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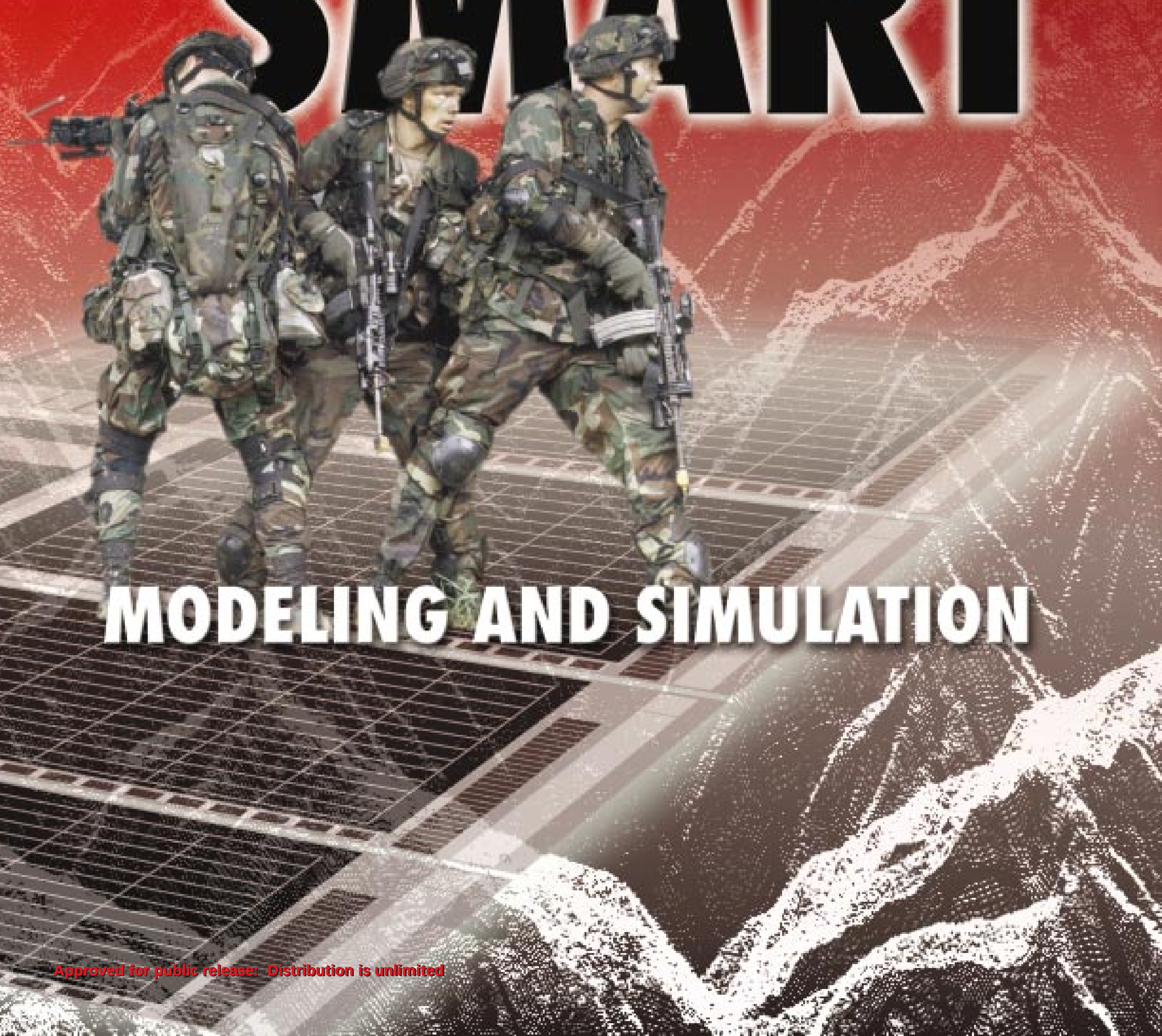
SMART



MODELING AND SIMULATION

THE MATURING OF SMART

Simulation and Modeling for Acquisition, Requirements and Training (SMART) is basically an initiative to use modeling and simulation (M&S) in an effective and efficient way to improve the process of modernizing the Army. Two years ago, the SMART concept was in its infancy. A year later, the vision for SMART was clearly articulated and the path for progress was paved.

Today, SMART is in its adolescence. We are exploring new partnerships, technologies, and ideas. SMART is working its way up the learning curve and, naturally, is experiencing some growing pains. Still, the discoveries and developments are exciting, and this momentum fuels a motivation to realize SMART's full potential. Several articles in this issue of *Army AL&T* showcase our progress. We look at the history of SMART as well as its future. We are now educating our U.S. Military Academy cadets about SMART and how it supports the Army's transformation.

SMART has taken root. There are many pockets and communities of varying levels of collaboration; efforts to develop practical applications for data and model reuse; organizations seeking to establish partnerships for technology and information exchanges; and research into incorporating the open standards, architecture, and protocols developed by industry. Here are some illustrative initiatives you will see in this issue. The Army Materiel Command's Research, Development and Engineering Center Federation is a project to integrate existing M&S resources for engineering design both horizontally and vertically throughout the geographically dispersed labs and centers. The Program Executive Officer for Intelligence, Electronic Warfare and Sensors plans to reuse data and integrate the cross-domain aspects of SMART to build the next generation Army Ground Integrated Target Identification System. The focus here is to design M&S for use in both the engineering designs and training simulators. In addition, the Program Executive Officer for Tactical Missiles is exploring the reuse of data between separate programs, Javelin and Follow-on-to-TOW. These are a few examples of the many initiatives to put the concepts of SMART into practice.

Given this remarkable progress in a relatively short period, SMART still has a ways to go to achieve its true vision. Our activities and efforts are not yet fully integrated throughout the Army or with other elements of DOD; nor is the SMART process yet seamless. A multiuse simulation support environment using a common standard for interoperable, integrated simulations remains to be defined. We need to develop common, reusable object representations, algorithms, and environments. We also need to establish a standard means for sharing and reuse, including registries,

Dr. Hank Dubin

disciplined access to simulations, and universal awareness.

As we continue to mature SMART, we seek to promote M&S as a medium for collaboration. This provides a means to ensure that the interests of all the stakeholders in the modernization process can be balanced. This enabler for breaking down organizational and cultural barriers will surely improve the systems we develop and operate.

In a collaborative environment, we are better able to expand the trade space for achieving our challenging transformation goals. Systems will be evaluated in terms of capabilities. We will have multiple ways of looking at and solving problems. Management of the trade space will allow the balancing of the needs and responsibilities of all stakeholders. M&S allows the trade space to include concepts of operations, doctrine, system design, TTP (tactics, techniques, and procedures), system support, training, cost management, and human performance and feedback. SMART links capabilities and stakeholders.

The Future Combat Systems will use M&S to expand the trade space and build "system-of-systems" capabilities. An article on Page 22 of this issue looks at the daunting challenges of exploring "Big Ideas" in the synthesis of concepts and technology.

Finally, as we continue to develop and realize the SMART vision, we need to keep focused on the next steps. We must begin to identify the means to measure the effectiveness of SMART. We must ask, "How do we know how well we are doing?" To do so, we need to develop two different, yet complementary, types of measures to evaluate our progress. Outcome-based measures will address aspects such as lower total-ownership costs, shorter time to field, increased operational capabilities, and the ability to simultaneously train and field systems. Process-based measures will address areas such as multiple uses of models and simulations, the extent of collaboration, and the ability to plan for and achieve an in-depth understanding of the principles of the return on investment for SMART.

Our goal is to be a world leader in M&S. We must provide a high return on investment by creating a disciplined, collaborative environment that eliminates barriers and ensures that all stakeholders in the modernization process have a voice. It is imperative that we succeed for many reasons, but especially to continually improve our ability to get affordable, leading-edge capabilities for our soldiers.

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FEATURES

DEPARTMENTS

COVER

Simulation and Modeling for Acquisition, Requirements and Training (SMART) is a major initiative that is expected to substantially improve the development, fielding, and sustainment of Army materiel systems.

SMART: A HISTORICAL PERSPECTIVE

Michael R. Truelove and Bruce J. Donlin

"Be a world leader in Modeling and Simulation to continuously improve Army effectiveness through a disciplined collaborative environment in partnership with industry, government, and academia."

—SMART Vision

Introduction

This issue of *Army AL&T* magazine is largely devoted to the Simulation and Modeling for Acquisition, Requirements and Training (SMART) concept and its impact on the Army acquisition process. In particular, this article provides a brief historical perspective on SMART and serves as an introduction to the other articles in this issue.

In 1997, Dr. Patricia Sanders, then Director, Test, Systems Engineering and Evaluation (DTSE&E), Office of the Under Secretary of Defense for Acquisition and Technology, provided a DOD vision for Simulation Based Acquisition (SBA). That vision encompassed all the Services and was further defined in the SBA road map that was developed by the Joint Simulation Based Acquisition Task Force chartered by the Acquisition Council of the DOD Executive Council for Modeling and Simulation (M&S). The SBA vision called for "an acquisition process in which DoD and Industry are enabled by robust, collaborative use of simulation technology that is integrated across acquisition phases and programs."

The SBA vision was briefed to all senior leaders of the Services to obtain their endorsement. When LTG Paul J. Kern, the Army's Military Deputy (MILDEP) to the Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASAALT), was briefed, he not only endorsed the concept, he took ownership for the Army.

Kern was the keynote speaker at the first U.S. Army Simulation Based Acquisition Symposium in January 1998, where he defined SBA for the Army as "the integrated process, culture, and environment through which quality products are rapidly and economically developed, fielded, and sustained." He added, "The use of modeling and simulation across all acquisition functions and phases enables the execution of SBA."

Getting SMART

Kern recognized that the SBA concept applied to more than just the acquisition community. The concept required the collaboration of M&S tools that could be integrated and matured throughout the entire life cycle of a system starting prior to concept exploration and continuing through fielding. Further, SBA is not just about system development, but also about the Army's overall modernization process. It is not just about weapon system design and development, but also about requirements generation, tactics, doctrine, leadership development, test and evaluation, training, logistics, and support. Thus, SBA went beyond the research, development, and acquisition (RDA) M&S domain. For the concept to work, it also required endorsement by those in the advanced concepts and requirements; and the training, exercises, and military operations M&S domains. This was an appropriate time to adopt a new name, so the Army version of SBA became SMART. The new name encompassed the need for collaboration among all those in the three Army M&S domains.

To help institutionalize the SMART concept, Kern designated the following flagship programs: Future Scout and Cavalry System (FSCS), Crusader, Longbow Apache (LBA), and Close Combat Tactical Trainer (CCTT). Each program represented a different level of maturity along the acquisition life cycle (FSCS-concept; Crusader-early development; LBA-legacy; CCTT-information/software intensive). Additionally, each could collectively address the challenges SMART would face concerning the various milestone requirements. Collectively, the four programs represented the scope of issues and challenges the Army would face in harnessing the power of SMART. (Lessons learned from the flagship programs were documented at the SMART 2000 Conference, which is discussed later in this article. Information on the conference is available at **http://www.amso.army.mil/smart/index2.htm**. On the left side, click on **SMART Conference**, and then click on **Last Year's Conference**.)

SMART Conferences

At the SMART 1999 Conference, held in San Antonio, TX, in January 1999, it was evident that SMART was still perceived as an RDA domain-centric initiative. To address this concern, a 1-day senior-level SMART Strategic Planning Workshop was held Aug. 30, 1999, to develop a vision statement and strategic goals for SMART. Members of each M&S domain participated in the workshop. On Nov. 3, 1999, the co-chairs of the Army Model and Simulation Executive Council (AMSEC) approved the SMART vision statement and the following four strategic goals:

- Promote comprehensive M&S policies, a disciplined process, and an efficient workforce to stimulate innovation and agility in developing an enhanced Army capability.
- Establish a means to continuously and quantitatively measure life-cycle cost and relevant measures of effectiveness in a joint environment.
- Create and maintain disciplined collaborative M&S environments for all stakeholders to exchange and reuse data and information to support modernization decisions.
- Establish habitual associations and incentives to leverage the investments and advances of academia, industry, and other government partners.

Also at the SMART 1999 Conference, several actions were identified to improve understanding of the Army SMART concept. Many of those actions resulted in a revision to the standard reference document "Simulation Support Plan Guidelines." Termed the "Planning Guidelines for Simulation and Modeling for Acquisition, Requirements and Training," the revision was first unveiled in January 2000 at the SMART 2000 Conference in Los Angeles, CA. The guidelines greatly expand on best practices to assist in developing a simulation support plan for both concepts and systems. It is intended as a living document and is updated as new lessons learned and as meaningful changes are recommended. It can be accessed on the U.S. Army Model and Simulation Office (AMSO) Web page at **http://www.amso.army.mil/smart/index2.htm**. (On the left side, click on **Guidance Documents**, and then click on **SMART Guidelines**.)

As a result of the briefings during many of the breakout sessions at the SMART 2000 Conference, it was apparent that the SMART concept had matured beyond the RDA domain and needed to be sponsored by an organization that transcended all three M&S domains. The three AMSEC co-chairs decided to serve as proponents for SMART with AMSO serving as their executive agent to implement the concept. The three AMSEC proponents for SMART are Walter W. Hollis, Deputy Under Secretary of the Army for Operations Research; LTG Larry R. Ellis, Deputy Chief of Staff for Operations and Plans; and LTG Paul J. Kern, MILDEP to the ASAALT.

Institutionalizing SMART

From April through September 2000, a number of significant initiatives were undertaken to institutionalize SMART throughout the Army. These initiatives, which were led by Ellen M. Purdy, then Senior Operations Research Analyst in the Office of Assessment and Evaluation, OASAALT, were as follows:

- Initial planning for the SMART 2001 Conference was conducted.
- "Planning Guidelines for Simulation and Modeling for Acquisition, Requirements and Training" was further expanded and refined.
- A comprehensive SMART education plan was developed.

The linchpin of this "transitional" effort, however, was the development of the SMART Execution Plan. This execution plan runs through FY07 and, for the first time, identifies a comprehensive funding plan for SMART. The plan was staffed and officially endorsed by the AMSEC co-chairs on Nov. 6, 2000. The SMART Execution Plan documents the strategy for implementing SMART throughout the Army and can be viewed on the AMSO Web page at **http://www.amso.army.mil/smart/index2.htm**. (On the left side, click on **Guidance Documents**, and then click on **SMART Execution Plan**.)

During the past few years, there has been consistent, methodical, and meaningful progress to advance the SMART concept. There are many more challenges ahead, but the Army has the talent and technology in hand to meet those challenges.

Once implemented, SMART will provide these four primary benefits:

- Reduced total-ownership costs and sustainment burden for fielded systems throughout their service lives;
- Reduced time required to explore concepts and develop and field new or upgraded systems;
- Increased military worth of fielded systems while simultaneously optimizing for structure, doctrine, tactics, techniques, and procedures; and
- Concurrent fielding of systems with their training devices.

SMART Partnerships

One partnership, internal to the Army, is the Army Materiel Command (AMC) Research, Development and Engineering Center (RDEC) Federation. The AMC RDEC Federation is aimed at providing the infrastructure to link the Army's geographically separated RDEC engineering-level tools through high level architecture. With this infrastructure in place, the Army can conduct the system-of-systems analysis needed to develop new systems and upgrade existing systems to operate in a combined-arms, joint-Service, and coalition-force environment.

The Army also established a partnership with academia and the entertainment industry via the consortium of the Institute for Creative Technologies. This partnership is designed to capture what the entertainment industry and academia have to offer and apply it to the Army's defined requirements.

Conclusion

During the past few years, there has been consistent, methodical, and meaningful progress to advance the SMART concept. There are many more challenges ahead, but the Army has the talent and technology in hand to meet those challenges. In some cases, the biggest challenges will be cultural because changing the way we do business often occurs slowly in organizations—especially within the government. One cultural change we need to immediately embrace is that of collaborating. The Army can no longer afford the "not invented here" syndrome. It must begin to share data, information, technology, and capabilities. Without collaboration, there will be missed opportunities, greater costs in developing and maintaining new systems, and developmental timelines that are no longer acceptable. In the SMART articles that follow, you will not only see the positive impact of the SMART concept, but also the beginning of collaboration.

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IMPLEMENTING SMART WITHIN PEO, TACTICAL MISSILES

Robert B. Perry, Ann H. Kissell, and Charles F. Bates

Introduction

Constraints on funding Army acquisition programs combined with the increased demand for Army systems is an all too common occurrence. Fortunately, however, modeling and simulation (M&S) technology is helping the Army acquisition community deal with this dilemma. In particular, the Program Executive Office, Tactical Missiles (PEO, TM) has been a major proponent in using M&S technology and has embraced the Simulation and Modeling for Acquisition, Requirements and Training (SMART) concept.

The Javelin Project Office, which reports to the PEO, TM, has recognized the impact of the SMART concept by incorporating it into the Javelin Simulation Program. By applying M&S throughout the Javelin missile system's acquisition life cycle, the project office has ensured that the required M&S resources and support are available for its government/industry support team to successfully complete acquisition decisions, system improvements, and user training. Specifically, the Javelin Simulation Program has allowed the project office to enhance system performance while simultaneously reducing program costs by reducing the number of flight tests necessary to demonstrate system capabilities.

To achieve the full benefit of the SMART concept, M&S technology must be reused. For example, the Tube-launched, Optically-tracked, Wire-guided Fire and Forget (TOW F&F) missile system, managed by the Close Combat Anti-Armor Weapon Systems (CCAWS) Project Office, has benefited from M&S techniques developed for the Javelin Simulation Program. In addition, the TOW F&F missile will benefit from this process when its own M&S suite is developed. To gain further benefit of the SMART concept, the Javelin Simulation Program can reuse tools developed for the TOW F&F Program in its own product improvement efforts.

System Description

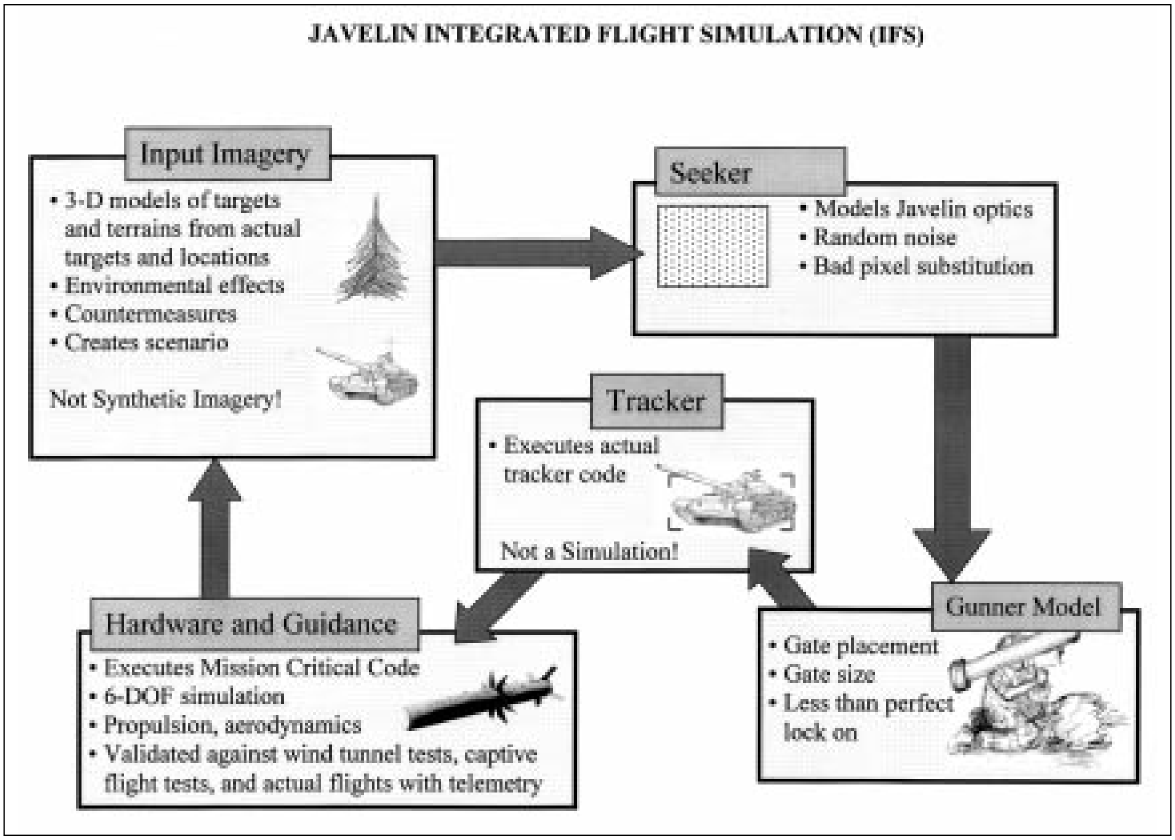
The Javelin missile system is a medium-range, man-portable, shoulder-launched, fire-and-forget, anti-armor weapon system. It has two major components: a reusable Command Launch Unit (CLU) and a missile sealed in a disposable launch-tube assembly. The CLU incorporates an integrated day/night sight and provides target engagement capability in adverse weather and countermeasure environments.

Javelin uses fire-and-forget technology that allows the gunner to fire the missile and immediately take cover or reload. The onboard tracker guides the missile to the target until impact. This tracker, and its ability to stay locked on the target throughout flight, emerged as the most critical aspect of the Javelin system. A cost-effective way to develop and test new tracker algorithms became a necessity. Additionally, an innovative way to determine system performance of a fire-and-forget imaging infrared system was needed. From these requirements, the Javelin Simulation Program evolved.

Initial Activities

The Javelin Project Office undertook a comprehensive program for managing key system, subsystem, and component-level models and simulations, related databases, and test data. These models and simulations evolved from initial all-digital simulations supporting requirements analysis, and they have continued to support the program throughout its development life cycle. The primary simulation developed to represent the Javelin system was the Javelin Integrated Flight Simulation (Javelin IFS).

The Javelin IFS is a high-fidelity, all-digital simulation whose primary functions are tracker algorithm development, flight test predictions and reconstructions, and system-performance assessment. The Javelin IFS contains an environment model, a seeker model, a tracker model, a six degree-of-freedom (6-DOF) model, and a gunner model.



Javelin's prime contractor and the U.S. Army's Aviation and Missile Research, Development and Engineering Center (AMRDEC) developed the Javelin IFS jointly during engineering and manufacturing development (EMD). Verification, validation, and accreditation (VV&A) of the Javelin IFS was performed by AMRDEC and accreditation by the Army Materiel Systems Analysis Activity (AMSAA).

Using the validated Javelin IFS, developers did a simulation-based system performance assessment to support the production acquisition decision. Using the Javelin IFS, developers also devised a suite of scenarios to measure the performance of the system, which included probability of hit, probability of kill, and intercept geometries. The performance assessment included more than 70,000 simulation trials, and the results were analyzed to determine whether the Javelin system met its requirements. These simulation results were provided to AMSAA for its independent analysis. The simulation results were implemented into various force effectiveness simulations to support Army-level studies.

Current SMART Activities

As the Javelin Program has matured, so has the Javelin Simulation Program. Recent simulation activities have illustrated how the Javelin Program has embraced the Army's SMART concept. The Javelin Project Office established the Javelin Simulation Center (JSC) at AMRDEC with the Javelin IFS as the backbone of the simulation capabilities. The JSC resulted from a Javelin Project Office decision to establish a capability at AMRDEC for software development, simulation, assessment, and demonstration activities.

The JSC combines AMRDEC organizations and the Redstone Technical Test Center (RTTC), part of the U.S. Army Test and Evaluation Command (ATEC), in a teaming environment via an integrated fiber-optic network. This allows for tracker algorithm development, tactical software coding and testing, simulation-based performance assessment, and hardware testing in an integrated environment. The Javelin system hardware contained in the JSC is maintained by RTTC. The JSC allows the Javelin Project Office, for the first time ever, to share information with the simulation and test communities.

TOW F&F System Description

The TOW F&F system will provide a long-range, lethal, anti-armor capability for light forces currently equipped with the Improved Target Acquisition System (ITAS). The TOW F&F missile requires a fire-and-forget primary mode of operation with an alternate mode as backup; increased range, lethality, and platform survivability; compatibility with the ITAS platform through use of a platform appliqué; and the ability to maintain ITAS platform capability to fire existing TOW missiles without performance degradation. The TOW F&F system was approved for System Development and Demonstration (SDD) (formerly known as EMD) in third quarter FY00, and a contract was awarded in fourth quarter FY00.

TOW F&F SMART Strategy

The TOW F&F Program acquisition strategy emphasizes the use of M&S to reduce schedule, cost, and performance risk. Previous M&S efforts on Javelin, as well as on other Army systems, have benefited the TOW F&F Program as a result of state-of-the-art simulation components and technologies. These capabilities allow more simulated component and system design and testing, thus reducing overall schedule risk associated with these functions.

These capabilities will lower cost risk by reducing the number of test missiles from 170 rounds needed for Javelin development to approximately 43 rounds needed for TOW F&F SDD flight testing. This reduction still allows all critical operational issues and criteria and key performance parameters to be addressed. This is possible because M&S permits performance assessment in simulation environments prior to live firing. This will allow destructive live-testing efforts to focus on reliability and performance issues related only to the live-fire environment.

The TOW F&F Program employs a suite of M&S tools that encompass all three M&S environments: live, virtual, and constructive. Additionally, Javelin simulation methodology, as well as synthetic targets and backgrounds developed during the Javelin development effort, will be used during TOW F&F development. The prime contractor will develop a TOW F&F IFS, which will consist of a 6-DOF model, system reliability estimates, and an Automatic-target Tracker Simulation (ATS). The ATS consists of automatic target tracking algorithms, a seeker model, and a synthetic scene generator. The ATS will be used to support the early analysis of TOW F&F autotracker and terminal homing guidance design.

Verification of TOW F&F IFS models will be conducted to ensure the execution of proper modeling techniques and structure as well as to ensure that the algorithms are implemented correctly. The validation of the TOW F&F IFS will be accomplished by comparing the system flight test data with post-flight reconstruction data and with the pre-flight statistical performance boundaries. The CCAWS Project Office will be the verification and validation proponent for the TOW F&F IFS, and ATEC will be the accreditation authority.

In addition to the all-digital TOW F&F IFS, a Virtual Prototype Simulator (VPS) will be used. The VPS is currently being updated with the real-time 6-DOF and the contractor's design concept for use in the project office's early user involvement. Soldiers from the U.S. Army Infantry Center will conduct simulated engagements using combat developer-approved scenarios.

CSF

The TOW F&F Common Simulation Framework (CSF) provides an object-oriented simulation model that allows TOW F&F components to be placed into simulations in a user-friendly environment. The commonality between these simulations will greatly streamline the VV&A process for TOW F&F. The CSF is also being considered as the simulation model for the next-generation Javelin IFS that will allow the TOW F&F Simulation Program to feed back to the Javelin Program leading-edge M&S technology.

Summary

The PEO, TM has used M&S technology in its various programs for many years and has supported SMART from its inception. Two examples of this are the M&S activities integrated into the Javelin and TOW F&F programs. Employing SMART has allowed both programs to demonstrate system capabilities in a resource-constrained acquisition environment.

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A SMART IMPLEMENTATION FOR GROUND-TO-GROUND COMBAT IDENTIFICATION

LTC Jonathan Maddux, Jon Kwiecien, and Steven A. DeChiaro

Introduction

In addressing the ground-to-ground combat identification (CI) link, the Product Manager for Combat Identification (PM, CI) is supporting both the near-term Battlefield Combat Identification System (BCIS) and the objective Ground Integrated Target Identification System (GITIS).

To support these efforts, modeling and simulation (M&S) is being used effectively in concept development, hardware development, laboratory testing and characterization, and field testing. With the aid of Simulation and Modeling for Acquisition, Requirements and Training (SMART) tools as an integral part of the iterative design, prototype, and test process, PM, CI plans to demonstrate that the BCIS and the GITIS meet military requirements. It is no longer sufficient that systems meet or exceed technical specifications. They must also improve operational performance and effectiveness. This requires an integrated and iterative design and development process where technical performance, soldier-machine interfaces (SMIs), and operational deployment considerations are addressed concurrently (Figure 1).

BISEPS

To facilitate engineering analyses, design verification, design optimization, and to evaluate "what-if" scenarios, PM, CI developed the Battlefield Identification System Environment Performance Simulation (BISEPS) model. BISEPS is an engineering-level, high-fidelity, non-real-time performance model of the BCIS. As an integral part of the BCIS hardware development, the BISEPS model has been compared against actual field test data and trials with good results in both one-on-one and one-on-many scenarios.

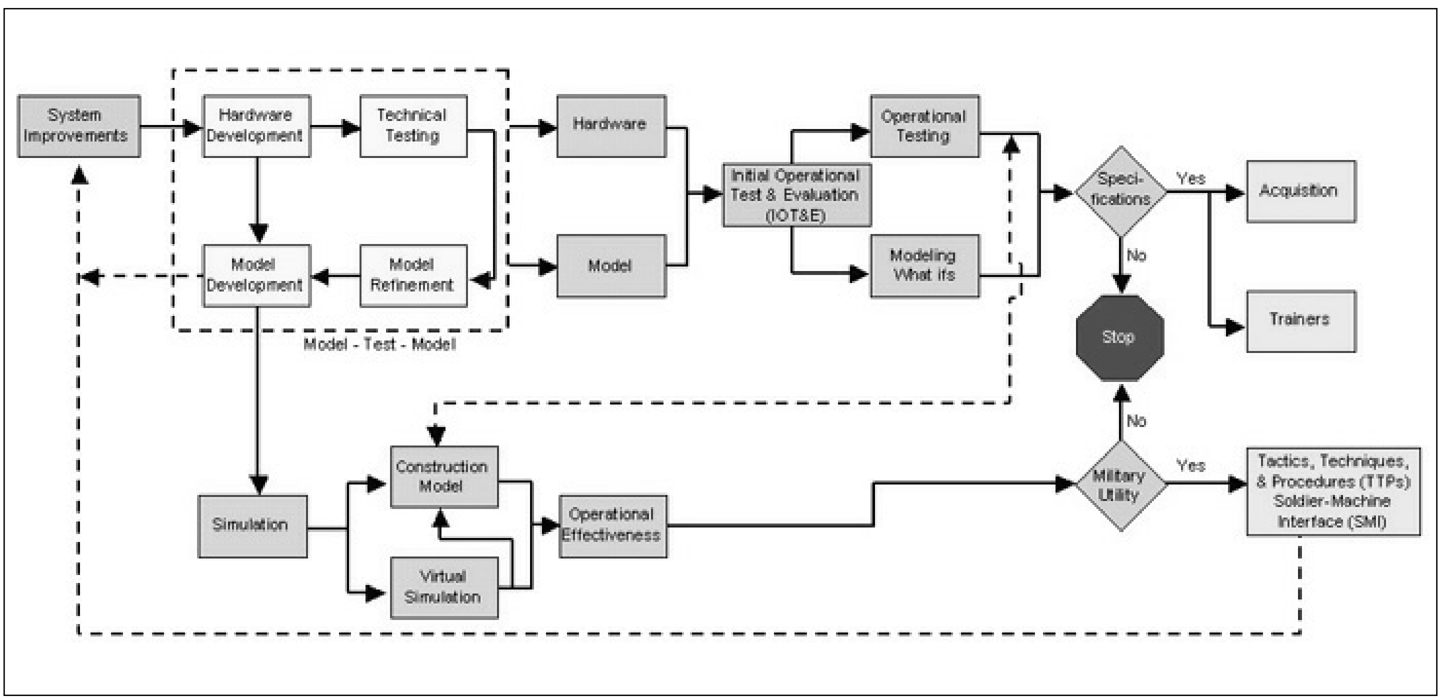

Figure 1.
Iterative concurrent design process

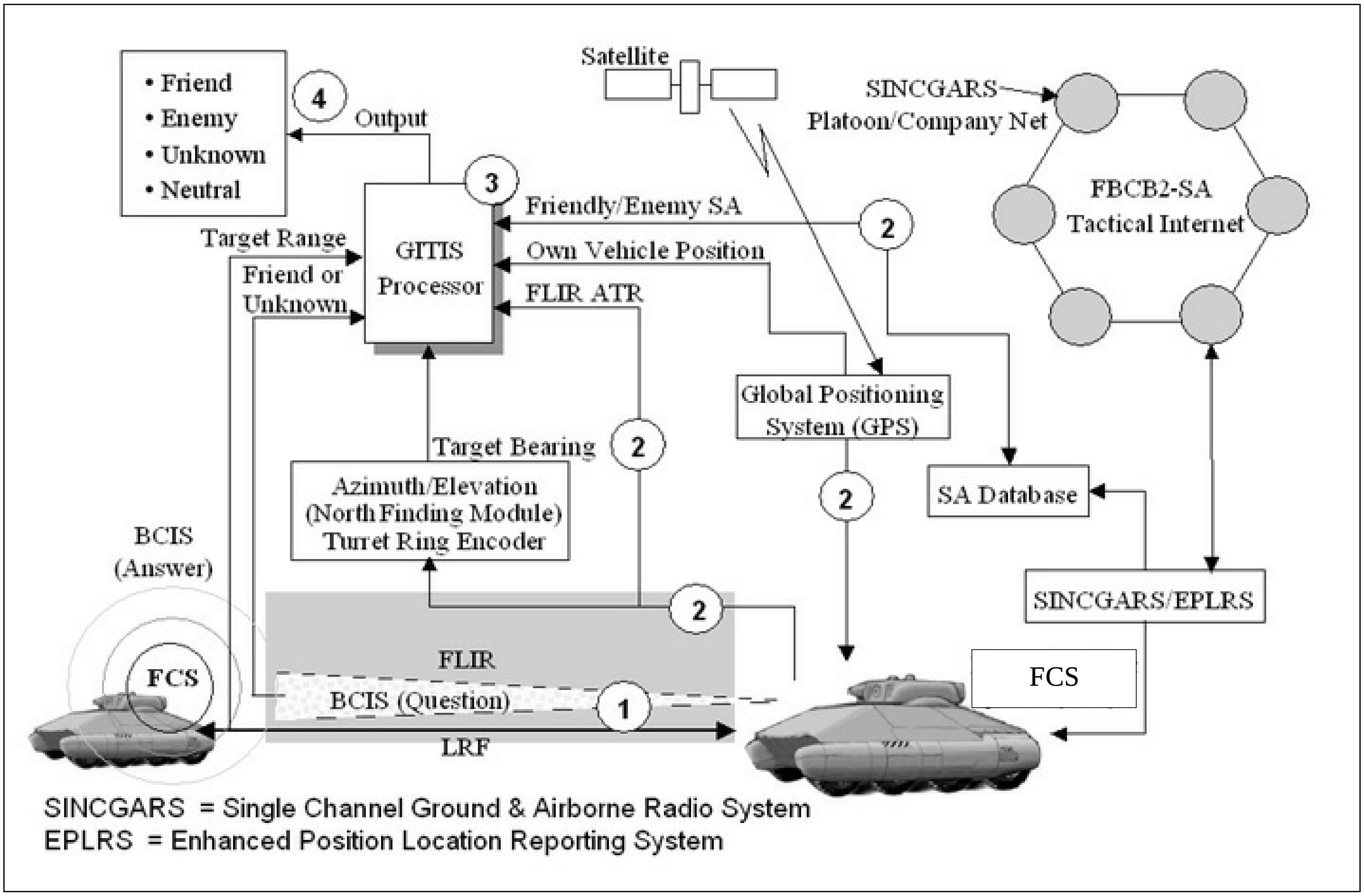

Figure 2.
GITIS concept

To support various distributed simulation exercises using the synthetic environment, BISEPS generated a family of performance contours to accurately and realistically emulate the expected BCIS performance. To facilitate the integration of BCIS within the simulation environment, its performance was evaluated as a function of range, azimuth, elevation, interrogator platform, density of responders, environment, and geometry.

A BCIS simulation module was developed and embedded within the host platform code of each Close Combat Tactical Trainer (CCTT)-manned simulator. Along with this simulation performance module, the BCIS SMI was implemented for both the Abrams M1A1 Main Battle Tank and the Bradley M2 Infantry Fighting Vehicle.

The SMI consists of both visual and audio cues. The visual cue, a red flashing LED (light-emitting diode), is seen in the reticle of the gunners' and commanders' sights. The audio cues, employing a digitized female voice, announce through the vehicle intercom system "friend," "unknown," or "friend at *range*." This friend at *range* response warns the crew that a friendly vehicle is close, although it may not be the targeted vehicle. The *range* is the BCIS computed range.

VIE I

The first Virtual Integration Exercise (VIE I) was conducted in support of the Joint Coalition Combat Identification Advanced Concept Technology Demonstration Program. The M1 and M2 ground vehicle simulators used to support VIE I were modified Simulation Network (SIMNET) simulators located at the Mounted Warfare Test Bed, Fort Knox, KY. Supported by the 3/7 Division Cavalry (DIVCAV) Squadron, this simulation effort involved typical DIVCAV scenarios such as guard, screen, zone, and movement to contact (MTC). Only day missions were conducted because of the limitations of the SIMNET Image Generators. In addition, troop participation was limited because of the short supply of simulators.

The Low-Rate Initial Production Army Systems Acquisition Review Council for the BCIS directed that a follow-on effort be conducted to fill data gaps remaining from VIE I (additional mission scenarios, nighttime operations, and more troops participating). This led to VIE II.

VIE II

The second exercise conducted by PM, CI (VIE II) was a virtual soldier-in-the-loop simulation at the Fort Hood, TX, CCTT Site 1. Through accredited M&S, VIE II quantified the reduction in fratricide by the BCIS above that provided by situational awareness (SA). The accreditation and analysis group consisted of representatives from numerous government and industry organizations. The 1st Cavalry's 1-12 Tank Company and 1-5 Infantry

Company conducted scenarios that included attack, hasty attack, hasty defense, and MTC under simulated daytime and nighttime conditions.

The CCTTs at Site 1 were capable of providing the necessary forward looking infrared (FLIR) imagery to support the nighttime trials. There were sufficient CCTTs to support the two companies. The battle trials were conducted during a 3-week period in September 2000. The VIE II results will assist the U.S. Army in making an acquisition decision regarding the BCIS.

The BCIS simulation modules that were developed and integrated within the CCTT simulators to support the VIE II remain at CCTT Site 1 to support future operational and sustainment training of the first BCIS-equipped units.

GITIS

Within the context of the science and technology objective, PM, CI is refining the ground-to-ground GITIS concept (Figure 2). As part of the development process, PM, CI is developing a soldier-in-the-loop virtual simulator incorporating the GITIS concept. The simulator will be used with other models, tools, and analyses to help refine the GITIS requirements.

The GITIS concept involves the fusion of SA information provided by the Force Battle Command Brigade and Below (FBCB2) System, CI data provided by the BCIS, and data from other sensors. These other sensors include the Commander's Independent Thermal Viewer (CITV) for the M1A2, the compass, the azimuth encoder, and the Laser Rangefinder (LRF).

The simulator, hosted on an M1A2 Abrams Main Battle Tank, includes advanced SMI display concepts that provide the combat crew with an integrated view of the battlespace. The commander's station is equipped with two Advanced Multi-Purpose Displays. Although completely reconfigurable by the commander, the commander's station could be one standard operational configuration consisting of the FBCB2 and the CITV displays.

AISU

The gunner's advanced sight system consists of a single display. The Advanced Integrated Sight Unit (AISU) allows both CI and SA data to be simultaneously displayed to the gunner or commander. When a target has been identified as a friendly vehicle, blue symbology is overlaid onto the target. The symbology chosen is consistent with that presently implemented for the FBCB2 display. This is visible at the left side of the display, where SA data regarding a friendly vehicle are maintained despite its placement behind a hill. When the target has been identified as an enemy, red symbology is used. When targets have been determined to be neutral, gray symbology is used. Finally, when a vehicle is being designated or targeted by the commander, it is overlaid with a yellow circle and an "X." At the bottom of the AISU, LRF information to the most recently targeted vehicle is noted in green text.

Conclusion

The GITIS concept will provide more timely estimates of present platform SA positions by employing innovative tracking algorithms, predictive filters, and correlation schemes to mitigate network latencies resulting from existing bandwidth and message traffic. The objective of the GITIS concept is to improve the quality of the SA data while maintaining the achievable FBCB2 message completion rates or speed of service. The GITIS simulator will also contain an Aided Target Recognition (ATR) algorithm to process the M1A2 CITV FLIR imagery. The GITIS concept can be adapted for various platforms and missions, including variants of Future Combat Systems (FCS) and rotary-wing platforms (e.g., Longbow Apache and Comanche).

With the exception of the advanced displays, the GITIS concept can be implemented predominantly with software modifications. This is predicated on the existence of many of the ancillary sensors and subsystems within the overall concept, including the eventual fielding of both FBCB2 and BCIS. It is anticipated that the AISU will be costly to retrofit to existing vehicles, a factor that will play a significant role in these implementations.

There are no constraints, however, regarding new platforms such as the objective FCS. Therefore, FCS may be ideal for the GITIS technology and advanced displays. A concept that integrates GITIS with a suite of survivability systems is under preliminary investigation. This concept includes a local SA display to designate lines of bearing or angles of arrival of potential threat emitters. Crews may then use these cues or warnings to quickly react (e.g., mask, discharge smoke, or initiate countermeasures) to immediate lethal threats.

To develop and field better systems quickly and at less expense, the PM, CI is successfully employing SMART initiatives within the realm of Simulation Based Acquisition.

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SMART APPLICATIONS FOR THE UH-60M PROGRAM

Eric F. Edwards and Will Nikonchuk

Introduction

The UH-60 BLACK HAWK Recapitalization/ Upgrade Program (the UH-60M Program) was established to meet new requirements for increased lift, range, and survivability, and to address the challenges of the aging utility helicopter fleet. The UH-60M is an improved version of the UH-60 BLACK HAWK helicopter (UH-60A and UH-60L models). The U.S. Army's recapitalization/upgrade of the UH-60 platform is designed to ensure that it remains an integral part of a deployable force on tomorrow's digital battlefield.

The Project Management Office for Utility Helicopters (PMO, UH) is successfully implementing the Simulation and Modeling for Acquisition, Requirements and Training (SMART) process in the UH-60M Program. Being a legacy system, the UH-60 BLACK HAWK does not have a history of modeling and simulation (M&S) development to reference, nor does it offer many M&S lessons learned. However, M&S will be incorporated into the UH-60M Program as a method to demonstrate system effectiveness and save costs in the test and evaluation phase. Furthermore, the PMO, UH understands that investing in M&S during the risk-reduction and engineering and manufacturing development (EMD) phases will result in substantial savings for future upgrades to the UH-60 platform.

UH-60M M&S Strategy

During preparation of the Milestone B contract requirements package, the PMO, UH called on employees from the Redstone Technical Test Center (RTTC) and the U.S. Army Aviation and Missile Command's Research, Development and Engineering Center (AMRDEC) to map out an M&S strategy. As a result, the UH-60M Simulation Support Plan (SSP) was developed to define M&S strategy and present a path to implement M&S in the UH-60M Program.

The U.S. Army developed the SMART process in response to a DOD-level directive to adapt Simulation Based Acquisition (SBA) for all future system acquisitions or major system upgrades. SMART expands SBA by not only including M&S in the acquisition phase of the system life cycle, but by also using it in the training and requirements definition phases.

M&S has been used increasingly throughout the design, analysis, and testing of other aircraft and missile systems that are under development. The application of M&S in the UH-60M Program supports this initiative through the effective use of state-of-the-art technology.

The UH-60M Program is in a risk-reduction phase to further define the system's baseline. As such, the government and Sikorksy Aircraft Corp. (SAC) are conducting trade studies to answer programmatic and baseline design issues prior to entering the integration and qualification (I/Q) phase. The I/Q phase replaces EMD in the UH-60M Program. During the risk-reduction phase, the user has many opportunities through the combat developer to provide feedback on baseline configuration changes to the SAC design team and the PMO, UH. Early user demonstrations (EUDs) will support this user/designer interface.

PMO, UH has also encouraged the use of M&S in the UH-60's design and modernization. The PMO, UH believes that EUDs offer an early opportunity to introduce M&S into the UH-60M Program. One benefit of M&S recognized by the PMO is the ability to rapidly prototype components, subsystems, and eventually the UH-60 system.

Incorporating engineering-level modeling and simulation as prototypes prior to bending metal on a production line is not new to industry or the military. Computer-based models developed for engineering analysis may transition to their hardware subsystems as physical mock-ups. Virtual prototypes capable of easy reconfiguration are an example of M&S used in this transition. Reconfigurable prototypes can be tested under simulated conditions. This allows the design team to evaluate their prototypes in virtual environments.

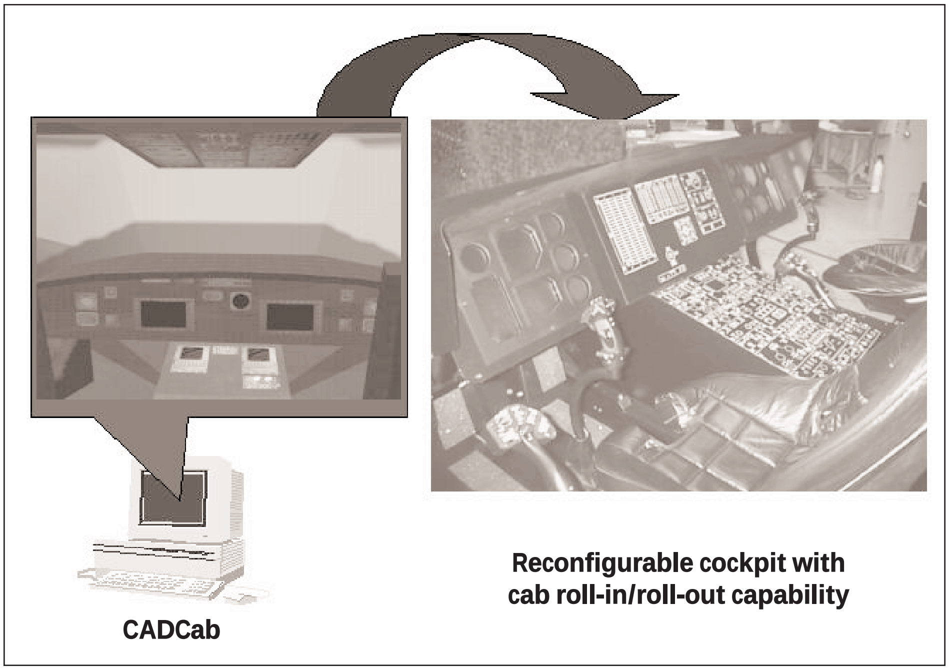
CADCab

UH-60M cockpit design changes are primarily focused on upgrading the controls and displays. PMO, UH will analyze the design changes using virtual prototypes, a reconfigurable cockpit, and a systems integration laboratory. Design changes and the upgrade process are supported by CADCab. CADCab is a Unix-based approach that uses high-end graphics and computer-aided design (CAD) tools to rapidly prototype the proposed UH-60 cockpit configurations within a virtual UH-60 cabin. CADCab provides a 3-D perspective to better assess subsystem spacing. Computer-based prototyping allows for rapid side-by-side analysis of many different configurations. Synthetic imagery allows the design team to properly define control and display requirements and, to a limited degree, assess system-level performance. Better dimensioning leads to a better form and fit analysis for many of the proposed changes to the cockpit and to the associated flight instruments.

Pilot input enhances the form and fit analysis of an instrument panel redesign. Pilot actions can be replicated, demonstrated, and measured when functionality is added to the instruments. A functional capability is possible with this virtual environment because the synthetic instruments are directly coupled with a UH-60 flight model. Current risk-reduction trade studies such as the "4 versus 2" multifunction display (MFD) will benefit from this analysis.

Reconfigurable Cockpit

The reconfigurable cockpit is the pilot's interface with the virtual CADCab instruments. The numerous cockpit configurations developed on the CADCab are ported to the reconfigurable cockpit, which is open-seated with four flat panel displays (FPDs) across the instrument dash panel. Another FPD is



located on the lower console. The FPD's touch-sensitive screen can display virtual MFDs and their associated pages, any number of primary flight instruments and gauges, as well as general-purpose switches. The reconfigurable cockpit has collective, cyclic, and tail-rotor control pedals that are linked to the flight model, allowing the pilot and co-pilot to fly through simulated environments. The cockpit is mounted on lockable casters that allow it to roll in or roll out of a 150 by 45-degree field-of-view dome and projector system. This allows the cockpit to interactively maneuver in any terrain box and with any number of different scenarios displayed onto the projector system.

The CADCab/reconfigurable cockpit approach was developed to address proposed modernization changes to the UH-60 BLACK HAWK during their EUDs. The CADCab/reconfigurable cockpit approach is a low-cost alternative to cockpit hardware changes, hard-wiring, or an extensive software development program prior to preliminary design review (PDR). This approach leverages the hardware and software investments made by other programs within the U.S. Army Aviation and Missile Command.

Early User Demonstration

Early user demonstrations consist of three events scheduled throughout the risk reduction and I/Q phases of the UH-60M Program. EUD1 will use CAD and computer-generated imagery to facilitate user and designer communication and analysis during risk reduction and prior to PDR. EUD1 allows pilots (users), designers, and PMO representatives to identify potential user issues and design solutions based on current configurations. EUD1 will also provide an opportunity to define the metrics necessary to measure situational awareness (SA) resulting from information presented to the pilot; establish measures of effectiveness/performance for future SA design and analysis activities; and facilitate initial human factors engineering of candidate instrument panel configurations. EUD1 is expected to provide many lessons learned for EUD2.

EUD2 will capture user feedback on design changes that have been incorporated and approved in preparation for critical design review.

SIL

EUD3 will involve examining hardware and software components on a fully instrumented UH-60M cockpit (aka the System Integration Laboratory (SIL)) located in AMRDEC's Software Engineering Directorate. The SIL contains a fully instrumented UH-60Q cockpit. Once the UH-60M's baseline configuration is defined, the SIL will be integrated with UH-60M upgrade components.

The cockpit will be capable of being stimulated by synthetic environments and simulated control responses. This will allow the user, combat developer, and test and evaluation community to acquire data that will eventually fully support a system analysis and assessment of the digitization and SA capability. During EUD3, the mature SIL cockpit will allow the user to access and interact with the UH-60M cockpit components and will allow user and pilot dialogue, feedback, and evaluation to continue without the delay of obtaining airworthiness and safety releases for the actual aircraft.

Conclusion

PMO, UH is implementing M&S as a design and analysis tool and as a means to communicate user requirements. The SMART approach is being embraced in the UH-60M Program as reflected in the EUDs. As the program progresses, the UH-60M SSP will provide guidance for M&S applications. Other opportunities for M&S applications and future program cost savings are expected.

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USING ADVANCED COLLABORATIVE ENVIRONMENTS IN DEVELOPING ARMY MATERIEL

Dr. Grace M. Bochenek-Broecker and Kenneth J. Ciarelli

Introduction

Engineers from the U.S. Army Tank-automotive and Armaments Command's Tank Automotive Research, Development and Engineering Center (TACOM-TARDEC), Warren, MI, in cooperation with their commercial and government partners, are combining emerging computer technologies with simulation to create robust, collaborative life-cycle processes for developing Army materiel. The primary objective is to empower each participant in a system's life cycle with timely and relevant information in "views" that are understandable and easily accessible.

Organizational Changes

In concert with advances in computer and Internet technologies, organizational structures are rapidly changing into small, decentralized, short-lived, loosely linked teams. These teams rely on collaborative relationships where sharing information is the key to success. Organizations are no longer characterized by physical assets but by a network of individuals who create, process, and distribute information.

An example of this trend is the joint Defense Advanced Research Projects Agency (DARPA)-Army Future Combat Systems (FCS) Program, which involves nontraditional teams including Defense contractors, commercial technology firms, and government groups.

Collaboration Tools

Many underlying technologies (e.g., modeling and simulation and network computing) form the basis of the Army's Simulation and Modeling for Acquisition, Requirements and Training (SMART) acquisition practices. Additional technologies are required to facilitate collaboration and the conduct of concurrent activities in a distributed enterprise as depicted in Figure 1. This article focuses on two key technologies that compose the TACOM-TARDEC

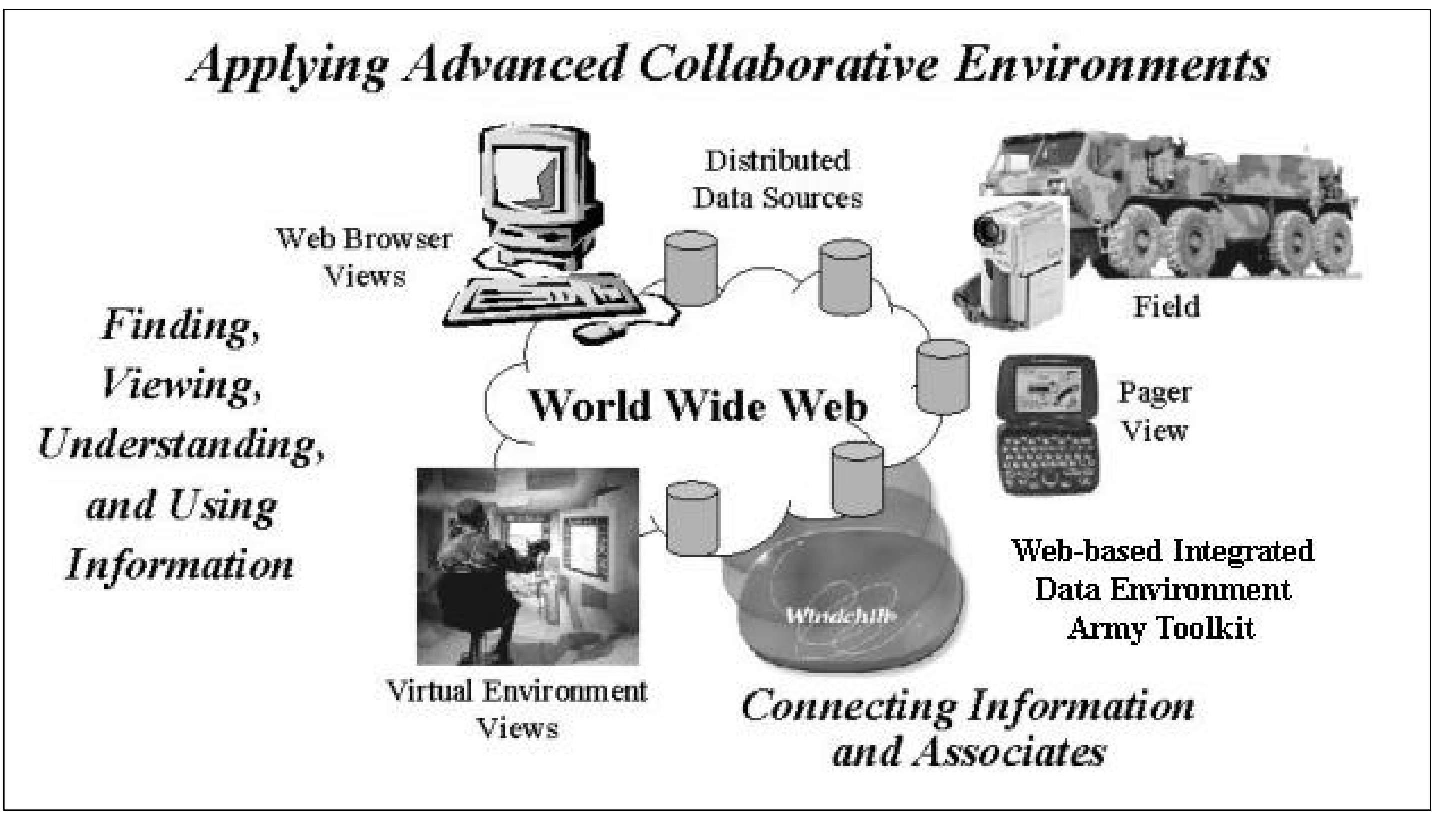

Figure 1.

Advanced Collaborative Environments (ACE) initiative. These technologies, which better link the people and information involved in Army processes, are Web-based information technology (WebIT) and immersive virtual environments (VE).

WebIT makes distributed information accessible in various useable forms and provides automated tools to assist in its processing. Immersive VE improve communication between process participants by providing natural shared views of system information that were previously available only to specialists. Both WebIT and VE facilitate the vital collaboration needed in re-engineered life-cycle processes.

Key to improving acquisition processes is the ability to connect people and information in a timely and flexible manner.

WebIT. Key to improving acquisition processes is the ability to connect people and information in a timely and flexible manner. To address this requirement, TARDEC has partnered with Parametric Technology Corp. to use their WebIT framework called Windchill. This framework provides a Web-based enterprise information management system with integrated tools that support automated workflows. Unlike existing point solutions that focus on a single department or product, Windchill addresses product and process life-cycle management across the extended enterprise.

Windchill leverages the Web's unique decentralized distribution model to "virtually" connect many autonomous information systems, allowing them to behave as a unified whole. Windchill uses existing network environments.

Immersive VE. Immersive VE technology, often called virtual reality or VR, is a suite of 3-D graphics-based visualization software and devices that allow multiple users to concurrently view a virtual system or product model while maintaining natural, human communications.

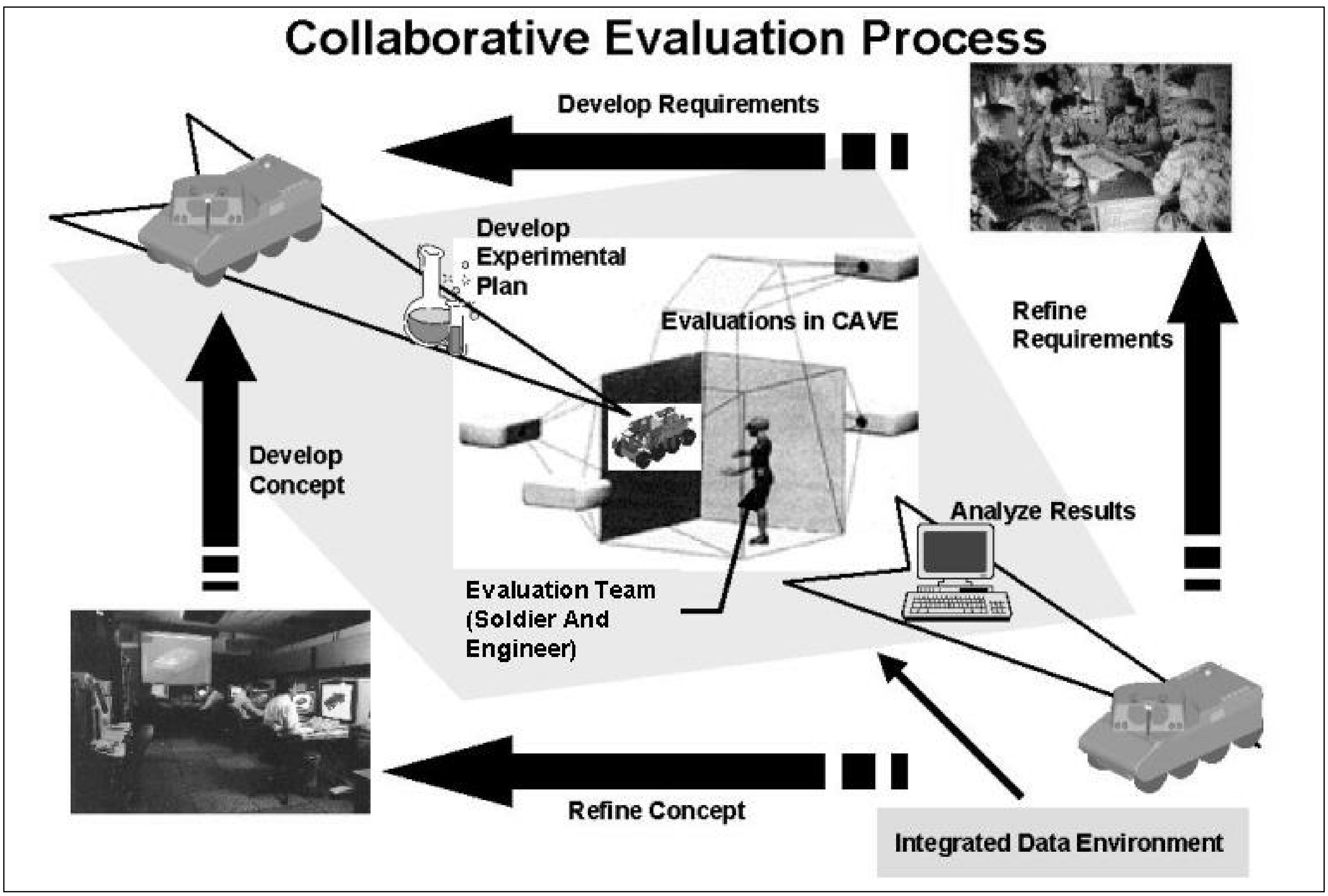

Figure 2.

These virtual systems operate within a computer-generated environment with real-time user interaction. These technologies involve sight, sound, and touch, making users believe they are interacting with real vehicle systems instead of computer-generated replicas.

TARDEC uses two immersive devices: the CAVE and PowerWall VE systems. The CAVE system is a 10 by 10 by 10 foot, room-size, high-resolution 3-D VE system that supports a maximum of 12 users. PowerWall is similar in function, but differs in physical structure. It uses a flat screen that varies from 14 by 10 to 30 by 30 feet and is limited only by space constraints. Within these environments, multiple users can concurrently view and interact with virtual systems and jointly evaluate design issues and ideas, each from their own experience, perspective, and functional responsibility.

TACOM-TARDEC experiences have shown that these technologies help clarify issues, resolve problems, and streamline acquisition decisions.

FCS. The FCS Program involves four contractor teams and many small distributed groups of government specialists. Even the FCS Program Management Office (PMO) is located at multiple sites. To improve the connectivity between these distributed resources, PMO, FCS chose the ACE WebIT solution, Windchill. To improve the communication of design information between the contractor and the government and between the designer and the technologist, PMO, FCS chose the ACE VE solution, CAVE.

By partnering with TARDEC to use and enhance ACE technologies, PMO, FCS has reduced startup delays of these state-of-the-art technologies. TARDEC will also impart any enhancements from FCS investments in these tools to other Army programs.

TACOM-TARDEC has worked closely with the Fort Knox Mounted Maneuver Battlespace Lab to establish procedures for the routine use of ACE technologies in FCS design evaluations. Through a series of CAVE experiments with soldiers at Fort Knox, a structured process was developed to generate, evaluate, and collaborate on future vehicle concepts. As shown in Figure 2, this collaborative process brings the materiel and combat developers together in a common virtual environment. Both operational requirements and technical solutions are reviewed, discussed, and evaluated. In real time, engineers and soldiers can conduct side-by-side trade-off evaluations, quickly iterate changes, generate new ideas, and make faster decisions.

Other ACE Successes

At TARDEC, ACE technologies have been applied in several vehicle programs. Communication and processes have been improved in vehicle concept evaluations, design trade-off studies, and technology insertion considerations for existing systems. The overwhelming support for these early applications has fueled considerable interest and demand for using ACE in other Army programs such as the Objective Individual Combat Weapon.

Future Infantry Vehicle (FIV). TARDEC engineers and combat developers from the Fort Benning Infantry Center used the CAVE system to support design evaluations of the FIV concepts and to review user requirements. Prior efforts involved frequent site visits to exchange two-dimensional drawings of computer-aided design models contained in briefing charts and text descriptions of requirements. Presentation of FIV concept designs in the CAVE permitted soldiers and engineers to stand next to, inside of, and on top of the virtual vehicles and examine and discuss their various components. Many of the conclusions, which were mutually agreed to in the CAVE, would not have been found until the construction of more expensive hardware mock-ups.

Future Scout And Cavalry System (FSCS). The FSCS Program involves a joint U.S./U.K. effort to develop prototype scout vehicles. To accelerate the effort, the program began with delivery of the Army's internally developed FSCS concept designs. All participants needed a clear understanding of the concept vehicles already considered and the rationale behind them.

The CAVE was used to present the initial designs to the two program offices, the contractor teams, and the two sets of user representatives.

Dual-use Army/industry partnerships have played a key role in developing advanced collaborative environment technologies. These joint efforts are based on a true partnership, where each partner contributes 50 percent of the investments toward a common goal.

By fostering relationships and forming cost-shared partnerships, the National Automotive Center accelerates the exchange and implementation of advanced technologies.

Family Of Medium Tactical Vehicles (FMTV). The CAVE was used to evaluate FMTV upgrades in support of TARDEC's ongoing engineering efforts for the Project Manager (PM), FMTV. One case involved assessing several new tailgate configurations that incorporated an integral ladder. Some of the proposed alternatives that included mechanisms for automatic deployment would have been difficult to describe using only two-dimensional drawings.

ACE User Observations

Without exception, participants felt that the CAVE design reviews helped them identify potential issues and shorten the process of determining the most promising solutions. The following quotes are from some of the users:

"Seeing a draft requirement function within an operational environment is much better than a large chart presentation. I want one of these at Ft. Benning." (Director, Combat Development Office, Fort Benning Infantry Center)

"Reviewing the designs in the CAVE with the engineers discussing characteristics of the subcomponents allowed me to very quickly compare my requirements to the concept design capability. I am interacting with design, engineers and staff simultaneously. Things become more informal and we quickly get down to business in our trade-off analysis." (Combat Developer, Fort Benning)

"It gives us the opportunity to visualize functionality of concepts when reviewing engineering change proposals." (Chief Engineer, Office of the PM, FMTV)

"Yes, seeing the designs and their movements helped speed up the decisionmaking process." (PM, FMTV)

Partnering

Dual-use Army/industry partnerships have played a key role in developing ACE technologies. These joint efforts are based on a true partnership, where each partner contributes 50 percent of the investments toward a common goal. Leveraging both government and industry resources falls under the DARPA-Army Dual-Use Science and Technology Program and is a primary mission of TARDEC's National Automotive Center (NAC). This center is responsible for identifying the needs of DOD and the automotive industry. By fostering relationships and forming cost-shared partnerships, NAC accelerates the exchange and implementation of advanced technologies. Descriptions of current partnerships and the opportunities for establishing new partnerships are on the NAC's SimTLC Web site at **http://www.simtlc.org**.

Leap Of Faith

Changing acquisition methods can be complicated, but as resources become more limited, it is essential that Army organizations make dramatic strides toward change. Our experience tells us that modeling and simulation, information, and Internet technologies can help reduce development time, especially when used to support acquisition decision-making. Today's immersive VE and Web-based IT are ready for routine use. However, a "leap of faith" is often needed during initial adoption. That is why TACOM-TARDEC has adopted a "change by doing" philosophy when embracing ACE technologies. This philosophy involves gradually integrating these tools and continually adjusting their use and capabilities in partnership with the whole Army community and commercial technology vendors.

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A 'SMART' CAPABILITY FOR ACQUIRING ARMY WEAPON SYSTEMS AND PLATFORMS

Dr. Myron Holinko, Richard Pei, James Wagner,
Dr. Nancy Bucher, Gregory Tackett, Arthur Adlam, and John Brabbs

Introduction

The U.S. Army continues to face a wide array of challenges as it prepares to win future conflicts and contribute to peace in this century. However, the face of the battlefield has changed significantly because of the increased range, precision, and lethality of weapon systems. Warfare has transitioned from a "platform-centric" battlespace to an "information-centric" battlespace. This change mandates new capabilities in the acquisition community to establish a robust, diversified, and agile capability or process for effective collaborative research, development, and engineering for these "system-of-systems."

Fortunately, the evolution of simulation capabilities and technologies now enables the interactive use of disparate simulations. This development, coupled with powerful desktop computers and workstations that are networked together, provides a mechanism to address system-of-systems challenges. Simulation is no longer a method of "last resort" but an integral part of the materiel development process.

The Army Materiel Command (AMC) is meeting this challenge by developing the AMC Research, Development and Engineering Center (RDEC) Federation. This modeling and simulation (M&S) federation capitalizes on previous AMC RDEC work on separate but related programs. These programs vertically integrated M&S capabilities in the AMC RDECs for their respective functionally related mission areas such as command and control (C2). However, the critical need to transform these individual programs into one synergistic entity that is both vertically and horizontally integrated across functional domains has served as the impetus behind the AMC RDEC Federation.

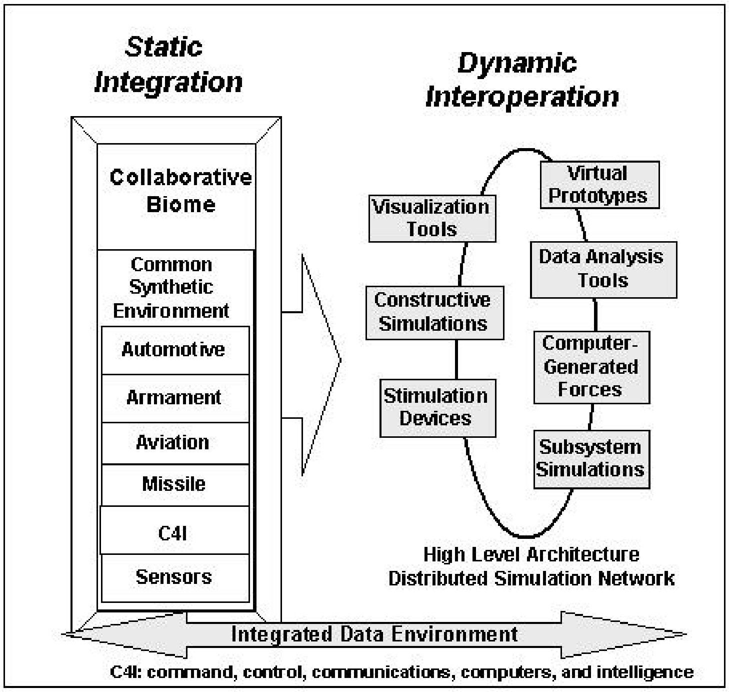
As used in the article title, the word "SMART" has two definitions. It's prudent to develop a *smart* (intelligent) approach to acquire weapon systems and platforms, but most important, SMART represents the realization that this federation directly supports the Army's Simulation and Modeling for Acquisition, Requirements and Training (SMART) initiative.

SMART is the Army's implementation of DOD's Simulation Based Acquisition (SBA) initiative, which is aimed at reinventing the systems acquisition process through collaborative use of information and simulation technologies. Army leadership believes that the acquisition process is continuous—from the warfighter identifying a material deficiency through system disposal. Thus, M&S should be applied throughout the Army's acquisition, requirements, and training communities—a systems approach.

Vision

The vision for the AMC RDEC Federation is to develop an AMC-wide distributed M&S environment. This environment will allow the research, development, and acquisition community to have wide access and linkages for the integrated use of diverse models and simulators at each of the federation partner's facilities.

Federation partners include the Army Communications-Electronics Command (CECOM), Fort Monmouth, NJ; the Army Aviation and Missile Command (AMCOM), Redstone Arsenal, AL; the Army Tank-automotive and Armaments Command (TACOM), Warren, MI; the Army Simulation, Training, and Instrumentation Command; the Army Research Laboratory; the Army Soldier and Biological Chemical Command; and the Army Corps of Engineers' Engineer Research



RDEC Federation Functional Components

and Development Center. The federation will provide the capability to address design issues from both the individual system and the system-of-systems perspectives for the optimal development, integration, and evolution of information, communications, mission equipment, and platform technologies.

To provide a structure to oversee this development, an integrated process team (IPT) is being chartered by AMC Headquarters. An IPT charter, currently under development, will give this IPT the authority and resources to plan, conduct, coordinate, integrate, and execute all actions necessary for the establishment of the federation. Of the many critical tasks this IPT will conduct, a most critical task is to identify and develop the required architecture, infrastructure, and concepts of operations to enable the federation to support the SMART/SBA process.

The M&S tools and techniques used within the federation will depend on the technical requirements of a given experiment and the required product. In some instances, work can be conducted locally within one simulation complex. However, when high-fidelity engineering models or hot benches comprising multiple systems and subsystems are required to represent the mission battlespace and test environment, they will be provided by the appropriate federation facilities via networked simulations using high level architecture (HLA).

HLA defines major functional elements, interfaces, and design rules pertaining to DOD simulation applications and provides a common framework in which specific system architectures can be defined. The RDEC federation will be HLA-compliant and will allow all stakeholders to collaborate virtually during the systems acquisition process and share information and data developed during this process.

Development

The implementation of the AMC RDEC Federation focuses on development of two complementary functional components (see figure). The collaborative biome (CB) component provides for the static integration of virtual models while the HLA Distributed Simulation Network component provides for the dynamic interoperation of simulations incorporating the models developed in the CB. When used together, these two components facilitate implementation of the design-collaborate-evaluate (D-C-E) materiel systems development construct.

The CB component will be the virtual community where a multitude of models and collaborative environments can interact to perform SMART activities. There is currently a high degree of internal integration (vertical integration) of model suites within each AMC RDEC (e.g., Communications and Electronics RDEC). The thrust of the CB component is to horizontally integrate these model suites and collaborative environments across the RDECs, thus facilitating interactive collaborative materiel development. This capability is currently lacking at AMC. Implementing the CB will allow the simultaneous interactive design of platforms, associated sensor suites, platform armament systems (missiles), and other necessary components at the RDECs.

This CB component is being developed by Illgen Simulation Technologies Inc., Santa Barbara, CA. This ongoing effort will provide an initial capability for three to five models to be horizontally integrated across several RDECs and is expected to be completed by the time this article is published. Future efforts will result in additional models being integrated horizontally and vertically within several RDECs. Leading-edge technologies such as Jini, Java, Common Object Resource Broker Architecture, and eXtended Markup Language will provide for integration and interoperation of virtual prototyping tools. They will also allow access to data such as resource repositories among the various collaborative environments already implemented by the AMC RDECs.

The results of the virtual prototypes produced in the CB carry over to the dynamic component of the AMC RDEC Federation—the HLA Distributed Simulation Network. This dynamic component, using performance and other operational and environmental simulations, will perform mission-effectiveness evaluations for the system designed in the CB.

A critical component for developing the HLA Distributed Simulation Network focuses on formulating and implementing the AMC RDEC Federation Object Model (FOM) to enable seamless interoperation of HLA-compliant models and virtual prototypes in simulation experiments and exercises. An FOM defines the essential classes of objects, object attributes, and object interactions to enable implementation of HLA. By iterating between the CB and the HLA network, a D-C-E construct can be implemented.

D-C-E

D-C-E methodology provides the bridge between the CB and HLA Distributed Simulation Network. The CB will allow multiple, interactive iterations where an engineering team optimizes the design and function of a system. This engineering team can be dispersed throughout the country at different RDEC locations (e.g., Redstone Arsenal, Fort Monmouth, and Warren), but by using networked collaborative environments made interoperable through the CB, they can interactively design a combat platform. However, to evaluate the mission effectiveness and contribution of this system in a system-of-systems environment, this virtual simulation developed in the CB must be inserted into an appropriate dynamic environment.

This dynamic environment, the HLA Distributed Simulation Network, is composed of appropriate simulations (modular semi-automated forces, Tactical Internet Model Suite, etc.) that add the functionality required for this virtual prototype to operate and be evaluated in a system-of-systems environment and interact with the myriad of other systems and sensors in its battlespace. The HLA Distributed Simulation Network allows these simulations to interoperate during runtime at or near real time. For example, a combat platform must interact with other combat systems in its parent combat formation (platoon) as well as sensors, artillery, aviation, C2 systems, and communications networks, to determine that system's contribution to overall mission effectiveness.

By operating under a D-C-E construct, a system—and a system-of-systems—can be iteratively optimized while taking into account all components that affect the functionality and effectiveness of the system under test in the HLA Distributed Simulation Network.

Once a system has been evaluated in the dynamic interoperation component, an assessment can be made of platform effectiveness and contribution, and insights can be made about how to improve system effectiveness. These changes can then be made in the CB component, and the cycle begins again and is repeated until the system is optimized for its intended mission and expected mission outcome.

Conclusion

The AMC RDEC Federation development effort addresses and corrects a twofold shortcoming in current engineering-level M&S capability. This federation, through its CB component, allows RDEC static engineering design tools to interoperate between RDECs during the design and development process. Additionally, the use of an HLA-compliant federation to perform dynamic evaluation of systems developed in the CB allows implementation of the D-C-E concept.

As the Army develops more complex systems operating in a system-of-systems environment, it's imperative that the capability represented by the AMC RDEC Federation be quickly developed and used. The Future Combat Systems Program is the centerpiece for Army acquisition as the Army develops an objective-force capability. Without initiatives such as the AMC RDEC Federation, it will be difficult, if not impossible, to design and evaluate systems in a system-of-systems context for the future force.

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From Concept To Reality . . .

THE VIRTUAL PROVING GROUND

Darrell Bench, Dr. C. David Brown, and Van Sullivan

Introduction

The Virtual Proving Ground (VPG) is an example of the U.S. Army Developmental Test Command's (DTC's) implementation of Simulation Based Acquisition and Simulation and Modeling for Acquisition, Requirements and Training (SMART) initiatives. The VPG is a multiyear umbrella project to coordinate the acquisition or development of complex synthetic environments, supporting tools, information infrastructure, and the architectural foundation to support the full range of live and simulation-based testing of the Army's weapon systems.

The VPG is now beyond the concept and design stages and is being used more and more to support testing. VPG supports pretest activities, actual testing, and post-test activities. Concurrent with support to ongoing customer tests, VPG is building a general-purpose simulation capability to enhance testing of future systems in a "system-of-systems" environment. The VPG continues to build simulation capabilities for the full range of Army systems in robust, complex synthetic environments representing all conditions in which the Army may operate. The VPG is truly making SMART happen for test and evaluation (T&E).

Overview

As computer modeling and simulation (M&S) increasingly becomes a part of the acquisition process, it presents both an opportunity and a requirement to apply computer-simulation technology to the testing process and to apply disciplined, valid T&E practices in the simulation environment. DTC, the lead tester of Army equipment for nearly 40 years, is continuing development of the VPG to fulfill this requirement. The VPG provides traditional and expanded simulation-based test capabilities in support of streamlined acquisition. It also saves weapons programs significant resources through reduced test-cycle time and cost avoidance associated with test prototypes, retests, ammunition, materials, and labor.

The Virtual Proving Ground provides traditional and expanded simulation-based test capabilities in support of streamlined acquisition.

The VPG consists of comprehensive and interrelated synthetic environments, stimulators, and simulation test procedures operating within a standard architectural framework. The guiding principle of the VPG is to provide the information needed in the most cost-effective manner. In some cases, such as initial operational tests, live assets on real ranges are absolutely necessary; but in other cases, they are not.

Test cost avoidance results when synthetic target environments supplant the need for live targets or ammunition and when synthetic missile-flight environments avoid the need to fire live missiles on a live range. Other cost avoidance results occur when synthetic stimuli accurately simulate the shocks and vibrations experienced in actual operation, when synthetic electromagnetic battlefield environments replace the need for many soldiers to operate radios, and when synthetic test environments are used to plan and rehearse tests to ensure optimized instrumentation placement and operation. In general, M&S significantly reduces program costs and schedule risks and expedites more and better system-performance data because there are fewer hardware prototypes.

Future Of VPG

The VPG is being developed not only to link test centers located across the United States and provide integration between the test centers, but also to establish a large number of reusable test resources that can be shared among test centers. VPG is using the systems-engineering process to design a fully functional simulation-based test capability. The "blueprint" for developing the VPG is based on five components, which are discussed in the following paragraphs.

The first component, VPG tools, consists of various types of test planning, execution, and analysis tools. These include instrumentation models; test planning and rehearsal; data collection and reduction; test visualization; complex-scenario generation; real-time and non-real-time simulation and analysis; systems engineering; test optimization; multilevel security; and verification, validation, and accreditation support tools.

The second component, integrated information systems, comprises the ground truth data contained at each test center, access to external data sources, and data-serving tools. Data standards are based on an integration-level hierarchy, a set of definition standards that correlate data across the command. Data tools are created that give authorized users a Web-based ability to access, view, and analyze all types of data such as numeric, text, audio, and videos.

The third component, the unit under test, includes models of systems, components, and interfaces to live hardware. Here, the VPG primarily uses models developed by customers and interfaces them to the VPG assets. In some cases, the VPG must maintain weapon system models for "virtual testing" and for use in test planning or analysis. The VPG will provide a detailed interface control document to its customers so they will know how to interface their models with the VPG.

The fourth component on the VPG blueprint is common synthetic environments (SEs), the representations of natural and man-made environmental influences on the unit under test. The representation can be any combination of computer-based simulations or physical stimulators, and the unit under test can be any combination of models, hardware, humans, etc. The acceptable representation level of detail required is dependent upon the specific test objectives and test space. The SE includes the input data description of the environment to be represented.

The Virtual Proving Ground provides traditional and expanded test capabilities in the Modeling and Simulaiton domain to support streamlined acquisition.

The final component of the VPG blueprint is the technical architecture—the mechanism that allows all elements of the VPG to communicate effectively using standard mechanisms. The VPG architecture is based on DOD high level architecture (federation object models, simulation object models, and specific or unique instances of a run-time infrastucture), a VPG collaborative test environment, and architecture implementation tools.

Conclusion

VPG is a re-engineering effort that will help DTC implement innovative, effective, and efficient test processes, procedures, and capabilities to support integrated M&S and T&E across the total life cycle of Army materiel systems. The VPG provides traditional and expanded test capabilities in the M&S domain to support streamlined acquisition. It also saves weapon programs significant costs associated with test prototypes, ammunition, materials, and labor. For additional information, see the VPG Web site at **http://vpg.dtc.army.mil** or e-mail **benchd@dtc.army.mil**.

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FUTURE COMBAT SYSTEMS: A BIG IDEA

Ellen M. Purdy

Introduction

Which came first, the chicken or the egg? With Future Combat Systems (FCS), it is also hard to know which comes first. Is it technology driving concept or concept driving technology? In part, the answer to this question lies with Bran Ferren, former Walt Disney Imagineering President for Creative Technology. Ferren, an Army Science Board member, postulated that the Army could use simulation to infuse greater innovation into the process of equipping the soldier. He referred to his concept as the "Big Idea," and suggested that true leap-ahead innovation is not achieved through a requirements process.

Ferren further suggested that there are two kinds of people in the world: Big-Idea people, who think in terms of broad, sweeping concepts; and Requirements people, who are proficient at applying specificity. According to Ferren, innovation tends to come from Big-Idea people, and it is the Requirements people who focus the discipline and ingenuity to bring the Big Idea to fruition. The trick is to bring these two types of people together, and simulation is a way to do it.

The Big-Idea approach is one of having a vision, creating a mock-up (in part through simulation), testing it, then repeating the process to apply lessons learned. This approach is different from starting with a requirements document and building to those requirements; this approach allows requirements to be tested and refined as necessary to achieve the Big Idea.

FCS

FCS is a Big Idea in more ways than one. First, FCS is a Big Idea in that the Army Chief of Staff proposes deploying the capability of a heavy digitized force anywhere in the world within 96 hours. FCS is also a Big Idea because it is executing the approach described above in partnership with the Defense Advanced Research Projects Agency (DARPA). Basically, the DARPA/Army partnership started with a "blank sheet of paper"; there will be no Operational Requirements Document until 2003. This is a dicey proposition because of the difficulty keeping everything in perspective, i.e., which comes first—technology or concept?

The truth of the matter is that both concept and technology are drivers, and the Big-Idea approach enables FCS to exploit both. Through the use of simulation, the Army Training and Doctrine Command (TRADOC) and the four FCS contractor teams are simultaneously exploring different operational concepts and technology mixes. Because of promising new technologies, different force structures, ways of fighting, and mixes of organic and "reachback" capabilities are being considered. On the other hand, technology requirements and developments are being shaped because of the range of missions and environments in which FCS is expected to operate. All of this really means FCS is exploring an extremely large trade space, and simulation is a key enabler.

One reason FCS encompasses such a large trade space is the third Big Idea. FCS is not a single platform but a "system-of-systems"—something else the Army has never really done with this magnitude. Take into account that contractors will conceive, design, and build a system-of-systems, and the scope of the trade space becomes evident. This system-of-systems will be complete with new force structure; doctrine; tactics, techniques, and procedures; some level of embedded training capability; training simulations; and hooks to operate with legacy, joint, and coalition forces. The FCS will face tremendous challenges because of the sheer magnitude of the undertaking and because of the new ground being broken, both in terms of a new way of fighting (i.e., network centric) and the way in which the Army is acquiring FCS.

SMART

One strategy being used in the FCS Program is the Simulation and Modeling for Acquisition, Requirements and Training (SMART) concept. SMART enables the program to address systems development from a cost, schedule, performance, operational effectiveness, and training perspective from the beginning. The FCS Program will make use of a collaborative integrated data environment (IDE) and digital product descriptions (DPDs) to facilitate the simulation needs of various integrated product teams (IPTs) and working groups.

Because of the scope and magnitude of FCS, Program Manager (PM) LTC Marion Van Fosson established several IPTs to address specific aspects of system development ranging from operational considerations, to technical considerations, to systems considerations. These IPTs are comprised of subject matter experts (SMEs) from throughout the Army, including the research, development and engineering centers; HQDA; the Army Corps of Engineers; and the Combined Arms Support Command. PM, FCS also established a Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) Tiger Team to assess proposed network concepts, sensor mixes, and command and control structures.

Relative to DARPA, PM, FCS established an experimentation effort as a means for DARPA to take developing technologies "out for a spin" to determine not only their potential contribution to FCS effectiveness but also their limitations.

The confluence for all these efforts is modeling and simulation (M&S). Simulation needs of the IPTs, the Tiger Team, and DARPA experimentation overlap. Not only do the same tools serve different IPTs and working groups, but output from the analysis and experimentation conducted by one IPT or working group feeds the efforts of the others. The same can be said for the activities of the contractor teams and the FCS TRADOC Systems Manager. Establishment of the collaborative IDE and, in the future, the DPDs, will assist in meeting the needs of the FCS "M&S consumers" in an efficient and cost-effective manner.

Collaboration Environments

To enable these moving parts to work in synchronicity, the FCS Program personnel are working to establish the Future Combat Collaborative Environment (FCCE). FCCE is tailored to address those concerns of M&S consumers and, when the time comes, the test community. For FCS, the FCCE is defined as a loose collection of models and simulations; SMEs both from the M&S perspective as well as the technology and operational perspective; the standards that enable interoperability; the government-furnished mission scenarios and threat representations; and the processes by which verification, validation, and accreditation; M&S ownership and access; and configuration management are executed.

Contractors are encouraged to establish a similar environment to meet their needs: the design, engineering, manufacturing collaborative environment (DEMCE). Because their activities are different from the government (i.e., they actually execute the design, engineering, manufacturing, and technology trades), their M&S tool suite, standards, and processes differ. When the same tools can meet the needs of both FCCE and DEMCE, they are shared between the government and contractor teams. The contractors are encouraged to make use of government-furnished tools, but they are also employing their own tools. When the time comes to evaluate contractor concepts and designs, the objects that comprise the contractor-developed DPD will be imported into a government-furnished environment and exercised using government scenarios, threats, and tools.

At the time of this writing, the FCCE and DEMCE are still works in progress. Initial success has already been achieved as part of the first phase of the program. TRADOC Analysis Centers (TRACs), in conjunction with the IPTs, have worked with contractors to represent and exercise their proposed concepts in the Combined Arms And Support Task Force Evaluation Model (CASTFOREM) and the Joint Army Navy Uniform Simulation (JANUS). The partnering was facilitated by first releasing the tools to the contractors through Memorandums of Agreement that stipulated rules for configuration management, data access, approaches for representing technologies, and C4ISR that were not previously accommodated in the tools. The contractors use the tools to refine their concepts, then bring them to TRAC to ensure required modifications are appropriate and acceptable. These simulation runs provide the government and the contractor teams better understanding of the concepts.

The key to determining what is brought into the collaborative environment is identifying concerns and their associated metrics, designing the analysis or experimentation to resolve those concerns, and "crosswalking" to M&S tools. The crosswalk involves identifying tools that may potentially support the analysis or experimentation and assessing the limitations of the tools to determine what modifications are needed so the tools can be used for the proposed application (as a last resort, new tools will be developed).

Framework

To ensure traceability between analysis and experimentation, a common framework was needed that accounted for the varied perspectives of the IPTs, working groups, etc., and to ensure integration across the advanced concepts and requirements; research, development, and acquisition; and training, exercises, and military operations M&S domains. This framework was borrowed from the work of BG Huba Wass de Czege (USA, Ret.), member of the FCS Senior Advisory Group. In short, combat power is formulated as a function of firepower, maneuverability, and protection—all multiplied by leadership. Each of these elements can then be decomposed to greater levels of resolution. It provides a very effective bookkeeping methodology to account for all the doctrine, organization, training, leader development, materiel and soldiers. Using this framework allows the M&S crosswalk to accommodate a SMART approach. Because combat power is defined not only in terms of technology but also in terms of doctrine, tactics, training proficiency, and leadership, it provides a traceable way of cutting across all the concerns of the three M&S domains.

Conclusion

Just as the Army transformation is about fighting differently with different equipment, the successful fielding of FCS is about conducting combat development and materiel development differently than in the past. The Big Ideas being pursued as part of the FCS effort hold promise that the right changes are taking place to meet the challenge of the Army transformation. With successful fielding of FCS in 2012, the Army will prove it is well on its way to the objective force and that it has the right processes for bringing together the Big-Idea people and the Requirements people. Capturing the synergy between these groups is important because people make Big Ideas happen.

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ACQUISITION SYSTEMS MANAGEMENT CURRICULUM DEVELOPMENT

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Introduction

The success of our Armed Forces in ending the Cold War and winning the Gulf War with new technological advances has changed the face of combat. Our forces now rely on sensors, computers, and other information technology (IT) tools to provide commanders with a clearer, more accurate picture of the battlefield. IT provides the ability to digitally command, locate, position, and move friendly forces. In general, computer-enhanced systems have greatly improved information processing and dissemination. Thus, there is a greater need for expanding this technology to other applicable force components and systems.

Our military leadership recognizes the need to seamlessly integrate these technology systems into a changing force structure and operational perspective. As such, interoperability, training, education, research and development, production, testing, operation, and support issues must be factored into the entire life-cycle development of a system. This requires the ability to establish effective acquisition procedures and processes for developing systems that can be integrated into and operated by each military Service. This will maximize system capabilities and increase strategic, operational, and tactical force performance.

Integrating acquisition processes within our fighting forces is a cultural shift requiring a transformation throughout our military institutions. For example, the Department of Systems Engineering at the U.S. Military Academy (USMA) will contribute to the cultural shift by educating officers in acquisition systems management. This article is devoted to explaining our vision for this course of instruction.

Course Justification

The purpose of the acquisition systems management course is to provide officers with a logical framework from which to understand the acquisition process. Additionally, we will educate officers so they realize that collaboration, in all its forms, is essential to an integrated and digitally dependent force.

Information technology provides the ability to digitally command, locate, position, and move friendly forces.

Analyses of Gulf War processes and technologies, Force XXI experimentation, and Joint Vision 2010 provide evidence of the benefits of modeling and simulation (M&S) and other information and analysis technologies. The capabilities of M&S must be merged across the advanced concepts and requirements; training, exercises, and military operations; and research, development, and acquisition domains. This will go a long way in transforming the force in an efficient and systematic manner. However, this transformation requires a cultural change in the way the Army thinks and implements its acquisition processes.

One element necessary to achieve this cultural change is education, which—via an acquisition systems management course—will target officers at the outset of their careers. Furthermore, this course could potentially be expanded, refined, updated, and presented at critical stages throughout an officer's career. The course will exploit and teach concepts supported by the Simulation Based Acquisition and Simulation and Modeling for Acquisition, Requirements and Training efforts. These concepts include the following:

- Encouraging cross-domain collaboration such as sharing of data;

results; and operational, procedural, and process information;

• Fostering effective and efficient stewardship of resources;

• Using M&S tools and techniques designed to identify and help resolve system life-cycle issues;

• Promoting horizontal technology integration (HTI) such as hardware systems (sensors, sites, weapons, etc.), IT, and software; and

• Developing an environment of innovation, knowledge creation, information sharing, and trust.

Moreover, for the acquisition systems management course to be relevant, it must be founded on universal concepts related to acquisition management and business procurement. Ultimately, the curriculum for the acquisition systems management course will focus on providing a holistic and systematic understanding of the acquisition process. The Department of Systems Engineering will accomplish this by institutionalizing overarching acquisition concepts and principles in its courses. Thus far, the following concepts have been identified as key and essential acquisition education principles:

• *Systems Theory.* Acquisition management is the process used to produce systems. Thus, the developed methodology uses a systems perspective to evaluate and manage acquisition projects. Systems theory will form the logical foundation for providing the requisite understanding and tools to develop strategy for managing and leading large-scale complex acquisition projects.

• *Program And Project Management.* Understanding and applying the fundamental tools and techniques of program and project management is a clear requirement. The course will teach program management philosophies to provide cadets with the principles, concepts, and methods necessary to manage complex programs and projects from a systems perspective. Likewise, the course will allow cadets to conceptually design, plan, and evaluate real-world acquisition projects. This will help in developing their ability to assess and resolve human, technical, and administrative acquisition issues in an acquisition systems management project.

• *Acquisition Life Cycle.* The course will take the many life-cycle processes and synthesize them into a coherent and integrated methodology.

There are four major phases in the acquisition life-cycle process. The first phase is the need statement or requirement. The need is the rough identification of a problem that requires a solution. The second phase is requirement generation and problem restatement. In this phase, the requirement is developed, evaluated, and refined. The feasibility of the requirement is examined, current and future capabilities to meet the requirement are considered, concept of exploration is planned, and the problem is restated to fit in the realm of the possible.

Concept exploration is the third phase, which compares competing alternatives with established criteria, ultimately resulting in a selection of a particular alternative. The fourth phase is application of the alternative. In this phase, the alternative is used for a period of time and then retired.

As the systems acquisition life cycle progresses, mature technology and innovative ideas may emerge for use in other acquisition projects or programs. These ideas and technologies often result in hardware, software, or process and procedure solutions.

• *Innovation And Core Rigidities.* Innovation is an important aspect of all technology-based organizations and must be encouraged.

Core rigidities refer to the impediments and intransigence within an organization that must be overcome to unbridle learning and knowledge creation. Learning new skills that may be vastly different from past skills sometimes causes a sense of uneasiness and uncertainty. Also, learning new roles and behaviors can be difficult, intimidating, and a barrier to change. Ultimately, managers need to unlearn outmoded ways of thinking and use new approaches to achieve innovation and knowledge creation. The acquisition systems management course will explore methods to mitigate and manage organizational rigidities while enabling innovation and a knowledge-creating atmosphere.

Conclusion

The learning environment for an acquisition systems management course at the USMA will be based on use of concepts such as systems theory, HTI, project management, M&S, the acquisition life-cycle process, and innovation and core rigidities. This approach will ultimately contribute to developing leaders who are intellectually capable and professionally motivated to meet the challenges of the Army's future acquisition process.

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FLOYD AND WALLY'S OPERATIONAL TEST AND EVALUATION TOP 10 LESSONS LEARNED

LTC Floyd B. Smith Jr.
and LTC Wally Tubell

Introduction

Using the knowledge acquired from our direct and indirect experiences in operational tests and evaluations (OT&Es) during the last 2 years, we would like to share some hard-won lessons learned. Although every acquisition program is unique, one common thread running through all of them is the operational evaluation and associated developmental and/or operational testing. Both combat developers and program managers (PMs) can benefit from some of these lessons.

Requirements

As the old saying goes, "first things first." We see several common problems with requirement documents. First and foremost, be careful what you wish for because the T&E community will test and evaluate to your standard. This implication is particularly critical in the area of survivability, described later in this article. Second, why would the user wish to require something that the PM, for whatever reason, cannot deliver? For example, why require a nondevelopmental item system to survive an electromagnetic pulse if the PM cannot afford to harden the system?

Finally, document your requirements clearly, concisely, and in measurable terms. We know this may be difficult in today's environment of performance specifications. However, the Army Test and Evaluation Command (ATEC) member of the PM's Test Integrated Product Team can provide valuable assistance with this.

Documentation

Despite the impact of recent acquisition streamlining, T&E remains a document-intense field. The main documents needed from the Army Training and Doctrine Command are the Operational Requirements Document (ORD), Critical Operational Issues and Criteria (COIC), Operational Mode Summary/Mission Profile (OMS/MP), and the Failure Definition and Scoring Criteria (FDSC). The ORD, COIC, and FDSC are essentially the rulebooks for all testing. These documents are the basis for the System Evaluation Plan (SEP) and the various test plans developed to meet the SEP's requirements. The OMS/MP guides the Army Operational Test Command's (OTC's) test planning for shaping the operational environment. The PM's T&E Master Plan documents the general concepts for all aspects of testing. Combat and materiel developers are encouraged to frequently consult with their ATEC System Team (AST) representatives when preparing or modifying these documents.

Schedule Planning

All programs inevitably have unforeseen problems that cause schedule and performance trade-offs. Philip E. Coyle III, former Director of OT&E in the Office of the Secretary of Defense, recently addressed this concern in his article in the November-December 2000 issue of *Program Manager*. Coyle said, "… Nevertheless, acquisition programs are taking more risk, and it is showing up in operational testing. … The greatest current concern of the Service Operational Test Agencies is the so-called *rush to failure*. …" How should a PM best plan to mitigate this risk? Lay your schedule out realistically and include ATEC in the process of costing out and scheduling the various test events. We also recommend an early-on operational test or assessment prior to the Initial OT&E (IOT&E).

DT Versus OT

Many PMs believe that their developmental testing (DT) plan can provide all or most of the information required for the independent operational evaluation. We absolutely disagree. DT and operational testing (OT) are not different ways of obtaining the same results; rather, they complement one another. In our experience, regardless of the scope of the developmental test, every operational test uncovers something not found in DT. We recommend rigorous, thorough DT with all (or as much as possible) nondestructive testing completed prior to beginning OT. The scope of OT focuses on the user's COIC.

Logistics

The two activities that normally suffer the most from program delays are logistics and OT. Because OT relies so heavily on the logistics activities of developing training, manuals, and system support, the best way to mitigate risk in OT is to have a strong logistics program. We highly recommend completion of the log demo prior to the IOT&E and having final draft-quality manuals delivered to the OTC at least 4 months prior to the start of testing for use in test planning.

OT Execution

Although most PMs are highly anxious about OT, they underestimate the pre-OT effort required to conduct a successful operational test. All test articles and support items should arrive at the OT site a minimum of 1 week prior to test training. PMs should use this week to ensure the test articles are in prime condition. All manuals, spare parts, and training aids should be present and serviceable. Remember that the soldiers you train will take their first impressions with them, regardless of how well your system performs. Your representative during this week should be a technician or engineer with a toolbox and a credit card who is not afraid to get his or her hands dirty!

Once the test begins, we recommend that PMs and combat developers maintain a representative at the test site to troubleshoot any problems the OTC test officer may encounter. We can provide office space with phone and Internet access in our test headquarters. This allows us to have ready access to your troubleshooter, and allows you to remain in close contact during the test.

If you have a solid new equipment training plan, your system has completed a rigorous developmental test, and your manuals and system support are in place, then leave the test execution to OTC and relax. You are best served by remaining a step removed and not taking the first reports at face value. Once the test ends, you will have your chance to discuss and dispute the test findings with the evaluator and test officer during the data authentication group and reliability, availability, and maintainability scoring conference.

System Operational Employment

To effectively evaluate a system's performance, the evaluator must understand the system's operational mode of employment. Both combat developers and PMs, in their haste to meet cost schedule and performance requirements, provide numerous program-review briefings and system-information papers to AST members. Each AST member is responsible for understanding the operational employment of the system. Failure to do so may result in a poorly written SEP or, even worse, development of an ineffective SEP—the guidebook for the system evaluation. Combat developers and PMs should work with the AST to ensure understanding of how the system will be employed on the battlefield. As an IPT, we are able to design a better plan that will evaluate the right performance requirements and reflect a clear picture of the system's capability.

SEP

As stated previously, the SEP defines our plan for T&E of a given system. It has been our experience in writing and implementing SEPs that, during the course of the program, significant requirement or system-employment changes occur. Depending on when these changes occur, they are often not reflected in the SEP. We recommend that combat developers not change ORD requirements after the SEP is approved, or within 90 days of starting IOT&E.

With few exceptions, changes to the SEP must be discussed, coordinated, and approved before going into the IOT&E. Failure to update the SEP when significant changes occur often results in T&E requirements that are no longer valid, poorly planned additional test requirements hastily added to the SEP, and costly and time-consuming retest. We highly recommend that the materiel developer, combat developer, and the AST continuously monitor significant changes affecting the system through frequent and open communication during IPT meetings.

System Evaluation Report (SER)

The SER is an acquisition tool used by the PM and the user as a guide to improve system performance in areas such as effectiveness, suitability, and survivability, which were either marginal or not met during the IOT&E. Unfortunately, many PMs view the SER as a pass/fail or go/no-go report for their respective systems. This is not the case from the standpoint of the AST. The AST, in coordination with the PM and user, reviews all data collected from T&E events and simulations as well as the results from the IOT&E. The group meets, reviews, and authenticates the data.

The AST develops the SER using agreed-upon data. There are no secrets regarding how well or how poorly the system performed. As Detective Joe Friday of the TV program *Dragnet* frequently said, "The facts and only the facts ma'am," is what we present in the SER.

Another issue related to the SER is the Emerging Results Brief (ERB). Many PMs request an ERB based on their schedule, which has usually slipped to the right. ATEC will make every effort to accommodate the PM. However, release of emerging evaluation results is the ATEC commanding general's call and is done on a case-by-case basis. Our experience has shown that routinely providing an ERB is counterproductive to good and timely analysis and completion of the SER. PMs, please keep this in mind when requesting an ERB.

Materiel Release

Many systems are not ready for full materiel release to the Army. A conditional materiel release (CMR) is becoming the norm rather than the exception. Full release of a system requires that it be Type Classified-Standard, safe to operate, operationally effective, and logistically supportable. More and more often, our SERs are reflecting that many systems are not meeting the COIC.

An area of particular concern that results in many CMRs is survivability requirements. The specific areas of survivability that continue to require weapon systems be granted a CMR are high altitude electromagnetic pulse, electromagnetic environmental effects, and chemical contamination/decontamination survivability. DOD 5000.2-R states "Unless waived by the MDA [milestone decision authority], mission critical systems regardless of their ACAT [acquisition category], shall be survivable to the threat levels anticipated in the operating environment." Ineffective T&E of these areas and MDA waivers continue to occur more and more frequently.

We recommend that PMs review the number of CMRs granted, the subsequent cost to their programs to implement get-well plans, and take appropriate action to ensure that the number of CMRs do not increase.

Conclusion

The PM, and the acquisition community as a whole, do a great job of ensuring that we field operationally effective, suitable, and survivable equipment to the warfighter. Remember, we are not in the pass/fail business. Our job is to give decisionmakers, developers, and users a clear picture of what a system can and cannot do.

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LTG Paul J. Kern and ACMA of the Year Glenn Buttrey

LTG Paul J. Kern and ACM of the Year Christi Steiner

Spotlight On Supervisors . . .

ARMY ACQUISITION CAREER MANAGEMENT WORKSHOP 2001

Sandra R. Marks

Introduction

The role of the supervisor is critical in the development and success of tomorrow's leaders. To further understand this issue and how supervisors will influence the composition of the future acquisition workforce, more than 150 members of the Army Acquisition and Technology Workforce (A&TWF) convened at the annual Army Acquisition Career Management Workshop in Austin, TX, Jan. 9-12, 2001. Through a series of interactive workshops, attendees learned how supervisors play a key role in helping employees manage their acquisition careers.

In separate pre-workshop sessions, Acquisition Career Managers (ACMs) and Acquisition Career Management Advocates (ACMAs) addressed new career-development initiatives and pending changes to institute them.

The workshop formally convened with a keynote address by LTG Paul J. Kern, Army Acquisition Corps Director. Kern addressed the importance of supporting the transformation of the Army and the need to commit to develop future leaders. Noting the anticipated high rate of attrition within the Army A&TWF in the next 5 years, Kern emphasized that career development not be viewed as something just for ourselves but as something we do for all the people we work with, especially younger workforce members. Kern stressed that supervisors and their subordinates achieve Level III certification in their single career field. He also called on managers and supervisors to take cross-functional training and acquire the skills to stay current through continuous learning.

Kern concluded by recognizing ACMA of the Year Glenn Buttrey and ACM of the Year Christi Steiner. Buttrey is the Director, Business Management/ACMA in the Program Executive Office, Aviation at Redstone Arsenal, AL. Steiner serves at Rock Island, IL.

ACMO Director COL Frank C. Davis III

AAC Update

Following the awards ceremony, COL Frank C. Davis III, Director of the Acquisition Career Management Office (ACMO); Sandy Long, then Acting ACMO Deputy Director; and COL Rob Reyenga, Chief of the Acquisition Management Branch (AMB) at the U.S. Total Army Personnel Command (PERSCOM), engaged in an interactive discourse with the audience to assess recent changes in the Army Acquisition Corps (AAC). Davis began by reviewing issues related to downsizing, missions, readiness, morale, the aging workforce, and training. He noted that despite progress during the past 25 years, much work remains to be done on these same issues. Davis emphasized the need for innovative approaches to deal with these challenges.

Reyenga called on the workforce to help develop long-range plans for acquisition career management. Some recent changes he cited were placement of ACMs in the field, new management personnel, and new education and training opportunities. He added that these changes all support the AAC vision, and we need to ensure we have the right programs and people in place to continue supporting it. In addition to having systems in place to fill current jobs, we need systems to develop future leaders, he concluded.

To assess the conferees' responses to current policies, procedures, and programs, Long opened the floor for comments and questions. She also stated that some of the ACMO's objectives are to simplify the career development model, refine education and training programs, better inform career managers and define their roles, educate supervisors, and increase understanding of the career development model. She added that the ACMO will use information from the workshop to achieve these objectives, develop new initiatives, and review individual development plans (IDPs) and acquisition career record briefs (ACRBs).

Specialized Workshops

Five select interactive workshops were conducted, each focusing on a different aspect of enhancing career development. Each workshop is highlighted below.

Senior Rater Potential Evaluation (SRPE) Seminar. This workshop, developed by the Office of Personnel Management, focused on the importance of writing narratives that address potential, not performance. Senior raters use SRPEs for that purpose to identify future AAC military and civilian leaders. Sharon Senecal, a Management Training Consultant with 32 years of federal government service, and Edward Vela Jr., a retired Senior Executive Service employee with more than 15 years of federal government service, provided a number of hands-on exercises that showcased the language and process necessary in writing quality senior rater comments. For example, one of the lessons learned from these exercises is that senior raters should keep

Then Acting ACMO Deputy Director Sandy Long

notes throughout the rating period on those they evaluate. Senior raters were also advised to write in the active voice, avoid generalities, make statements quantifiable, make specific recommendations for the next assignment, and be results-driven.

DAU-IDP/CL (Defense Acquisition University-Individual Development Plan/Continuous Learning) Demonstration. Randy Williams, ACMO Education and Training Specialist, and Brent Lesko, Programmer Analyst at the U.S. Army Research, Development and Acquisition Information Systems Activity (RDAISA), presented an overview on the Career Acquisition Personnel & Position Management Information System (CAPPMIS). The CAPPMIS Web site is an integrated suite of tools and information to help acquisition workforce members, ACMs, the ACMO, and the Army Acquisition Executive Support Agency better manage and serve the A&TWF. The Web site provides access to IDPs, CL policy, and DAU listings. More timely and efficient approval/disapproval of courses and awarding of CL points are now possible using the IDP portion of the CAPPMIS Web site.

Position Management. Peggy Mattei, then Chief of the ACMO's Information Management Team, stated that the objectives of the position management process are to store, maintain, and accurately report acquisition position data. In support of the Director for Acquisition Career Management, the position management process also entails the validation of positions to ensure that they meet the definition of acquisition and are subsequently assigned acquisition position list (APL) numbers. Supervisors, Mattei said, play a key role in position management efforts. They ensure that employee positions are coded "acquisition" if they involve acquisition duties, keep APL command points of contact informed of position changes, and advise employees regarding help on their ACRBs.

PERSCOM AMB Chief COL Rob Reyenga

The position management process, said Mattei, is currently undergoing an extensive review by an integrated product team (IPT), which seeks to improve the acquisition position request and validation/approval process. Preliminary recommendations emerging from the IPT point to position management as a continuous process. Significant changes could include an open request process where positions are reviewed and approved as they are submitted, thus abolishing the annual review cycle and board.

Workforce Of The Future. Steve Tkac, Army representative on the Acquisition 2005 Task Force, summarized the findings of that task force, which termed workforce downsizing and serious skills imbalances the causes of a "national security crisis." Tkac said that human resource strategic planning is the key enabler of change and the cornerstone for other initiatives. As such, employees must be viewed as assets, and recruitment and development treated as an investment rather than a cost. Some of the key proposals of the task force are to implement human resource performance plans, reinvigorate recruitment programs, develop multidisciplinary acquisition professionals, and prepare more individuals for key leadership roles.

Peggy Mattei, then Chief of the ACMO's Information Management Team

Edward Vela Jr.

Sharon Senecal

MAJ Cris Boyd, ACMO FA 51R Proponency Officer

Ken Winters, ACM, PERSCOM

The Basics of Acquisition Career Management. Mary Berg, then ACM, National Capital Region, and Ken Winters, ACM, PERSCOM, presented a briefing on what supervisors should know to help individuals achieve their career goals. ACMs play a vital role in educating supervisors about the acquisition career development plan and the career management process. Berg and Winters also outlined the documents that supervisors and ACMs help subordinates update. They concluded by summarizing the board application and review process and the supervisor's role in assisting their subordinates through it.

Luncheon Briefings

The ACE Program. Sandy Long presented a luncheon briefing on the Acquisition Career Experience (ACE) Program. This 2-year paid intern summer employment program, Long says, is an opportunity for the AAC to recruit exceptional college students with multidisciplined backgrounds. She presented an overview of the program, including timelines, specific opportunities, program benefits, and eligibility requirements. By getting college students to work with us, Long said, the interns can learn about Army acquisition, get involved in the kind of work we do, and hopefully be retained for the long term.

Lessons Learned Effort. A second luncheon briefing by MAJ Cris Boyd, the Functional Area (FA) 51R Proponency Officer in the ACMO, addressed the establishment of the acquisition branch at the Center for Army Lessons Learned (CALL). This branch will serve as a virtual information resource, allowing acquisition professionals to share knowledge by collecting, analyzing, and disseminating lessons learned, best practices, success stories, and relevant research findings. In addition, Boyd detailed an initiative for using current CALL practices to conduct a lessons learned effort for the Brigade Combat Team.

Final Session

The workshop concluded with an address by Keith Charles, Acting Director, Acquisition Education, Training, and Career Development, Office of the Deputy Under Secretary of Defense for Acquisition Reform. Charles is also the Acquisition 2005 Task Force Director. His presentation focused on the future acquisition workforce and the need to "grow" leaders. A number of recruiting, compensation, retention/attrition, career development, and motivational efforts are ongoing, Charles said. These efforts, he noted, will encourage development of an acquisition workforce capable of coping with 21st century issues such as the current aging workforce. Additionally, Charles said, individuals must broaden their business knowledge, gain multifunctional expertise, learn to delegate, and take on more varied opportunities.

In closing remarks, Sandy Long termed the workshop a "great success" because its emphasis on the supervisor's role in the career development process brought to light the critical need to develop future acquisition leaders.

SANDRA R. MARKS, an employee of Science Applications International Corp., provides contract support to the Army AL&T magazine staff. She has a B.S. in journalism from the University of Maryland, College Park.

22ND ARMY SCIENCE CONFERENCE FEATURES R&D ACHIEVEMENT AWARDS AND BEST PAPERS AWARDS

Pearl Gendason

Introduction

More than 450 people from government, industry, and academia attended the 22nd Army Science Conference (ASC), Dec. 11-13, 2000, in Baltimore, MD. Opening remarks were presented by then Assistant Secretary of the Army for Acquisition, Logistics and Technology (ASAALT) Paul J. Hoeper, who was also the conference sponsor, and Secretary of the Army Louis Caldera. The conference focused on what science and technology (S&T) can do for the soldier of the future. Since 1957, this biennial event has served as a forum for the discussion and recognition of significant accomplishments that are considered highly beneficial to the Army's mission.

Program Theme

This year's conference theme was "Accelerating the Pace of the Transformation to the Objective Force." The agenda was developed by the Executive Steering Committee, chaired by Dr. Walter F. Morrison Jr., Director for Research and Laboratory Management, Office of the ASAALT (OASAALT), and the Technical Program Committee (TPC), chaired by Dr. Walter Bryzik, U.S. Army Tank-automotive and Armaments Command. The TPC selected 50 technical papers and 84 poster papers that presented the technical work being done for the soldier of the future.

Keynote addresses delivered by Dr. Hans Mark, Director of Defense Research and Engineering, and MG Robert Scales (USA, Ret.) challenged the audience to think about the future from a fresh perspective. This set the stage for a panel discussion on "The Role of Technology in the Transformation to the Objective Force." Panelists included Edwin Mazzanti, U.S. Army Training and Doctrine Command; Dr. A. Michael Andrews II, Deputy Assistant Secretary of the Army for Research and Technology, OASAALT; Dr. Jane Alexander, Defense Advanced Research Projects Agency; and Dr. William Forster, Chairman of the Board on Army Science and Technology.

R&D Achievement Awards

One of the conference highlights was presentation of Army Research and Development (R&D) Achievement Awards for accomplishments during 2000. LTG Paul J. Kern, Military Deputy to the ASAALT, presented the awards to 52 Department of the Army researchers. These awards recognize scientific or engineering achievements that materially improve the Army's technical capability, contribute to the national welfare, and acknowledge scientific or engineering leadership that significantly advances the state of a technology. Each major Army command annually nominates personnel who have conducted innovative and outstanding R&D efforts. Both individuals and small groups are eligible for consideration. The evaluation panel is chaired by the Director for Research and Laboratory Management, OASAALT, and consists of leading experts in the Army S&T community. Listed by the major Army command and activity where they are employed, the recipients of Army R&D Achievement Awards are as follows:

U.S. ARMY MATERIEL COMMAND

U.S. Army Research Laboratory (ARL)
Dale R. Shires
Dr. Andrew Mark
Dr. Shawn M. Walsh
Dr. Ray Yin
Dr. James M. Sands
Dr. Bruce K. Fink
Dr. Steven H. McKnight
John A. Escarsega
Kestutis G. Chesonis
Dr. Dawn M. Crawford
Dr. Jeffrey L. Duncan

U.S. Army Edgewood Chemical Biological Center (ECBC)
Dr. H. Dupont Durst
Dr. Richard R. Smardzewski
David W. Sickenberger
Felix L. Reyes
J. Michael Cress
Karen L. Vado

Bruce W. Jezek
Patrick L. Berry

U.S. Army Communications-Electronics Command Research, Development and Engineering Center (CERDEC)
Steven R. Goodall

U.S. Army Armament Research, Development and Engineering Center (ARDEC)
Dr. Ernest L. Baker
Arthur S. Daniels
Joseph Orosz
Dr. Sury Iyer
Nathaniel Gelber
Dr. C. Rao Surapaneni
Dr. Paul Cote
Dr. Gay Kendall
Mark Todaro
Edward J. Hyland
Richard W. Tortorici
Edward Troiano

U.S. Army Natick Soldier Center
Dr. Carolyn K. Bensel
Dr. Lynne A. Samuelson

U.S. Army Aviation and Missile Research, Development and Engineering Center (AMRDEC)
Jon C. Shuck
Roswell Nourse
James C. Kirsch
Alfred M. Wright
William D. Washington
Milton E. Vaughn
Elizabeth Collier
Thomas H. Maier
Robert J. Shively

U.S. ARMY MEDICAL COMMAND

U.S. Army Medical Research Institute for Chemical Defense (AMRICD)
CPT Stephen T. Hobson

U.S. ARMY CORPS OF ENGINEERS

U.S. Army Engineer Research and Development Center
Dr. David Horner
Wendell Gray

LTG Paul J. Kern presents a silver medallion and certificate to Dr. Charles M. Bowden, winner of the 2000 Paul A. Siple Memorial Award. Dr. A. Michael Andrews (third from left) and Dr. Walter F. Morrison Jr. participated in the award ceremony.

Jody Priddy
Michael E. George
William M. Hossley
Pamela G. Kinnebrew
Dr. Stephen W. Maloney
Dr. Neal E. Adrian

Best Papers Awards

The 22nd ASC culminated with the Best Papers Awards Luncheon, which honored the authors of those technical papers representing the best in Army research. Hosted by LTG Kern, the luncheon featured a keynote address by Dr. Neil Gershenfeld, Massachusetts Institute of Technology Media Lab, on "Things That Think." The following 17 papers, which were selected for honorable mention, earned the authors certificates of achievement and a $500 cash award:

"Novel Elastomeric Membrane for Soldier Protective Clothing" by Dr. Dawn M. Crawford, ARL; and co-authored by Dr. James M. Sloan, Dr. Nora C. Beck Tan, and Gene Napadensky, ARL; and Quoc Truong of the U.S. Army Natick Soldier Center.

"The Elimination of Hazardous Chemicals in the Preparation of High Performance Transparent Armor for Soldier Protection" by Dr. Douglas J. Kiserow, ARL; and co-authored by Dr. George W. Roberts, North Carolina State University; and Drs. Stephen M. Gross and Joseph M. DeSimone, University of North Carolina.

"Development of Advanced Interband Cascade Lasers for IRCM Applications" by Dr. John L. Bradshaw, ARL; and co-authored by Dr. John D. Bruno and John T. Pham, ARL; and Drs. Donald E. Wortman and Rui Q. Yang, Maxion Technologies Inc.

"Force Detected Magnetic Resonance of CaF_2 and GaAs" by Dr. Kent Thurber, ARL; and co-authored by Drs. Doran D. Smith and John A. Marohn, ARL; Dr. Lee Harrell, U.S. Military Academy (USMA); and Dr. Raul Fainchtein, Johns Hopkins University.

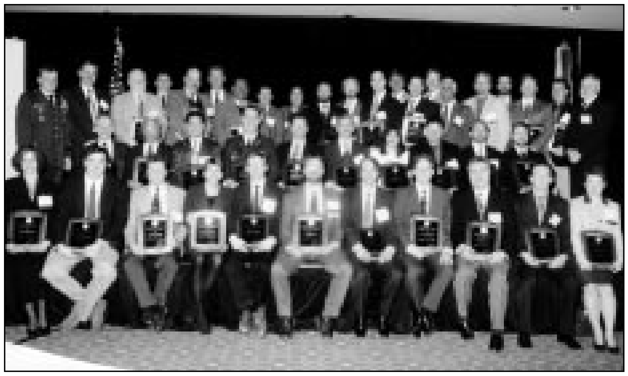
"Formulation of a Free Jet Shear Layer Ignition Model for Application to Direct Injection Diesel Engines" by Dr. Peter Schihl, ARDEC; and co-authored by Dr. Walter Bryzik and John Tasdemiroglu, ARDEC.

"Rarefaction Wave Gun Propulsion" by Dr. Eric Kathe, ARDEC; and co-authored by Dr. Robert Dillon, Dr. Sam Sopok, and Mark Witherell, Benét Laboratories; and Stewart Dunn and Douglas Coats, Software Engineering Associates Inc.

"Control of Nerve Agent-Induced Seizures Is Critical for Neuroprotection and Survival" by Dr. Tsung-Ming A. Shih, AMRICD; and co-authored by Drs. Steven M. Duniho and John H. McDonough, AMRICD.

"Mission Rehearsal in Virtual Places" by Dr. Bob G. Witmer, U.S. Army Research Institute for the Behavioral and Social Sciences; and co-authored by Dr. Wallace J. Sadowski, University of Central Florida; and Dr. Neal M. Finkelstein, U.S. Army Simulation, Training, and Instrumentation Command.

"Isolation of an RDX-Degrading Acetogenic Bacterium from a Mixed Culture that Degrades TNT, RDX, and



Some of the Army R&D Achievement Awards recipients are shown with LTG Paul J. Kern (back row far left), Dr. A. Michael Andrews (back row second from left), and Dr. Walter F. Morrison Jr. (back row far right).

HMX Under Anaerobic Conditions" by Dr. Neal R. Adrian and co-authored by Clint M. Arnett, U.S. Army Engineer R&D Center.

"Broad Bandwidth Lidar for Standoff Bioaersol Size Distribution Determination" by Dr. James B. Gillespie, ARL; and co-authored by Drs. David L. Ligon, Paul M. Pellegrino, and Nicholas F. Fell Jr., ARL.

"Degradation of Components of Mustard Agent Filled Assembled Chemical Weapons in Laboratory and Pilot Scale Immobilized Cell Bioreactors" by Mark A. Guelta, ECBC; and co-authored by Dr. Joseph J. DeFrank and Nancy A. Chester, ECBC; and Dr. Steven Lupton and Mark Koch, Honeywell International.

"Navier-Stokes Computations of Finned Missiles at Supersonic Speeds" by Dr. David J. Haroldsen, USMA, and co-authored by Dr. Walter B. Sturek Sr., ARL.

"Coupled Macro-Micro Nonlinear Transient Asymptotic Expansion Homogenization Method on Scalable Computers for Heterogeneous Structures" by Dr. Raju R. Namburu, ARL, and co-authored by Drs. Peter W. Chung and Rama R. Valisetty, ARL.

"From Theoretical Equations to Practical Army Applications: The High Performance of Polymer Electrolyte Membrane Fuel Cells for Individual Soldier and Future Combat System Applications" by Dr. Deryn Chu, ARL; and co-authored by Dr. Rongzhong Jiang and Charles Walker, ARL; and Kris Gardner, Richard Jacobs, and James Stephens, CERDEC.

"Human Performance Issues in Battlefield Visualization" by Michael J. Barnes, ARL; and co-authored by Dr. Linda G. Pierce, ARL; Dr. Christopher D. Wickens, University of Illinois; Dr. Mary T. Dzindolet, Cameron University; and Dr. Jerzy W. Rozenblit, University of Arizona.

"Dual-Band FLIR ATR - Status and Value to FCS" by Dr. Lipchen Alex Chan, ARL, and co-authored by Drs. Nasser M. Nasrabadi and Sandor Z. Der, ARL.

"Using Magnetic Sensors in the Battlefield as Unattended Ground Sensors" by Dr. Alan S. Edelstein, ARL, and co-authored by Jonathon E. Fine, David M. Hull, Dr. L. D. Flippen Jr., Dr. N. Gokemeijer, and Dr. Greg A. Fischer, ARL.

Scientific peers judged three papers as representative of the Army's highest quality research. Authors of two of these papers received bronze medallions and certificates of achievement and will share a $1,000 cash award. The authors of the paper judged to be the overall best in Army research received the Paul A. Siple Memorial Award, silver medallions, and shared a cash award of $2,500.

The first bronze medallion was awarded to Dr. Donald T. Resio, U.S. Army Engineer R&D Center, for "The Development of a Rapidly Installed Breakwater for Force Projection." Co-authors are Drs. Jimmy E. Fowler and Jeffrey A. Melby, U.S. Army Engineer R&D Center.

The second bronze medallion was awarded to Dr. Kevin P. O'Connell, ECBC, for "Recombinant Antibodies for the Detection of Bacteriophage MS2 and Ovalbumin." Co-authors are Drs. Peter A. Emanuel, Akbar S. Khan, and James J. Valdes, ECBC; Drs. Timothy J. Stinchcombe and Robert Shopes, Tera Biotechnology Corp.; and Drs. Maha Khalil and Mohyee E. Eldefrawi, University of Maryland.

The winner of the 2000 Paul A. Siple Memorial Award was Dr. Charles M. Bowden, AMRDEC, for "Long-Range Propagation of Intense Ultra-Short Laser Pulses in Air." The co-author is Dr. Neset Akozbek, AMRDEC.

Conclusion

The 22nd Army Science Conference was a tremendous success as a result of the dedicated effort put forth by the planners, presenters, and session chairs; HQ AMC (the military host); and the substantive support provided by ARL.

PEARL GENDASON was the Conference Manager for the 22nd Army Science Conference. She is a Physical Scientist in the Office of the Director, ARL. She has a B.S. degree in chemistry from Temple University and an M.B.A. from the University of Baltimore.

FIELD PACK-UP UNITS PROVIDE INCREASED MOBILITY

Natalia Chujko

Introduction

The next time you visit your local automobile supply store, take a look at the amount of stocked parts. Now, put yourself in the shoes of the manager when he or she is told that to maintain their customer base, they must be prepared to move when the customers do. This could involve frequent moves of 30 miles or more in 1 day. Similarly, imagine the problems service managers of automobile repair shops and local electronic repair shops encounter in trying to keep up with these customers who move far and frequently.

For Army maintenance units, the problem of having long and frequent moves is not suppositional. If units are to remain operational, logistics support (including maintenance and supply of spare parts) must be in sync with the operational movement. Army maintenance units were designed and equipped to meet this challenge. They have repeatedly demonstrated their ability to move, and they will maintain this capability in the future. This article describes a new system that can make the job of moving easier. It has the capability to help Army maintenance units move more rapidly and more efficiently while requiring fewer vehicles. This system is not a breakthrough in technology. It represents the ability of a number of people to review a problem, imagine new ways to use available resources, and to get the job done.

Mobile Warehouses

This system started as the Field Pack-up Unit (FPU)-20, which consists of a 20-foot side-loading International Organization for Standardization (ISO) container, customized storage modules, and palletized loading system (PLS) flat racks. BG Claude Christianson, former Deputy Commanding General, 21st Theater Support Command (TSC), had the initial idea of using ISO containers as "mobile warehouses" for European theater operations. He tasked the Army Materiel Command Field Assistance in Science and Technology (AMC-FAST) Science Advisor to determine the feasibility of the mobile-warehouse concept.

During the feasibility analysis, it was discovered that two 20-foot ISO containers would fit onto one PLS flat-rack system, resulting in much more storage capability than the system available at the time (which used M129 vans). PLS flat racks could be made available, and there was a strong possibility that the combination of ISO containers and PLS flat racks would provide an efficient mobile-warehouse system.

Investigation of Army and Air Force use of ISO containers determined shortcomings each Service had encountered such as poor accessibility to items stored, shifting of cargo in transit, breaking of door handles and tie-downs, and vulnerability to theft. The investigation concluded that although the standard 20-foot ISO containers could potentially serve as mobile warehouses, an efficient system would require modifications to the basic container.

Modifications

The first problem to be addressed was accessibility. Army maintenance units, like their civilian counterparts, cannot spare the time to shift around stock to locate an item stored behind others. Using a storage area with a broad front and shallow depth could alleviate this problem. A side-loading ISO container would provide the broad front and shallow-depth solution.

A search of commercial off-the-shelf equipment identified a unique 20-foot side-loading ISO container developed by Boh Environmental LLC, New Orleans, LA. This container design would solve the accessibility problem. Additionally, to address the problem of shifting and movement of cargo in transit, Boh LLC proposed construction of customized storage modules.

A 20-foot side-loading ISO container

AMC FAST Project

A Project Summary Sheet (PSS) was submitted to AMC-FAST requesting that the FPU be established as an AMC-FAST project. The PSS described the need and identified the field proponent, potential solution, and expected results. This led to initiation of AMC-FAST Project No. 1000.

Once the project was approved, a technical team convened to define the mission-area requirements, critical-design features, and evaluation criteria. The key performance features defined for the system included reducing the class 9 (repair parts) authorized stockage list (ASL) footprint, allowing accessibility from both sides, and reducing preparation time for deployment.

The requirements for FPU prototype concept evaluation were submitted to Boh LLC, which constructed a prototype unit made of 16-gauge steel. The unit was equipped with unique hidden-hinge doors with locks and customized storage modules. The prototype underwent extensive American Bureau of Shipping testing to confirm structural integrity. In fact, tests showed that the units could be stacked nine high.

The container was shipped, via C-5 aircraft, by the Air Mobility Command to Ramstein Air Base, Germany, and delivered to the 512th Maintenance Company at Spinelli Barracks, Manheim, Germany. There, a member of the contractor's product integration team provided a training session to the 512th Maintenance Company's Supply Support Activity (SSA) personnel.

Prototype Evaluation

The 512th Maintenance SSA was then ready to evaluate the prototype unit. The 3-month evaluation, which was designed to take place both in garrison and in the field, had the following objectives:

- To upload 70 percent of the target ASL into an FPU-20 equipped with 10 storage modules,
- To maximize storage space for the Class 9 ASL,
- To compare effectiveness of FPU with the current system,
- To make packing and deploying easier and less time consuming,
- To determine compatibility of FPU-20 with the PLS/materiel handling equipment (MHE), and
- To determine operational requirements for soldiers.

The FPU-20 met or exceeded all of the evaluation goals. The 512th Maintenance SSA transferred up to 81 percent of its target load from four M129 vans into one FPU-20 container. Throughout the evaluation, loading and unloading of the 10 modules took less than 30 minutes. During repeated movements between the field and garrison, there was no shifting of cargo, and the stored items were readily accessible at all times. No problems were encountered in the use of the PLS or its equipment.

A mobility analysis report provided by the 512th Maintenance Company to the 51st Maintenance Battalion stated that the PLS enables one soldier to load and unload heavy, palletized loads quickly and without assistance from other MHE. The report also pointed out that for 100-percent mobility of the 512th SSA, the modified table of organization and equipment provided 23 trucks (10 of which were supply vans). Only 10 trucks (8 components of the PLS) would be required when the FPU-20 is used in combination with the PLS.

In every aspect, the FPU-20 clearly demonstrated its capability to greatly improve maintenance unit mobility and operational efficiency while using less equipment. The decision to buy production models of the FPU-20 was not a cliffhanger. However, during the field evaluation, soldiers operating the equipment identified several factors and items that would make the system even better. These included reduction of overall container weight; installation of vents to improve heating, ventilation, and air conditioning; a grounding lug; an electrical wiring plug; and a device to lock travel bars of individual modules for high-security items. Boh LLC incorporated these improvements into lighter models of the prototype (FPU-20-1 and FPU-20-2) and began production.

FPU-8

Prior to the 21st TSC placing its production order for the FPU-20, it was learned that Boh LLC had developed the FPU-8. Although the FPU-8 was only 8 feet long, it had the same features as the FPU-20 and met the immediate needs of the 21st TSC. For example, five FPU-8s were used at five locations versus two locations for two FPU-20s. This increased the flexibility of operations, and the size of the FPU-8 enhanced air mobility. Based on the flexibility and air mobility of the FPU-8, the 21st TSC decided to purchase several FPUs. In particular, the 21st TSC received six FPU-8s. Additionally, three systems were sent to the 512th, and three were sent to the 5th Maintenance SSA. The 512th SSA is in the process of transferring its ASL to FPU-8s.

Conclusion

Many officials interested in the FPU-20's potential to improve Army logistics operations observed its evaluation. Among those favorably impressed was GEN John G. Coburn, AMC Commanding General. As a result of the FPU-20's successful evaluation, a number of actions were initiated to ensure that the FPU-20 and FPU-8 are available to units throughout the Army. Among these actions are the following:

- The Defense Logistics Agency has completed the national stock number assignment for the FPU and associated modules.
- Production models of FPU-20 and FPU-8 have been ordered for incorporation into the Army transformation effort taking place at Fort Lewis, WA.
- The Combined Arms Support Command has approved the Operational Requirements Document for the ASL Mobility System.

NATALIA CHUJKO is the Item Manager for the 120mm Multi-Purpose Anti-Tank Ammunition in the Office of the Project Manager for Tank and Medium-caliber Armament Systems, Picatinny Arsenal, NJ. Chujko is Level III certified in program management and systems planning, research, development and engineering.

THE ALTERNATIVE TECHNOLOGIES AND APPROACHES PROGRAM

Donald J. Palughi and J. Richard Ward

Background

In 1982, after reviewing and testing various disposal technologies, the U.S. Army selected incineration as the best disposal method for its stockpile of chemical agents and weapons. In 1985, federal legislation actually mandated the disposal of the Nation's chemical agent stockpile. However, in 1992, in response to growing public concern surrounding incineration, Congress tasked the Army to assess alternative technologies for chemical weapons disposal. Subsequently, responsibility for the independent assessment of alternative technologies was turned over to the National Academy of Sciences' National Research Council (NRC).

In 1994, NRC and Army assessments called for an evaluation of "neutralization" for disposing of bulk agents stored in steel containers. Shortly thereafter, the Alternative Technologies and Approaches (ATA) Program Office was established to investigate neutralization for disposal of bulk HD (blister agent mustard) stored at the Aberdeen Chemical Agent Disposal Facility (ABCDF) in Edgewood, MD, and the Newport Chemical Agent Disposal Facility (NECDF) in Indiana.

In 1995, the ATA Program Office also solicited concept design packages for chemical agent disposal technologies via the *Commerce Business Daily*. More than 23 designs were submitted and reviewed, and three technologies were chosen for further evaluation. The evaluations were conducted by the NRC, the Army Materiel Systems Analysis Activity, a core evaluation team consisting of subject matter experts from government and industry, and the Maryland and Indiana Citizens Advisory Commissions (CACs). Subsequently, unanimous recommendation was made to use hydrolysis followed by biotreatment for HD destruction, and hydrolysis followed by supercritical water oxidation for VX destruction.

To meet Chemical Weapons Convention disposal deadlines, Milestones I and II were combined and commitment was made to construct full-scale pilot facilities to test the disposal technologies for both the ABCDF and NECDF. In 1997, the Under Secretary of Defense for Acquisition and Technology gave Milestone I and II approvals for pilot testing the recommended technologies.

This article addresses the successful management and business practices that are being employed in the ATA Program.

Acquisition Strategy

It was determined that an acquisition strategy with a "business as usual" approach would not serve the best interests of the ATA Program. After signing systems contracts in October 1998 and March 1999 for the ABCDF and NECDF, respectively, the ATA Program Office adopted an approach in which the contractor is responsible for everything from final design to closure. A subset of this method also eliminated the use of government-furnished equipment. The ATA Program Office's streamlined acquisition approach was subsequently codified into the new DoD Instruction 5000.2, effective October 2000.

The ATA Program Office's acquisition strategy also incorporated two unique policies. The first brought all stakeholders—concerned community representatives and state and local agencies—into the technology-evaluation process. The second policy established detailed and objective assessment criteria prior to the examination of the proposed technologies and provided them to all stakeholders for review and comment prior to the evaluation. These policies were developed to address the following stakeholder concerns: alternatives to incineration were being overlooked, and there were preconceived ideas about the disposal technologies that would be used at the bulk-agent storage sites. As a result, stakeholders were continually informed, and the evaluation results were presented to all involved parties.

Once the technology options were selected, the program's management strategy depended heavily on the use of concurrent science and engineering to accelerate progress from the laboratory and bench scale to a full-scale pilot facility. This strategy paved the way for the highly successful Milestone I/II in-process review and resulted in the program's rapid progress.

Management Philosophy

An important aspect of the ATA Program Office's management philosophy was the use of integrated product teams (IPTs). The Indiana and Maryland CACs worked in concert with the IPTs. Everyone was kept informed of the program's status and all ongoing activities. This communication fostered support for the disposal program and eliminated the problems that can occur when presumed "surprises" are presented to stakeholders. Because all stakeholders were involved, the IPT also served to streamline regulatory actions by expediting comment resolution and approvals. This approach helped the ATA Program Office take bold actions and assume prudent risks with CAC support, reduce costs and shorten schedules, while maintaining safety as the top priority.

In the daily management of the ATA Program, the ATA Program leadership and staff focused on the overall goal of demilitarizing the stockpile and closing the demil facilities. The urge to focus exclusively on getting to the next phase was avoided. Rather than rely on Department of the Army (DA) waivers to meet scheduled milestones and maintain costs, the leadership intensively managed the critical path and incorporated goals and targets from the baseline-incineration program. This intense management style was supported by technical and operations staff from the U.S. Army Soldier and Biological Chemical Command. These personnel were experienced in chemical agent research and development or construction of binary chemical agent facilities.

The matrixed staff was augmented by personnel from the Office of the Program Manager (PM), Chemical Demilitarization, who were skilled in public outreach, operations and design, risk management, environmental monitoring, resource management, and program evaluation and integration. The combined team had the skills and experience to expeditiously resolve problems and minimize delays.

Testing And Evaluation

The ATA Program leadership had to ensure that the test data on which its decisions were based were indisputable and sufficient in scope to address all program issues. To accomplish this, a Test and Evaluation Master Plan (TEMP) was carefully crafted and submitted to the Office of the Secretary of Defense and DA test committees for comment. The Deputy Under Secretary of the Army for Operations Research gave final approval of the TEMP. This additional coordination resulted in a more efficient and effective testing program.

The testing was under the control of a Test Integration Working Group (TIWG) that prepared the test plan report. Data requirements were outlined in a report that could be presented to stakeholders and decisionmakers. Missing data requirements were quickly identified and added to the program. The TIWG also ensured that all data were analyzed and validated as they were generated so that uncertainties could be immediately addressed and requirements for additional testing identified.

Environmental Permitting

Environmental permitting is a critical activity in developing and operating chemical agent demilitarization facilities. Before permits are issued, state environmental agencies carefully scrutinize such programs to ensure absolute safety for the facility's staff, civilian communities, and the environment. Required environmental permits normally take 3 to 5 years to obtain. However, the ATA Program Office acquired the necessary permits in only 20 months for ABCDF, and 19 months for NECDF.

Two factors contributed to permitting process success. The first factor is the effort made by the ATA Program Office leadership to involve stakeholders and CACs in the program through the IPT process. This strategy allowed ATA Program Office staff to provide information and address emerging issues before they became a permit impediment. Additionally, this strategy allowed ATA Program staff to keep environmental officials up to date and provide them with a detailed understanding of the program prior to submitting the official paperwork for permits. This significantly minimized the state's permit review time.

The testing program was the second factor responsible for the ATA Program Office's success. Immediate validation of the test data allowed the ATA Program Office to meet regulatory information requirements quickly. In addition, letting the "data speak for itself" made the regulator's job easier and expedited issuance of the necessary permits.

Conclusion

The ATA Program is an excellent example of effective management and use of good business practices. Program results show how sound, upfront planning and keen attention to detail lead to success. The ATA Program has evolved in a short time to where contracts have been awarded for demilitarizing facilities at both bulk agent storage sites. These accomplishments are above the norm for military programs of this scale. Hence, the ATA Program Office serves as a positive example of how a major research and development program should and can be managed. The following points capture the spirit of the ATA and are worth remembering:

- Know which issues require "micro" versus "macro" attention;
- Demonstrate moral courage and candor at all times;
- Maintain proficiency at communicating within a highly politically influenced project; and
- "Let the data speak for itself."

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ARMY-SPONSORED SCIENTISTS WIN NOBEL PRIZE

Drs. Michael A. Stroscio, Jim C.I. Chang, and Robert W. Whalin

Introduction

The most recent announcement of the Nobel Prize winners was especially meaningful to the Army Research Laboratory (ARL) because three of the six winners for physics and chemistry had been supported—beginning in the 1970s—by the extramural research arm of ARL, the U.S. Army Research Office (ARO). This brings ARO's "Nobel count" to more than 12!

The Nobel awards have drawn increasing public attention over many decades—perhaps disproportionate attention—like that of the Masters Tournament in Augusta, GA. But who wins the Masters and who gets the Nobels fascinates everyone. We just have to admit our fascination too. One thing is certain: there is no doubt that the research of Nobel laureates has had a dramatic impact on the U.S. Army.

Background

ARL's support of research leading to Nobel Prizes dates back 50 years, when ARL's research arm was located on the Duke University campus and was known as the Office of Ordnance Research (OOR). Back then, OOR coordinated with the U.S. Army Signal Corps in supporting and fostering research that led to discoveries underlying many of today's Army technology capabilities, such as the light amplification by stimulated emission of radiation (laser) and the portable atomic clocks used in the Global Positioning System. In fact, the Army-funded demonstration of microwave amplification by the stimulated emission of radiation (maser) was the key discovery that led to laser use in Army target-designation and range-finding systems.

In recognition of the maser demonstration, professor Charles H. Townes received the Nobel Prize in physics in 1964, "for fundamental work in the field of quantum electronics, which led to the construction of oscillators and amplifiers based on the maser-laser principle." This early research on the laser was extended to the nonlinear optics field by professor Nicolass Bloembergen, winner of the 1981 Nobel Prize in physics.

Among the early Nobel Prize winners supported by the Army are professors John Bardeen, Leon Cooper, and J. Robert Schrieffer. They shared the Nobel Prize in 1972 for developing the "BCS" theory of superconductivity (named by referencing the first letter of each last name).

In more recent times, ARO supported the research of professors Richard E. Smalley and Robert F. Curl, who were awarded the 1996 Nobel Prize in chemistry for their discovery of buckminsterfullerenes. ARO's support of Smalley's research, and that of Rice University collaborators such as Curl, occurred at a critical time in the sequence leading to their discovery of the fullerene series. This discovery resulted in an entire class of structures with novel electronic, optical, and materials properties. Army research is now using these new structures for future-ballistic protection and information-processing systems.

No doubt that in the Nobel selection process, where committees canvas thousands of scientists throughout the world, many equally appealing scientific milestones continue to remain obscured from the public mind.

The Army Research Laboratory's extramural research arm—the Army Research Office—is working to ensure that the Army portfolio of research programs will continue to foster research discoveries worthy of the Nobel Prize.

The Nobel Prizes for 2000 recognize events that took place 20-30 years ago, a period during which many milestone science and technology events transpired. The Nobel Prize selections for 2000 for physics and chemistry also coincided with the influence of information technology on the global economy. No doubt that in the Nobel selection process, where committees canvas thousands of scientists throughout the world, many equally appealing scientific milestones continue to remain obscured from the public mind.

ARO, now part of the Army Research Laboratory (ARL-ARO), supported three American scientists who figured prominently in the first Nobel chemistry and physics awards of the new millennium: Alan Heeger, Alan MacDiarmid, and Herbert Kroemer. Indeed, they received substantial Army sponsorship for their research at various intervals during the past 26 years.

Heeger's application to the ARO in the summer of 1976 was presented in the framework of a "new class of synthetic metals ... to provide special materials properties unavailable to technological application." The Army readily agreed that understanding and controlling defects in these materials would be necessary for technological progress. Following this first Army support, Heeger and his University of Pennsylvania Chemistry Department colleague MacDiarmid initiated the collaboration with Japanese researcher Hideki Shirakawa. This collaboration resulted in the seminal research developments cited in the Nobel award. In later years, ARO also supported MacDiarmid independently in areas such as research on electrochromic and thermochromic polymer systems.

Kroemer detailed a research plan to ARO in 1973 to develop a quantitative theory of heterojunction discontinuities. Several semiconductor devices used in military systems are based on heterojunctions, including night-vision photodetectors, lasers and light-emitting devices for target illumination, and high-frequency radar and communication devices. Kroemer, now a professor at the University of California at Santa Barbara, has expressed gratitude to ARO for providing resources to purchase his first molecular beam epitaxy system, which enabled the early work for which he earned the Nobel Prize.

ARO celebrates its 50th anniversary in June 2001. A number of Nobel laureates will be attending the celebration, as Brown, Cooper, Esaki, and Townes did for ARO's 40th anniversary in 1991. In addition, an even larger number of Nobel laureates are expected to attend the June 2001 50th Anniversary Symposium and play key roles in its program.

Conclusion

Today, ARL is the home not only of ARO, but also of elements of the Army Signal Corps and the Army Ordnance Corps. Indeed, the Army has unified all of these great basic research organizations under the ARL, which continues to foster world-class research in a wide range of disciplines relevant to the Army. ARL's extramural research arm—the ARO—is working to ensure that the Army portfolio of research programs will continue to foster research discoveries worthy of the Nobel Prize.

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Ushering In A New Contract Strategy . . .

INNOVATIONS IN THE BRADLEY PROGRAM

COL Paul S. Izzo and John P. Velliky

Introduction

In today's age of acquisition reform, changes to the way we do business are the norm rather than the exception. If you take a moment and think back to where we were 10 years ago, and consider how we do things today, the magnitude of the change is really evident. However, in an environment where change is the norm, many changes go unnoticed.

Recently, the FY00 Bradley A3 low-rate initial production (LRIP) contract was awarded to United Defense Limited Partnership (UDLP). The award is referred to as the "corporate contract" because it contains all of the Bradley Program Manager's (PM's) requirements under one UDLP Ground Systems Division contract. The FY00 corporate contract encompasses the Bradley A3 vehicle (80 each), the Bradley A2ODS vehicle (60 each), the Bradley Fire Support Team (BFIST) vehicle, and associated spares. This contract is for the remanufacture of existing Bradley vehicles of earlier configurations to various new configurations cited above. The award of the corporate contract probably didn't even register a blip on the Department of the Army's radar screen, but for the U.S. Army Tank-automotive and Armaments Command (TACOM), Warren, MI, and the Bradley Project Manager's Office, it unveiled a new philosophy and a new way of doing business.

The advent of acquisition reform, coupled with budget cuts and diminishing resources, made the time ripe for a change in contract strategy. The Bradley PM Office initiated a series of innovations into the FY00 contract aimed at increasing the contractor's overall vehicle responsibility from start of manufacture to vehicle handoff.

Increased Contractor Flexibility

The various innovations may at first seem like individual initiatives, but ultimately they give the contractor increased responsibility in the vehicle's manufacture. With increased responsibility comes increased risk, but most important, increased flexibility with less government oversight in managing procurement of the vehicle. The increased flexibility gives the contractor latitude to more effectively control system design, manufacture, configuration management, and procurement, thereby resulting in potential savings for his or her firm and for the government.

The primary change in the corporate contract was the use of performance-based specifications instead of a technical data package. Also incorporated into the contract was a design constraints clause. The bottom line is that the contractor has increased flexibility in the overall vehicle system design changes with less government oversight for configuration changes that do not directly affect testability, interchangeability, and manpower and personnel integration (MANPRINT) domains. The end result is less government oversight in the overall configuration management process, which leaves the contractor with the flexibility to independently make cost-saving design changes. The contractor is still required to maintain the technical data package, but not to a Level III format. In addition, there are no delivery requirements for drawings under this contract.

Fielding Handoff

Perhaps the most unique innovation is the requirement for the contractor to "DD250" (inspect and receive) the vehicle at the fielding handoff point itself rather than at the factory. Initially, this approach was met with a certain amount of resistance from both the contractor and the government. However, a pilot program was conducted under the Bradley system technical support contract with three vehicles from the Bradley A3 LRIP III contract (FY99) testing the change. The results were extremely favorable because the contractor discovered many areas of duplication that occur in the Final Inspection Record (FIR)

Bradley A3 conducting night gunnery

activity leading up to factory DD250 and the deprocessing effort that takes place prior to vehicle handoff.

The contractor identified, by percentage, the potential reduction in man-hours per vehicle attributable to the duplication of tasks that occur between FIR activity and deprocessing. The A3 vehicle can realize a potential reduction in man-hours of up to 51 percent for deprocessing.

Basically, deprocessing will now be treated as an extension of the production line under the corporate contract. Redundant inspections will be reduced to critical performance characteristics. This significantly reduces the man-hours to deprocess each vehicle configuration under the corporate contract. The pilot program results showed a potential reduction in man-hours for deprocessing for the Bradley A2ODS vehicle of up to 69 percent, and for the BFIST of up to 68 percent. This innovation made good business sense even without a move toward performance-based contracting. However, it fully complements the performance-based philosophy by assigning responsibility for overall management of the vehicle to the contractor from the start of production until vehicle handoff.

Fielding Schedule

This leads us to the next innovation. Instead of incorporating a monthly delivery schedule into the contract, a vehicle fielding schedule was imposed on the contractor instead. This "fielding schedule management" philosophy goes hand in hand with the requirement to DD250 at handoff. The contractor was provided the various vehicle-fielding schedules during the requirements definition period of the overall vehicle procurement. As such, it is the contractor's responsibility to manage the overall build schedule, shipping, delivery, and deprocessing to meet the Army's fielding needs. The advantage of this is that the contractor manages the build schedule for each vehicle in the most economic fashion for the government.

UDLP's manufacturing facility in York, PA, maintains the same production line for each vehicle configuration under the corporate contract. Instead of having to meet monthly delivery requirements for each vehicle independently, the contractor can flip-flop monthly manufacturing schedules to meet fielding requirements. For example, instead of requiring a certain number of specific vehicles each month, the contractor can build all A3 vehicles or all A2ODS vehicles as the fielding schedule dictates. The end result is that the contractor makes maximum use of the production facility in the most economic fashion possible for the government. The drawback to this is that fielding schedules change over time.

Bradley A3 on the move at Fort Hood, TX

To minimize the impact of changing fielding schedules, a "time range" is built into the schedule by which the schedule can slip a certain number of months from left to right without a cost impact to the contract. Because the FY00 fielding requirements were relatively stable, a flexibility range was not incorporated into that contract. However, the follow-on Bradley A3 effort will be a 3-year procurement (FYs 01-03), requiring incorporation of a time range into that contract.

Final Innovation

The final innovation designed to complement the overall philosophy outlined above is the "break in" of several major vehicle components. Traditionally the PM, Bradley Office has sought to break out stable design components to avoid the pass-through costs associated with going through a prime contractor (the primary components being the transmission, engine, and the turret drive system). In addition, several complex components in the Bradley A3 Program that were targeted for breakout years ago were kept under the management of the prime contractor. As noted previously, all of these innovations are designed to give overall system responsibility to the prime contractor. Therefore, it made good business sense to include as many major vehicle components as possible under this system's responsibility umbrella.

Traditional pass-through costs were minimized by the contractor's technique of "bundling" the component quantities over several fiscal years, thereby securing economies of scale and a reduced profit rate applied to major components. Assigning system integration responsibility to the contractor and the complexity of individual items were key in determining whether a specific component was a good candidate for break in. Some items, such as the Improved Bradley Acquisition System and track and roadwheels, were left as government-furnished equipment.

Conclusion

Because of diminishing resources, these innovations are necessary to keep up with the constant changes in the Army acquisition world. Although initially driven by resource issues, the innovations described in this article have clearly made good business sense. The emphasis on contractor responsibility and the flexibility has provided new incentives to seek program cost reductions and manufacturing process improvements. At the time this article was written, the next step for the Bradley A3 Program was scheduled to be the Milestone III decision in March 2001 and the award of a 3-year (FYs 01-03) contract in which all of these innovations will remain intact.

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NATURAL ENVIRONMENT WORKSHOP HIGHLIGHTS SEVERE CLIMATE TESTING

Chuck Wullenjohn

A Heavy Equipment Transporter (HET), a huge vehicle capable of hauling a 70-ton payload, recently strained through the blowing snow and ice of Alaska's Cold Regions Test Center (CRTC) on a wilderness road course. The HET's braking ability gradually diminished as snow, kicked up by the wheels, entered the brakes through the open brake assemblies. Eventually, the brakes froze entirely.

Though the transporter had undergone a gamut of tests in the lower 48 states before being sent to Alaska, this problem had never before been encountered. The problem was eventually solved by the installation of metal-backing plates to prevent snow from entering the brake drums; however, this event dramatically demonstrates why natural environment testing is so important. Environmental chambers, though they have their place, did not prove adequate in thoroughly and reliably testing the HET's system.

As stated by Bob Torp, CRTC Technical Director, "Wars are not fought in cold chambers."

The Army Test and Evaluation Command held a 2-day natural environment testing workshop in Baltimore, MD, late last year to discuss the Army's declining natural environment testing workload. The first day was devoted to various speakers, and the second day centered on small working groups. The groups were so successful and generated such intense discussion that several had to be reminded to break for lunch.

Attended by more than 130 testers and equipment developers, the workshop highlighted the importance of natural environment testing as part of the testing "mix" of each weapon system. Experts recognize four natural environments as important in military equipment and munitions testing: desert, cold weather, tropic, and temperate. Of these, the first three are under the management of the U.S. Army Yuma Proving Ground (YPG).

"You don't get a second chance when equipment fails on the battlefield. Soldiers depend on us to get it right," stated Army Acquisition Corps Director LTG Paul J. Kern during his keynote address at the outset of the workshop.

He explained that testing must consist of a combination of three things: modeling and simulation (M&S), chamber testing, and natural environment testing. Each has its appropriate place in the weapon system and munitions development process, he said.

"You don't get a second chance when equipment fails on the battlefield. Soldiers depend on us to get it right."

**—LTG Paul J. Kern
Army Acquisition
Corps Director**

According to BG Dean Ertwine, Commander of the Developmental Test Command, there is no question that the Army's environmental test capacity has declined in recent years as funding levels have been reduced. However, with the increasing use and reliance on less expensive chamber and M&S testing by Army equipment developers comes an element of risk.

"The Army has been faced with declining resources throughout the acquisition world," said Ertwine. "Project managers across the board have been faced with decisions that have all too often forced them to cut something. Natural environment testing has been sliced too much, in my opinion."

Warfare statistics gleaned from the last half-century provide sobering food for thought. Nearly 75 percent of all armed conflicts throughout the world occurred in cold, desert, or tropic environments. Weapon system and munitions testing was extremely spotty prior to World War II, with many problems surfacing there and in later conflicts in Korea and Vietnam. Though the Army's natural environment test capability was built up to a fairly robust state in the 1950s, '60s, and '70s, the last 10 years have witnessed a slow decline. Many experts are concerned that systems provided to soldiers today will not perform properly if not tested in severe natural environments. Historically, this type of testing has brought about many equipment "fixes" that have reduced risks to American soldiers around the world.

COL W.C. King is a physical scientist assigned to the U.S. Military Academy who has devoted his professional life to the study of environmental extremes. His focus for the last 2 years has been specifically on the tropic environment, as the Army attempted to relocate its natural environment test facilities from Panama to other areas.

"Our tropic testing challenge today is to evolve from the excellent testing facilities the Army once enjoyed in Panama to the Army needs of today in less than perfect tropic testing conditions," stated King. "Schofield Barracks in Hawaii has some very attractive testing locations, with troop availability and a firing capacity. We will need to travel to other tropic areas, however, for specific missions."

Some developers maintain that Florida or Louisiana offer the conditions necessary for tropic testing, a contention King dismisses. "Those areas don't have the constancy of heat and humidity available elsewhere," he maintained. "The scientific criteria for a tropic area just don't exist in the continental United States. The tropics are defined by a belt around the equator."

King says military planners must look ahead and be prepared to face the conflicts in which American forces are most likely to be involved in future years. He says small conflicts over resource scarcities appear likely, as in Somalia and Ethiopia right now. These conflicts involve a clash of cultures, but the regions also feature dramatic deforestation, lack of water, overpopulation, and overburdened infrastructure. As people relocate from one area to another, they meet resistance from people already inhabiting the new territory. Tempers flare and hostilities result.

"The Army is creating small, agile forces to meet the uncertainties of the future," explained King. "These missions may involve patrolling after a disaster or peacekeeping activities, but we have to be ready."

King is a believer in the value of testing weapon systems and munitions in the natural environment. "No piece of equipment is fully ready to field until it is given to the soldier and tested for use in harsh conditions," he stated. "Environmental chambers and modeling and simulation are important parts of the testing process, but they cannot simulate a soldier actually using a piece of equipment. There is no way to manage all the synergies involved. In my opinion, removing soldiers from the developmental testing process is risky."

Lance VanderZyl, Acting Director of the Tropic Regions Test Center, shared a number of significant points about the tropic environment. "The jungle canopy loves to absorb radio frequency signals, which, naturally, is a circumstance that significantly impacts communications," he explained.

"Because of the tangled undergrowth and rugged nature of typical tropic terrain, accurately navigating along the ground takes experience. Sound waves are also different in dense jungle—it's tough to distinguish precisely where sounds come from. In short, the tropic environment is a super-challenging environment that tests military systems to the fullest extent possible."

LTC Michelle Stoleson, Commander of YPG's Materiel Test Center and a featured workshop speaker, described the desert environmental testing being conducted at the southwest Arizona installation. Although people typically identify YPG solely with desert testing, she pointed out that the general-purpose proving ground is responsible for a wide range of severe environment testing—desert, cold, and tropic.

"The Materiel Test Center's role is to provide testing services for nearly every item of ground combat equipment," Stoleson explained. "Yuma testing takes place in a desert environment on an installation that is over 840,000 acres in size, so it's a great place for developers to conduct realistic, sophisticated testing on a very wide variety of equipment. Many tests take place at the same time in different parts of the proving ground."

According to Stoleson, desert testing typically takes place in one of three ways. The first is that a solid test plan is developed that incorporates complete desert testing, such as with the M1 Abrams Main Battle Tank or the Bradley Fighting Vehicle. The second is when the test center conducts a general test on a developed item, but in Yuma's severe natural environment. In this case, desert testing is a bonus for the developer. The final is when a last-minute requirement for desert testing takes place, as was frequently the case during the 1991 Persian Gulf War. As an example, Stoleson cited a quick fix made to a blade wear problem aboard the AH-1 Apache helicopter caused by the dust and grit of the desert environment.

COL James Althouse, Commander of YPG, says the workshop showed that the Army Test and Evaluation Command is taking a very serious look at environmental testing issues. He added, "We have to be prepared to fight anywhere in the world, so the Army cannot ignore extreme environmental tests. Modeling and simulation can be used, but this doesn't eliminate the need for actual natural environment testing. It's just one of the tools in the testing mix."

BG Ertwine summed up the workshop's goal when he addressed the attendees at the conclusion of the final session. He said that when the balloon goes up and a soldier is sent to some forsaken place, we must be able to look his or her parents in the eye and say we've done everything we could to ensure that the equipment worked exactly as it should.

CHUCK WULLENJOHN is Chief of the Public Affairs Office at the U.S. Army Yuma Proving Ground, AZ. He is a graduate of Humboldt State University and has completed postgraduate work at San Jose State University and Hayward State University, all in California. He is a frequent contributor to this magazine and other military publications. He is also an active Reservist in the U.S. Coast Guard.

THE COUNTERMINE CAPABILITY SET

Richard Ess, LTC Lee R. Rosenberg (USA, Ret.), and Eric K. Steckmann

Introduction

The nature of military operations has been changing over the last decade. While prosecuting and winning the Nation's conflicts is still the primary mission of the U.S. Army, other less-traditional missions have recently consumed many of our resources. For example, today we find our Army deployed worldwide to support "Operations Other Than War (OOTW)," which range from humanitarian assistance and nation building to peacekeeping, stability, and support operations. Each of these missions poses unique challenges to a force largely organized to defeat the Warsaw Pact threat of the 1980s, particularly in the area of countermine operations. Route and area clearing and proofing functions are of particular concern.

The landmine threat covers the spectrum from home-grown, simple mines to very sophisticated ones. While the threat from landmines has been present and increasing, on-hand countermine capabilities have been limited. Additionally, the process of obtaining supplementary mine-clearing equipment for deploying U.S. forces has been improvised or ad hoc at best. While commanders-in-chief (CINCs) rightfully demand a countermine capability for force protection, the Army has only sparsely fielded this capability on an urgent basis, largely through the procurement of equipment to support specific deployment missions.

Background

The classic example of the Army's ad hoc process involved the U.S. Army Europe (USAREUR) deployment of Task Force Eagle to Bosnia in late 1995. U.S. forces were deployed into an area where three warring factions had emplaced a variety of landmines during several years of military operations. These forces were often withdrawn from their locations in haste either as a result of being pushed out by opposing forces or because of negotiated agreements that precipitated their departure. Despite highly detailed records provided under U.N. accords, the mined areas were not completely marked, leaving behind a potential hazard in the wake of these withdrawals.

Faced with this mine threat, the CINCUSAREUR requested emergency procurement of countermine equipment in March 1996. For various reasons, it ultimately took about 6 months for the first countermine equipment to arrive in theater. Because items were acquired on an urgent basis, logistics and training support were lacking or less than optimum. During subsequent mine-clearing operations, there were casualties among military forces and the civilian population.

Concept Team

Energized by this situation, the Project Manager for Mines, Countermine and Demolitions (PM, MCD), in cooperation with the Directorate of Combat Developments at the Maneuver Support Center, Fort Leonard Wood, MO, formed an integrated concept team (ICT) that generated a new requirement for a fully supported countermine capability set (CMCS). The CMCS could be rapidly constituted, regionally stored, and quickly issued to deploying forces.

In late 1999, the ICT briefed senior officers in the Office of the Deputy Chief of Staff for Operations and the Military Deputy to the Assistant Secretary of the Army for Acquisition, Logistics and Technology. Following these briefings, the PM, MCD was charged with developing and deploying the CMCS as soon as possible to support worldwide operations.

The CMCS ICT was faced with the challenge of acquiring this contingency countermine capability without having to pay for outfitting the entire Army with countermine equipment. Additionally, the ICT recognized the critical need to provide full contractor logistics support (CLS) to the user.

Finally, the ICT recognized that an "out-of–the-box" acquisition solution would be required because of the worldwide responsiveness required of the CMCS, the low-density, nonstandard nature of the CMCS equipment, and the need to rapidly develop and field the CMCS within a constrained budget environment.

Teaming

Weighing the available acquisition alternatives, PM, MCD personnel decided on a teaming approach with contractors that includes a full range of training and logistic support. Under this partnership, the contractor will provide the CMCS using commercial off-the-shelf and nondevelopmental countermine equipment. In addition to providing the hardware and integrating government-furnished equipment, the contractor will develop the logistics support materials including training materials and technical manuals and supplemental data for existing commercial maintenance instructions.

The contractor will also provide maintenance allocation charts on required maintenance tasks, data on transporting CMCS equipment, and safety data for use by deploying soldiers.

Finally, a mechanism will be established to provide all CLS once the CMCS is fielded. This includes regional storage of the CMCS and all the necessary maintenance to keep the sets in a "ready-to-issue" and rapidly deployable condition. Once the sets are issued to using units, contractors will provide all the maintenance of the CMCS equipment above the unit level. This includes supply support for CMCS-unique spare and repair parts not already in the Army's supply system.

Implementation

To implement such an ambitious endeavor, we recognized that early involvement of all stakeholders and innovative management approaches were required. Extensive efforts were made early in the development of the acquisition strategy to involve combat developers, training developers, testers, evaluators, logisticians, safety and contracting personnel, and others in an integrated product team (IPT) environment. Key to this was the interface between the ICT and the "Council of Colonels" at the Maneuver Support Center.

Early industry involvement was solicited via a March 2000 Industry Day and a public Web site. Comments were encouraged, particularly during Industry Day briefings and through two draft Requests for Proposal (RFPs).

The adopted contracting approach includes a hybrid-type contract containing cost-plus-fixed-fee efforts for the research and development aspects of the program, firm-fixed prices for hardware, and time and materials payments with fixed labor rates for the CLS effort. Finally, an "all-or-none" award fee will be established for the CLS required during urgent deployments. This is intended to incentivize quality and timely contractor performance during critical periods.

A performance work statement (PWS) was developed to focus the contractor's efforts on outcomes rather than processes. As such, the PWS covers all aspects of the program and provides the contractor with a road map of the required outcomes desired by the PM, MCD for the various tasks.

IPTs

Four separate IPTs addressing technical issues and testing; training, tactics, techniques, and procedures; supportability; and contracting and finance will manage the program. Following contract award, the contractor will participate as a member of these teams and will co-chair the supportability IPT. This is particularly important because the quality and level of CLS will ultimately determine the success of the CMCS Program. The goal is to provide timely, quality CLS that is transparent to the soldier-user while allowing adequate government/military control.

Another feature of the program is management of information through an IPT Web site established specifically for the CMCS effort. All IPT members can access the program logistics and other data and participate in the data review and development process much more effectively than the usual rounds of back-and-forth revisions between the contractor and the government.

The U.S. Army Training and Doctrine Command approved the CMCS Operational Requirements Document in August 2000, and a Department of the Army-directed CINC-validation process is ongoing. Two draft RFPs were posted publicly for industry review and comment. The final RFP was released on March 2, 2001.

Summary

The CMCS Program is defined by its evolutionary approach, fielding existing commercial and nondevelopmental countermine technologies in a seamless manner. The capabilities afforded by the CMCS will be reviewed periodically and new technology insertions, such as those emerging from the Joint Area Clearance Advanced Concept Technology Demonstration, will be incorporated into the sets.

In summary, the goal of the CMCS Program is to field an effective, countermine capability to the warfighting CINCs without need of a massive logistics support infrastructure. The contractor will be a full partner in this effort, and the ultimate beneficiary will be the soldier, who will be protected from mines during future OOTW deployments.

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Intensive Program Credited . . .

SAFER DISPOSAL OF U.S. CHEMICAL WEAPON STOCKPILE

COL Christopher F. Lesniak

Introduction

An intensive programmatic lessons learned (PLL) Program implemented by the Project Manager for Chemical Stockpile Disposal (PM, CSD) has resulted in safer, more effective, and more efficient destruction of the U.S. chemical weapons unitary stockpile.

The PLL Program is designed to benefit diverse users including plant managers, operators, maintenance workers, public affairs staff, and others. Participants gather lessons learned from multiple sources, disseminate them, and track the issues so that required actions can be taken.

PLL Program results have been demonstrated throughout the PM, CSD effort. The Johnston Atoll Chemical Agent Disposal System (JACADS) team, which has destroyed 100 percent of the JACADS chemical weapons stockpile, worked 392,000 hours without a lost-time injury during a recent campaign. During the same campaign, the site's recordable injury rate (RIR), which compares the number of injuries per man-hours worked, was much lower than that of agricultural chemical factories (0.90 at JACADS versus 5.3 at the factories). As of February 2001, construction of the Pine Bluff Chemical Agent Destruction Facility exceeded 2.2 million man-hours without a lost-time accident.

The impact of the PLL Program is best demonstrated in the difference between early sarin (GB) rocket campaigns at the prototype facility, JACADS, and the Tooele Chemical Agent Disposal Facility (TOCDF), the first production site. At the time of each campaign, each facility was fairly new and had comparable workforces and equipment. Using lessons learned from JACADS (which began operations in 1990), TOCDF had demonstrably better performance and safety records. The RIR fell from 6.79 at JACADS to 3.68 at TOCDF. The disposal rate in terms of rockets per year increased from 5,206 to 11,472. In addition, days of environmental compliance-required shutdown fell from 11 at JACADS to 0 at TOCDF.

Building on these results, PM, CSD has continued its commitment to the PLL Program and has successfully instituted a lessons-learned culture.

Program Methods

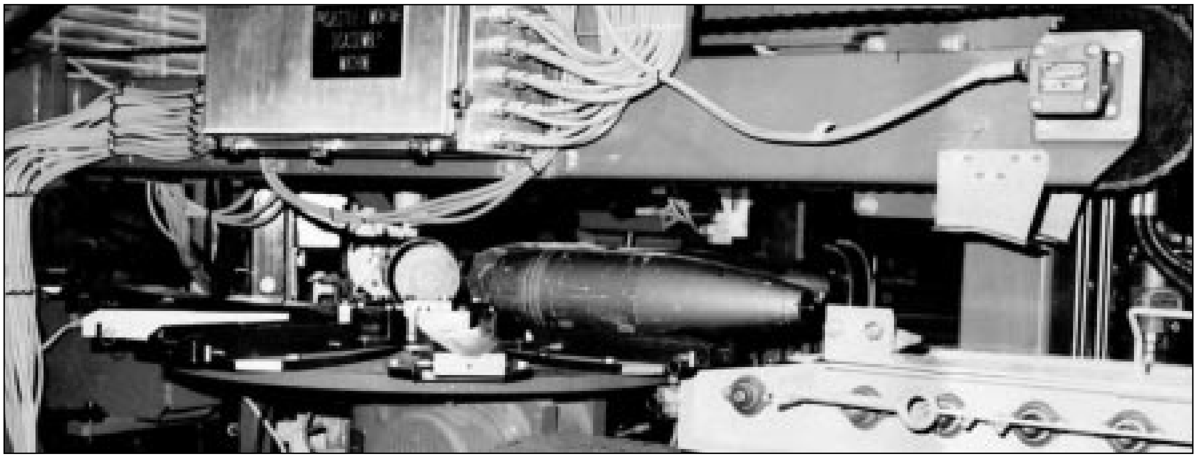
PM, CSD developed the PLL Program in 1992 to meet the technical, managerial, and geographic challenges involved in safely destroying the U.S. unitary chemical weapons stockpile. The stockpile included 31,496 tons of sarin, mustard gas, lewisite, and other chemical agents stored at eight sites across the United States and on Johnston Island, 825 miles southwest of Hawaii. PM, CSD's mission includes the safe and environmentally sound destruction of chemical agents and industrial chemicals contained in a variety of rockets, projectiles, bombs, mines, and bulk containers.

In addition to dealing with the different containers, PM, CSD had to be prepared for dealing with unpredictable chemical agents. After being in storage for decades, some of the liquid munition fills had either crystallized or become a thick sludge. Other agents had degraded, creating pressurized gas in their containers.

To meet these and other challenges, the U.S. Congress required lessons learned at the prototype demilitarization facility be transferred to subsequent facilities. To expand on that direction, PM, CSD initiated a program to capture the lessons learned at all the PM, CSD facilities and forward them to future and, on occasion, to earlier sites. The purpose of the program was to pass along best practices, reduce the likelihood of mistakes being repeated, and to enhance safety and efficiency as the project expanded. PM, CSD worked with its integration contractor, Science Applications International Corp., to develop the program. As the *Site Programmatic Lessons Learned Program Plan* states, PM, CSD's goal is to ensure that experience gained by one site "was not lost as a result of organizational boundaries, geographical separation, or the passage of time."

To achieve this goal, PM, CSD designed the PLL Program to transmit information via several methods, including the following:

- *PLL Database*. This comprehensive, searchable database stores and links issues that have been raised at meetings, workshops, etc. Streamlined issues that contain related information allow for greater flexibility and speed in searching the database. A distributable CD-ROM version can be supplemented with biweekly electronic file transfers.
- *Quick React*. For rare cases in which operational safety or environmental protection might be affected, the Quick React system immediately transmits information to affected program participants via facsimile.
- *Workshops*. These venues provide an opportunity for experts from each facility as well as PM, CSD to exchange lessons learned and give their input on issues.
- *Engineering Change Proposal (ECP) Review Process*. This process is designed so that each site can review other sites' ECPs and adopt any that are applicable.
- *Technical Bulletin*. The PLL Team publishes a quarterly bulletin with information that is valuable to program participants but does not need the peer-review aspects of workshop discussions.
- *Operational Assessments*. Studies and analyses have been performed on issues that demand in-depth research. Assessments to date have resulted in improvements to the safety culture at sites, an analysis of how to better track



Automated equipment removes explosives from a weapon.

munitions, and an evaluation of environmental permit-compliance history.

• *Programmatic Documentation.* Experience gained has been distilled and incorporated into programmatic documentation such as the *Chemical Demilitarization Operations Manual* and the *Guide to Emergency Response Planning.* Users can now refer to the electronic versions of these documents and use their hypertext capabilities to quickly link to the detailed information they need.

• *PLL Board.* Issues that exceed the authority of the PLL Coordinator or PLL Team are presented to the PLL Board (chaired by the project manager), which then decides on the issue. The PLL Team then disseminates the information.

The PLL Program has aggressively implemented these methods. In the last 2 years alone, more than 75 workshops have taken place; 244 issues have been collected and disseminated; 677 directed actions, which require sites to provide additional information necessary to close an issue, have been issued; and 1,664 ECPs have been recorded.

PLL Results

The PLL Program has improved safety, efficiency, and efficacy throughout the PM, CSD mission. By tracking the changes in the fill compositions (when agent crystallizes or becomes a thick sludge), some of these variations can now be predicted by lot number, manufacturing location, and type of assembly. Information such as this was compiled into a stockpile tracking system, which in conjunction with lessons shared, ensures the most appropriate processing is performed.

The PLL Program assists in strategic planning (as with the modification of processing to react to fill composition changes) and in resolving issues that require immediate attention. When a JACADS worker received a caustic burn from a neutralizing agent because of an inner-glove failure of his demilitarization protective ensemble (DPE) in June 1996, JACADS officials used the Quick React system. They immediately warned other facilities about the glove failure and recommended the short-term solution of wearing an additional glove. Longer-term solutions involved investigating DPE lots that failed and securing improved glove materials.

Recent lessons learned also have led to important facility design changes. JACADS was designed to maximize operational efficiency; however, now as the JACADS Team begins closure planning, it has learned how the facility's dismantling could have been made easier had the original design taken closure into account to a greater extent. Doors could have been placed in different locations to ease equipment removal. Concrete could have been coated with a material that would block agent from seeping into it and prevent a time-consuming removal and treatment process. Using these JACADS ideas, designers of subsequent facilities have been able to better plan for each site's entire life cycle, cradle to grave.

Even much simpler changes can improve safety. For example, maintenance workers in DPE suits communicating with operators via radio now use "repeat backs." When told to open a certain valve, for example, the worker repeats back the command to ensure that the correct action is taken. Additionally, the PLL Program promulgated a solution for the backup personnel who stand by when colleagues enter an agent area. Wearing DPE, the backup personnel were forced to stand for their 2-hour shift because air bottles made it impossible for them to sit in normal chairs. After a team at the Chemical Agent Munitions Disposal System designed new chairs that accommodate the DPE, the PLL Team informed other sites of the chairs and their benefit in keeping backup personnel fresh and alert.

Conclusion

The PLL Program has reached across government and contractor lines to help engineers, operators, warehouse workers, laboratory technicians, and others. PM, CSD has institutionalized communication and knowledge transfer throughout the effort to destroy the chemical weapons stockpile, ensuring that the process meets its primary goals of public and worker safety, environmental protection, and effectiveness.

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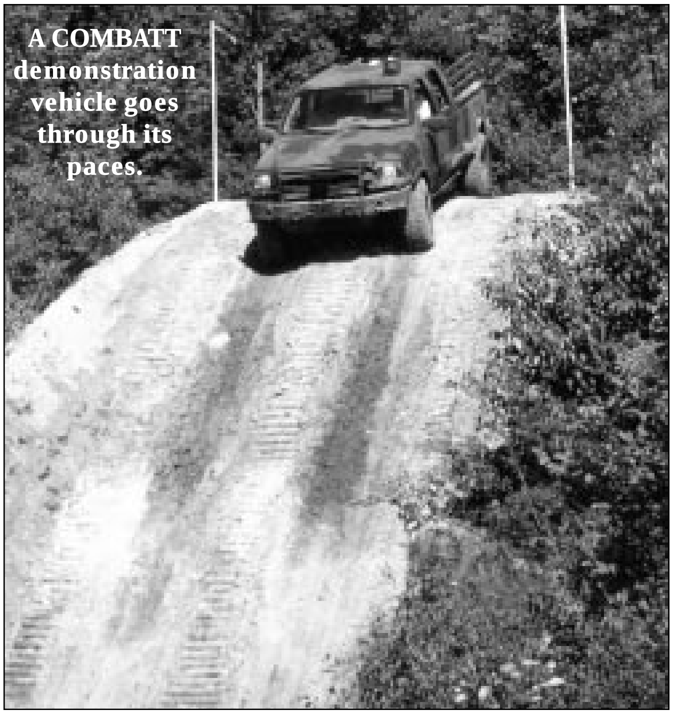


THE COMMERCIALLY BASED TACTICAL TRUCK

Ronald D. Morton

Introduction

In January 1983, the U.S. Army Tank-automotive and Armaments Command (TACOM) and General Motors Corp. unveiled Commercial Utility Cargo Vehicles (CUCVs) in Flint, MI. This effort began in July 1980 when Congress directed the Army to buy commercial trucks to replace many of the M880 vehicles, Gama Goats, and 1/4-ton trucks operating in areas where high mobility was not essential. As such, the Army accepted 70,889 vehicles between 1983-1987.

Between 1987-1991, the Army learned that neither the M880 nor the CUCV really worked in the Army environment off-road. Neither vehicle had sufficient mobility in mud, sand, snow, or ice, according to Hal Almand, Program Manager for the Commercially Based Tactical Truck (COMBATT) in TACOM's National Automotive Center's (NAC's) Technology Demonstration Group.

Since then, the NAC, Ford Motor Co., DaimlerChrysler, and Veridian ERIM Inc., sought to develop the COMBATT from commercially available trucks such as the Ford F350 and the Dodge 2500/3500. "Our main goal was to modify a commercial truck, make it mobile off-road, where it can go on soft or hard conditions, and make it rugged enough so it would last when working off-road with a payload," said Almand.

COMBATT is a commercial light-tactical vehicle that would be mass produced and upfitted to Army specifications. It provides four overwhelming benefits: reduced production and design costs through economies of scale, lower parts production and distribution costs, the capability of using commercial service manuals, and greatly reduced maintenance costs because of dealership accessibility.

Requirements Determination

A computerized NATO Reference Mobility Model was created by incorporating from the contractors all the design data input on the vehicles. Using this model, engineers determined what kind of mobility the vehicle would yield on any given terrain. NAC personnel examined the model and quickly realized that these unmodified trucks would not go in many of the places that the Army needed them to go.

The NAC then examined performance specifications from the various vehicles, Army requirements, and the High Mobility Multipurpose Wheeled Vehicle (HMMWV) requirements document. Following this, the NAC rated and ranked the various performance characteristics with various vehicle components. Finally, the NAC prioritized the items or components on the vehicle that most needed to be changed.

Tires

Tires were found to be the item that most needed to be changed. Subsequently, engineers increased tire size to 37 inches, the same as the HMMWV tire. However, the COMBATT uses a 17-inch wheel rather than the 16 1/2-inch wheel used on the HMMWV. To maximize the footprint, a central tire inflation system was installed that allows the driver to inflate or deflate the tire as needed. To accommodate the larger tires and wheels, the fender wells were enlarged.

With the footprint appropriate for the vehicle's weight, the engineers realized that a "true" four-wheel drive vehicle was required, one that engages all four wheels simultaneously. Typical four-wheel drive vehicles engage either the left front and right rear tire, or the right front and left rear tire when in the four-wheel drive mode. The Dana Corp. was designated to develop a true four-wheel drive vehicle that met Army requirements.

Ruggedizing The Vehicle

The NAC ruggedized the vehicles for off-road conditions by adding air-helper springs. These cylindrical tubes are filled with air and sit between the axle and the chassis. A central computer within the vehicle's cab controls each spring. The driver can add or subtract air as needed. Thus, a vehicle with a heavy load can be raised and bounce room added to protect the chassis.

To augment the air-helper springs, the NAC added a beefed-up shock absorber. This electrically controlled bistate shock absorber senses energy and automatically switches from firm to soft or vice-versa as dictated by the energy input from the vehicle's environment.

NAC gave COMBATT the same stance as the HMMWV by extending the wheel end and lengthening the axle housing. The steering and front-end geometry are also altered to ensure and maintain a 50-foot turning radius. The entire front axle housing and wheel end are also new. "This was a significant challenge for our engineer staff to make happen and still maintain the feel that you want when you drive," said Almand.

The Computer

Veridian ERIM Inc. built a computer to automatically handle the central tire inflation system, air-helper springs, bistate shock absorbers, and other components. The driver inputs data such as, "I'm off-road or I'm loaded." The computer automatically engages the necessary components. There is even a safety feature, according to Almand. "At 40 mph, you can't have the vehicle suspension all the way up unless you intentionally override the system. The system will automatically set you back down," notes Almand.

For mobility, a Global Positioning System was added, with maps displayed on a flat-panel screen. The screen shows navigation or vehicle system diagnostic information and can be operated by the driver or a passenger.

Night Vision

Night vision technology was also added. The night vision system is mounted on top of the vehicle just above the driver. A camera samples the area directly in front of the vehicle in a 40- by 30-degree field of view. Although the system cannot identify potholes, it has a visual range of 500 feet.

To display night vision images on the panel screen, the system's electronics convert temperature impulses from the sensor array using a digital-to-analog converter. "The final display is not unlike black and white television," said Mitchell Kozera, an electrical engineer with TACOM-NAC.

Collision Warning

COMBATT uses a collision warning system to help eliminate convoy accidents. This system features radar technology with sensors on the vehicle's front and right rear. The front sensor uses an alarm and yellow light to alert the driver that the vehicle is following too closely. If an accident is imminent, a red light and audible alarm are activated. The right rear sensor tells the driver if a vehicle is in a blind spot in the right lane.

Power Generation

COMBATT requires a 110-volt output. The typical Army vehicle output is 28 volts of direct current. In the Dodge vehicle, a system was installed that fits like an alternator and produces up to 5,000 watts. "You could run a house basically on it," said Almand. Inverter technology was used in the Ford, producing a similar output.

Protection

Several safeguards were also added to protect the new components. For example, a brush guard was added to the front of the vehicle, a steel or aluminum plate was attached underneath to protect the oil pan and other components, and a special spray was added to the cab floor and pickup bed. The spray adheres to the base metal, keeping out water and mud. "You can drag anything you want across it and it doesn't scratch into the base metal," said Almand.

To stiffen the chassis, two cross members were tied to the vehicle's bumpers. In addition, a data bus will handle the new electronics, perform diagnostics, accommodate night vision requirements, and process all the signals from the various components.

Conclusion

By leveraging commercial vehicle technology, the Army intends to maintain a consistently modern, mission-ready vehicle fleet while reducing development, production, and spare parts costs. The Commercially Based Tactical Truck should help the Army achieve this goal.

RONALD D. MORTON was a Department of the Army Public Affairs Intern who was assigned to TACOM when this article was written. He is a 1998 graduate of Cameron University, Lawton, OK, with a bachelor's degree in communication and a minor in public relations.

IMPORTANT NOTICE

If you are an individual who receives *Army AL&T* magazine and you have changed your mailing address, do not contact the *Army AL&T* Editorial Office! **We cannot make address changes regarding distribution of the magazine.** Please note the following procedures if you need to change your mailing address:

• Civilian members of the Army Acquisition Workforce must submit address changes to their Civilian Personnel Advisory Center (CPAC).

• Active duty military personnel must submit address changes to their Military Personnel Office (MILPO).

• Army Reserve personnel must submit address changes to the U.S. Army Reserve Personnel Command (ARPERSCOM) in St. Louis, MO.

• 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.

Your attention to these procedures will ensure timely mailing of your magazine.

FROM THE DIRECTOR ACQUISITION CAREER MANAGEMENT OFFICE

As this issue of *Army AL&T* goes to press, the Acquisition Career Management Office (ACMO), the Total Army Personnel Command's Acquisition Management Branch (AMB), and the Army Acquisition Executive Support Agency (AAESA) are working hard to improve the Acquisition Position Management System. We are finalizing the Career Acquisition Personnel & Position Management Information System (CAPPMIS) implementation and system refinements, fully defining education requirements, and supporting programs to implement congressional and DOD policy regarding the professional development of the Army Acquisition and Technology Workforce. Each of you will take the lead in managing your career.

We will provide the path, tools, and opportunities for you to use to attain your professional career-development goals. Our goal, as always, is to make the process as simple as possible. We are striving for an individual development plan that is fully automated for individual completion and supervisory review and approval, and for automated retrieval of information used to budget resources and determine requirements. This automation will provide the foundation for a much simpler and responsive process to use in applying for career-enhancing opportunities and professional-development training. It will also serve as a single information source for position management and will allow for easy transfer of positions in response to changing priorities and other mission adjustments. Collectively, the ACMO, AMB, and AAESA appreciate your patience as we work to define these new requirements and redefine the process we use to manage positions.

Our job is to communicate to you where the acquisition workforce needs to go and to provide the means to get there. Acquisition is a multifaceted process that depends on the combined talents and dedication of all participants. Thus, a highly competent Acquisition and Technology Workforce is critical to ensure a successful transformation of the Army.

Following a careful examination of the purpose and results of our Army Acquisition Roadshows, we have decided to use resources more selectively and take a more targeted approach to communication. Although the March-April 2001 issue of this publication advertised this year's schedule of roadshows, they will not occur. However, the intent of the roadshows, "to provide timely information and support to you," remains the same. As such, we will continue to "get the word out" by providing acquisition workforce update briefings at other major conferences and meetings.

Additionally, we will provide regional directors with the resources and tools necessary to increase their activities in this area. Giving the regional directors a more prominent role increases your direct contact and face-to-face opportunities with them and improves the flow and timeliness of information. Additionally, ACMO, AMB, and AAESA senior leaders will continue to visit field activities and will be prepared to present updates and address local concerns during their visits.

As always, we welcome your comments and recommendations. There probably isn't a "one-size-fits-all" solution to every need. Only through continuous dialog with you can we hope to find the solution that best serves the majority and gives us the flexibility to manage the exceptions.

COL Frank C. Davis III
Director
Acquisition Career
Management Office

Acquisition Corps Recruiting Briefings Announced

Army officers can now learn about career opportunities in the Army Acquisition Corps (AAC) as the result of a new series of AAC recruiting briefings recently announced by the Acquisition Career Management Office. Specifically targeted for captains interested in accession into the Army Acquisition and Technology Workforce, the briefings may also be of great interest to supervisors and other personnel seeking additional information about the AAC. Access the AAC home page at **http://dacm.sarda.army.mil** for the dates and locations of upcoming recruiting briefings. General information is also available on the Total Army Personnel Command's Acquisition Management Branch Web site at **http://www.perscom.army.mil/Opfam51/ambmain.htm**.

Specific questions regarding recruiting briefings may also be directed to Army Acquisition Recruiting Officer MAJ Jeannette Jones at DSN 664-7136, (703) 604-7136, or e-mail **jeannette.jones@saalt.army.mil**.

Three New Career Fields In The AAC

On May 13, 1999, the Under Secretary of Defense for Acquisition, Technology and Logistics signed a memorandum establishing the refined Packard definition as the official method for identifying key Acquisition and Technology Workforce (A&TWF) professionals. This new methodology is based on an algorithm that uses occupational and organizational data to identify members of the acquisition workforce. Upon implementation, the latest refined Packard algorithm will add a large number of new members to the acquisition workforce.

When implementing guidance from the Office of the Secretary of Defense (OSD) is announced, these new members will be assimilated into the Army A&TWF and into the Army Acquisition Corps within a specified career field category. For those newly identified members whose positions cannot be included under one of the existing career field categories, new position categories/career paths are being developed. The three new categories under development are sustainment logistics, science and technology management, and facilities engineering.

These new career fields are being developed by a functional integrated process team (FIPT). Under the direction of a Senior Executive Service (SES)-level functional advisor, each FIPT is comprised of SES and OSD functional representatives within the specified career area. The FIPT's job is to develop a notional career position description that explains the tasks to be performed by professionals within the new career fields. After these task roles are clearly defined, the acquisition community will begin the process of assimilating newly identified positions (and people) into the acquisition workforce. Approximately 9,000 new employees will be assimilated into the Army acquisition workforce. The exact number will not be known until the FIPTs conclude their work establishing the three new career fields.

Uniformly identifying the acquisition workforce using the refined Packard approach enhances the ability to manage critical acquisition workforce assets. It also provides a more precise understanding of the activities and skills mix within the workforce. When fully implemented, the refined Packard algorithm will significantly help in planning for the recruitment, retention, and requisite training and education of the workforce.

IMPORTANT NOTICE

Career Management Handbook 2001 Address Changes

A number of addresses have changed in the *Army Acquisition Career Management Handbook 2001* since its publication. Here is the list of changes for your reference. The handbook can be found on the Army Acquisition Corps home page at **http://dacm.sarda.army.mil/handbook/handbookTOC.htm**.

Wrong Address	Correct Address	Pages
e-mail: http://www.opacqtn.corps@arpstl.army.mil	e-mail: opacqtn.corps@arp.stl.army.mil	17
https://rda.rdaisa.army.mil/idp/idpprod/newidpstart.htm	https://rda.rdaisa.army.mil/cappmis/idp/idpprod/login.cfm	18,45,67,68, 81,83
https://rda.rdaisa.army.mil/ACRB/login.cfm	https://rda.rdaisa.army.mil/cappmis/idp/idpprod/login.cfm?app=acrb	17
https://rda.rdaisa.army.mil/acrb/login.cfm	https://rda.rdaisa.army.mil/cappmis/idp/idpprod/login.cfm?app=acrb	33
http://dacm.sarda.army.mil/workforce/acrb/	https://rda.rdaisa.army.mil/cappmis/idp/idpprod/login.cfm?app=acrb	68
http://www-perscom.army.mil/Opfam51/amb_main.htm	http://www.perscom.army.mil/Opfam51/ambmain.htm	27,46,47
http://www.acq.osd.mil/dau	http://www.dau.mil	42,46
http://alei.doddacm.com	Works, but needs Internet Explorer 5.0 or higher, or Netscape 4.0 or higher, and Shockwave.	42
http://www/perscom.army.mil	http://www.perscom.army.mil	61
http://www.cpms.osd.mil/dlamp.info_center.html	http://www.cpms.osd.mil/dlamp/index.htm	44

32 Graduate From MAM Course

In March 2001, 32 students graduated from the Materiel Acquisition Management (MAM) Course, Class 01-002, at the Army Logistics Management College, Fort Lee, VA. Among the graduates were two international students from South Korea and Slovenia. The Distinguished Graduate Award was presented to CPT Steven Ansley, who is assigned to the U.S. Army Aviation and Missile Command at Redstone Arsenal, AL.

The 7-week MAM Course provides a broad perspective of the materiel acquisition process and includes a discussion of national policies and objectives that shape it. Areas of coverage include acquisition concepts and policies, research and development (R&D), test and evaluation, financial and cost management, acquisition logistics, force integration, production management, risk assessment, and contract management. Emphasis is on developing midlevel managers to effectively participate in managing the acquisition process.

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

PERSCOM Notes . . .

The Advanced Civil Schooling Program

Each fiscal year, the U.S. Total Army Personnel Command's (PERSCOM's) Acquisition Management Branch (AMB) receives a specific number of quotas to send military officers for advanced degrees via the Army's Advanced Civil Schooling (ACS) Program. The ACS Program provides military personnel the opportunity to attend graduate school at an accredited university on a full-time, fully funded basis. The available degrees range from highly technical ones to management and business-related ones. Typical graduate programs take 12-24 months to complete.

Approximately 50 quotas are anticipated for Army Acquisition Corps (AAC) officers to attend graduate school in FY02. Highest priority is given to technical programs in the engineering and science disciplines, but a variety of business and management programs are also available to include degrees incorporating the business hours required for AAC membership. Regardless of the discipline, approved programs must support AAC requirements and long-range goals.

AAC officers interested in attending graduate school must formally apply for the ACS Program. The AMB conducts two ACS selection boards each fiscal year during January and July. The next board, scheduled for July 24-26, 2001, will consider officers with proposed start dates between October 2001-March 2002. The January 2002 board will review applications with start dates between April-September 2002. During the selection process, board members consider information such as the program and school requested, academic transcripts, graduate-level entrance examination test scores, military personnel files (specifically evaluation reports and promotion potential) and career timelines.

The AAC is committed to the continued professional development of officers through high-quality educational programs. For the latest information on ACS application procedures and board dates, go to AMB's Web site at **http://www-perscom.army.mil/OPfam51/acsfeb00.htm**.

Training With Industry For AAC Military Officers

The Army's Training With Industry (TWI) Program is a work-experience training program designed to take selected officers out of the military environment and expose them to the latest civilian business practices, organizational structures and cultures, technology development processes, and corporate management techniques. The companies that participate with the Army in this training program are developers of innovative cutting-edge technologies and/or established leaders in their respective fields.

The scope of training available at these corporate sites varies greatly from company to company but could ultimately be in one or more of the following areas: acquisition, contracting, research and development, test and evaluation, program management, systems automation, computer science, and engineering.

The Army Acquisition Corps (AAC) receives a specific number of TWI quotas each fiscal year. Once the quotas are received and the participating industries have been confirmed, the U.S. Total Army Personnel Command's Acquisition Management Branch conducts a selection board and competitively selects individuals to participate in the 1-year training program.

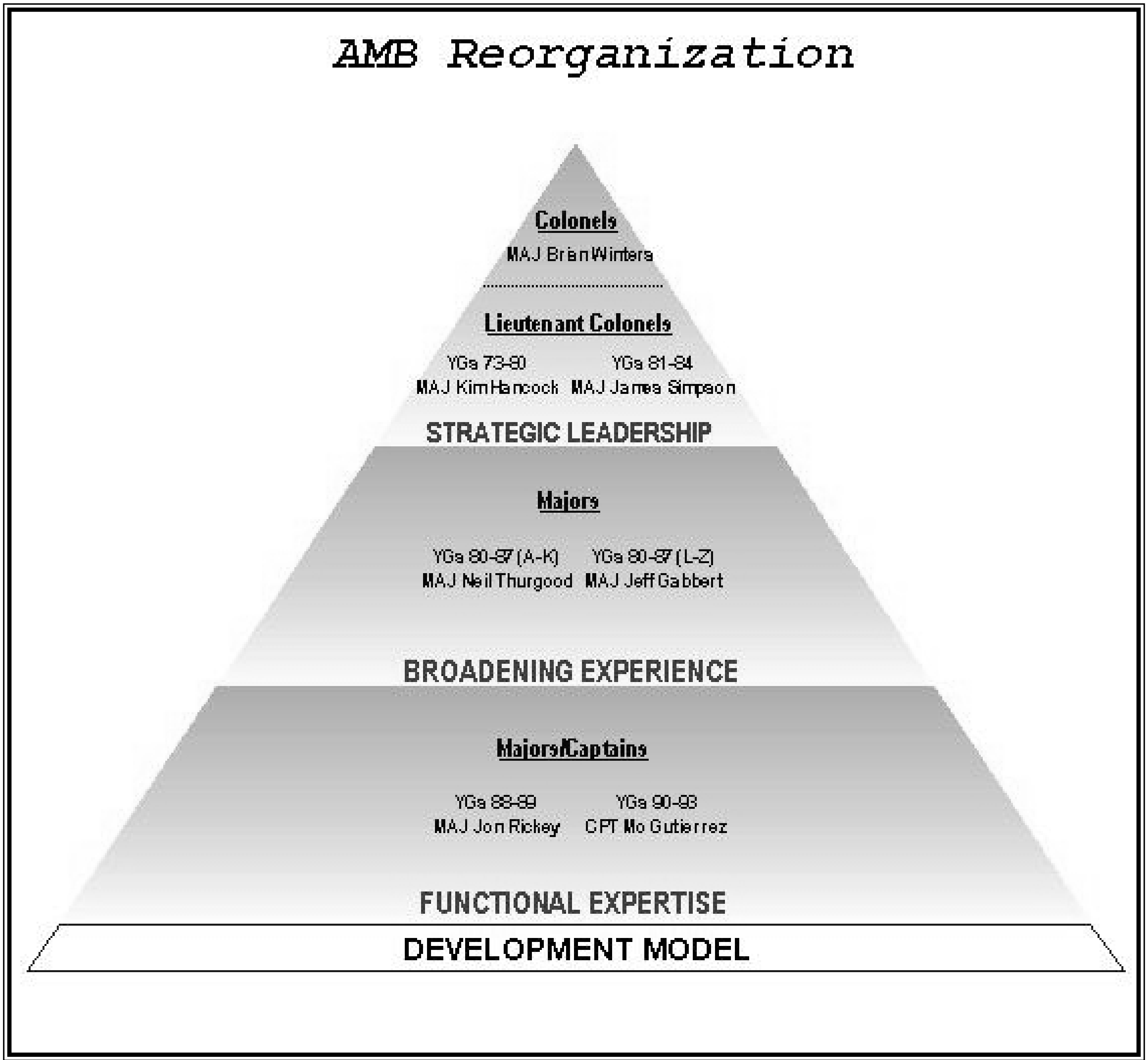
AAC officers selected for TWI come from a variety of military organizations and backgrounds and usually have a minimum of 10-12 years of Army service. They have completed several military operational assignments culminating in a tour as a company commander. In addition, they have served at least 24 months in an acquisition assignment. Most officers also have a master's degree.

Once placed in the industry assignment, officers are assigned a coordinator who introduces them to the company, assists during their transition to the corporate world, and serves as a point of contact while in the program. Ideally, a mentor or advisor is also designated to advise the participant. At the end of the TWI year, officers receive a formal evaluation from the company in the form of an Academic Evaluation Report (AER). The AER is placed in the officer's permanent military personnel file.

TWI officers prepare a training plan during their first month at the company. The plan is a joint effort between the officer and the company coordinator and identifies individual goals and objectives. The TWI training plan will typically expose the officer to daily issues at middle- and senior-management levels. In addition to hands-on work experience, individuals are encouraged to participate in any training programs available through the company.

Officers selected for the TWI Program are military professionals with the initiative to immerse themselves in a corporate work environment with minimal guidelines and flexible learning conditions. The result is a career-broadening experience that has the potential to strengthen their technical competency, problem-solving skills, and leadership abilities. It will undoubtedly provide insight and understanding when interfacing with the Defense industrial base and tackling the challenges of the future Army.

For additional information on the TWI Program and application procedures, go to the AMB Web site at **http://www-perscom.army.mil/OPfam51/TWI-Feb01.htm**.



Army Technology Transfer Awards

Scientists and engineers from the U.S. Army Research Laboratory (ARL) and the U.S. Army Aviation and Missile Command, both major subordinate commands of the U.S. Army Materiel Command, won FY00 Federal Laboratory Consortium (FLC) Awards for Excellence in Technology Transfer. Winners were honored at the FLC Annual Meeting held in Charleston, SC, last year.

The FLC is a congressionally chartered network of federal laboratories designed to promote and strengthen technology transfer nationwide. The FLC established this annual award program to recognize individuals from federal laboratories as well as commercial sector partners who have done outstanding work in transferring technology to the commercial marketplace.

Nominations are submitted by the laboratories and are judged by a panel of technology transfer experts from industry, state and local governments, academia, and the federal laboratory system.

The award criteria are as follows:

• An individual or team of individuals has demonstrated uncommon creativity and initiative in the transfer of technology.

• The benefits to industry, state and local governments, and/or to the general public are significant.

• The achievements are recent.

Recipients of Awards for Excellence in Technology Transfer and highlights of their achievements follow.

The LASFORM Rapid Prototyping System. A team of engineers from ARL and AeroMet Corp. of Eden Prairie, MN, successfully transferred a new rapid prototyping technology—the LASFORM laser-forming system. This technology, which has DOD and commercial aerospace applications, is a flexible, one-step process whereby a precursor material (usually a powdered metal introduced into a laser beam) is deposited as molten droplets onto a metallic substrate located beneath the focused beam. Prompted by computer instruction, a multiaxis positioning system drives the substrate in motions reproducing a horizontal layer, or slice, of the part as described by a computer-aided design model. After the initial layer has been deposited and fused to the substrate, the beam and powder delivery subsystem are indexed in the vertical direction by an amount equal to the layer thickness. A layer-upon-layer deposition sequence is then repeated until the desired density is achieved. Although other rapid prototyping processes are available, none has the size capability of LASFORM, and the properties of its prototyped parts do not have sufficient strength or toughness to be used in the field.

This transfer effort is being executed through a cooperative research and development agreement (CRADA) between ARL and AeroMet, a subsidiary of MTS Systems Corp. AeroMet was founded in 1997 for the sole purpose of commercializing LASFORM, as well as capitalizing on ARL's vision and direction in rapid prototyping. To that end, AeroMet installed and is now operating the large-scale laser-forming system in its 16,000-square-foot facility.

LASFORM provides many benefits for AeroMet, which now can produce less costly aerospace parts for both industry and DOD. Other users such as the Navy are seeing the cost of parts decrease by as much as $50 million.

Digital Eye Screening. Refractive photography has been used to diagnose eye disease for years. The problem with this process is that the quality of a picture is uncertain until the film is developed. If the film is unsatisfactory, another photo session has to be scheduled with the patient. Also, the entire process—from photo session to analysis—can take several weeks.

In 1997, Vision Partners of Memphis, TN, contacted the U.S. Army Aviation and Missile Command's Research, Development and Engineering Center (AMRDEC) to investigate automating and improving the refractive process using advanced imaging and signaling processing. Wayne Davenport, an AMRDEC expert in digital imaging and optics, who is also knowledgeable in the mechanics of the human eye, immediately went to work on the problem.

Through a CRADA between Vision Partners and AMRDEC, Davenport designed a small, light system that provides real-time feedback and increased accuracy versus standard 35mm systems. Called the iScreen, the device is capable of screening both children and adults in a matter of seconds for eye diseases such as amblyopia, strabismus, and cataracts; and refractive problems such as myopia, hyperopia, and astigmatism.

Once the iScreen was developed, Davenport constructed five of the photo-screening devices himself, eventually transitioning the construction process to SPARTA Inc. of Huntsville, AL. A patent is expected to be issued for the iScreen sometime this year.

Not only will children who undergo mandatory screening by pediatricians immediately benefit from this technology, the general public will benefit as well because children will be able to be screened through state-run programs that will make the process more affordable.

Acoustic Physiological Monitoring Sensor. The acoustic physiological monitoring sensor, developed by Michael Scanlon of ARL, is a breakthrough technology with the potential to save many lives. Marketed first as the Sudden Infant Death Syndrome Monitor and Stimulator (SIDSMAS), the sensor employs a fluid-filled bladder with a hydrophone inside that matches the acoustic impedance of an infant in contact with the pad containing the sensor. By removing impedance mismatches, excellent acoustic coupling of heart and breathing sounds—as well as vocalizations and movement noises—is achieved. The sensor can be attached to beds, wheelchairs, or other body-contacting equipment. Smaller versions of the sensor can be body-worn by soldiers, firefighters, or police, or be used for health monitoring of individuals. The sensor's transmitter and alert functions allow personnel in nurseries, hospitals, daycare centers, and private homes to continuously assess the health and performance of individuals. A single acoustic sensor can collect information concerning heart, lungs, and digestive tract functions, or detect changes in voice or sleep patterns, motor activity, and mobility. Surgeons and research physiologists have commended the data Scanlon collected and processed for this technology. Many in the field believe the technology will be the basis for next-generation stethoscopes and long-term health monitoring.

The preceding article was submitted by James K. Wanko, the Army Domestic Technology Transfer Program Manager at the U.S. Army Research Laboratory, Adelphi, MD.

BOOKS

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.

The Professional Service Firm 50

By Tom Peters
Alfred A. Knopf, Inc., New York, 1999

Reviewed by LTC John Lesko, U.S. Army Reserve, a Decision Coach and Group Facilitator with Anteon Corp. He provides collaborative decision-support services to the U.S. Air Force acquisition community. Lesko is also a member of the Army Acquisition Corps and a frequent contributor to Army AL&T. Contact him at John.Lesko@saftas.com.

"Fifty ways to transform your 'department' into a professional service firm whose trademarks are passion and innovation!" Thus starts Tom Peters in another of the *50Lists Series* books that describe work in today's knowledge-based economy. So what is a professional service firm (PSF)? What lessons are to be learned from such firms and how might the acquisition community apply these lessons?

In the first chapter, Tom Peters states, "The starting point of all significant change is mind-set. I.e., shifting from the internally focused, 'task' mind-set to a fanatical 'Incredible-Client-Service-through-Awesome-Projects' mindset." He suggests that organizations that take on a winning PSF attitude must transform their human resources department, purchasing, finance, and other so-called support services into client-focused, value-added entities. Only in this way will the entire enterprise contribute to the organization's and client's shared success.

In Chapter 2, the author states that this change in attitude is all encompassing, transforming one's point of view as well as one's day-to-day vocabulary. For example, *customers* become *clients* who then become *partners*. Members of today's professional service firms enter into an intimate relationship with their clients as business processes are transformed and capabilities strengthened. In Peters' own words: "A client is …

• a partner
• someone with whom I have an intimate relationship
• in it with me for the long haul
• someone with whom I co-invent the future
• a person/organization in whose outcomes I have a big personal stake
• someone with whom I have an emotional bond
• someone with whom I can't work if trust is not paramount
• a fellow professional who, like me, wrestles with intractable problems
• the source of my reputation (for better or for worse)
• my No. 1 'word-of-mouth' marketer!
• someone who grows with me
• someone who loses when I lose
• someone who wins when I win."

Chapters 3 through 50 outline how professional service firms must seek out clients who are leaders, fire bad clients, commit to working on cool projects, achieve wow results, manage a project portfolio, position oneself closely with their clients, pursue excellence with passion, take risks on quirky projects, work with a sense of urgency that exudes enthusiasm, etc. Critics will say that this list of 50 commandments—the gospel according to "Saint Peters"—is too long, the author's tone too strident. Others will say that Tom Peters is ranting and repeating himself. Some will see this as the same old stuff drawn from *In Search of Excellence, A Passion for Excellence, Thriving on Chaos*, or *The Pursuit of Wow!* packaged in a new cover.

This reviewer thinks otherwise for the following reasons:

• Each chapter is about four to six pages in length, and this makes for easy reading as well as bite-sized consumption. This book begs to be read on the commuter train, at the subway station, in a grocery line, or during those 10-15 minute periods we all find between appointments. Each chapter is focused, thought-provoking, and insightful. Today's pace lends itself sound bites, quick summaries, and Web-like design. With this book, form follows function.

• Each chapter begins with a fairly clear thesis statement—what Peters labels, "The Nub"—and ends with suggested "Things To Do (TTDs)." In between, the author offers cogent examples drawn from commercially successful companies, shares relevant business stories, or explains his rationale behind each thought or observation.

• Peters cites statistics, plots trends, and gives references throughout the book and does so in detail. Additional reading suggestions are offered for continued study of leading professional services and consulting firms.

So why read this book? Acquisition professionals are called upon to provide the absolutely very best products and services to support both current and future operations. Simply stated, acquisition professionals must wow and delight their clients for the very lives of soldiers, sailors, airmen, and Marines depend upon the collective best judgment and the professional services this community offers today. That said, Tom Peters' *The Professional Service Firm 50* is a must-read guidebook for positive change and an excellent addition to the acquisition professional's library.

Project Management for the Technical Professional

By Michael Singer Dobson,
Project Management Institute, 2001

Reviewed by LTC Kenneth H. Rose (USA, Ret.), a Management Consultant in Hampton, VA, and former member of the Army Acquisition Corps.

Most technical professionals have faced the prospect of moving from a staff to a management position. To some, it was a welcome challenge; to others, a never-ending nightmare. Michael Singer Dobson addresses this situation in a new book, *Project Management for the Technical Professional*, which provides practical advice for a successful transition.

The book is divided into four sections. The first focuses on individual leadership. Dobson starts strong on Page 1 with a clear graphic that shows leadership as something that originates from within and looks outward. Readers would do well to prepare a contrasting image: write the word "me" on a piece of paper and surround it with a circle of inward-pointing arrows. If this image depicts their view of leadership, what follows will do them a world of good.

Readers should keep their pencils close at hand, for Dobson intends his book to be an interactive journey. Frequent exercises require readers to get involved by doing things, not just reading about them. Section 1 includes a survey aimed at "knowing thyself," as well as exercises that require readers to think about what they have read and how it applies to them.

Dobson's final point in Section 1 is that moving into management is nothing less than a career change that demands different goals, skills, and methods. It requires a broader view and an ability to recognize and deal with problems that may be very fuzzy, complex, and new.

Section 2 presents some tools for the new manager. People skills are paramount. Dobson reviews the classic styles of management and reminds readers that a combination of styles tailored to the situation is usually most effective. He reviews the criticality of communication and provides guidance on giving feedback to others, emphasizing the importance of listening. Delegation is an essential task for new managers. Dobson offers a diagnostic exercise and clear advice on what to delegate and how to do so.

Recruiting, hiring, training, and the always-thorny issue of performance appraisal get down-to-earth treatment. Dobson's summary of motivation theory is clear and concise. His discussion of conflict management is complete, including various foundations of conflict and how to address them.

Section 2 closes with an overview of the many "alphabet soup" management initiatives that new managers may encounter: TQM, MBO, ZBB (total quality management, management by objectives, zero-based budgeting), etc. The discussion will not make experts of readers, but will provide a level of functional literacy necessary for basic understanding.

Section 3 focuses on managing technical professionals. Dobson discusses technical culture and provides an amusing list of techno-terms. For example, "encrypted English" means that the writer has poor writing skills. But more important, Dobson offers useful suggestions for changing culture in a technical environment.

Technical projects are often completed by teams. Dobson's extensive treatment of this issue is one of the book's great strengths. Good teams don't just happen. New managers must know both techniques and traps if they are to get this right. A sound discussion of power and informal organizations combines to make Section 3 the real powerhouse of this fine book.

Section 4 is the book's only shortcoming. At 14 pages, this section on managing technical projects hardly fulfills the promise of the book's title. But this is not a fatal flaw. Dobson's brief introduction to project management is probably best fleshed out by perusal of the *PMBOK® Guide*. So much of value precedes this section that duplication of detail is both unnecessary and unwise.

Project Management for the Technical Professional is a unique and valuable addition to project management literature. Throughout, author Dobson illustrates theory with a series of case studies—brief stories that clarify content by way of real-world examples. He uses references from popular films and cartoons to illuminate points in an engaging and memorable way. In so doing, Dobson has produced a text that speaks to today's professionals in today's language, communicating information and knowledge that will aid the leap from technical worker to technical leader.

This book is available for $34.95 from Project Management Institute at **http://www.pmibookstore.org**.

Army's MRICD Featured In New Book

The research findings of scientists pursuing the Army's mission of developing medical protections against the effects of chemical warfare agents are the substance of a new book by CRC Press entitled *Chemical Warfare Agents: Toxicity at Low Levels*. The book is edited by Dr. Satu M. Somani of the Southern Illinois University School of Medicine, and COL James A. Romano Jr., who holds a doctorate in experimental psychology. Somani has conducted research on nerve agents for more than 15 years while under contract with the U.S. Army

BOOKS

Medical Research and Materiel Command. Romano is the Commander of the Army Medical Research Institute of Chemical Defense (MRICD), Aberdeen Proving Ground, MD. MRICD is DOD's premiere laboratory for medical chemical defense research.

Seven of the book's 14 chapters were authored or co-authored by MRICD experts in toxicity of chemical warfare agents and experts in development of medical countermeasures. Additionally, scientists from MRICD's sister laboratory—the Walter Reed Army Institute of Research—contributed to the book, as did scientists from the Army Edgewood Chemical Biological Center, the Army Center for Health Promotion and Preventive Medicine, academia, and allied government research laboratories.

The comprehensive text covers topics such as the health effects of low-level exposure to nerve agents and to the blister agent sulfur mustard, the acute and chronic toxicity of cyanide and riot-control agents, the development of pharmacological countermeasures to botulinum intoxication, and the psychological factors in chemical warfare and terrorism. Chapters also explore how stress can affect the toxicity of chemical agents, the effectiveness of treatment compounds, and the Army's pursuit of new methods of detoxification through the development of circulating scavenger enzymes and enzymes covalently bound to a decontaminating sponge. The final chapter discusses the emergency response to a chemical warfare incident and describes domestic preparedness, first response, and public health considerations.

ACQUISITION REFORM

Important Memorandums

Note: The point of contact for the following acquisition reform article is Monti Jaggers, (703) 681-7571, ***monteze.jaggers@saalt.army.mil****.*

Prior to his departure, then Under Secretary of Defense for Acquisition, Technology and Logistics Dr. Jacques S. Gansler signed two very important memorandums that will significantly enhance the use of commercial practices and acquisitions in DOD. The subject of the first memorandum is commercial acquisitions, and the subject of the second is incentive strategies for Defense acquisitions.

Commercial Acquisitions

This memorandum directs that "To the maximum extent possible, commercial acquisitions should be conducted using Federal Acquisition Regulation (FAR) Part 12." The integrated process team (IPT) that was chartered to review DOD commercial-item determinations found that obstacles to assessing commercial items include inconsistent commercial-item determinations, weak market research, and confusion concerning pricing of commercial items. The memo further directs that the following actions be taken to help overcome the barriers:

- Provide clarification on FAR Part 12 use for consistency in DOD,
- Establish goals,
- Request each Service and Defense agency provide an implementation plan to meet goals, and
- Request the IPT to determine feasibility of establishing a pilot program for developing a central database or other tools to assist in consistent commercial-item determinations.

Additionally, the attachment to this memo provides some immediate clarification, and the Commercial Item Handbook provides further guidance. The complete memorandum and attachment can be found at **http://www.acq.osd.mil/ar/doc/commercialacq010501.pdf**.

Defense Acquisitions

This memorandum stresses the importance of adopting "incentive strategies to successfully attract, motivate and reward traditional and non-traditional contractors, thus ensuring successful performance. Incentive strategies must also maximize the use of commercial practices to enhance our ability to attract non-traditional contractors."

As noted above, program teams are encouraged to structure incentive strategies to attract nontraditional Defense entities and reward successful performance of traditional Defense firms. Thorough market research should be conducted to develop a better understanding of the business strategy from the viewpoints of both the government and the contractor, leading to behavior that jointly achieves the mutual goals of all parties (e.g., best-value acquisitions and targeting high performance based on best-business practices).

Additionally, the memo's attachment provides guidance that amplifies existing policy regarding use of incentives in Defense acquisitions. To assist the acquisition workforce, an incentive guidebook is also being developed based on work conducted by the Army and the Massachusetts Institute of Technology.

The memorandum, attached guidance, and guidebook can be found at **http://www.acq.osd.mil/ar/doc/incentives010501.pdf**.

Pest-Proof Uniforms

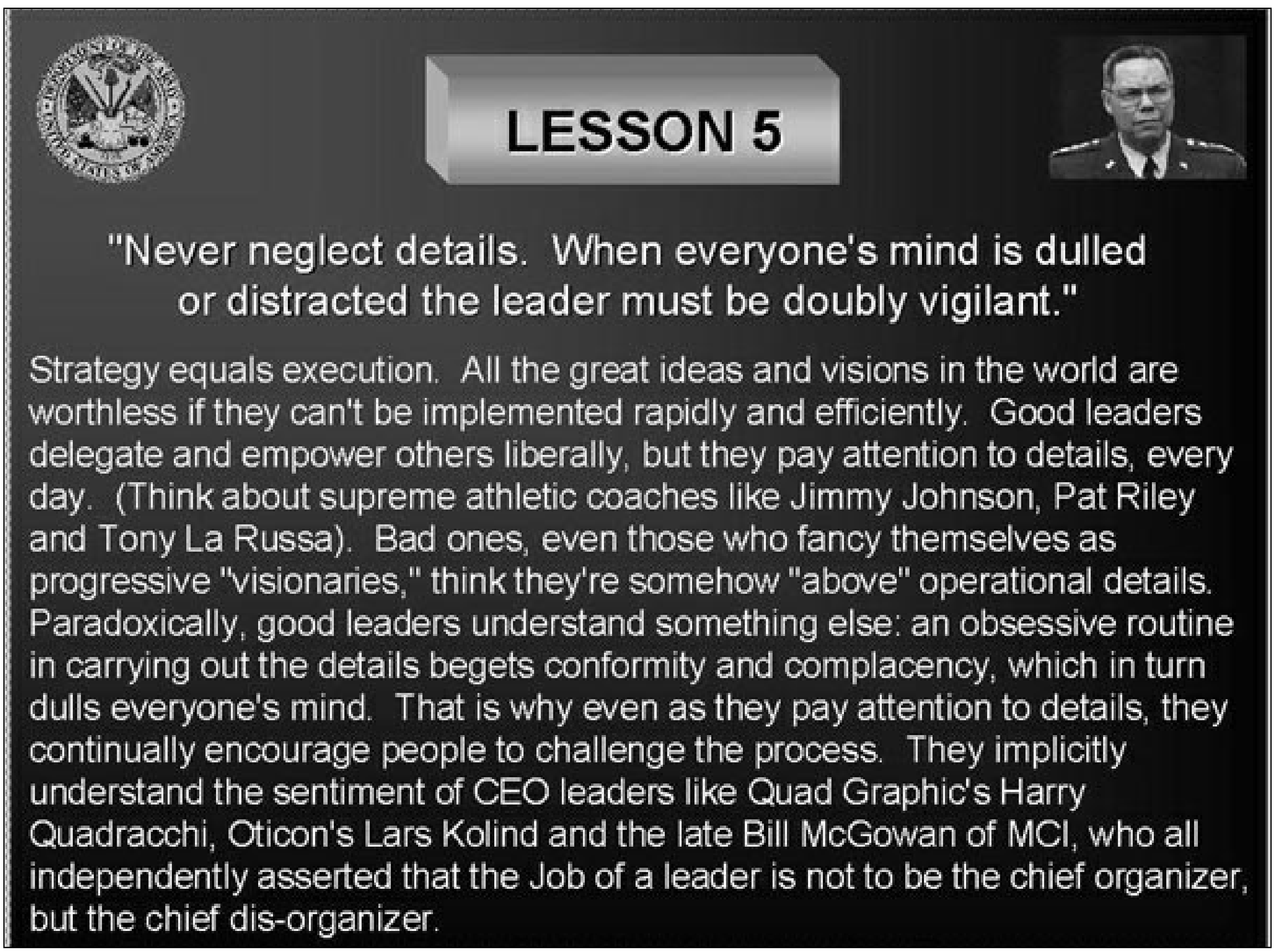
Smacking, scratching, and twitching caused by attacking bugs may be reduced dramatically with permethrin-treated Battle Dress Uniforms (BDUs). In March 2000, more than 350 soldiers from the 1st Battalion, 509th Infantry at Fort Polk, LA, completed an 8-month evaluation of permethrin factory-treated BDUs. The uniforms are pending Army Uniform Board approval to become a clothing item troops can purchase.

Fifteen years ago, the Army began investigating the possibility of applying insect repellent to textiles—BDUs in particular—to ward off diseases, according to Bart McNally, Senior Research Chemist at the U.S. Army Soldier Systems Center in Natick, MA, who patented the process of machine-treatment of BDUs with permethrin.

Permethrin is a popular and safe chemical that repels and kills insects. The U.S. Environmental Protection Agency and Surgeon General have approved it for years for use on textiles. In the early 1980s, the Army approved a permethrin spray can that soldiers could use to treat their uniforms. Unfortunately, the spraying was only effective for a short time.

During the recent 8-month evaluation, the treated uniforms were tested to ensure their effectiveness. Three sets of hot-weather permethrin BDUs were issued to the soldiers, allowing them to wear a treated uniform throughout the study. The soldiers wore each uniform an average of 20 hours per day.

Permethrin had no significant impact on basic uniform performance. Soldiers believed that wearing the treated uniform led to fewer insect bites, controlled insects on and around them, and offered better protection than an untreated uniform with insect repellent. Eighty-seven percent of the evaluation participants preferred the permethrin uniform to current options, which for this group consisted mainly of insect repellent. Some users were sensitive to the uniform and developed a small rash, but complaints have been minimal, according to Kathy Swift, a Textile Technologist in the Office of the Product Manager, Soldier Equipment.



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