
Craft, Jason T.
Cummins, Robert W. Jr.
Davis, Rodney A.
Edens, Clayton W.
Fugate, Thomas M.
Gautreaux, Jay P.
Hamilton, Andrew B.
Herres, Roger A.
Hollingsworth, Shawn L.
Holmes, Angela M.
Hughes, Frederick J. IV
Hunt, Kristen L.
James, Dannie E. Sr.
Jaynes, Howard R. Jr.
Johnson, Eddie A.
Kelley, Thomas C. III
Kennedy, James R.
Kerish, John F.
Kirk, Eric D.
Kollhoff, Joy N.
LaChance, Eric M.
Lee, Jong H.
Lonardo, Richard J.
Maloney, Patrick W.
McRae, Timothy R.
Mobley, Kevin D.
Morano, Anthony M.
Moses, Kathaleen D.
Munster, Matthew G.
Nakano, Victor M.
Nash, Kevin M.
Nichols, Walter G. Jr.
Nugent, John O.
Paul, Gregory J.
Perryman, Theodore M.
Peterson, Samuel L.
Phillips, Joel R.
Phillips, Mark E.
Rew, Scott A.
Rieman, Joel B.
Rodriguez, Michael L.
Russell, William M.
Schliesman, Steven G.
Shaw, Trevor W.
Short, Daniel R.
Spencer, Gary T.
Starostanko, Timothy A.
Stein, Cynthia H.
Stephan, Vincent N.
Stewart, Maurice H.
Terrell, Paul D.
Tschida, Carol M.
Tyler, Scott A.
Washington, David B.
Williams, Andrea R.
Williams, Kevin D.
Wizner, Anthony M.

FY01 Colonel Promotion Board Results

The release of any promotion list is always followed by an exhaustive data analysis to "map" the characteristics of the considered and selected population. This article summarizes the analysis of the Army Acquisition Corps (AAC) population for the FY01 Colonel Promotion Board.

Overall AAC Results

The selection board chose 37 AAC officers for colonel from all zones of consideration. Board members reviewed the files of 55 AAC officers in the primary zone. From this population, 32 officers were selected for promotion. The resulting selection rate of 58.2 percent was slightly below the Operational Support Career Field rate of 58.4 percent and above the Army Competitive Category rate of 53.9 percent. (Army Competitive Category rates are based on published career field statistics.)

Board members also reviewed the files of 32 AAC officers from above the zone. From this population, two officers were selected for promotion, a selection rate of 6.3 percent. The above-the-zone Operational Support Career Field selection rate was 4.6 percent, and the above-the-zone Army Competitive Category selection rate was 3.5 percent.

Board members further reviewed the files of 80 AAC officers from below the zone. From this population, three officers were selected for promotion, a selection rate of 3.8 percent. The below-the-zone Operational Support Career Field selection rate was 3.5 percent, and the below-the-zone Army Competitive Category selection rate was 2.8 percent.

Primary Zone Promotions

Of the 32 officers selected in the primary zone, 31 (97 percent) were either current or previous centrally selected product managers (PMs) or acquisition commanders

(ACs). Of these 31 officers, 30 had at least one command Officer Evaluation Report (OER) in their board file. Four of the 32 selectees (13 percent) in the primary zone were not Senior Service College (SSC) graduates or selectees prior to the FY01 Colonel Promotion Board.

The average number of command OERs for primary zone officers selected was three. Only four officers had one or more DA Form 67-8 command OERs; all other officers had only DA Form 67-9 command OERs. Regarding only DA Form 67-9 OERs, selectees had an average of two above-center-of-mass (ACOM) command OERs and an average of just under one center-of-mass (COM) command OER. The officers selected had ACOM and COM+ files.

The majority of selectees had been or currently serve as a Command Select List (CSL) PM or AC. No trends were noted with respect to any other category of positions.

Eighty-one percent of the officers selected have served tours in the Military District of Washington (MDW). Thirty-five percent of the officers had also served at Fort Monmouth, NJ (if Picatinny Arsensal is included, this percentage increases to 42 percent). Other previous acquisition tour locations included Alaska, Arizona, California, Florida, Michigan, Texas, Utah, Canada, Germany, Korea, Kuwait, and Turkey. Several officers also had served short-term rotations in Haiti, Honduras, Kosovo, and Saudi Arabia.

A large portion of selectees were assigned to the Army Materiel Command (AMC) (71 percent) or the Army Acquisition Executive Support Agency (AAESA) (65 percent). However, this is not indicative of any trend; it is simply a result of which commands “own” positions.

Above And Below The Zone

All officers selected above and below the zone were current or former PMs or ACs. Eighty percent of these selectees completed or were selected to attend SSC. Duty locations during their acquisition careers varied (Alabama, Florida, Fort Monmouth, Kwajalein Atoll, etc.) Eighty percent of these officers served in the MDW. As with the primary-zone selectees, the above- and below-the-zone officers served in a wide variety of commands, and all of them were assigned to AAESA at some point in their career.

Trends

Based on this analysis, officers competitive for promotion to colonel generally are serving or have served successful tours as a PM or AC. Command performance evaluations include (on average) two ACOM ratings and one COM rating under the new DA Form 67-9. Overall file quality was ACOM or COM+ (i.e., performed well in any positions they have held).

Who Was Not Promoted?

Of the 23 officers in the primary zone not selected for promotion to colonel, 13 were either current or former PMs or ACs. Nine officers not selected for promotion had not served as a lieutenant colonel PM or AC.

As with selectees, no trends were noted regarding duty positions other than CSL PM or AC. With respect to assistant PM and deputy PM positions, officers selected for promotion did not hold these positions at any greater rate than did officers who were not selected.

Sixty-five percent of these officers served a tour in the MDW. Other previous tour locations included Alabama, California, Kansas, Kentucky, Germany, Greece, Turkey, and the United Kingdom. Several officers also served short-term rotations in Saudi Arabia and Somalia. These duty locations are similar to the duty locations listed for the officers selected for promotion.

A large portion of these officers were assigned to AMC (78 percent) or AAESA (48 percent). These are the same commands in which the largest number of officers selected for promotion served. Again, this is not indicative of a trend; it is simply a result of who “owns” a large number of positions within the AAC. Officers not selected for promotion (regardless of whether they had been or were now PMs or ACs) had an average of one ACOM and two COM DA Form 67-9 OERs. The majority of officers not selected for promotion had overall COM+ or COM performance files.

Trends

Officers with straight COM OERs are not competitive for promotion to colonel. Officers with COM+ and ACOM files are competitive if they have performed well (strong COM+ or ACOM) as a lieutenant colonel PM or AC. Late selection for PM or AC can result in nonselection if the officers do not have any, or a significantly less than average number of, PM or AC OERs in their board file. Late selection is defined as being selected or activated from the alternate list on your third or fourth look for lieutenant colonel PM or AC (i.e., timing such that you could not expect to have the average number of command reports before your primary zone look for promotion to colonel).

Duty positions (with the exception of PM or AC), duty locations, and specific commands do not show any type of trend.

General Observations

The file quality of officers selected for promotion continues to be strong. Because of the tough competition, not all successful PMs or ACs will get promoted. Early selection for lieutenant colonel PM or AC can improve the chances of selection simply because of the additional command evaluations available for the board’s review (assuming the evaluations support promotion). COM evaluations should have substantive narrative comments, provided by senior raters, which focus on an officer's potential.

Summary

Competition for promotion to colonel remains very high. Strongly documented duty performance (including command) is the key to selection. Additionally, officers in all zones should personally review their Officer Record Brief and microfiche to ensure the information is accurate and complete. Photos that are more than 2 years old, are in full-length format, are not current (e.g., awards), or are not particularly good should be replaced. The bottom line: promotion to colonel is very tough, and overall file quality in addition to ACOM/COM+ performance as a lieutenant colonel PM or AC is crucial.

FY01 AAC Colonel Selectees

The following is a list of acquisition officers selected for colonel by the FY01 Colonel Promotion Board:

Barber, Jesse Lee
Bell, Anthony Bernard
Bliss, Gary Lee
Brewster, Robert Ethan Jr.
Cantor, Michael Eric
Castaldo, Albert Anthony
Chase, Deborah Jane
Coker, David William
Coppola, Alfred Anthony Jr.
Crizer, Scott Hampton
Diego-Allard, Victoria
Driessnack, Charles Henry
Fritz, Gregory John
Fuller, Peter Nelson
Green, Allen Lawrence III
Greene, Harold Joseph
Gwilliam, Jeffrey Lawes
Hayne, Ronald James
Hogan, Thomas Harold
Huff, Donald Clifford Charles
Kreider, Stephen Daniel
Maddux, Jonathan Alan
McCoy, Edward Daniel
McDaniels, Lloyd Edwin
McQuain, Paul Michael
Neumann, Markus Ralph
Nichols, Camille Marie
Norgaard, Kevin Robert
Norwood, John David
Parker, Wilbur Anthony
Patterson, William Neal
Payne, Jerome Franklin
Polczynski, Kennith Dean
Rust, Stephen Layne
Smith, Michael Joseph
Stone, Jesse Mike
Willey, Jeffery David

BOOKS

Now, Discover Your Strengths

By Marcus Buckingham and
Donald O. Clifton, Ph.D.
Simon & Schuster, New York, 2001

Reviewed by LTC John Lesko (U.S. Army Reserve), a Decision Coach and Group Facilitator with Anteon Corp. Lesko is a member of the Army Acquisition Corps and a frequent contributor to Army AL&T. He can be contacted at John.Lesko@saftas.com.

According to Marcus Buckingham and Donald Clifton, both from the Gallup Organization, "Most of us have little sense of our talents and strengths, much less the ability to build our lives around them … Guided by our parents, by our teachers, by our managers, and by psychology's fascination with pathology, we become experts in our weaknesses and spend our lives trying to repair these flaws, while our strengths lie dormant and neglected."

This particular observation may or may not be true for today's Army program manager, acquisition executive, or career government employee, for throughout the various stages of the careers of this group, officials have taken any number of psychometric instruments, personality tests, or interest surveys such as the Myers-Briggs Type Indicator, the Kirton Adaption-Innovation Inventory, and the Strong-Campbell Interest Inventory. Now there is an Internet-based questionnaire and self-assessment called the StrengthsFinder Profile.

The StrengthsFinder Profile introduces 34 dominant "themes" with thousands of possible combinations. These themes initially help the survey participant along a journey of self-discovery. Progress along this journey is based on the premise that we will "succeed in life" by focusing first on our individual strengths and talents. The authors suggest that these talents are "hard-wired" into our very being, or at least into our brains running along the many parallel synapses that have been formed from our total experience, reinforcing one's natural learning tendencies.

Now, Discover Your Strengths is the product of a multiyear study of data collected for Buckingham's earlier work, *First Break All the Rules*, and of related study projects completed by the Gallup Organization's International Research and Education Center. This book is easy to read and works well to explain the results one gets from taking the online survey. The back matter contains an appendix that outlines the research underpinning for the StrengthsFinder Profile instrument.

BOOKS

For those who are too busy or who cannot take the online survey, the gist or essence of *Now, Discover Your Strengths* is based on two core assumptions: each person's talents are enduring and unique, and each person's greatest room for growth is in the areas of the person's greatest strength.

This reviewer suggests that to periodically remind oneself of these two thoughts is acceptable if one is to focus on gaining the most from a team member, office mate, or colleague—particularly during a short-term assignment. After all, the energy required for a radical change in behavior may be counterproductive or a diversion of much needed energy focused "on task." Such insights may help in the assignment of tasks to the most appropriate members of a team or work group.

For those who accept these assumptions, this book will help them examine their own "theme" strengths. Furthermore, this book's insights may help managers or individuals better understand their colleagues, co-workers, or direct reports.

One criticism of this book comes from the authors' tendencies to coin new words or labels for their 34 themes or profiles. Readers must work through the introduction of new terms such as "ideation," "intellection," "maximizer," "positivity," and "woo."

In conclusion, it is this reviewer's opinion that the most practical application of this book comes from applying any one of four suggested problem-solving and coping strategies offered by the authors. In short, when faced with a situation where one's talents or strengths cannot address a challenge, consider the following:

- Get just a little better at the skill needed.
- Design a support system for yourself that complements your strengths and bridges your weaknesses.
- Find a partner.
- Stop doing or attempting to do something for which you are not hard-wired or capable.

Now, Discover Your Strengths is a book best read during an annual retreat, between major projects, or en route to a new job. I'd recommend that it be integrated into the nonresident portion of the Advanced Program Management Course at the Defense Systems Management College and/or into the curriculum of the Industrial College of the Armed Forces.

Have You Read A Good Book Lately?

To inform our readers of recently published books that may be of interest to them, the *Army AL&T* magazine staff welcomes book reviews. Submissions should be no more than two double-spaced typed pages and include the book's complete title, publisher, and year of publication, and the reviewer's full name, title, address, and phone number. Book reviews can be e-mailed to **bleicheh@aaesa.belvoir.army.mil** or sent to DEPARTMENT OF THE ARMY, ARMY AL&T, 9900 BELVOIR RD, SUITE 101, FORT BELVOIR, VA 22060-5567.

CONFERENCES

Force Projection Symposium III

The third annual Force Projection Symposium will be held May 7-8, 2002, at the Williamsburg Marriott, Williamsburg, VA. The Program Executive Office for Combat Support and Combat Service Support's Project Manager for Force Projection sponsors the symposium in partnership with the National Defense Industrial Association (NDIA)-Michigan chapter. The theme of this year's symposium is "Intratheater Transportation and Distribution." The featured exhibit is Joint Venture (HSV-X1), a 96-meter, high-speed sealift catamaran.

For more information or to receive a registration form, contact the NDIA Office at (586) 445-2041 or via e-mail at **FPSymposium@mindspring.com**.

MRICD Sponsors Toxicogenomics Conference

On Nov. 9, 2001, the U.S. Army Medical Research Institute of Chemical Defense (AMRICD) sponsored a mission-associated toxicogenomics conference. Founded within the fast-moving field of genome sequencing, toxicogenomics is an evolving discipline that applies recent advances in the molecular sciences involving deoxyribonucleic acid (DNA), ribonucleic acid (RNA), and protein to the problem of toxicology. By defining which genes are affected during toxicity and which are important to successful treatment, scientists can further their effort in many areas of chemical warfare agent research.

The importance of this research area was realized in 1997 when AMRICD scientists started an effort to vigorously apply recent advances in game expression technology to the challenge of medical chemical defense. Other government laboratories such as the U.S. Air Force Research Laboratory, the U.S. Army Center of Environmental Health Research, the U.S. Army Medical Research Institute of Infectious Diseases, the U.S. Army Edgewood Chemical Biological Center, and the Walter Reed Army Institute of Research expressed similar research interests. The conference was planned so that scientists at these laboratories could meet to discuss recent technological advances, share data, and plan future directions for their research.

COL James A. Romano Jr., Commander of AMRICD, opened the conference by challenging its participants to determine how advances in gene technology can be applied to understand and medically defeat chemical warfare agents. In addition, Romano hoped that participants would gain a better understanding on how technologies are being applied in chemical defense and how fostering collaboration among scientists would enable DOD laboratories to leverage intellectual power with that of industry and academia.

Organized by Dr. John Schlager, one of the AMRICD's Principal Investigators, and LTC Harry Slife, Chief of AMRICD's Pharmacology Division, the conference brought together scientists from 14 different laboratories, representing industry, academia, and government. Topics included the application of new toxicogenomics technologies to the study of specific chemical warfare agents, the use of alternative species and cultured cells as models, the use of toxicogenomics in environmental monitoring, and emerging methods of research and data analysis in the field.

According to Slife, the conference met the commander's expectations. He said that the informal discussions helped promote collaboration and information exchange and went a long way toward promoting the program.

Romano agreed. As the conference concluded, he observed that the ability to identify DNA changes as well as advances in computer software development are already effectively being used in medical chemical defense research. He added that the willingness of the participants to intensely share intellectual interests offers the potential for remarkable advances in medical protection against chemical warfare agents.

For more information, contact Cindy Kronman at (410) 436-1866 or by e-mail at **cindy.kronman@amedd.army.mil**.

Ground Vehicle Survivability Symposium

The 13th annual U.S. Army Ground Vehicle Survivability Symposium is being held April 8-11, 2002, in Monterey, CA. Sponsored by the U.S. Army Tank-automotive and Armaments Command's Research, Development and Engineering Center, the symposium will provide a setting to discuss the implications of ground vehicle survivability technology on the Objective Force and Future Combat Systems. A broad range of sessions will address how survivability will enhance capabilities of the Objective Force, both near and far term. The conference will be classified up to and including SECRET U.S. ONLY.

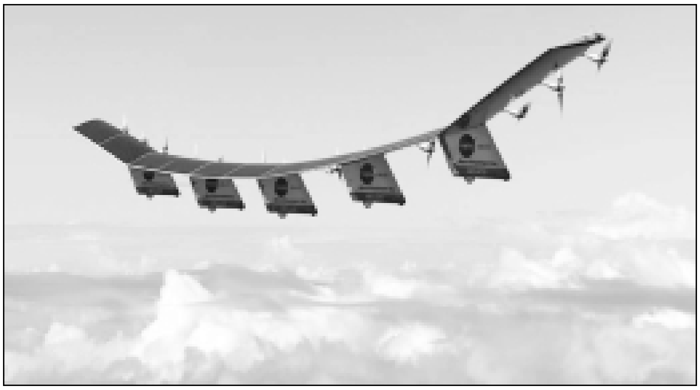
For additional symposium information, contact Joe Moravec at (586) 978-3106, fax (586) 978-3131, or at **moravec_joseph@bah.com**.

NEWS BRIEFS

"10-Mile-High" Communications Tower

As far-fetched as the concept of an ultrahigh communications tower may seem, we are living in a time where what was once impossible is now probable. Twenty years ago, DOD funded a classified effort to develop an unmanned solar-powered aircraft with the potential to endure 3 to 6 months of continuous flight at 50,000-65,000 feet (9.46 to 12.3 miles) above the Earth's surface.

The Pathfinder project was the predecessor to today's Helios 1. In the early 1980s, a number of bright minds in DOD came up with the idea of using an ultrahigh altitude communications platform that would also serve as an intelligence, surveillance, and



Helios Unmanned Solar-Powered Aircraft

reconnaissance gatherer. Despite economic concerns, the program has continued to develop at the same pace as the technology used on the vehicle.

A solar array is the vehicle's primary power source and greatest expense—approximately $10 million per aircraft. Solar technology is slow in development and cost-prohibitive, except when benefits outweigh the costs. The good news, however, is that the extra kilowatt of power produced by the solar panels will power as much as 220 pounds of command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) enabling equipment, not to mention the cost savings and availability when compared to satellite usage.

Currently, Helios 1 performs day flights characteristically flown to a predetermined altitude of 50,000-80,000 feet, and then gracefully descends toward the surface. On Aug. 13, 2001, Helios set a world record by ascending to 96,863 feet before beginning its descent. The next step in development of the platform is Helios 2, which will reach altitudes of 100,000 feet and carry a 700-pound payload.

Commercial industry has seen the benefit of an ultrahigh communications tower and plans to launch fixed and mobile broadband, voice, and direct broadcast audio and video using this platform. (See **www.skytowerglobal.com**.) In the summer of 2002, Helios 1 is scheduled to launch with a commercial communications package and, later in the year, the Japanese plan to test remote sensor equipment on it.

Why should the Army and the other Services also be interested in developing C4ISR packages for this platform? Other than this being a shining example of beyond-line-of-sight communications, the answer is cost, availability, survivability, mobility, deployability, duration, and an area of coverage in excess of a 400-mile diameter line-of-sight footprint. It also affords the capability of communicating with space-based and terrestrial-based communication assets, whether fixed or mobile, ship-to-ship, unit-to-unit, or across the battlefield.

The Fort Gordon Battle Command Battle Lab, along with NASA and the Space and Naval Warfare Systems Command, are aggressively examining candidate technologies for use on the platform, including a number of communication packages. In addition, there are numerous ISR tools that are viable for consideration on this platform. A daunting factor in considering technologies, however, is the frequency spectrum. For example, in the United States, there is a 1,000-foot limitation on the Single Channel Ground and Airborne Radio System as well as a 54-kilohertz ceiling on the operational spectrum. Similar issues affect each option under consideration. The management of the frequency spectrum is nothing new, which is why a spectrum-request package that addresses both foreign and domestic frequency use is under development.

The development of Helios for use in military operations is a smart move—the sky is literally the limit. A number of Army, Navy, Air Force, and Marine future operational capabilities will be realized sooner by employing this platform.

For further information on this project, contact CPT Shawn Hollingsworth at (706) 791-4819, DSN 780-4819, **hollings@gordon.army.mil**, or **shawn-hollingsworth@us.army.mil**.

President Honors CECOM Deputy To The Commanding General

In a ceremony late last year at Constitution Hall in Washington, DC, President George W. Bush honored the Deputy to the Commanding General of the U.S. Army Communications-Electronics Command (CECOM), Fort Monmouth, NJ, for his exceptional federal service. Victor J. Ferlise was one of only four Department of the Army executives recognized with the 2001 Distinguished Executive Award. Each year, the president presents the Distinguished Executive Award to those members of the Senior Executive Service (SES) who have excelled as leaders over an extended period.

During the proceeding, Bush praised the select group of SES members who attained this distinction. "Those of you in high places of government are more than administrators and experts. You hold the ideals and hopes of the Nation in trust," Bush said.

Ferlise said the award was the result of the support he received from thousands of CECOM civilians and soldiers. "It was a humbling experience to win this award, and an honor to represent the wonderful and hard-working people of CECOM. My thanks go out to every-

NEWS BRIEFS

one in our command who serves our Nation so well each day," Ferlise said. He was credited for achievements ranging from acquisition reform initiatives to being the sole architect of a revolutionary wholesale logistics modernization program.

Ferlise was the first civilian to be appointed Deputy to the Commanding General of a major subordinate command within the Army Materiel Command. His leadership was recognized as a major factor in CECOM's centers garnering the Research and Development Laboratory of the Year Award, Secretary of the Army Award for Productivity Excellence, the first David Packard Award for Acquisition Excellence, and the Presidential Quality Achievement Award.

Prior to his appointment as the Deputy to the Commanding General, Ferlise served as the Chief Counsel of the Legal Office at Fort Monmouth.

ACQUISITION EXCELLENCE

Award-Term Contracts in Europe

The U.S. Army Contracting Command Europe (USACCE) Regional Contracting Office (RCO), Seckenheim, Germany, recently awarded USACCE's first award-term contract. The contract, valued at more than $49 million over a 10-year period, provides base-maintenance services to the 6th Area Support Group, Stuttgart, Germany.

The contract term was set at 10 years including a base year, two 1-year options, and seven 1-year award-term periods. The award-term plan was established in accordance with a provision in the contract that calls for periodic evaluations of the contractor's performance. The contract can be extended based on the contractor's performance in meeting its requirements. Ratings of "good" or better in the initial 2 years will earn the contractor additional performance periods. But performance ratings of "very good" during the third year and "excellent" in all other years must be earned to merit contract extensions beyond contract year three. With consistent scores of "excellent" during succeeding years, the contractor will continue to earn incremental contract period extensions up to the maximum of 10 years.

On Oct. 30, 2001, the RCO, Seckenheim awarded USACCE's second award-term contract. This performance-based service contract was awarded as an award-term contract with a base year, 4 option years, and 5 award-term years. The contract value over 10 years exceeds $1.4 million. The contractor will be responsible for all management services, personnel, and equipment needed to perform required tasks. In addition, the contractor will help individuals in finding homes and will perform relocation and referral services.

USACCE's use of award-term contracts is a significant step toward the Army's goal to "incentivize the contractor to execute orderly transition of workload, provide superior support to the government, and control prices through extensions or reductions of the term, based directly on performance."

*For additional information, contact Monti Jaggers at (703) 681-7571 or **monteze.jaggers@saalt.army.mil**.*

IMPORTANT NOTICE

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• National Guard personnel must submit address changes to the Army National Guard Acquisition Career Management Branch at **perkindc@ngb-arng.ngb.army.mil** or call DSN 327-7481 or (703) 607-7481.

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ARMY AL&T WRITER'S GUIDELINES

http://dacm.rdaisa.army.mil/

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Purpose

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

Subject Matter

Subjects may include, but are not restricted to, professional development of the Army's A&TWF, 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.

Length of Articles

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 articles containing 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 a separate file from the manuscript. Please ensure that artwork is 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 resolution of at least 300 dpi (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 educational background and current position.

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.

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 bleicheh@aaesa.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; office phone number (DSN and commercial); and a typed, self-adhesive return address label.

Attention Army AL&T Authors . . .

DIGITAL PHOTO SHOOTER'S GUIDE

The current revolution created by digital cameras allows individuals to take and instantly download photos to their computer. This revolution, however, presents challenges to publications, including *Army AL&T*. For printing purposes, the *Army AL&T* magazine editorial staff needs photos shot at the highest resolution and in the largest frame size that the digital camera allows.

We prefer to receive glossy prints from traditional film cameras. This allows us to scan and work the photos in our publishing software and ensures each electronic image has the high-quality resolution we require. However, if you must send us electronic photos, please read the following steps.

• **Shoot the Picture.** When taking a picture, set the camera on the largest image size and the highest quality resolution settings that the camera will allow. The largest image size is usually "Full" or "XGA." The highest resolution settings are usually called "High," "Super Fine," or "Ultra-High." (Cameras set at "Standard" or "Basic" quality produce images only good enough for Web sites.)

Do not shoot a small photo on a low-resolution setting to save data storage space in your camera. Shooting small images at low resolution will allow you to take more photos per shooting, but we won't be able to publish any of them. Higher settings create larger photos and files, and generally a higher quality product.

If your camera gives you the option, shoot the photo as a PC TIFF file. We also accept JPEG files. When saving a file as a JPEG, choose a quality setting of "Maximum" or "10" and the format option of "Baseline (Standard)."

• **Download the photo in raw data .** When downloading a file from your camera or its removable storage card to another drive, save the image in raw data. Do not manipulate the data by resizing or editing the image. Let *Army AL&T* take care of that.

And please don't try to "beef up" the resolution of the small, low-resolution photo you shot. For example, shooting a 500-kilobyte image and enlarging the pixels per inch until the file size is 1.5 megabytes will not make the image clearer—it only makes the image larger (bigger dots, not more of them).

• **Send us the digital photo.** Following the first two steps will create a large file for each photo. One way to get your photos to us is to save them on a 100- or 250-megabyte Zip disk or a CD and mail or express ship them to DEPARTMENT OF THE ARMY, ARMY ALT, 9900 BELVOIR RD, SUITE 101, FORT BELVOIR, VA 22060-5567. In some cases, a JPEG file will fit on a 3.5-inch floppy disk, but do *not* resize the JPEG photo to make it fit.

You may be able to e-mail photos one at a time. Be sure each message with a photo attached includes a caption of who's doing what, when, and where in that image; the title of the article it is intended to illustrate; and the name and phone number of the author.

If you have questions, call Debbie Fischer-Belous, Executive Editor, *Army AL&T* at (703) 805-1038 or DSN 655-1038 or e-mail **fischerd@aaesa.belvoir.army.mil**.

The majority of our digital shooters are not professional photographers. *You* are our authors and photographers—soldiers and civilians in the Army Acquisition and Technology Workforce. Help us illustrate your article with your photos—follow these instructions for taking and sending us digital photos. ***Good Shooting!***

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