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SEPTEMBER - OCTOBER 1996

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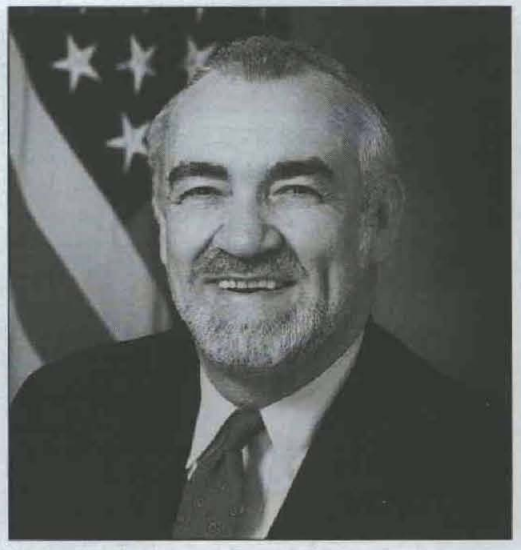
FROM THE ARMY ACQUISITION EXECUTIVE. . .

MAKING TECHNOLOGY WORK



We've always known that technology is critical to the combat power of our soldiers, but the context in which technology plays was never shown more dramatically than in Operation Desert Storm. Perhaps the most dramatic lesson taken from the Gulf War was the understanding of technology leverage and its contribution to military combat power.

A lesson relearned was that technology by itself provides no combat power. Rather, it is the application of technology along with three other critical elements that make up a superior military force. The four elements are:

1. Excellent, well-qualified leadership on the battlefield;
2. Bright and well-trained soldiers;
3. High morale and a sense of purpose; and
4. Applied technology.

All four of these factors culminated in the U.S. Army's outstanding performance in Operation Desert Storm. The net result was that once the ground campaign began, our forces were so dominant that it was a 100-hour war rather than a few weeks or a few months war. I believe that we could assert with validity that if any one of the four elements had been missing, including technology overmatch, the war would have been considerably longer with far greater numbers of casualties.

It is absolutely critical, however, that we not pursue technology for technology's sake. We must make technology work for the soldier. There are several initiatives underway within our technology program to achieve this end. Let me highlight a few of them.

First, the concept of Integrated Product Team management has been adopted by the Army, specifically the U.S. Army Training and Doctrine Command (TRADOC) in its requirements determination process. Mission Need Statements and Operational Requirements Documents are developed using Integrated Concept Teams (ICT) led by a TRADOC team leader. ICT members include scientific and engineering personnel, acquisition personnel, and test personnel. This process enables us to select technology and assess affordability in the earliest stages of developing requirements.

Second, we are maintaining a relevant, robust, ongoing Science and Technology (S&T) program within our overall research, development and acquisition budget. Senior warfighting leaders of flag rank are asked at least biannually to review our S&T programs to ensure they are pertinent to perceived Army needs. By so doing, we hope to have applicable technologies at a state of maturity or at least know the state of maturity of different technologies when the ICTs are faced with selecting technology solutions to meet candidate requirements.

Finally, one of the major initiatives in acquisition reform is the acquisition of technology from the commercial sector. Substantial emphasis is placed on acquiring commercial technology to match our needs and not duplicate our in-house research and development efforts. It is particularly true that information, computation, processing, and communications technologies are clearly led and advanced by the commercial sector at a far greater rate than we could ever afford within our own S&T program. In fact, the information technology that we have acquired from the commercial sector is the underpinning of Force XXI, an information-based Army with emphasis on complete situational awareness at all levels of the force.

A current, dramatic example of making technology work for the soldier, consistent with the theme of an information-based Army, is battlefield digitization, often referred to as the tactical Internet. As stated, we have acquired the information and communications technology from the commercial sector to enable us to "see" the battlefield at all levels so that leaders from squad and platoon levels through division and corps commanders will have complete situational awareness pertinent to their mission. Without the advances in commercial information technology, we could not have designed this system at this time.

The creation of the digitized battlefield is critical to the Army's efforts to maintain a modern, but smaller force capable of decisive victory. But, battlefield digitization is of little use by itself unless we bring in the other three elements of a superior military force: excellent, well-qualified leadership; bright and well-trained soldiers; and high morale and a sense of purpose. It is vitally important that we make technology work for the soldier so that the soldier is ready to meet the challenges of today, tomorrow, and the 21st century.

Gilbert F. Decker

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FEATURES

DEPARTMENTS

COVER

The Bosnia Technology Integration Cell, establishment of the Army Countermine Task Force, Crusader Software, and the National Automotive Center are among the subjects discussed in this thematic issue devoted to Army efforts in making technology work for the soldier.

INTERVIEW WITH LTG RONALD V. HITE MILITARY DEPUTY TO THE ASSISTANT SECRETARY OF THE ARMY (RDA) AND DIRECTOR OF THE ARMY ACQUISITION CORPS

Q. How would you describe your management philosophy?

A. First, I determine the mission and what needs to be done to accomplish that mission. I also get the right kind of people involved, provide them guidance, and then let them do what's required to accomplish the mission. I am a people-oriented person and believe that people will give you their best if you give them as much leeway as you can. I trust people and believe in keeping close to them.

Q. You have initiated a major effort to reengineer the civilian component of the Army Acquisition Corps (AAC). What, specifically, will be accomplished by this effort?

A. Let me give you some background first. Initially, we took a look at our military people in the Army Acquisition Corps and determined that we were doing a pretty good job in managing their careers. However, we realized that we really needed to focus more effort on the civilian side of the house so we looked at our career expectations for them in terms of education and experience. We have now developed programs which will provide our Acquisition Corps civilians with the type of education and experience necessary to compete for senior level leadership positions in the Acquisition Corps. We are also trying to centralize management of our Acquisition Corps civilians, similar to the way we do it for our military personnel. When we achieve this, we believe we will have a much better understanding of their training needs and a much improved process to ensure that these individuals obtain the training opportunities intended by the Defense Acquisition Workforce Improvement Act. So, we are giving more attention to our civilians by focusing on training and education and providing them with the right kind of jobs and experience to become product managers, project managers, PEOs, or senior managers in the acquisition community.

Q. Civilian members of the AAC frequently express concern that too little attention is given to their professional development in contrast to the military portion of the AAC. What is your response?

A. Until recently, I think that was a valid concern because we were new in the business of developing an Acquisition Corps, which was mandated by a series of new laws. So, during the past three or four years we learned a number of things required that we had not done previously. However, I now believe our civilians should be much happier as a result of the attention we are giving to their training, education and workforce experience needs. I think we are now doing more in these areas than ever before. We have brought together an Acquisition Corps reengineering team with representatives from the various commodity commands, PEO/PM offices, test commands, and contracting commands. At our request, this team has developed our vision for the Acquisition Corps and is looking at what we need to do to improve the training, education and experience for our civilian acquisition workforce. We have a lot of good things going on to make our civilians more competitive and will continue to make further improvements.

Q. The ASA(RDA) recently signed a policy memo on career development as a mission. What is your perspective on this?

A. I think it is a very good memo. By the way, it is a joint memo, signed not only by the Honorable Gilbert F. Decker, the Assistant Secretary of the Army for Research, Development and Acquisition, but also by the Honorable Sara E. Lister, the Assistant Secretary of the Army for Manpower and Reserve Affairs. What it shows is that we are committed to improving the training and education of our acquisition workforce. If you look at the military side of our Army, you will understand that if we don't have a trained Army then we also don't have a ready Army to perform the mission our nation expects. We have known this for many years and, subsequently, have put a great deal of emphasis on individual and collective training for the uniformed side of the Army and there is no reason why we shouldn't do this for the civilian side of the Acquisition Corps. In fact, we have established several innovative programs, such as the Corps Eligibles for GS-13s in the acquisition workforce. We are looking at these people to see what training and education they need to become competitive for Critical Acquisition Positions. I believe we have

now accepted about 2,000 GS-13s into the Corps Eligible Program. These individuals may compete to enter the Acquisition Corps as GS-14s in those Critical Acquisition Positions. We are also taking what we refer to as the "best of the best" top layer GS-13s and providing them with additional training and developmental assignment opportunities. This will make them even more competitive for Critical Acquisition Positions. My Deputy for Acquisition Career Management, Keith Charles, and the Acquisition Corps Reengineering Team have done a superb job in pulling this all together.

When all of our efforts are put into motion—in the next five or 10 years—people will see tremendous results from those we today refer to as our "junior Acquisition Corps population."

Q. How do you assess the importance of education and training in developing the Army's acquisition professionals?

A. I think it is extremely important. This was recognized by the Congress when it passed the Defense Acquisition Workforce Improvement Act, which laid out the various types of training and experience required to become a senior leader in the acquisition business. It is just like anything else—a person must have the proper training and education to be a contributor in a particular profession. I believe training and education are critical.

Q. Could you clarify what official Army policy is regarding mobility agreements for AAC members?

A. To get into the Acquisition Corps, our personnel sign a mobility agreement. They agree to move to wherever the Army needs them to best serve. For military personnel, this is not a problem because we move all the time. However, for civilians it is a little bit different. I do think that people should be aware that we are not pushing mobility just for the sake of mobility. Mobility can mean moving between jobs within the same geographical area without having to move an individual's entire family. However, we do ask that Acquisition Corps members, who serve in critical acquisition positions, be ready to serve wherever the nation needs them. Of course we will take personal needs into consideration, but being a professional means being mobile. It is no different in major corporations. Folks who want to be senior leaders in corporations are given various cross-functional and cross-company assignments in order to climb up the ladder and become senior leaders.

I do realize there is some concern regarding mobility agreements, so we will apply them judiciously. However, we must first do what's best for the Army, but we will certainly consider quality of life and personal concerns. For example, if an individual has a child who is a senior in high school and we can delay moving that person for a year, we will take that into consideration. We won't be impersonal about it. We are not going to just start moving people all over the country just so we can say we are now moving civilians.

Q. The Army recently held a Project Manager (PM) Selection Board to select the best qualified military and/or civilian ACAT I PMs. Are you confident that civilians will be competitive for these positions?

A. Without question, I am very confident. We have great civilian product and project managers and PEOs who are doing superb work. My major concern with civilians being competitive is related to how their files are managed compared with their military counterparts. Military files are centralized, very organized, easy to review and we have an easier time determining an individual's capabilities and potential. Civilian files, on the other hand, are decentralized and are not maintained with the same consistent attention to detail as military files. That is my concern but, I can tell you without question—from a capability standpoint—that civilians are competitive for these positions. If anyone questions this, I suggest that they look at George Williams, who recently retired as PEO for Tactical Missiles. In my view, he was the most outstanding PEO in the Department of Defense—and a civilian!

Q. The active duty Army has undergone significant downsizing in the past few years. How has the AAC been affected by this, and what does the future hold?

A. When the Army Acquisition Corps was established a few years ago, we were given a smaller personnel ceiling because we had projected a significant downsizing in terms of structure. So, we started out much lower because of that projection. However, having said that, we were sized at about 2,500 military, with a pyramid leading up to 250 colonels in the Acquisition Corps. Although I can't project precise figures, I do believe our size will be reduced, along with the rest of the Army. I think we will probably end up with about 1,900 to 2,000 military personnel. We are taking a hard look across the Army at the Military Acquisition Position List and, by the end of fiscal year 2000, will have eliminated those positions which are very "soft," relative to acquisition. We only want to put Acquisition Corps folks into hard-core acquisition positions. We are also doing the same thing with our civilians. We are looking at all Critical Acquisition Positions with the intent of also reducing the size of the civilian Acquisition Corps.

Q. General, you've obviously accomplished a great deal in your more than 30 years of service. What advice would you give to young AAC officers in order to succeed in today's Army?

A. First, our young officers need to get a good grounding in their basic branch. They need to learn what the Army is all about by obtaining six to nine years experience in the operational side of the Army. Once they are accessed into the Acquisition Corps, these young officers must continue doing the things that made them successful thus far. They need to seek hard-core acquisition positions and do the best they can in those positions. They also must understand what it takes to become a senior acquisition leader—whether it is a product manager, a project manager, a PEO, a test center commander, or a contracting commander. In addition, they need to determine what the career path is for these positions and what level I, II and III certification procedures are required in order to compete for the positions.

Q. What do you believe are essential attributes of a successful acquisition professional?

A. The first attribute is understanding the total Army and how acquisition supports the total Army. It is more than going out and awarding a contract or developing a particular item or weapon system. A successful professional must understand the relationships with the user that are necessary to ensure that a safe, effective, and reliable product is fielded for our soldiers. Sensitivity to the politics of the acquisition business is also very important. Additionally, a successful acquisition professional has to understand the process of taking a program through the various cycles necessary to field an item. Flexibility is another important attribute because acquisition can be very frustrating due to the many institutions and people influencing an individual involved in the acquisition process. This can include cuts to a program because of higher priority bills that must be paid or cuts from Congress or OSD. This is a fact of life and an individual must have the leadership and managerial skills, and flexibility to accommodate these changes in order to be successful in providing the soldier what he or she deserves. Acquisition is a very complicated business, which a lot of people don't understand.

Q. Is there anything else you would like to comment on?

A. Yes. I want to emphasize that I do share the concerns that I have heard from civilians during the past three or four years. However, I think that if they look at some of the things we are trying to do to help them become better acquisition professionals, they will see a very positive side to our business. I would hope that both our military and civilian acquisition professionals never get out of focus as to why they are here. That focus, of course, is to provide our soldiers the items they need to do their mission. We do need to worry about our careers, our training, and our assignments, but the most important thing we need to worry about is the kind of product we are providing to our soldiers.

Making Technology Work For The Soldier . . .

BOSNIA TECHNOLOGY INTEGRATION CELL SUPPORTS OPERATIONS OTHER THAN WAR

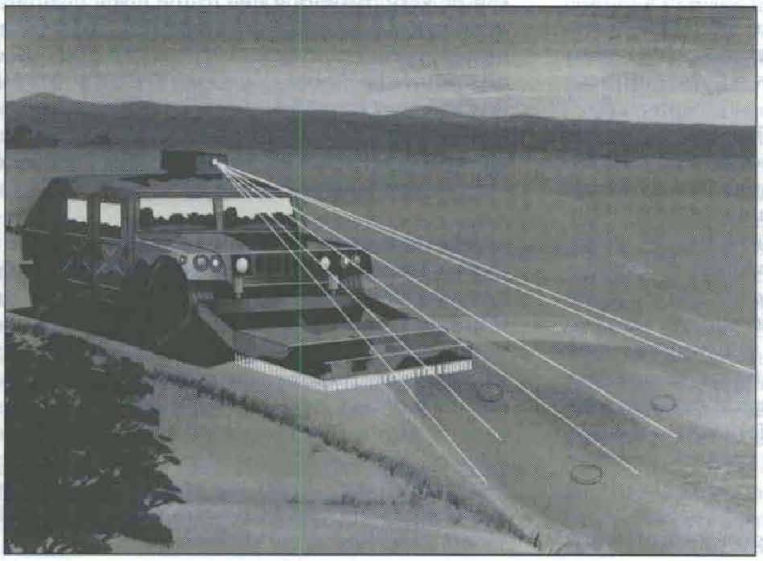
By LTC Kevin A. House

Since the collapse of the Berlin Wall and the end of the Cold War, the threats facing U.S. forces are more diverse and less predictable than those of the former, bipolar but relatively stable, environment of central Europe. Besides potential combat missions, the Army must be able to accomplish a variety of tasks, such as peacekeeping, peacemaking, nation building and humanitarian assistance around the globe.

Each contingency operation has its own unique mission, terrain, weather, climate, geopolitical environment, and many other factors. For example, in places like Panama, Saudi Arabia, Kuwait, Iraq, Haiti, Rwanda, Somalia, and now Bosnia-Herzegovina, the Army has seen over the past seven years just about every environmental condition from hot, flat and dry; tropical; temperate; to cold, mountainous and wet.

Outfitting every unit today for every mission in every part of the world is not practical or economically feasible, since the 1996 research, development, test and engineering (RDT&E) and procurement funding for the Army, in constant dollars, is the lowest in 30 years. Gaps in operational capabilities under certain conditions will likely appear, widen and deepen as resources dwindle. The Army can fill some of those gaps in capability through the selective and timely application of technology.

Based on lessons learned from Operation Desert Shield and Operation Desert Storm, the Army needed a single focal point to compile, screen and evaluate technology ideas on a quick reaction basis to fill the gaps in capabilities unique to emerging contingencies. During the Gulf War, ideas from commercial industry and private citizens flooded, not only the Pentagon, but the field commanders as well on ways to help soldiers fighting in southwest Asia. Some ideas were long on promise but short on reality. Many were not economically or operationally feasible. More than a few contractors marketed on site; some even deployed products into the operational theater at company expense; and occasionally, the user proved these products to be of little value.



An artist's concept of the Ground Standoff Minefield Detection System.

For the Army, the U.S. Army Materiel Command (AMC) is now the single point through which technology ideas pass. AMC simplifies the process for the intended user since they see only those ideas with merit. This process places technical ideas in a technology chain so that feasibility, availability and potential cost can be factored into decisions on fielding and preclude immature concepts deploying into a theater.

In anticipation of the deployment to Bosnia, BG(P) Roy E. Beauchamp, AMC Deputy Chief of Staff for Research, Development and Acquisition, directed the creation of a Special Technology Office last fall to support Operation Joint Endeavor. Beauchamp appointed Dr. Paul E. Ehle, Chief of the RDTE Integration Division, to manage the activities of this office. With an objective to provide technology solutions which improve current capabilities or eliminate identified deficiencies, Ehle immediately identified needs emerging from the deployment of U.S. soldiers to Bosnia. The vision was to make technology work for soldiers by improving operations and safety through the seamless integration of science and technology, research and development, acquisition, logistics support, and soldier readiness. Guidance from the Department of the Army made it clear that the Bosnia operation was not to be treated like an Army Warfighting Experiment or a proving ground. AMC must instead prove technologies valid and supportable before introduction into a theater.

The Bosnia Technology Integration Cell (BTIC) stood up on Dec. 4, 1995, with the mission to serve as the Army nerve center for tracking and integrating the efforts of the entire technology community to support soldiers in Bosnia. Implied tasks include managing the collection and evaluation process of requirements and solutions; retaining specialists in technical disciplines for evaluation expertise and innovative ideas; tracking and recommending solutions to validated requirements; and serving as a central repository on technology information, requirements, solutions, taskings and

points of contact.

The BTIC provides the mechanism to get the best technology ideas, concepts, proposals or hardware from government, industry and the public to the commanders in Europe for their consideration as recommended, potential solutions to their problem areas. Using subject matter experts, the BTIC is the focal point to compile, screen and evaluate technology ideas on a quick reaction basis. Only those solutions that have merit, based upon applicability, availability, affordability and supportability criteria, are presented as recommendations to the user. While the overall idea is predominantly "requirements pull," the Cell is engaged in a soft "technology push" that may result in a requirement. In either case, Headquarters, Department of the Army, Joint Chiefs of Staff, and Office of the Secretary of Defense (OSD) leadership must validate any requirement coming from Europe and, "unless Europe asks for it, don't send it."

By early January, the BTIC had received more than 500 good ideas from many sources ranging from chief executive officers to ordinary citizens across the country. To complete the evaluation process on these ideas, the BTIC convened a recommendations panel with representatives from Department of the Army, Office of the Deputy Chief of Staff for Operations and Plans, U.S. Army Training and Doctrine Command (TRADOC) and major subordinate commands within AMC. This panel selected the top candidates for immediate recommendation to the U.S. Army, Europe (USAREUR).

With approval from the Army and the Department of Defense, a team composed of members from AMC, the Defense Advanced Research Projects Agency (DARPA) and OSD formally presented 50 of the best ideas to USAREUR during the week of Feb. 12, 1996. Based on these recommendations, the Cell has validated requirements for different products ranging from low-tech waterproof socks to a high-tech counter-sniper system to advanced technology such as the DARPA Translingual Communications System. Many items have been shipped and requirements filled. Blast-resistant footwear and new titanium mine probes have been delivered to complement organic countermine equipment. The Military Police (MP) School has completed training the trainers from the 18th MP Brigade on non-lethal munitions for potential use in case of civil unrest in Bosnia. These are examples of technology working for our soldiers in Bosnia.

As money becomes available, the Cell will ensure that the acquisition and fielding process is carried out to meet user requirements. Details of all user requirements and the latest on BTIC activities are found on the BTIC Home Page (http://www.dtic.mil/amc/bosnia/btichome.html).The implications for soldiers are clear: mission success while reducing casualties and while improving the quality of life in a uniquely dangerous and remote area. In the meantime, with more than 800 recorded solutions,AMC continues to seek opportunities to help soldiers and to aid in the advancement of peace, relief of human suffering, and minimizing U.S. casualties in Bosnia and beyond.

One of the candidate systems for the Handheld Standoff Minefield Detection System.

Well before troops crossed the Sava River, AMC, TRADOC and the Armored Systems Modernization Program Executive Office began formulating plans to augment the support already provided to the Commander-in-Chief, USAREUR. These plans included expanding the activities of the BTIC to match the magnitude of the mine problem in Bosnia. Troops there are at serious risk because of widespread and indiscriminate employment of land mines, from small anti-personnel to large anti-tank mines, perhaps as many as two million in a country the size of Tennessee. Bosnia has the highest density of mines of any country in the world. These mines have metallic content ranging from fractions of a gram to many pounds with the potential employment of a variety of fuzing mechanisms including pressure, magnetic, chemical and remote or seismic detonating systems. U.S. soldiers have the best countermine equipment fielded such as AN/PSS-12 hand-held metallic mine detectors and the Battalion Countermine Set. Although this equipment has helped mitigate the risk to soldiers, it has not eliminated the problem.

The land mine issue is a high priority for USAREUR due to the number and complexity of land mines in and around the Zones of Separation. Factors affecting countermine operations include inconsistent mine patterns, uncertainty of mine locations, lack of mining records, use of plastic mines with minimum metallic content, the presence of old, unstable mines and, on top of all of that, terrible climatic conditions. In recognition of this priority, and the fact that mines are potentially one of the largest casualty producers in operations other than war and all forms of ground war, the Army Vice Chief of Staff established the Army Countermine Task Force (ACTF) on Feb. 9, 1996. The mission is to accelerate the fielding of equipment to improve the capability to detect, avoid, clear or neutralize land mines deployed in areas of operational interest to U.S. forces in Bosnia and to lay a solid foundation for a long-term countermine program. BG(P) Beauchamp at AMC, and MG Clair Gill at the Engineer School, TRADOC, co-chair the ACTF using an integrated product team approach to give the warfighter more capability, sooner and at less cost.

The operational headquarters of the task force is at the U.S. Army Communications-Electronics Command's (CECOM's) Night Vision and Electronics Sensors Directorate. It draws staff expertise from its organic Countermine Technology Division and the Project Manager for Mines, Countermine and Demolitions, both at Fort Belvoir. Moving technology from the laboratory to the soldier in Bosnia as quickly as practicable is the objective.

On Feb. 21, 1996, the ACTF posted a "Sources Sought" notice in the *Commerce Business Daily*, inviting interested parties to submit their concept papers with approaches for the detection of land mines in all types of terrain and weather conditions. The task force gave priority to those proposals offering technology which can be deployed earliest to Bosnia and suitable for fielding in 90-150 days after contract award.

As a result of the *Commerce Business Daily* announcement, countermine experts

Surface Mine Plow for light armored vehicles.

The effects of a 16-pound charge (roughly equivalent to one anti-tank mine) on an unprotected 2½-ton truck.

evaluated and tested detection technologies at Fort A.P. Hill during March 18-22, 1996. The ACTF tested a total of 13 mine detection systems—four were vehicle-mounted and nine were man-portable. The test evaluated the capability of advanced mine detection technologies to reliably detect buried and surface metallic and non-metallic anti-personnel mines and anti-tank mines. The Operational Evaluation Command and representatives from the user, safety and logistics communities assessed technology candidates to decide suitability for deployment and whether further operational testing is required prior to deployment to Bosnia. The Institute for Defense Analyses is currently analyzing data and will report on equipment performance including probability of detection and false alarm rates. Procurement action is expected for some of these concepts.

The ACTF also hosted demonstrations of countermine technologies for Dr. William J. Perry, Secretary of Defense, on March 21, 1996, and for GEN John M. Shalikashvili, Chairman of the Joint Chiefs of Staff, on April 1, 1996. To further increase awareness of ongoing countermine activities, the ACTF hosted a series of briefings and demonstrations of mine and countermine technology May 14-16, 1996, at Fort Belvoir, VA. Each day different groups of distinguished visitors, including members of the congressional staff and senior DOD officials, observed current and developmental countermine equipment and learned about the complex nature of mine detection and neutralization. The final day was for members of the broadcast and print media, including national network and major newspaper representatives. In addition, BG(P) Beauchamp provided briefings on countermine equipment now in country and on emerging technology support to Bosnia as well.

With respect to the short term, the ACTF has accelerated the acquisition of "low-tech" but important equipment that will protect soldiers. This equipment includes Mine Rollers and Surface Plows for Light Armored Vehicles and Mine Resistant Vehicles.

A significant challenge facing soldiers in Bosnia is accurate information on exact minefield locations.To address this problem, the ACTF has expedited development of a high-tech program called the Minefield Database Recon System that will assist soldiers in the accurate recording of minefield locations. These types of systems will provide significant "step-ahead" technologies to our soldiers in Bosnia.

Building for the long term, three emerging technologies—Airborne Standoff Minefield Detection System (ASTAMIDS), Ground Standoff Minefield Detection System (GSTAMIDS) and Handheld Standoff Minefield Detection System (HSTAMIDS)—will provide the "leap-ahead" capabilities for mine detection operations. These technologies incorporate a "system of systems" approach fusing different technology approaches such as magnetic induction detectors with ground-penetrating radars and infrared sensors that will significantly increase probabilities of detecting mines while providing a standoff capability for operators of the detection systems.

Both the BTIC and the ACTF are dealing with the near term and building for the long term. Critical technology solutions are getting into Bosnia with more to follow, and AMC is exploiting initial successes to prepare for future contingency operations. As a new way of conducting business, the processes established by the BTIC are now institutionalized under a recent re-engineering effort within Headquarters, AMC. The technology database will be maintained and expanded for the next operation to quickly draw upon solutions and past requirements and technical expertise.

Building on lessons learned by the BTIC and the ACTF, the follow-on Contingency Technology Integration Cell will be more responsive to the demands of the contingency at hand and to its customer, the soldier in the field. Accordingly, AMC will be ready with a responsive technology program to provide safe, reliable and enhanced capabilities for soldiers wherever and whenever they deploy.

In summary, AMC has moved technology, proven safe, reliable and relevant from the laboratory to soldiers in Bosnia and has begun laying a solid foundation for a long-term countermine program to better protect soldiers in future deployments. Lastly, based on proven processes and lessons learned, a reorganized AMC is now better positioned to respond to urgent needs with the right solutions in time to make a difference for ground forces.AMC continues to "make technology work for soldiers."

LTC KEVIN A. HOUSE is a science and technology staff officer in the Office of the Deputy Chief of Staff for Research, Development and Acquisition at Headquarters, U.S. Army Materiel Command. He holds a Bachelor of Science degree from Furman University.

CRUSADER SOFTWARE DEVELOPMENT

By MG John F. Michitsch
and Larry L. Yung

Introduction

In the new environment of a reformed, streamlined system acquisition approach, Team Crusader has responded to the need to apply new and innovative techniques to minimize the cost, development time and technical risk associated with the Crusader system, while achieving required system performance. In no area is this challenge greater than software. Given the high level of automation required to support system features such as command and control, communication, mobility, armament, resupply, and survivability, software represents a critical path for achieving program success.

In response to this challenge, Team Crusader has adopted a software acquisition strategy that is based on the best practices of both DOD and commercial industry, as well as state-of-the-art software engineering technology. The goal of this strategy, when applied within the context of a reformed program acquisition environment, is to promote the development of high quality, reliable, and maintainable software while minimizing cost, technical risk, and development time.

Although Crusader is currently in the demonstration/validation (DEM/VAL) phase, Team Crusade plans to reuse software developed for DEM/VAL in the objective system to be produced in the engineering manufacturing and development (EMD) phase.

The Concept

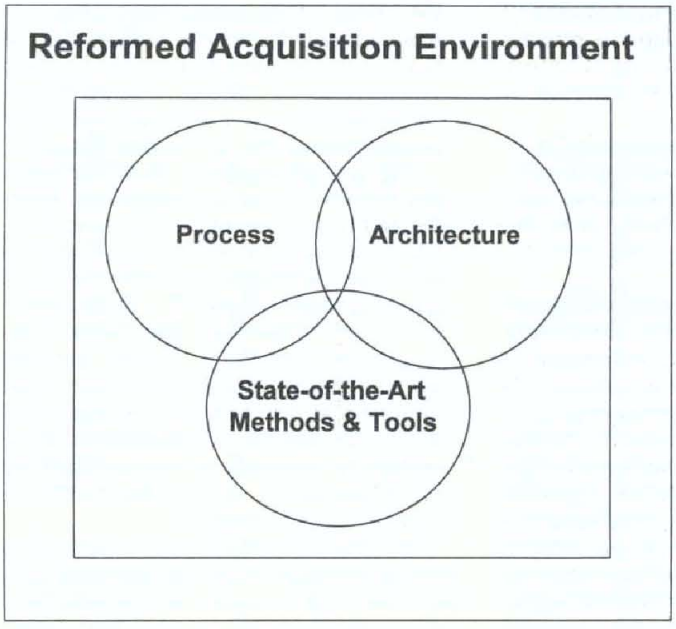
The Crusader software acquisition approach, shown in the accompanying figure, is composed of three major elements: process, architecture, and state-of-the-art software engineering methods and tools. While each of these elements has been applied on past projects, Team Crusader is planning to fuse these elements so that they are used in an integrated and systematic manner. By doing this, the risks associated not only with each element, but also those associated with the relationships among them, can be identified and mitigated early in the Crusader Program. A brief discussion of these elements follows:

Process

The scope and complexity of Crusader software requires that repeatable, disciplined software practices be brought to bear on the program. To enforce such practices, Team Crusader developed a software development process which ensures consistency and commonality in software activities and products. This process has been documented in the form of a Software Development Framework (SDF).

The SDF provides the guideline to allow Team Crusader software developers and managers to share a common understanding of how Crusader software is to be conceived, designed, coded, tested, and maintained. For each activity in the process, the associated products, entrance and completion criteria, methods, tools, and tasks are clearly defined. This allows the scope of software activities to be fully understood, thus promoting the development of more accurate and realistic software cost and schedule estimates, as well as the early identification of associated risks. In addition, it enables software and system developers to more easily plan and coordinate integration activity. Specifically, the Crusader software process provides the following:

• A build planning procedure that permits tailoring of process activities for each



Crusader software approach.

The scope and complexity of Crusader software requires that repeatable, disciplined software practices be brought to bear on the program

build to accommodate the unique needs of specific software efforts. Such tailoring is based upon guidelines specified in the SDF.

• An integration planning procedure which promotes the coordination of software activities to ensure timely delivery of software products to support software and system integration.

• A mechanism to allow each Crusader software organization to implement the process using their internal software procedures, while adhering to the common activities, methods and products required by the SDF. Furthermore, in order to take advantage of the best practices of each organization, tailoring of the process is permitted, based upon guidelines provided by the SDF. Each Team Crusader developer is required to document any organization-unique process tailoring or implementation in an annex to the SDF.

• A mechanism which governs the selection and management of software subcontractors. This includes promoting the use of Software Engineering Institute (SEI) software capability evaluations (SCE) as part of the selection process.

• A software risk management approach which governs the assessment, management, and mitigation of risk which have impact at the software, system, and program levels. Team Crusader is committed not only to enforcing this process, but also to its continuous improvement. To facilitate this effort, Team Crusader adopted the SEI Capability Maturity Model (CMM) as a guide for process improvement. This involves the use of the SEI SCE method to obtain a baseline of the overall software capability of Team Crusader member companies. Based upon the funding of the SCE, Team Crusader developed recommendations for the improvement of each company's software practices in order to mitigate the risks associated with applying the practices required in the SDF. As recommendations are implemented, improvement will be measured through a series of CMM-based assessments, to be conducted semi-annually. In addition, Team Crusader is exploring the use of award fee incentives to encourage process improvement.

Computer System/Software Architecture

Crusader will shoot faster, further and more accurately; resupply more efficiently and move with more agility on the battlefield than existing field artillery systems. However, the true technology leap-ahead for Crusader will be information processing. Never before has the Army had such an opportunity to drastically increase the system's capability to aid the soldier in decision making, logistic management, planning, training, diagnostics, prognostics and communication. All these are possible by the software and computer system architecture selected for Crusader.

One of the major challenges for Team Crusader is to develop a system architecture that implements the major features of the Army Technical Architecture (ATA), while providing the required levels of performance. Furthermore, the Crusader architecture must be tolerant to changes in the ATA, as it evolves to include requirements for the embedded weapons system. To achieve such an architecture, the Office of the Project Manager, Crusader is working with the Army System Engineering Office (ASEO) to explore alternative options of extending the ATA to include embedded weapon system requirements. In this role, Crusader will be the forerunner of a new generation of weapon systems that are based on the ATA.

As a key component in the Crusader system, software is one of the primary drivers behind the structure of the system architecture. In defining the architecture, Team Crusader will determine the right match of commercial-off-the-shelf (COTS) components such as processors, operating systems (e.g., POSIX compliant), display standard (e.g., X-Windows/MOTIF), database architectures, and distributed computing products to provide the core infrastructure to support the operation of both real-time and C2 applications in an embedded environment that is ATA compliant.

To obtain the most efficient use of computing resources within the software infrastructure and to ensure the proper allocation of functionality to software components, Team Crusader is developing an architecture of software applications. Based upon the use of Object-Oriented (OO) analysis and design techniques, this architecture will facilitate the following:

• The logical partitioning of functionality into software components; and

• The identification of common functionality and utilities in order to minimize redundancy among software components, allowing more efficient use of computing resources.

Once fully partitioned into software components, this architecture will serve as a primary input to the software development process, where a more detailed OO model of each component will be produced to support the design of software applications.

Methods and Tools

Team Crusader has adopted a host of modern software engineering methods and tools. When applied within the context of the Crusader software process, these methods and tools will promote the development of high quality software within cost and schedule constraints. They include the following:

• ***Evolutionary Development.*** Recognizing the reality of evolving requirements in a DEM/VAL program, Team Crusader will develop software in an iterative manner. Known as evolutionary development, this method will enable developers to explore various alternatives in interpreting and implementing system requirements. Depending on the nature of the software, functionality will be implemented in a series of software builds. Each build will add functionality, as well as enhance that of previous builds as the system requirements evolve. These builds are planned and developed within the context of the Crusader software process and build approach.

• ***Common Development Environment.*** A common and integrated software engineering environment is being developed in the Crusader Program to promote commonality in the products and activities required by the Crusader software process. Based upon a suite of tools, this environment provides an integrated solution to providing automated support for the entire development cycle, as well as support activities such as configuration management and metrics collection. This resulted in a reduced development time. In addition, it enforces the use of specific product formats and coding standards in order to ensure product commonality. Furthermore, the exchange of product data is facilitated by the use of the Crusader Contractor Integrated Technical Information Service (CITIS).

The CITIS is a technical information service which includes procedures, processes, specifications, workflow and software applications for the generation, protection, integration, storage, exchange, and on-line access of digital data. The CITIS enables virtual collocation of Crusader data, supporting an expanding user community involving multiple tiers of users in geographically dispersed areas. The data contained within CITIS also includes program management data, support data and engineering data.

• ***Object-Oriented Design/Ada95.*** OO methods facilitate the maintainability and reusability of Crusader software. This will allow developers to quickly and easily enhance the software functionality as the Crusader system evolves throughout DEM/VAL and EMD. To support the use of such methods, Team Crusader is using Ada95, the new version of the Ada language which provides full support for OO.

A major new capability of Ada95 is the addition of direct support for OO programming. OO programming is an approach for managing software complexity by encapsulating data and its related set of operations in a software entity called an object. OO programming reduces Crusader software complexity because changes to an object are decoupled or isolated from other objects.

Ada95 includes the concept of inheritance between objects to mimic the way people normally think when they classify related objects. Inheritance permits new types of objects to be defined as extensions of other existing object types, forming a hierarchy of type definitions. This approach promotes reuse of software/object code since objects can be defined that extend the behavior from pre-existing objects without the need to edit or recompile the pre-existing, pre-tested object.

• ***Reuse.*** Team Crusader has committed itself to achieving a high degree of software reqse within the system. This includes reuse among system components, as well as the reuse of DEM/VAL software for use in the objective system to be developed during EMD. Achieving this requires not only the use of OO and Ada95, but also the proper infrastructure to obtain the required level of coordination among development organizations. Team Crusader is in the process of putting this infrastructure in place, based upon the integrated product development (IPD) environment. In addition, the reuse effort will include the implementation of integrated government-contractor software reuse management approach that measures the effectiveness of the reuse process and continually improves it.

Ultimately, the goal is to create a collection of reusable software artifacts that are applicable to future field artillery systems and armored system improvement initiatives. For the Crusader Program, reusable software artifacts would include code, documentation, executable programs, software tools, test data and plans, requirements, design and architecture.

• ***Metrics.*** To effectively identify and manage risks associated with Crusader software development, Team Crusader has developed a comprehensive metrics approach. While based upon the Army's Software Test Evaluation Plan (STEP) metrics, this approach includes measures to determine the quality and status of OO designs. Where appropriate, OO based metrics have been used in lieu of STEP, thus allowing Crusader to satisfy the intent of STEP while accounting for the Crusader development approach.

New Acquisition Environment

Crusader software is being developed in an environment which promotes proactive participation of both government and contractor personnel in a less formalized setting. Key to this environment is the use of integrated product development teams (IPDTs). As members of IPDTs, government personnel are encouraged to raise concerns early in development when they are less costly to address. This approach has already yielded successes. Government personnel provided significant input into the development of the Crusader SDF. This reduced the time required to produce the SDF and ensured that all related government concerns were addressed up-front.

By participating in an IPDT, government personnel have access to products throughout their development and can review them in an informal manner. Because of this, Team Crusader has adopted an informal, incremental process for the review of software products. The goal is to conduct informal reviews of products, leading to major program reviews and milestones. When milestones are reached, the government has the insight required to make any necessary decisions, without relying on more formalized product reviews. We expect this approach will yield even greater benefit once we transition from the software requirement definition to the software implementation phase of the Crusader Program.

Design-To-Cost (DTC)

The development and maintenance of software is considered one of Crusader's high cost areas. It is expected, therefore, that the life cycle cost impact of the Crusader software will have high visibility throughout the DEM/VAL program. The DTC initiative makes cost consciousness a mandatory corporate requirement that permeates the entire Crusader developer's organization.

Cost awareness is not to be an attribute applied in some undefined way by a few experienced engineers. A formal structure and process will be implemented to identify, monitor and evaluate development actions and decisions which impact life cycle costs and to initiate corrective actions when cost targets are in danger of being exceeded.

Conclusion

For the Crusader Program to be successful, we must plan, we must manage and we must measure and track progress in the areas of software development. Planning is the most important of the three activities during the early stage of development. We have done a good job so far. We will further reduce software risk through iterative software development. We will continue to stress the importance of software architecture as well as program level software reuse and the use of OO methods in our day-to-day analysis, design, implementation, and maintenance phases. Software development schedule, quality, reliability and cost of ownership are a few of the issues which could plague the program unless we are extremely careful and address them up-front. The management of Crusader is aware of the challenges that we face and we have taken the necessary steps to minimize these potential problems even before they become a reality.

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U.S. Army TACOM. . .

NATIONAL AUTOMOTIVE CENTER FOCUSES ON DEMONSTRATING VALUE TO THE ARMY

By Anthony Comito

Overview

After three years of providing technology seed money to leverage off the many millions invested by the automotive industry, the National Automotive Center (NAC) is beginning to reap benefits through a series of demonstrations that prove the merits of its investments. Recently, a demonstration of collision avoidance technology was conducted by a Collision Warning Safety Convoy that is highlighted in an article on page 36 of this issue of *Army RD&A*. This will be followed by other demonstration programs involving the user to fill the technology insertion pipeline. (See Figure 1.)

Background

The NAC was formed in 1993 to leverage the commercial automotive technology base and accelerate technology insertion into military vehicles. Congress, DOD and the Army leadership recognized that in an era of downsizing and budget restrictions, it was fiscally prudent to increase the utilization of commercial automotive technology to realize the economies of scale and reduce the costs of Army vehicles. Hence, the NAC was formed in the heart of the automotive industry at the Army's Tank-automotive and Armaments Command (TACOM) in suburban Detroit. (See Figure 2.)

During its first two years, the NAC focused on establishing relationships with the automotive industry and providing seed monies for emerging automotive technologies that had potential military applications. More than 35 contracts were awarded, predominantly to non-traditional Defense suppliers. The NAC overcame such difficulties as data rights. There was a reluctance to work together on the part of an industry, due to the lack of familiarity that industry representatives had in working with the government. Indeed, NAC led the way with establishing Cooperative Research and Development Agreements (CRADAs). A big achievement was the signing of the "blanket" CRADA by the big three (Chrysler, Ford and General Motors) and the U.S. Army in 1994.

Another NAC priority was to match the needs of the Army with the capabilities of the automotive industry and vice versa. Obviously, not all commercial automotive technology is useful or applicable for Army vehicles. However, it is becoming more and more evident that there are more similarities than differences in the required technologies, especially in relation to Army Tactical Wheeled Vehicles (TWVs).

Perhaps just as important as the similarities is the knowledge of the differences between commercial and military technology needs and capabilities. This distinction has allowed the Tank-Automotive Research, Development and Engineering Center (TARDEC) to refocus its strategic emphasis on those technologies uniquely required for military vehicles, thus avoiding wasteful duplication of R&D dollars.

During FY 95, the NAC saw an adjustment of its tactics in an effort to accelerate the introduction of commercial automotive technology. Director Dennis Wend restructured the NAC into cross-functional teams to bring in innovative commercial technology, demonstrate its value to the user, and transition it into the vehicle fleet. The NAC "defines and mines" the appropriate technology, applies it to a military need, and demonstrates application(s) to the program executive officers and other users. Wend envisions a process of no more than three years from the definition of a particular technology to its demonstration, validation, and documentation for procurement and installation. Furthermore, the NAC intends to go beyond the traditional role of only demonstrating technology by assisting the program executive officers (PEOs) in the preparation of the necessary documentation to specify or procure the technology and a plan to field it!

Guiding Principles

The NAC teams work under new guiding principles to ensure success. Four principles are essential to every project. The most important principle states that each initiative must respond to identified customer needs—a customer that signs up to incorporate the proposed new system, component, or process upon successful development and demonstration. The NAC will pursue only those projects that pose definitive potential application in the field by our customers.

Each initiative must also have a demonstrable return on investment (ROI) for the Army. In the current environment of dramatically reduced budgets, the Army cannot afford to conduct business as usual. Only through positive ROI can the Army enhance operational effectiveness with limited resources.

The third guiding principle is the need to leverage industry's large investment in R&D. Only by leveraging the expertise, technology, and economies of scale available through the commercial industrial base can the Army afford to procure new components and systems. And finally, in an effort to meet customer-driven "exit criteria," each project must have a well-documented milestone schedule associated with it.

Commercial technology adaptation is not new, but the NAC is trying to make it work. Emphasis is on performance and use of commercial specifications and standards. Additionally, the automotive industry's needs are beginning to coincide with ours, especially in the area of automation and information handling. The Army is looking to benefit from the automotive industry's high volume and low prices, and the automotive industry seeks to gain by obtaining advanced high-performance technology from the military.

Modeling and Simulation

In August 1994, the NAC initiated a Center of Excellence for Automotive Research to

advance technology in high-fidelity automotive simulation for military and ground vehicle systems. Under this initiative, the NAC partners with the University of Michigan, University of Iowa, Wayne State University, University of Detroit, Howard University and the University of Wisconsin. This unprecedented partnership also includes the involvement of 18 private companies, including the big three automotive manufacturers.

The mission of the research center in coming years is to conduct research, enhance education, and facilitate technology exchange/deployment in support to: (1) meet vehicle design objectives, (2) provide linkages between automotive suppliers with original equipment manufacturers and the government in the product development phase, and (3) provide the education necessary for technical personnel to design and support future vehicle products. The Automotive Research Center at the University of Michigan, Ann Arbor, MI, and the U.S. Army TARDEC Center of Excellence for Modeling and Simulation, developed the modeling and simulation tools and techniques which will be used and applied to several of the technology development projects in the NAC.

Technology Demonstrations

A series of technology demonstrations are planned in the near future. Among these are:

• ***Four Stroke-Direct Injection (4SDI) Engine.*** The NAC will support the development of an advanced four-stroke direct injection engine with lower weight, improved fuel economy and durability, and lower life cycle costs. The program will exploit the use of commercial and military technologies such as high-pressure, universally variable fuel injection, high-temperature materials, low- friction techniques, low-heat rejection designs and exhaust aftertreatment. The improvements are envisioned to improve the current 4SDI engine for improved military propulsion, while at the same time supporting the goals of the national initiative to develop the "clean car."

• ***6.2/6.5 Liter Diesel Engine Improvements***. With the potential of the High Mobility Multipurpose Wheeled Vehicle (HMMWV) 6.2/6.5 liter engine going out of production, the supportability of this critical element of the Army's tactical fleet is in jeopardy. In an effort to maintain the supplier base for this system, the NAC will take a lead role in improving the engine for enhanced military performance and continued commercial demand. The program's goals are to reduce the engine weight, increase its efficiency, and reduce emissions. These improvements will be made possible by using a revolutionary new process for SiC whisker implantation, which was sponsored by the NAC in 1994. Using a squeeze cast process, metal matrix composite pistons and cylinder heads can be selectively reinforced with low cost SiC whiskers, producing stronger and more efficient engine parts. (See Figure 3.)

Military-Commercial Commonality

Historically, commercial automotive technology advances have drawn from the military. Technologies such as anti-lock brakes, lightweight metallic alloys, industrial plastics, electronic engine controls and data bus architecture all were developed by the Defense community (anti-lock brakes were used on WWII airplanes). However, the industrial engineering manufacturing capabilities of the auto industry made these technologies affordable. It seems appropriate to

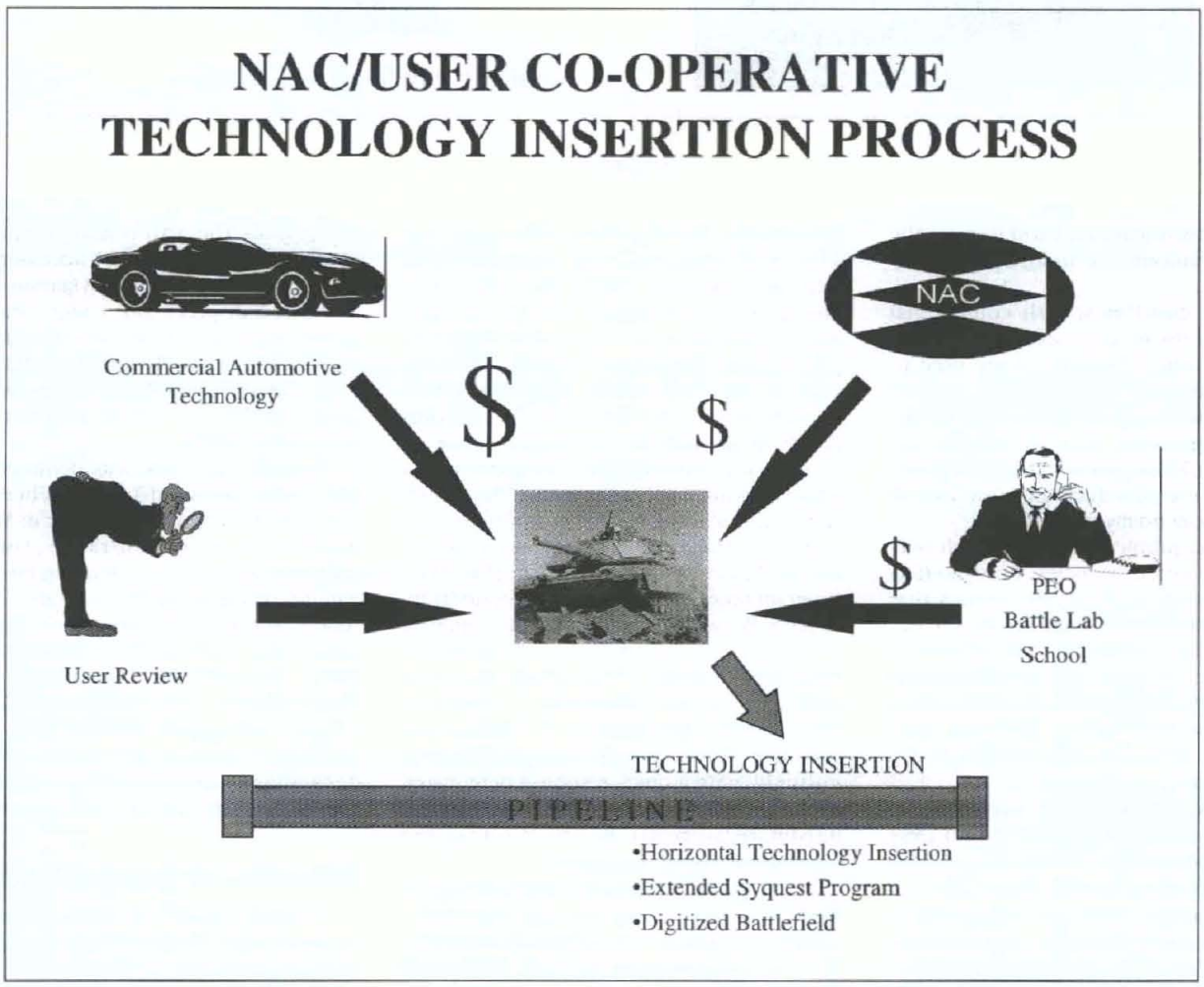


Figure 1.

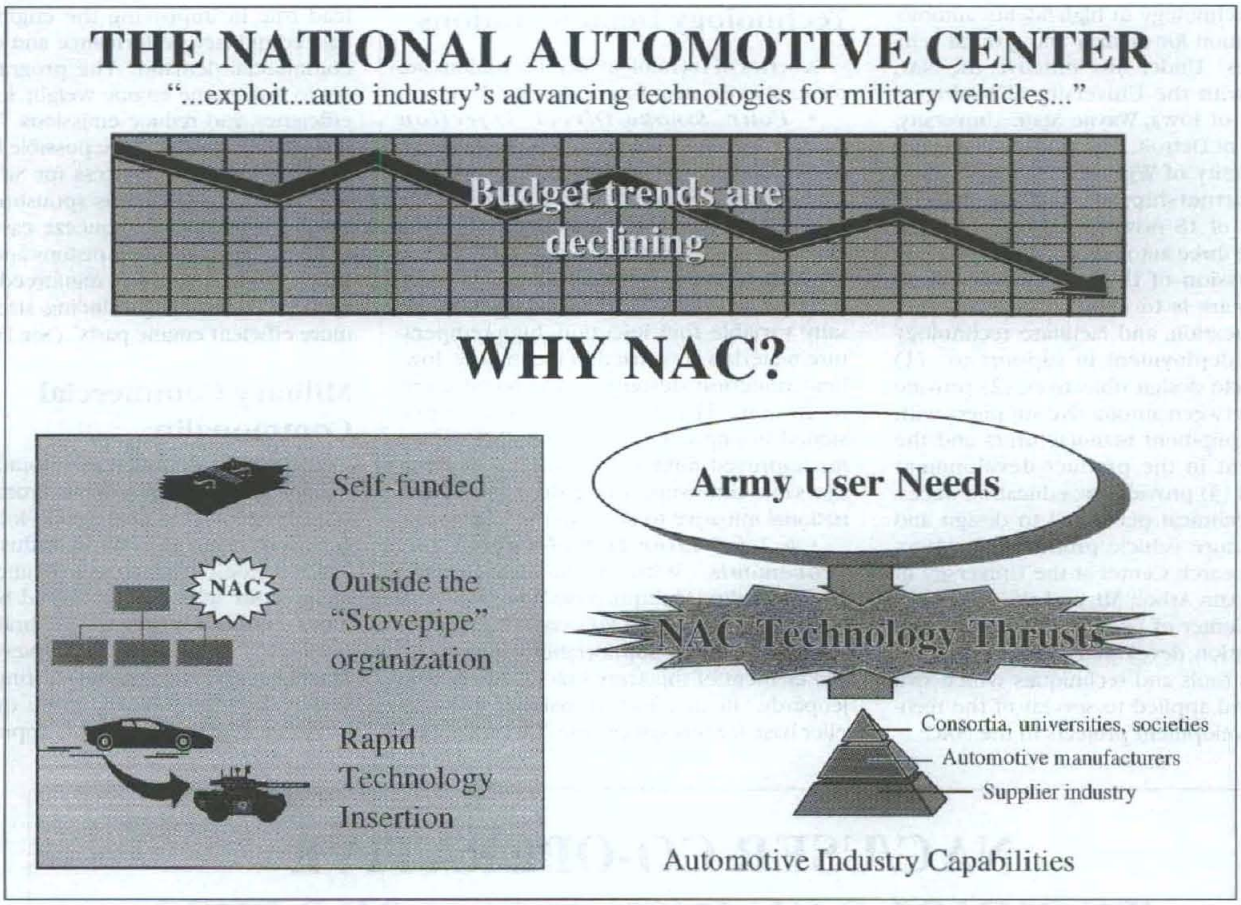


Figure 2.

reverse the historical trend and lean on the commercial automotive industry for Army application.

Since the mid-1980s, both commercial and military vehicles have seen an increased use of electronics. Electronics are used to control engines and transmissions, provide information to operators, reduce emissions, perform diagnostics, identify targets, and give position/location data. All indications are that the use of vehicle electronics will increase exponentially in the future.

A common problem exists for both military and commercial vehicles: how to effectively interconnect these electronics that are more often than not supplied by sub-tier suppliers. The rudimentary electronics of 1980s cars and trucks, and the M1 Abrams and M2/3 Bradley vehicles could be interconnected via hard wires. However, hard wiring many electronic black boxes is neither space nor cost efficient.

The M1A2 Abrams and the M2/3A3 Bradley have incorporated a MIL-STD-1553 Digital Multiplexed Data Bus to alleviate this problem. Similarly, the big three are currently developing their own Digital Multiplexed Data Bus Architecture. However, driven more by cost than performance, the big three are looking to the Society of Automotive Engineers (SAE) to develop a standard bus architecture for their combined use. The NAC believes that Army tactical wheeled vehicles (TWVs) are synergistic enough with commercial vehicles to evaluate incorporation of the commercial SAE J1939 Digital Multiplexed Data Bus. If desirable, the Army could save millions of dollars during the procurement of its 30,000 plus Family of Medium Tactical Vehicles alone.

Time is all-important in this approach to adapt commercial standards. The J1939 standard is a second generation data bus architecture that is now emerging for use on cars and trucks of the late 1990s. The FMTV Program recently passed its Milestone III In-Process Review and will move into full production. The Army must evaluate and determine the feasibility of this standard *now* to capitalize on the economies of scale afforded by this architecture. The National Automotive Center is responding to this opportunity with a quick response demonstration effort that results in both analysis and hardware/software verification *as the standard is being developed.*

In cooperation with the PEO for Tactical Wheeled Vehicles, the NAC has obtained a Family of Medium Tactical Vehicles (FMTV). In a two-phase effort, the NAC will install and operate a J1939 data bus that will control the vehicle's engine, transmission and diagnostics. The NAC is also providing additional data "ports" so that accessory equipment such as position/navigation systems, advanced displays, and rudimentary prognostics can be installed and evaluated. Bus performance and Electro-Magnetic Interference (EMI) susceptibility testing will ascertain whether the J1939 standard can be adopted by TWVs.

Initially, the truck was demonstrated at the ADPA-sponsored Tactical Wheeled Vehicle Conference earlier this year in Monterey, CA. Due to time contraints, this was a demonstration of the operating bus without engine or transmission controls. Later this year, Caterpillar and Allison will supply their electronic engine and transmission controls. Eventually, the plan is to evolve the demonstration into a "smart truck." A "smart truck" is synergistic with the Force XXI concept of exploiting information handling technologies and the digital revolution of the automotive industry. (See Figure 4.)

Benefits of Standardization

Cost effectiveness in the commercial automotive market (indeed, all commercial markets) is the result of competition. In turn, competition is spurred by standardization. A simple example is the drastic cost reduc-

Figure 3.
6.2-liter HMMWV Improvement.
The objective is to ensure market demand and enhance engine capability.

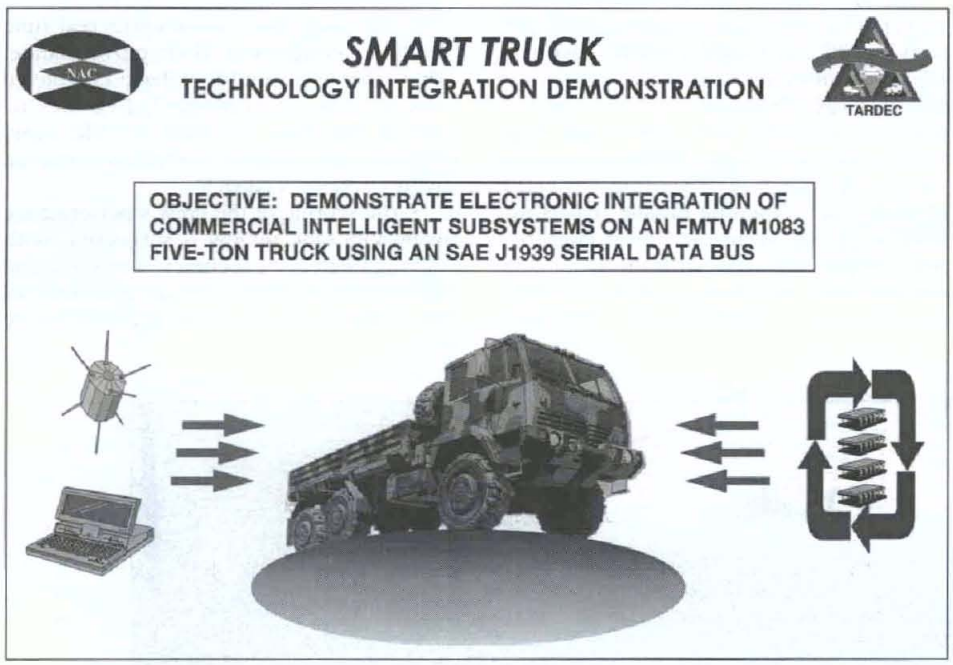


Figure 4.

tion in personal computers and peripherals. This is almost entirely due to the standardization on two hardware/software interfaces...those for IBM compatibles and those for Macintosh.

The NAC believes that commercial standards can yield similar cost reductions for the Army, if judiciously applied. The adoption of J1939 would reduce development time to interface advanced electronics to TWVs. Only slight modifications to existing commercial hardware/software would allow the Army to take advantage of the huge commercial production base. Diagnostic and prognostic equipment would be readily available for those products there by reducing operation and support costs.

Summary

Changing global political and economic factors have generated the vision of "Force XXI...the posture of the Army as we move into the 21st century." Two factors which are central to the success of Force XXI are:

- Exploitation of the United States' advantages in electronics technology (e.g. digitization of the battlefield); and
- Leveraging the commercial sector (e.g. commercial rather than military standards) to offset budget reductions.

The National Automotive Center is working to take advantage of our ongoing work with commercial automotive manufacturers and the Society of Automotive Engineers to adapt applicable automotive technology to Army vehicles.

ANTHONY COMITO is Associate Director of the National Automotive Center, which is part of the U.S. Army Tank-Automotive Research, Development and Engineering Center in Warren, MI. He has a master's degree in engineering from Wayne State University and has done post-graduate work towards a doctorate at the University of Detroit. Comito is also a registered professional engineer in Michigan.

LASER AIM SCORING SYSTEM:

A FIELD ASSISTANCE IN SCIENCE AND TECHNOLOGY SUCCESS STORY

By COL Patrick J. Bennett
and Kevin S. Rees

Introduction

A new training device may soon be available to help AH-64 Apache helicopter crews improve their proficiency with the HELLFIRE missile. The 7th Army Training Command (7ATC) requested that this system, known as the Laser Aim Scoring System (LASS), be developed to use emerging technologies to improve AH-64 training. The LASS is the result of a cooperative development effort between the Army Materiel Command (AMC) Field Assistance in Science and Technology (AMC-FAST) Office, the AMC Night Vision and Electronic Sensors Directorate (NVESD), and 7ATC. These organizations have all invested in the LASS project because this system provides a much needed improvement to HELLFIRE gunnery training.

Improving AH-64 HELLFIRE Gunnery

All AH-64 crews must shoot several HELLFIRE engagements as a part of normal gunnery qualification training. Each crew must successfully complete the gunnery qualification table (Table VIII) at least once each year. The targets for crew qualification are both stationary and moving. The HELLFIRE missile homes in on a laser spot designated on the target by ground observers, other aircraft, or the launching aircraft itself. Most training engagements are autonomous launches (the firing aircraft launches and the laser designates the missile).

AH-64 crews are not currently allocated HELLFIRE missiles to support annual gunnery qualification requirements. Live missiles are simply too expensive to fire on a regular basis. Therefore, the U.S. Army conducts all HELLFIRE crew qualification training on a "dry fire" basis. AH-64 crews, using the dry fire method of scoring HELLFIRE gunnery, use a training missile that is not launched from the aircraft. The training missile provides the crew with the symbology and feedback necessary to acquire a target and simulate a missile launch. The copilot/gunner identifies the target, pulls the trigger, and then laser designates the target until the time required for an actual missile to go down range has elapsed. The AH-64 video recording system (VRS) records the entire sequence of events, and the crew returns to the airfield after the completion of their mission. They then review the VRS tape with a master gunner and decide if a real missile would have hit the target.

There are a number of problems with the current scoring method. The two most obvious ones are as follows:

- The crew does not receive real time feedback concerning their performance. They must wait until they have completed several target engagements before they return to the base and view the VRS tape. Training effectiveness is severely hindered by this delayed feedback.
- The scoring of the crew's performance using VRS tape review is subjective, with varying degrees of accuracy. The crew and master gunner must evaluate the potential for a missile hit by viewing the VRS tape

Two AH-64 aircraft in firing positions at Range 118.

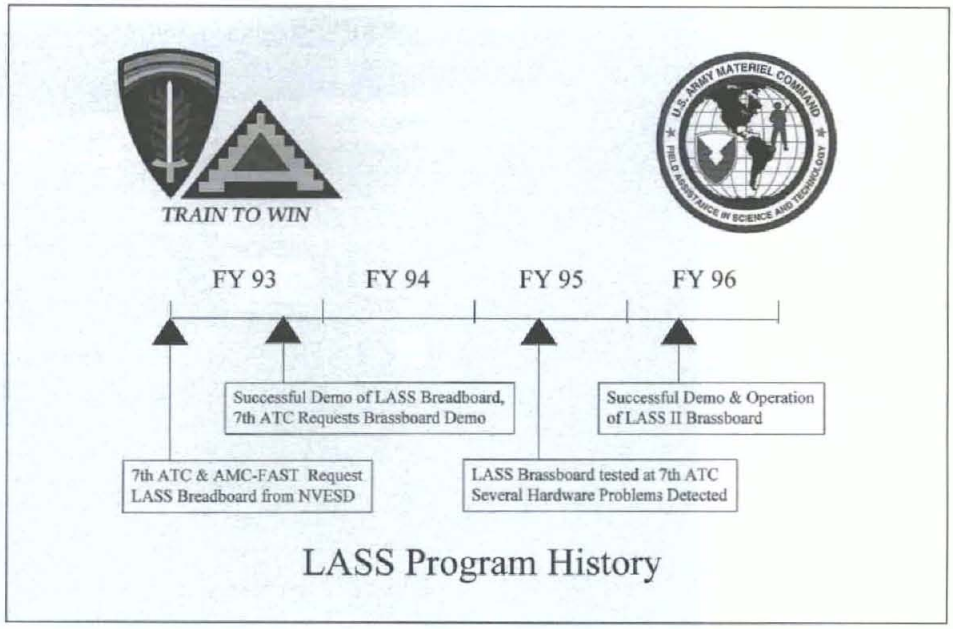
while timing the engagement with a stop watch. An evaluator could assess that a missile would have hit the target when in reality it might have missed due to problems with aircraft boresight. It is also very difficult to detect potential misses due to laser overspill or drop out by viewing the VRS tape.

The LASS Improves Training

The LASS provides an objective evaluation of an AH-64 crew's performance during dry fire HELLFIRE gunnery. The LASS detects, displays and records the laser designator spot on the target range in real time. The LASS times the entire engagement using a computer and verifies that the laser spot is on target during the time required for a missile to travel down range. LASS simulates a target hit by dropping the target board and firing off an explosive device when a crew conducts a successful HELLFIRE engagement. The LASS then resets and is ready for another run within seconds.

The NVESD developed the LASS using primarily off-the-shelf components. NVESD then integrated these components using a custom designed printed circuit board and computer program. The brassboard LASS consists of three modules. The target board module contains the video camera and laser sensors. The downrange module sits in the target pit and contains the LASS software and electronics. The control tower module consists of an off-the-shelf VCR, video monitor, and personal computer that runs the custom LASS user interface program.

The LASS provides several useful after action review (AAR) products in addition to the target effect feedback. The LASS operator in the range control tower is able to capture all of the unit's HELLFIRE engagements on standard VHS videotape. This video footage shows the actual laser designator spot on the target board, not aircraft cross hairs. AH-64 crew members can use this video tape to observe the tracking of their laser designator spot. The master gunner and crew can detect any movement, jitter, or diffusion in the laser spot with the high resolution video provided by LASS. The LASS operator can also capture detailed data from the computer concerning each engagement. This data includes time of missile flight, target distance, laser designation location (on or near the target), and hit or miss detection. LASS technology represents a significant improvement in AH-64 gunnery training through target effect feedback in real time. The LASS also provides detailed products for effective AARs.



LASS Program History.

Program History

The LASS program is the result of a user initiative through the AMC-FAST program. In August 1992, the 7ATC asked their AMC-FAST science advisor to recommend available technology capable of improving HELLFIRE training in Europe. The science advisor initiated a FAST project with NVESD after evaluating available technology. NVESD engineers met with 7ATC personnel and established preliminary system requirements and design parameters in October 1992. NVESD successfully installed and tested a LASS breadboard (preliminary) design on the 7ATC ranges in Grafenwoehr, Germany in May 1993. The initial evaluation of this breadboard design was very positive. The U.S. Army Aviation School incorporated the LASS capability into an Operational Requirements Document (ORD) for the aviation Area Weapon Scoring System (AWSS) based on the training value demonstrated by the LASS breadboard. TRADOC approved this ORD in May 1995.

As a result of the successful breadboard demonstration, 7ATC asked NVESD to continue development of the LASS system. NVESD produced a LASS brassboard (an improved version) and conducted a field evaluation of the system at 7ATC in March 1995. LASS performed all of the required operations, but some of the internal electronics failed to operate in temperatures below zero degrees Celsius. NVESD subsequently modified the LASS system to correct the environmental problems observed at 7ATC during the March 1995 demonstration.

Demonstration and User Evaluation

The NVESD tested the LASS II brassboard at 7ATC during January and February 1996. LASS successfully detected target hits and misses caused by laser dropouts, delays, poor offset technique, incorrect boresight, and incorrect designator codes. The FAST Science Advisor demonstrated the LASS for MG Walter H. Yates Jr., V Corps Deputy Commander; BG George H. Harmeyer (who has since been promoted to major general), 7ATC Commander; and other 7ATC personnel following the February testing. LASS was then used by 7ATC to support a 30-day training rotation of the 11th Aviation Regiment in March of 1996. LASS was also demonstrated by 7ATC for COL William W. Powell, U.S. Army Aviation School Director of Training; COL Noble T. Johnson, U.S. Army Project Manager for Training Devices; and Rhett Farrior, Deputy Project Manager for Air to Ground Missile Systems during the March training rotation.

The basic functionality of this system has impressed aviation crews and commanders alike. LTC John Kelley, Commander, 1st Battalion, 1st Aviation Regiment reports that "We could not wipe the smiles off the Apache pilots' faces when they experienced target panels fall during simulated HELLFIRE engagements." CPT Mike Ash, Assistant S-3 (training officer) for the 1st Battalion adds "Real time viewing of the laser spot is invaluable to validate boresight and target engagements. Cross hairs don't kill tanks—

LASS system installed on Target Board Range 301, Grafenwoehr, Germany. The target board is in down position to show all LASS components.

death dots do."

Program Accomplishments

The LASS development effort, funded by AMC-FAST and NVESD, has been a tremendous success. A brief description of a few of the program's accomplishments from the past three years follows:

- The user requirements for a dry fire HELLFIRE scoring system are now clearly documented as a result of the user-developer interchange facilitated by the AMC-FAST science advisor.
- The LASS brassboard has successfully demonstrated the performance of its embedded commercial technology in the military field environment.
- The LASS brassboard has minimized the technical risk for follow-on production and deployment efforts through the demonstrations and user evaluations already conducted.
- The 7ATC has already used the brassboard demonstrator to focus attention on the value of improved AH-64 HELLFIRE gunnery training. The user evaluations of the LASS brassboard system have identified improvements that can be incorporated into future systems.

Future Directions

The 7ATC is currently working with the U.S. Army Simulation, Training, and Instrumentation Command (STRICOM) to acquire a field hardened LASS. This production LASS system will be used to support AH-64 training in Europe on an ongoing basis. Enhancements being made to the current LASS design by STRICOM include improved data communications, transportability, maintainability, and control tower interface.

The user evaluations conducted with the LASS brassboard system have yielded the following useful ideas that will be incorporated into the basic LASS design through follow-on product improvements:

- Mount the LASS on moving targets;
- Provide hard copy score sheets with laser trace on target background;
- Develop overspill laser sensor; and
- Support simultaneous engagement of multiple targets.

Conclusion

The LASS may be fielded on an Army-wide basis as the user requirement documented in the operational requirements document is prioritized with other modernization needs. The successful demonstrations and user evaluations conducted at 7ATC have certainly helped aviation leaders appreciate the training value of the LASS.

The LASS brassboard demonstrator has proven that significant improvements in HELLFIRE training are easily achievable. In little more than three years the NVESD and AMC-FAST have translated 7ATC's training requirement into a functional system. The Army now has a proven path to significant improvement in AH-64 HELLFIRE missile training.

COL PATRICK J. BENNETT is the Deputy Commander/Chief of Staff, 7th Army Training Command, Grafenwoehr, Germany. Previously, he commanded the 4th Brigade, 3rd Infantry Division and the 1st Squadron, 6th Cav Brigade (AC). Bennett is a master Army aviator with more than 700 hours in the AH-64.

KEVIN S. REES is the AMC-FAST Science Advisor assigned to 7ATC. His sponsor for this assignment is the Aviation and Troop Command. Rees holds a bachelor of science in mechanical engineering from the Rose-Hulman Institute of Technology and an M.B.A from Texas A&M. He is a registered professional engineer and a certified Level III member of the Army acquisition workforce in systems planning, research, development, and engineering.

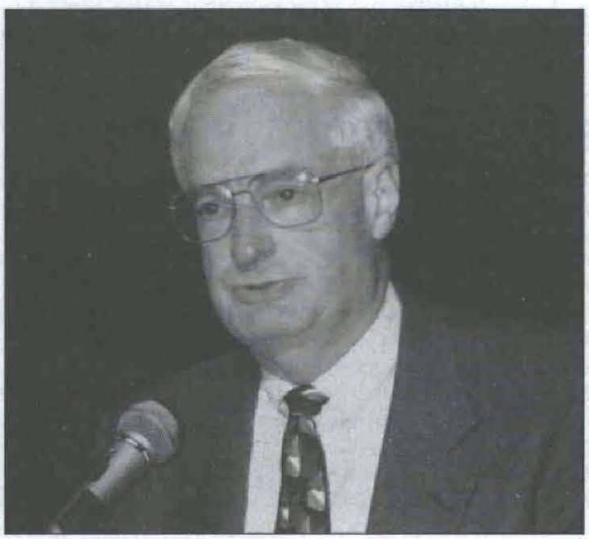
20th ARMY SCIENCE CONFERENCE HIGHLIGHTS FORCE XXI TECHNOLOGY

By Catherine Kominos

The 20th Army Science Conference, highlighting the theme *Science and Technology for Force XXI*, was held June 24-27, 1996, in Norfolk, VA. Sponsored by the Assistant Secretary of the Army for Research, Development and Acquisition, the conference provided an ideal forum for the presentation, discussion and recognition of significant research and science accomplishments by Army scientists and engineers. Attended by more than 500 scientists and engineers from government, industry and academia, the conference provided attendees the opportunity to hear the presentation of 160 technical papers by Army researchers, and nine keynote presentations from leading experts in academia and industry. In addition, prominent guest speakers included Professor Noel MacDonald, School of Electrical Engineering, Cornell University, and Steve Nelson, President of Steve Nelson and Associates.

The conference opened with an executive luncheon hosted by Dr. A. Fenner Milton, the Deputy Assistant Secretary of the Army for Research and Technology. After presenting the updated Army science and technology program vision and strategy, which emphasizes the timely demonstration of affordable weapon system concepts, Milton presented the 1995 R&D Achievement Awards to 68 researchers throughout the Army's science and technology community. A detailed article on the 1995 R&D Achievement Award recipients and their achievements was published in the January-February 1996 issue of *Army RD&A* magazine.

The executive luncheon was followed by a panel discussion of past, present and future challenges to the Army science and technology community. This panel, chaired by Dr. Richard Chait, Director of Army Research and Technology, provided perspectives from a cross-section of senior Army and DOD executive managers. Highlights of the panel discussion included a presentation on the DOD laboratory reinvention initiatives by Dr. Lance Davis, Deputy Director, Defense Research and Engineering For Laboratory



Dr. Richard Chait, Director of Army Research and Technology.

Dr. A. Fenner Milton, the Deputy Assistant Secretary of the Army for Research and Technology.

LTG Ronald V. Hite, Military Deputy to the Assistant Secretary of the Army for Research, Development and Acquisition.

Management and Technology Transition.

Technical papers were presented during the remaining two days of the conference. The papers were arranged in two to three parallel sessions representing the following broad technology groupings: advanced materials and manufacturing; microelectronics and photonics; biological, chemical and nuclear defense; engineering sciences; sensors and information processing; advanced propulsion technologies and power generation; environmental sciences and geosciences; life, medical and behavioral sciences; and high-performance computing. Keynote speakers during the technical sessions included: Professor Craig Rogers, Virginia Polytechnic Institute; Dr. Lewis Gruber, Chief Executive Officer, Hyseq, Inc; Roy Nichols, Vice Chairman of the Board, Nichols Research Corporation; and Professor Arvind, Massachusetts Institute of Technology.

The conference culminated June 26 with an awards banquet. LTG Ronald V. Hite, Military Deputy to the Assistant Secretary of the Army for Research, Development and Acquisition, hosted the banquet. During his remarks, Hite told the more than 400 banquet attendees that he takes great pride in knowing our soldiers have the most technologically advanced war-fighting systems, and this would not have been possible without the contributions of the Army scientists and engineers attending the conference. Following his remarks, Hite presented the best paper awards.

The winner of the 1996 Paul A. Siple Silver Medallion, the most distinguished award presented at the conference, went to Dr. Herbert A. Leupold of the Army Research Lab (ARL), for his work on *A Lightweight Electron-Beam Focusing Structure for Missile Radars.* Bronze medallions were awarded to Dr. James F. Harvey of the Army Research Office, for his paper, *Advances in Quasi-Optical Power Combiners Provide Path to Radar and Communications Enhancements;* and to Lazlo Kecskes of ARL for his paper entitled, *The Fabrication and High-Strain-Rate Properties of Hot-Explosively-Compacted Tungsten-Titatinum Alloys.*

Of the 160 papers presented during the conference, 18 were cited for special recognition. These papers, listed by technical session, are:

Advanced Materials and Manufacturing

• *Nonlinear and Quantum Optics of Multicomponent Media,* by Michael E. Crenshaw, U.S. Army Missile Command (MICOM) and co-authored by Charles Bowden, MICOM.

• *Multi-Process Synthesis of Novel Ferroelectric Oxide Ceramic Composites for Use in Phased Array Antennas,* by Louise C. Sengupta, E. Ngo, Somnath Sengupta and S. Stowell, ARL.

Microelectronics and Photonics

• *New Light Coupling Scheme and Quantum Transition Noise of Quantum Well Infrared Photodetectors,* by Kwong Kit Choi, ARL, co-authored by W.H. Chang, ARL; and C.J. Chen and D.C. Tsui, Princeton University.

• *Strain Engineered Semiconductor Heterostructures for Novel Optoelectronic Devices,* by Paul H. Shen, Jagadeesh Pamulapati, Michael Wraback, Weimin Zhou, Monica Taysing-Lara and Mitra Dutta, ARL.

Biological, Chemical and Nuclear Defense

• *A Protein Engineering Approach to Designing Staphylococcal Enterotoxin Vaccines,* by Robert G. Ulrich, U.S. Army Medical Research Institute of Infectious Diseases.

ARMY SCIENCE CONFERENCE POSTER AWARDS

One Best Poster Award per technical session was given at the 1996 Army Science Conference in Norfolk, VA. Recipients and the titles of their displays are listed below by technical session.

• **Session I—Advanced Materials and Manufacturing.** *"High Temperature/Pressure Expansion of Elemental Semi-conductors and Tungsten,"* Robert R. Reeber, U.S. Army Research Office (ARO); and Kai Wang, University of North Carolina.

• **Session II—Microelectronics and Photonics.** *"Optical Error Diffusion for Analog-to-Digital Conversion,"* Barry L. Shoop and Eugene K. Ressler, U.S. Military Academy; Joseph N. Mait, ARO.

• **Session III—Biological, Chemical and Nuclear Defense.** *"Stand-off Detection: Computer Simulation of the Response Signals from Chemical and Biological Agents,"* C.F. Chabalowski, U.S. Army Research Laboratory (ARL); J.O. Jensen, U.S. Army Edgewood RDE Center; P.J. Stephens, University of Southern California; and M. Frisch, Lorentzian Inc.

• **Session IV—Engineering Sciences**. *"High Pressure Inflatable Structures Incorporating Highly Oriented Fiber,"* Jean W. Hampel, U.S. Army Natick RDE Center; Glen J. Brown, Vertigo Inc.; and Garrett C. Sharpless, Fiber Innovations Inc.

• **Session V—Sensors and Information Processing.** *"Compact IR Laser for Calibration of Space Based Sensors,"* K.M. Dietrick and G. Dezenbery, U.S. Army Space and Strategic Defense Command; C. Hamilton, Aculight Corporation; J. Vann, Joint Tactical Ground Station Product Office; and John LaSala, Lawrence Livermore National Laboratory.

• **Session VI—Advanced Propulsion Technologies and Power Generations.** *"Pulse-Power Rotating Machines for Electric Guns,"* Thaddeus Gora, U.S. Army Armament RDE Center; Donald Eccleshall, ARL; and Ian R. McNab, Institute for Advanced Technology.

• **Session VII—Environmental Sciences and Geosciences.** *"Phytophysiological Response of Crops to Irrigation Waters Containing Low Concentrations of RDX and TNT: Ecotoxicological Implications,"* Ronald T. Checkai, U.S. Army Edgewood RDE Center; and Michael Simini, Geo-Centers Inc., Aberdeen Proving Ground.

• **Session VIII- Life, Medical and Behavioral Sciences.** *"Acoustic Monitoring Sensor for Combat Casualty Care,"* Michael V. Scanlon, ARL.

• **Session IX—High Performance Computing and Simulation.** *"The CREATION Scene-Generation Program Applied to Battlefield Flight Scenarios,"* Hung Nguyen, Joseph Penn and Teresa Kipp, ARL.

LTG Hite presents the Siple Medallion to Dr. Herbert Leupold of the Army Research Lab.

Dr. Oswald (right), who recently retired from his position as Director of Research and Development, U.S. Army Corps of Engineers, receives from Dr. Chait a plaque for his 34 years of service to the Army.

• *Production of Recombinant Antibodies for Biosensor Applications,* by Peter A. Emanuel, James J. Valdes and Mohyee E. Eldefrawi, Edgewood Research, Development and Engineering (RDE) Center.

Engineering Sciences

• *Laser Velocimetry and Doppler Global Velocimetry Measurements of Velocity Near the Empennage of a Small-Scale Helicopter Model,* by Susan A. Gorton, James E. Meyers and John D. Berry, U.S. Army Aviation and Troop Command.

• *Concrete Constitutive Modeling in High Velocity Penetration Analysis,* by Vladimir M. Gold and James Pearson, U.S. Army Armament RDE Center; and George Vradis from Virginia Polytechnic Institute.

Sensors and Information Processing

• *High Resolution Acoustic Direction-Finding Algorithm to Detect and Track Ground Vehicles,* by Tien Pham, Brain Sadler, Manfai Fong, and Donald Messer, ARL.

• *Machine Aided Search: Results of Human Performance Testing Using Automatic Target Recognition and Second Generation Forward Looking Infrared Sensors,* by Donald A. Reago and William C. Gercken, U.S. Army Communications-Electronics Command.

Advanced Propulsion Technologies and Power Generation

• *Modeling of the Mixing/Combustion Process in a Quiescent Chamber Direct-Injection Diesel Engine,* by Peter Schihl, Walter Bryzik, Ernest Schwarz, and Eugene Danielson, U.S. Army Tank-Automotive RDE Center.

• *Molecular Beam Mass Spectrometric and Modeling Studies of Neat and Nb_3 Doped Low Pressure $H_2/N_2O/Ar$ Flames: Formation and Consumption of NO* by Rosario Sausa, ARL, and co-authored by W.R. Anderson and G. Singh, University of Maryland Eastern Shore; and G.W. Lemire, Dugway Proving Ground.

Environmental Sciences and Geosciences

• *Source Characterization Modeling for Demil Operations,* by Christopher Biltoft, Dugway Proving Ground, and co-authors Elain Oran, Jay Boris and C. Lind, ARL; and William Mitchell, Environmental Protection Agency.

• *Theoretical Determination of Potential Hazards in the Handling of CK and AC Munitions,* by Betsy Rice, Sharmila Pai and Cary Chabalowski, ARL.

Life, Medical and Behavioral Sciences

• *Measuring Visual Resolution in the Contrast Domain: The Small Letter Contrast Test,* by Jeff Rabin, Aeromedical Research Laboratory.

• *Carboxylesterase: Regulatory Control and Peptide-Induced Secretion of an Endogenous Scavenger for Organophosphorus Agents,* by Donald M. Maxwell, Medical Research Institute of Chemical Defense; Kenneth Lanclos, Medical College of Georgia; and Hendrik Benschop, TNO Prins Maurits Laboratory.

High Performance Computing and Simulation

• *Building Simulations for Virtual Environments and Prototyping,* by Ming C. Lin, Army Research Office.

• *Parallel Finite Element Computation of Missile Flow Fields,* by Walter Sturek, and Steven Ray, ARL; and S. Aliabadi, Chris Waters and Tayfun Tezduyar, Army High Performance Computing Research Center.

In addition to best paper awards, the best poster in each technical session was recognized (see sidebar article).

Overall, the conference proved a success, thanks in large part to the efforts of the Army senior technologists who chaired the technical sessions. In particular, special recognition is given to Dr. James Valdes, the Scientific Advisor for Biotechnology at the U.S. Army Edgewood RDE Center. Valdes was instrumental in organizing the session chairs, and advising on the technical content and program structure of the conference.

CATHERINE KOMINOS is the Associate Director of Army Research in the Office of the Assistant Secretary of the Army (Research, Development and Acquisition). She holds a B.S. degree in civil engineering and an M.S. in engineering administration from George Washington University, and is a doctoral student in public administration at the University of Southern California.

From Industry...

ACQUISITION REFORM

Dream or Mirage?

By Norman R. Augustine

Norman R. Augustine.

The following remarks, edited slightly for publication, were presented earlier this year by Norman R. Augustine, Vice Chairman, President and CEO of Lockheed Martin Corporation, at an American Defense Preparedness Association (ADPA) Conference in Atlanta, GA. Augustine received ADPA's Industry Leadership Award.

Being a person who occasionally thinks about the future since, as the saying goes, that's where we will spend the rest of our lives—and keeping in the mind this conference's goal of improving the acquisition process—I thought I might begin by projecting ahead to what I might say to you were I addressing you 20 years hence, in the year 2016, under circumstances where we had *failed* to reform the acquisition process. It seemed to me that I might begin with words somewhat along the following lines:

Good morning. It's a great pleasure to be with all of America's Defense industry as you gather here at this year's Atlanta XLII conference and to welcome both of you to this historic site—where the Army once had facilities, prior to BRAC XXXVII. I would like to preface my remarks this morning by quoting from the lead article in today's *Washington Post.*

Washington, D.C., April 23, 2016. Senate Armed Services Committee Chairman Strom Thurmond today announced that the GAO, IG, FBI, OMB, OSD, DCAA and New York Times would be investigating each other this year, since there is no Defense industry left to investigate.

Secretary of Defense Mike Wallace, who earlier this year nationalized the nation's remaining Defense contractor, dismissed outcries from thousands of law firms throughout the nation's capital over the end of the lucrative practices they had developed processing procurement protests. Last year, subsequent to the awarding of one large fixed-price development contract, in a "first" even for the Pentagon, every single bidder submitted a protest—even the winner. The firm's CEO cited the monopsonistic legal principle that, "When someone shows you a gun and asks for money, they are not necessarily trying to sell you the gun."

According to the head of Army aviation, John Madden, the Defense Procurement Office, which now conducts all purchasing for the purple-suited Department of Homeland Defense, was considering buying an aircraft this year.

An influential Congressional staffer, who asked not to be named, told CBS News that based on his two weeks in the job, he could assure the American public that one aircraft would be sufficient. He pointed out that all active-duty military forces had been phased out years earlier in favor of simply telling the enemy we had a huge inventory of helicopters...and claiming that they were designed with stealth so no one could see them. According to this same individual, who rose in meteoric fashion to the position of senior staff member on the Armed Services and Fisheries Committee just last Friday, "The United States no longer maintains troops overseas, so it is quite convenient for the nation's soldier to rotate periodically throughout the entire base structure—which was moved to West Virginia in 1996."

Also yesterday, Vice President Jane Fonda stated that it was irresponsible for people to promote rumors such as the one now circulating that the U.S. government had once operated under 13 continuing resolutions and had two shut-downs in a single year, and that 60 percent of that year had passed with numerous federal departments having no final budget at all. She further said there was no truth to the claim that next year the Congress and the OMB would be abandoning its customary "out-year" planning in favor of "out-week" planning.

In other news today, Attorney General Marion Barry completed his investigation of Norman R. Augustine, CEO of Lockheed-Martin-Loral-Northrop-Grumman-Boeing, for his attempted hostile takeover of the U.S. Army. Speaking through his attorney, Augustine responded, "This is absolutely untrue. The Army had too much debt."

William A. Anders, the former General Dynamics CEO and aerospace tycoon who had first reported Augustine to

The principal cause of inefficiency in the acquisition process is not the infamous coffee pot, not the renowned hammer, or even the legendary toilet seat; it is the perpetual motion of requirements, people, schedules and funding

the Inspector General, speaking from his yacht, the now privatized USS Forrestal, sailing somewhere off Tahiti, defended his action, claiming, "The DoD made the offer during the Great Fraudwasteandabuse Investigations of the '90s that if you turned in two other contractors they would take you off the list. That's all I was trying to do."

Thus will read the news on April 23, 2016. Or, more accurately, that is the way the news will read if we do not take decisive steps to prevent it from doing so.

I have thus decided to speak this morning about how we might change the procurement process to assure that it serves those who serve our country in the armed forces—and not ***vice versa.*** And in the spirit of total disclosure, let me state at this point that I speak from the perspective of one who has spent a decade in five different assignments in the Pentagon under three different presidents representing both parties, as well as serving three major industrial firms. Having seen the acquisition process from both sides of Shirley Highway, I can say with some authority that the most remarkable thing about the acquisition process is that it does somehow succeed; after all, America's military hardware is sought by virtually every nation in the world.

But the process does not work nearly as well as it should. And in light of today's grim procurement budget forecasts, it does not work anywhere near as well as it must. Further, the reason it succeeds at all is too often because of the enormous talent and dedication of the people who administer it, rather than any inherent virtues in the process itself. And when we do encounter a failure, in its fervor to apply band-aids, the government all too often arranges the firing squad into a circle.

One of the best summaries of acquisition reform efforts was provided in a speech by then-Deputy Secretary of Defense Bill Perry a few years back. He said, "The resistance to changes [in the acquisition process] is substantial. There's resistance in Congress, there's resistance in the Defense Department, and there's resistance in industry. So it will be a very tall task to work on."

Of course, a few things have changed since that speech by the Deputy Secretary. For one thing, he's now ***Secretary*** Perry, and through his determined leadership and the efforts of many in the Office of the Secretary of Defense, Congress and the Services—some of whom are in this room—we now can point to the Federal Acquisition and Streamlining Act of 1994, which put into statute a first step in reforming defense procurement.

Unfortunately, however, most would agree that this monumental achievement represents only a small, first step. The problem is that the acquisition process simply does not function well and has not functioned well for years. I recently testified before the Congress and one of the members with a remarkable memory indicated that in 1965 I had said that the acquisition process had been broken for 20 years—and asked if I thought anything had changed? I answered, "Yes, the acquisition process has now been broken for 50 years."

This is a view widely shared among those officials who have had to deal with the acquisition process over the years. For example, former Assistant Secretary of Defense Leonard Sullivan Jr. said shortly before the fall of the Berlin Wall, "Defense acquisition may be the only free-world enterprise that matches the stultification and hopelessness of the centrally-directed Soviet economy." Admiral Thomas Hayward, former Chief of Naval Operations, once asserted, "This is a system that is broke and truly needs fixing." Former Air Force Chief of Staff General Merrill McPeak has stated even more bluntly, "The system is broken and everybody knows it."

What, then, is the Augustine prescription for acquisition reform? First it is important to understand the problem. Let me suggest a few broad initiatives that could, if implemented, represent a major step forward in improving the acquisition process. But be forewarned—these suggestions will require doing things differently from the past. We must move away from the failed "band-aid" procurement practices of old—much as the fellow who read that 90 percent of all accidents occur within 10 miles of one's home—so he moved.

First: We should halt for once and for all the turbulence in the acquisition process. The principal cause of inefficiency in the acquisition process is not the infamous coffee pot, not the renowned hammer or even the legendary toilet seat; it is the perpetual motion of requirements, people, schedules and funding. Each funding cycle all too often begins with wiping the slate clean from the previous year and deciding what ***this*** year's priorities will be. The current process is akin to hiring a home builder and directing, "Build me a month's worth of house ..." and then promising, "I'll return next month with further instructions."

I once added up the total amount of money "wasted" on highly publicized examples of procurement "inefficiency"—the $600 toilet seats, $7,000 coffee pots, $400 hammers, the whole works—and came up with a grand total of $92,000. This sounds pretty egregious until you consider that over a period of three decades four successive generations of forward area air defense systems—from Mauler to Roland to Sgt. York to ADATS—were all canceled, at a total cost of more than $6.7 billion. That's a poor return for the taxpayer ... and, even more importantly, a poor air defense for our soldiers.

I also added up the money spent in recent years on canceled programs as a whole—programs which did nothing to help our nation's fighting capability—and found that the funds expended could have purchased 1,000 Abrams tanks, 100 F-16 fighters, 1,000 AMRAM missiles, 10 Titan IV launch vehicles, 20 JSTARS aircraft, 10,000 Javelin missiles, 70,000 MLRS rockets *and* one nuclear attack submarine.

What is needed is common agreement—in the Congress and in the Executive Branch—to make it extremely difficult to start new programs; and then to give very few people the authority to change those programs or their funding once started. This, in turn, demands setting realistic funding baselines for out-year planning, and establishing multi-year appropriations for the Pentagon and its programs.

In other words, the time has come to appropriate funds by the ***project***, not by the ***year***—to try new capabilities by the system and not by the yard. I cannot over-emphasize the importance of this need...and until we recognize it, our efforts to reform procurement practices will largely be confined to tinkering at the margins.

Second: Put someone in charge and give them authority and accountability. Among the most important things we can do is to escape the situation described by the Fitzhugh Defense Blue Ribbon Panel of the 1960s, namely, "Where everyone is in charge of everything, no one is in charge of anything." We should assign both authority and responsibility for meeting a goal to the same individ-

ual—and, in the case of acquisition projects, that individual should, in my judgement, be the program manager. We need to encourage such activities as prudent risk-taking, delegating, and making long-term commitments.

Third: We need to embrace commercial practices whenever practicable. Commercial practices include placing great credence in a supplier's past performance, in using near-term additional funding to maintain schedule rather than vice versa, and working cooperatively with one's suppliers to help them provide a better value product.

Most Defense contractors complain about the extensive "military specifications" and procurement practices that govern the purchase of even the most mundane supplies and equipment. One case in point was illustrated for me shortly after I left the Department of Defense some years ago and was then running Martin Marietta's Astronautics business. Each year we contracted to buy a handful of gaskets for use on the Titan space launch vehicle from a company that did almost all of its business with the commercial automotive industry. We had been imposing on this company all of the inspection and paperwork requirements stipulated by the government's procurement regulations—as well as a few we managed to think up ourselves.

One day a box arrived at my desk in the incoming mail which proved to be filled with gaskets. Attached to the box was a polite letter from the president of our supplier, saying that his company wanted to do its part on behalf of national Defense—but that they simply couldn't stand doing business with us. It ended by saying, "Here is a five-year free supply of gaskets. Now, would you please go away and leave us alone?"

As if this was not bad enough, making contractors the "pack horse" for an endless array of ***non-Defense-related*** initiatives has further saddled taxpayers with costs and, on occasion, brought the system to the brink of breakdown.

Fourth: While recognizing that a consensus does not yet exist for substantial increases in Defense spending, I believe at the very least the ***Defense budget should be stabilized.*** The recent initiatives to add back billions of dollars over several years to Defense is a constructive step, but in my judgement does not address the full range of challenges the nation's Defense establishment faces. Current plans call for the Defense budget to decline to 2.7 percent of GDP in 2002, the lowest level since immediately prior to Pearl Harbor. Of course, these reductions are not news to this audience—but there does not seem to be widespread understanding of the difficulties that the rapidly declining U.S. military procurement budgets are causing for the Defense industrial base as well as for the nation's military forces themselves. That is, there is a point below which even perfect management will not provide an adequately equipped force.

Fifth: The balance among modernization, readiness and force structure needs to be restored. I calculated recently that we are now operating with an equipment replacement cycle of about 54 years, meaning that the average item provided our armed forces has to last 54 years. This is in a world where technology generally has a half-life of from two to 10 years. It means flying P-51s in an F-16 era, using compasses in a GPS era, and firing bazookas in a Javelin era. It also means not being able to see in a night-vision era and being seen in a stealth era.

According to the Joint Chiefs of Staff, the procurement budget should be funded at the $60 billion level in order to carry out the Administration's own Defense plans. Unfortunately current projected procurement spending falls short of that goal by about $20 billion for the next three to four years. In my opinion, we cannot wait another three or four years to reach the $60 billion level. Yet, the lag time between authorizations and outlays in the procurement budget, coupled with the effects of inflation, virtually assures several more years of real procurement erosion.

To the credit of those bearing the grave responsibility of providing for America's armed forces, the nation has, in this recent downsizing, largely avoided the trap of building a so-called "hollow force" in terms of its readiness to fight. But we must also be mindful that we do not gradually build a force engendering a new kind of hollowness, namely the lack of modernization needed to fight ***effectively.*** That is, we must be concerned ***both*** with readiness ***and*** with modernization. Lack of attention to the former produces ***near-term*** casualties, to the latter produces ***future*** casualties.

One of the complicating factors in Defense budgetary planning is that the time horizons are so distant. It is useful to recall that the systems that performed so well in the Persian Gulf largely represented the technology of the 1960s, the development of the 1970s, and the production of the 1980s—all utilized by the people of the 1990s. In other words, the decisions we make today will to a considerable extent determine the casualties we will suffer in carrying out our national security objectives in the next century. This is a very great responsibility that must be borne by all of us who have fiduciary responsibilities for national security.

Sixth: Provide budgetary reserves as an essential component of all major system developments. No component aircraft pilot would ever take off without an adequate reserve of fuel for contingencies that might be encountered along the way. Similarly, no contractor in the private commercial sector would ever initiate a large, complex project without first establishing a "cushion" of funds and schedule slack that could be used if the project happens not to evolve precisely as planned. Without such a cushion, we give our program managers virtually no chance of succeeding. It is much as an instance said to have been encountered one evening during the curfew in Dublin when at 9:50 p.m. a policeman approached a group of citizens standing on a street corner and shot one of them. When the victim's associates vociferously protested that the curfew did not begin until 10 p.m., the officer replied, "Look, I know where that guy lives, and there is no way he could have made it home by ten."

Even relatively straightforward engineering tasks will, from time to time, encounter unanticipated problems. Recently in Washington, DC, there was the example of the major federal office building being constructed some two blocks from the White House. Despite the fact that the terrain was presumably well-known to the designers and architects, the project encountered extensive delays due to design changes and construction pitfalls. It has now been estimated that the building—originally approved at a projected cost of $362 million—will eventually cost more than $1 billion. And this project was not exactly rocket science. We all recall that the Hart Senate Office Building had an overrun of a factor or two. And this project also should never be confused as being a technological tour de force.

As long as America's military establishment seeks to lead the world in Defense technologies, as long as those in industry seek to push the envelope of the state of the art, there will be occasional stumbles and falls. We must make the same acknowledgment of risk in military procurement, as we do in often far more mundane commercial projects; namely, building in reserves for uncertainties and unprogrammed events that occur during even the best managed major system developments.

In summary, what is needed is some good old-fashioned management: ***setting realistic goals, putting capable people in charge, and leaving them alone so they can do their jobs.*** That, in just 18 words, is what is needed to "fix" the acquisition process.

There are, of course, pessimists among us who would characterize today's situation in the words of Woody Allen: "More than any other time in history, [we] face a crossroads. One path leads to despair and utter hopelessness. The other, to total extinction. Let us pray we have the wisdom to choose correctly."

I personally prefer the perspective of Yogi Berra, namely: "When you come to a fork in the road, take it."

It is time for those of us, both in government and the private sector, who care about national security to take a new road.

THE WORLD'S FIRST INFORMATION AGE GROUND COMBAT WEAPON SYSTEM

By LTC George Patten and Jimmy W. Whiteley

With the warfighting potential of information-based technologies continuing to escalate, the Army has developed the Task Force XXI plan to incorporate the advances as rapidly as possible and facilitate the desired transformation from an analog to a digital force.

Editor's Note: This is the first of a two-part article. The second part will be published in a future issue of Army RD&A.

Introduction

As a smaller, technology-oriented Army reshapes itself to enter the 21st century, it faces challenges reminiscent of the 1920s. Though in a different context, the questions to be answered for the maneuver force are the same. Among them are:

- How must the armored force fight on a broader, higher tempo battlefield?
- How does a commander direct the extended forces he increasingly cannot physically see?
- How should the tank interact with the expanding array of sensors and systems without overwhelming the soldier? and
- What roles do we expect the tank to perform in the future?

The principal solutions are numerous and the subject of discussions as vigorous as those in the 1920s and 1930s. The notable difference is today's solutions are all built upon the power of the microprocessor, which has virtually created a digital battlefield. Thus, only by harnessing the power of the computer and the attendant information-based technologies to perform routine, repetitive functions will we enable the tank and the maneuver commander to fulfill the expanded roles and meet the challenges of the emerging battlefield. This article examines how the M1A2 Abrams Main Battle Tank, the first computer-based, Information Age armored weapon system, has revolutionized ground combat vehicle systems, and is leading the way to the 21st century digital Army, known as Force XXI.

With the warfighting potential of information-based technologies continuing to escalate, the Army has developed the Task Force XXI plan to incorporate the advances as rapidly as possible and facilitate the desired transformation from an analog to a digital force. The means for achieving that goal without overwhelming the soldier is digitization through automation.

The M1A2 tank's computer-based architecture has established the standard for embedded systems as transformation enablers for converting industry's "information highway" into the military's "digitization of the battlefield" through automation. In fact, the quintessential element of digitization of the battlefield is this automation—the harnessing of computer power to generate or collect, communicate, store and display tactical information.

The tank applications of the computer

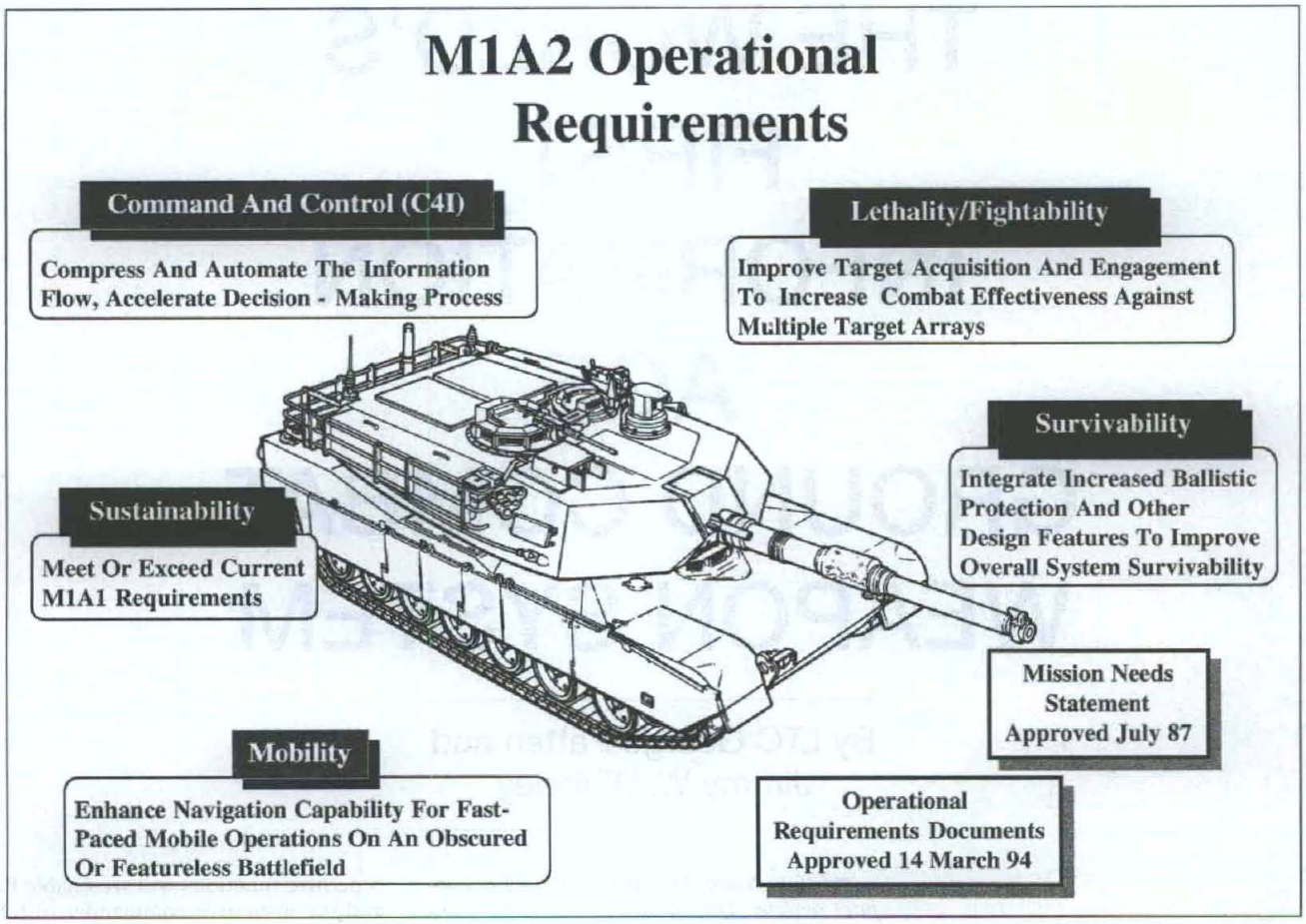


Figure 1.

technologies necessary to acquire, exchange, and employ timely digital information are aimed squarely at maximizing automation while correspondingly minimizing soldier workload. The tank's system consists of several major subsystems that are connected via a network of distributed microprocessors and memory banks. This enables the myriad tank functions to run simultaneously, sharing data, without requiring soldier input for each. Thus, the M1A2 system was tailored to meet the needs of the Force XXI commander, shooter, and supporter without overwhelming them with data or procedures.

While the unique aspect of the M1A2 is its *intra*-vehicular network that enables the automating of functions and the near real time display of tactical data, the most widely discussed aspect of the Force XXI effort has focused on establishing a reliable means of freely exchanging *inter*-vehicular communication of the tactical data. The intent is to provide warfighters with a horizontally (across units and weapons systems) and vertically (between echelons) integrated digital information network.

As a minimum, the Army desires to assure a simultaneous, consistent picture of the battlefield from soldier to commander at each weapon system and echelon. While the Army's various command and control information systems have yet to achieve that difficult goal, the M1A2 Inter-Vehicular Information System (IVIS) has delivered a significant measure of that desired capability to the tank battalion. As a result, the tank battalion of Force XXI already possesses a near real time presentation of the battlefield as well as automated tank functions that extends across the communication networks of the platoons, companies, and the battalion. With the advent of the M1A2, however, the Army has demonstrated that digitization can be optimized through the synergistic use of data generated by the automated functions within the various subsystems in the tank. Because of this, the *intra*-vehicular network is the most critical element of the digital battlefield as it provides the database from which the subsystems, including the command and control (C2), draw information.

In fact, digitization predictably has more far-reaching impacts to the internal or intra-processes of a combat weapon system than does the C2 or inter-vehicular. This is because the C2 services but one of the five critical requirements of the tank as a fighting system. All five—lethality, survivability, mobility, fightability/C2 and sustainability—must also be accounted for when subsystems are designed to satisfy the warfighting mission as a complete system. (See Figure 1.)

From the conception of the M1A2 through today, the "system of systems" philosophy guides every phase of development and maturation of this Abrams tank. The use of digitization throughout the vehicle's fire control, navigation, diagnostics, communications, power management and C2 subsystems yields synergistic tank and crew performance beyond the contributions of each individual subsystem. Moreover, the M1A2 delivers these synergies both within the tank crew and between tanks, in both English and Arabic for the Saudi Arabian and Kuwaiti tankers.

M1A2 Abrams Highlights

M1A2 Abrams digitization is founded on an open system, core digital architecture that enables the integration of these information technologies into a complete tactical weapon "system of systems." The integrated technologies (See Figure 2.) permit M1A2 *intra-* and *inter-*vehicular platform information sharing. Specifically, the technologies provide both the capabilities of, and is analogous to, the civil sector's local area network and wide area network. The synergistic effect of these automated, digital capabilities enhances the vehicle's performance on the battlefield permitting it to overmatch any known tank, both technically and tactically. Its core vehicle electronics (Vetronics) architecture and electronic sensors and subsystems have clearly set the stage for today's and tomorrow's digitized, integrated armor vehicle platforms.

Vetronics

The M1A2 vetronics provide a high-speed digital databus with an associated bus for power supply, utility function processing and mechanical controls. This integrated package provides more reliable and survivable control functions and power distribution, transmitting electronic information and commands throughout the tank. Displays for the commander, gunner, and driver provide soldier-machine interface. Electronic sensors and systems improve driving, navigation, target identification and the passage of information between computer-driven subsystems and the crew; and between tanks and C2 nodes.

The M1A2 system capitalizes on digital information systems. It is a 90 percent digital and 10 percent analog vehicle. Many functions, such as diagnostics and position location, are performed automatically without the crew's input or action. The digital technology enhances synchronization accuracy and timeliness. The subsystems provide capabilities such as responsive command and control including the near real time exchange of dynamic orders, reports and graphics; global positioning; fire data distribution; communications network status; real time intelligence dissemination; rapid and synchronized targeting; electronic fixes on enemy and friendly locations; shared situational awareness; and built-in diagnostics. The core vetronics concept also enables a high degree of standardization, commonality, and shared resources, which benefits both the armored crewman and the logistical system that supports him.

With that in mind, one can imagine a highly maneuverable, integrated digital tank moving over the battlefield. It is a tank system that includes the capabilities of advanced computer-based applications in

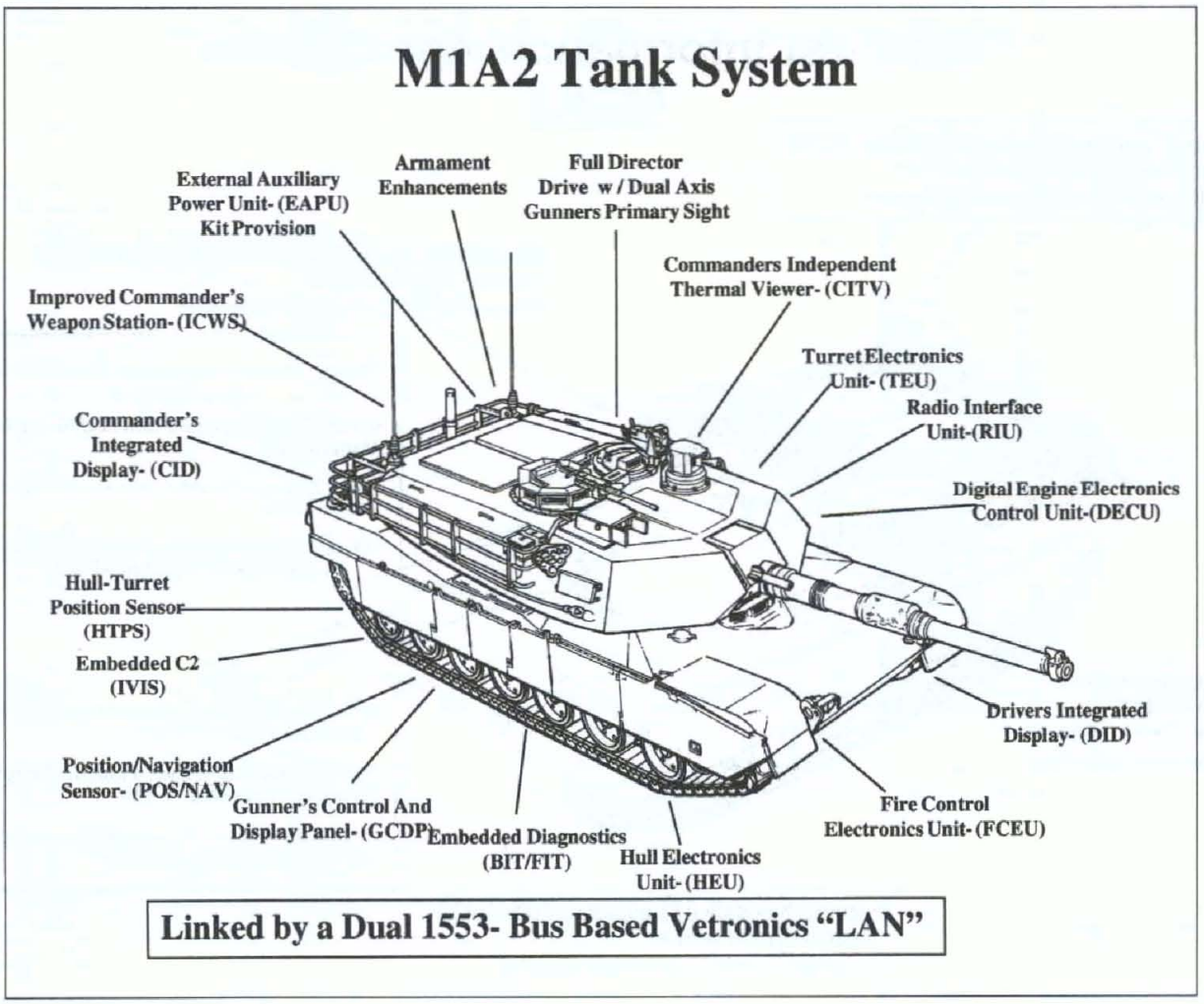


Figure 2.

command and control, lethality and fightability, sustainability, survivability, and mobility. It operates on a combination of processes and applications that provides to the maneuver force the most highly automated tactical fighting system on the digital battlefield—the M1A2 Abrams Main Battle Tank weapon system, the technological backbone to Force XXI.

To better understand the operational value added, we need to look at the subsystems that make up the "system of systems." One need only imagine a tank crew having current and accurate tactical situation information displayed, showing friendly and enemy positions clearly with accurate map information as well as heading information to battle positions and waypoints to understand the function of the navigation subsystem.

The M1A2 Position Navigation (POSNAV) technology provides leaders accurate position locations for individual vehicles with updates transmitted to other vehicles every 15 minutes when stationary and every 100 meters or 120 seconds when moving. The navigation data is also provided to other M1A2 Abram's sensors and subsystems to improve maneuver control, target identification and the passage of information between computer-driven subsystems and the crew; and between tanks. This yields improvements in target identification and hand-off, reductions in fratricide, and savings in fuel and ammunition consumption.

In the fire control subsystem, lethality and fightability improvements include the Commander's Independent Thermal Viewer (CITV) and a hunter-killer capability. The CITV provides the commander with a 360 degree, all weather, day or night, target surveillance capability under all battlefield conditions. This capability is independent from the gunner's sights. The hunter-killer feature makes it possible for the commander to acquire a target while the gunner engages another target. While the gunner fires the weapon at one target, the commander can identify another target and then hand it off to the gunner with the push of a single button. The gunner can then immediately engage that high priority target while the commander continues to seek other targets. The design also provides a significant advance in fire control system capability with a combination of full gun director drive and dual axis stabilized gunner's sight and the hunter-killer operation. These are all *intra*-vehicular digital functions.

The M1A2 Inter-Vehicular Information System (IVIS) provides never before seen C2 battlefield information, enabling the crew to react faster, engage targets faster, sustain the fight longer, and defeat opponents decisively (*intra*-vehicular functions). IVIS, the tank's C2 subsystem, automatically processes and feeds back battlefield information to both the vehicle commander and other vehicles and C2 nodes (inter-vehicular functions) through display and transmission of grid mapping of the area of operation, enemy and friendly vehicle positions, selected reports, and system status and diagnostics. Currently, IVIS contains 15 reports and eight overlays that may be sent or forwarded to more than 20 other tanks on a single communication network.

In the power management system, survivability is enhanced through the vetronics dual, redundant buses. The M1A2 has two duplicate computers, a Hull Processing Unit and a Turret Processing Unit. Two data buses

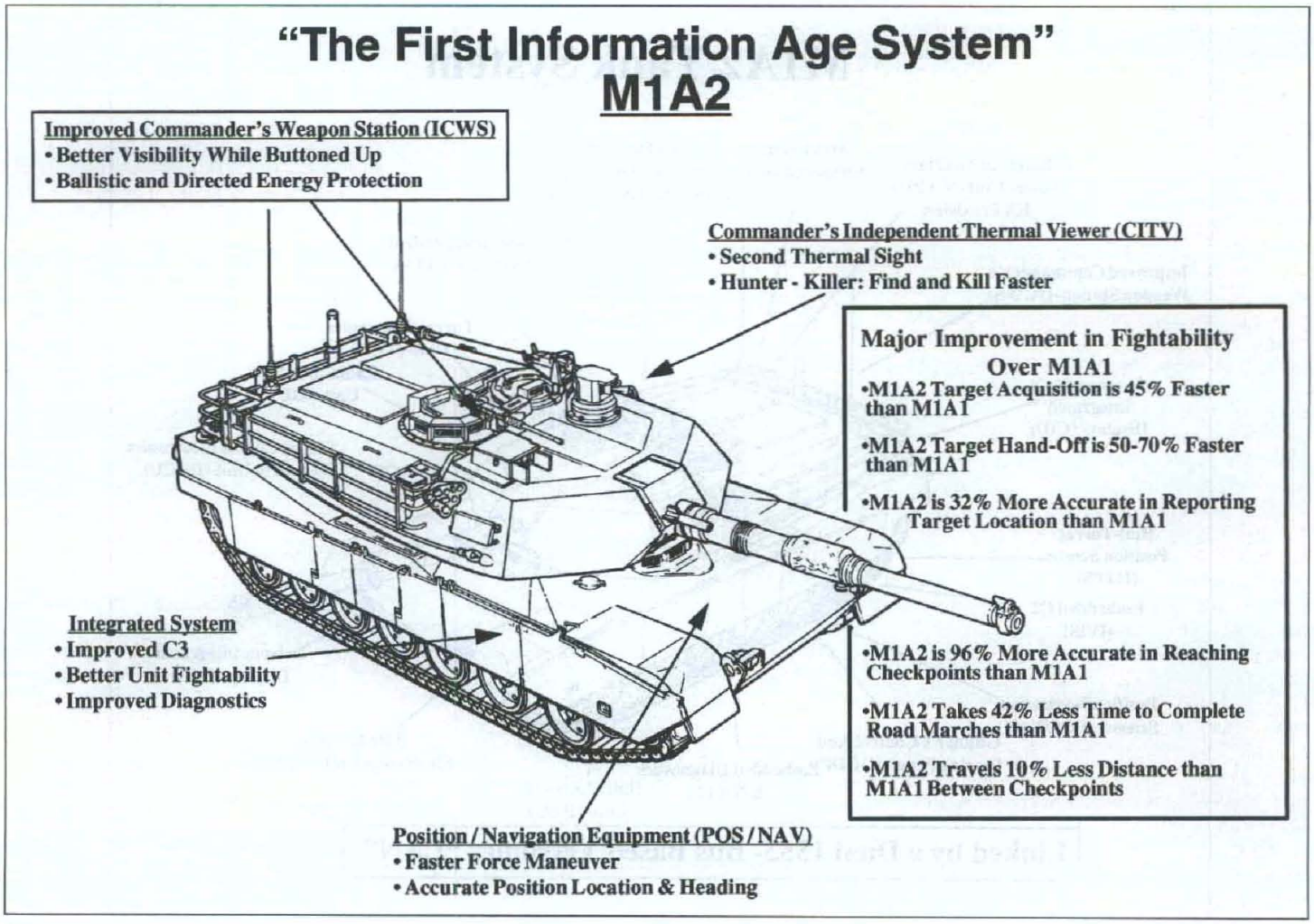


Figure 3.

The tank applications of the computer technologies necessary to acquire, exchange, and employ timely digital information are aimed squarely at maximizing automation while correspondingly minimizing soldier workload.

and two utility buses exist which provide dual functionality and dual utility processing and control for the system. Thus, if one bus or processing unit becomes damaged or inoperative, the tank continues to be fully mission capable. The Improved Commander's Weapon Station increases the commander's field of view to a nearly continuous 360 degrees. This improved field of view, the IVIS subsystem, and POS/NAV subsystem all add up to greatly enhanced commander's situation awareness and significantly improves the crew's ability to fight the weapon system. (See Figure 3.) The POS/NAV displays vehicle position and heading references to the driver and commander, providing the correct ground location at all times.

The diagnostic subsystem significantly improves the tank's supportability. Supportability features such as built-in tests and diagnostic fault isolation eliminate previously used special test equipment. The self-test feature runs continuously, transparent to vehicle operations, and senses system anomalies giving a fault indication to the crew in the form of a visual message on their display units. The software has the capability to automatically reconfigure the hardware to give the crew the highest level of functionality possible under the fault conditions. This too enhances the tank's survivability and fightability in battle.

The interaction of multiple subsystems provides remarkable synergies in the M1A2 that make it the dominant force on today's emerging digital battlefield. For example, the position and location data is automatically provided to the fire control and C2 subsystems. Enemy data entered in the fire control subsystem, when the laser range finder is fired, is also sent to the C2 subsystem where it is used for both *inter-* and *intra-*vehicular functions.

Building upon the extraordinarily flexible M1A2 Abrams core system, the tank's technologies have been leveraged into other ground weapon systems. M1A2 tanks are also designed for export to the Kingdom of Saudi Arabia and Kuwait. The designs use simple, low cost modifications to the core electronic and software systems to support key requirements of these nations. The tanks have a dual-language capability that is unique in the world. At the touch of a button, the tank tactical and status displays can be switched from English to the Arabic language. Radio sets compatible with each nation's armed forces are installed that retain the IVIS functionality. Additionally, unique intercom units are installed that minimize cost and training requirements for the respective armies.

In summary, the advent of the M1A2 clearly enables ground combat warriors to begin meeting the challenges of 21st century Information Age warfare. Moreover, it has established the standard to which armored vehicles will be built hereafter.

Growth Potential

The M1A2 Abrams Main Battle Tank is leading the revolution of digital ground combat vehicle systems. However, Information Age technology is rapidly evolving and other challenges will come to the forefront; such as, having the potential for growth in your existing system and keeping pace with change. The current M1A2 Tank's computer growth potential is nearly maximized, limiting any future add-on of subsystems. Thus, the Army has initiated the M1A2 Abrams System Enhancement Program (SEP)/2nd Generation Forward Looking Infra-Red (FLIR) program. The first M1A2 with these enhanced capabilities will reach the field in the year 2000. The M1A2 Abrams SEP Tank will be the continued product improvement of a proven platform. Again, the M1A2 Abrams Main Battle Tank is meeting the future head-on with integrated digital Information Age technologies.

Conclusion

The tactical level of war in the digital environment promises tremendous payoffs in speed, battlefield dynamics and flexibility. In today's leaner and smaller Army, this promise can be achieved only through freeing the soldier of routine tasks, allowing him or her to focus on critical tasks and automating functions to optimal performance. The digital applications and subsystems on the M1A2 are pathfinders in Information Age ground combat weapon systems. With its digital, automated, multi-sensor architecture, the M1A2 has truly harnessed computer power. The result is the fielded centerpiece of the Army's digitization of the battlefield and a catalyst for Force XXI.

LTC GEORGE B. PATTEN is Product Manager, M1A2 Abrams Tank System. He was selected to be the M1A2 Product Manager in 1994 and assumed that position in December 1994. Patten was commissioned in 1977 as a Distinguished Military Graduate of the University of Texas at Austin.

JIMMY W. WHITELEY is a military vehicle senior systems engineer with Camber Corporation, headquarterd in Huntsville, AL. Having served 13 years as a signal officer, he conducted C4I systems integration with assignments at Fort Gordon, GA, Fort Monroe, VA, and Germany. Whitely also served previously as the C4 subject matter expert assigned to the Center for Army Lessons Learned, Combined Arms Center, Fort Leavenworth, KS.

DIFFERENCES IN SPECIFYING 'WHAT TO TEST' PARAMETERS FOR HARDWARE AND SOFTWARE

By LTC Edward D. Jones

From the test manager's perspective, the requirement to address software maturity and performance prior to operational testing makes software testing unique and somewhat problematic.

The Basics

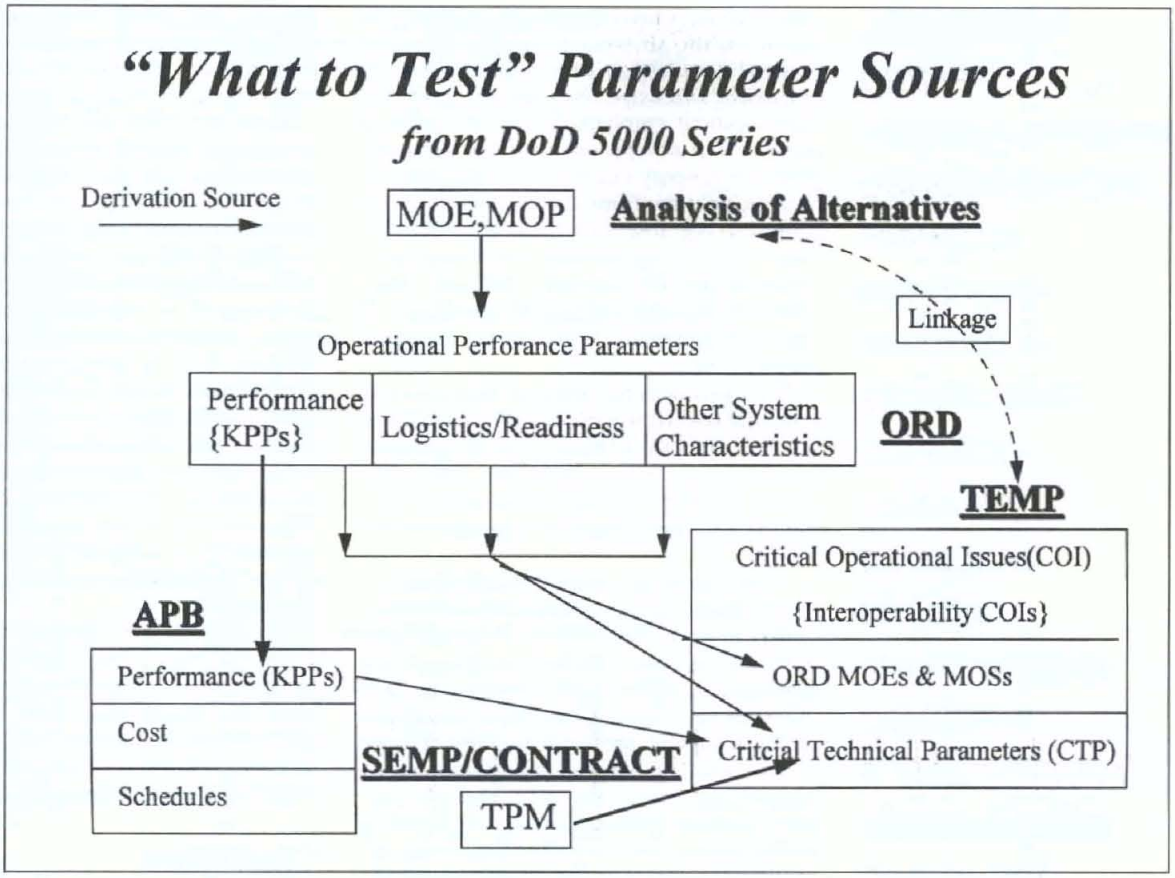
Today, practically all modern weapon system designs include embedded computer hardware that host software. This software is often complex and sometimes has a million or more lines of code. Consequently, during most tests, an embedded computer system is often difficult to distinguish from other commonly used electrical parts. Because of this, the following question must be asked: *Do test managers for modern software intensive weapons need to employ different processes when specifying "what to test" parameters than those used for systems having little or no software?* Many argue that the answer is clearly yes! I assert that the process is essentially the same, but more complex. This complexity originates from the proliferation of what to test terminology and the terminology associated with software metrics, the measurements used to effectively manage software development.

When assessing software maturity and performance, it is not always clear whether a what to test parameter or a software metric is more appropriate. I define what to test parameters to include measures of effectiveness (MOEs), suitability (MOSs) and performance (MOPs) from the operational requirements document (ORD) and the critical technical parameters (CTPs), the most significant technical performance measurements (TPMs). The accompanying chart illustrates the sources for what to test parameters and the key acquisition documents where they are located.

The New 5000 Series

DoD Regulation 5000.2-R, released by Secretary Perry on March 15, 1996, recognizes the additional challenges presented by software intensive systems during development and testing. The majority of procedures and policy for testing hardware and software intensive systems are, for the most part, identical, with three key differences:

- *One significant difference is that the developing agency shall provide software maturity criteria and performance exit criteria necessary for certification for operational test.* The assessment for software maturity is based on developmental testing of the critical technical parameters and the evaluation of how well the criteria associated with software metrics are met. The requirement to formally specify exit criteria for certification for operational testing became a requirement because many systems arrived at a major initial operational test and evaluation (IOT&E) with uncertain or changing software configurations. The exit criteria normally is associated with growth patterns of thresholds for CTPs.
- *The second difference is that the test manager must ensure that the CTPs adequately address software maturity and performance.* From the test manager's perspective, the requirement to address software maturity and performance prior to operational testing makes software testing unique and somewhat problematic. Most what to test parameters are defined to measure system level performance. They are not specified to separate hardware driven performance from performance that depends exclusively on software performance.
- *The third difference is the requirement to use software metrics to instill the necessary discipline of the software development process and to assess the maturity of the software product.* Software metrics provide a tool that the system engineer and software engineer can use to monitor the development progress and to assess software quality and maturity. The test manager should normally use software metrics as a tool to assess software maturity and readiness to proceed into operational testing.



Test and Evaluation Policy

Test planning, at a minimum, shall address all system components (hardware, software, and human interfaces) that are critical to the achievement and demonstration of contract technical performance specifications and operational effectiveness and suitability requirements from the ORD.

Software test and evaluation (T&E) is often the most difficult, frustrating, and expensive test activity during system development. The test and evaluation master plan (TEMP) provides the basis for all other detailed T&E planning documents, including those pertaining to software testing. For software intensive systems, the TEMP should address the following:

- Operational performance parameters and critical technical parameters that address required capabilities and technical performance which is dependent on software performance.
- Test support equipment required to conduct software testing.
- Computer-driven simulation models and hardware-in-the-loop test beds identified by specific test phases.
- Key events in the software test and evaluation plan (normally developed by the developing contractor) in part III of the TEMP.

A common testing principle is that quantitative test criteria should be phrased to provide information used for assessing hardware, software, system maturity and the readiness to proceed through the acquisition process. Common to hardware and software testing is the requirement to specify the operational performance parameters (measures of effectiveness, suitability, and performance (MOEs, MOSs, MOPs)). They are most appropriately tested during operational testing and are used to address critical operational issues (COIs). COIs address the top level mission essential tasks and are stated as a question. An appropriate COI might be: "Does System A provide an Army Corps an effective air defense against enemy tactical ballistic missile attacks?" Army COIs are stated with criteria and are called COICs. The COI criteria are based upon the MOEs, MOPs and MOSs from the operational requirements document.

COIs and operational performance parameters are not normally specified to address technical performance that is clearly hardware or software dependent. They address required capabilities essential in supporting accomplishment of mission essential tasks as defined in the ORD.

In order to proceed beyond low rate initial production, testing must demonstrate that the system is able to meet a subjective number of thresholds of the operational performance parameters. Those parameters must be met or the system will not normally be allowed to proceed into full rate production. Some of the key performance parameters (KPPs) may be heavily dependent and, in some cases, totally dependent on capabilities that are provided by software.

The test manager and system engineer must be capable of identifying what technical performance must be provided by hardware, software, and the integrated system. A key "what to test" parameter is the critical technical parameter. These parameters (CTPs) measure hardware and software technical performance at the system and major sub-system levels.

Government testing of CTPs at the subsystem level is normally restricted to those components that have high technical risks or are cost drivers. It is possible to specify a CTP to address a measurement that is associated purely with software performance. For many programs, the test manager and the system engineer jointly manage the process to confirm contractual specification compliance. The test manager will normally

Historically, testing weapon systems with embedded software has been a process that checks software application execution against requirements extracted from the user's requirements document.

have the lead in government planned developmental and operational tests while the system engineer will have the lead in overseeing contractor planned developmental testing.

Key Differences

It is important to note that the majority of the guidelines for hardware and software T&E are the same, regardless of the amounts of embedded software. What is unique about testing software as compared to testing hardware? Historically, testing weapon systems with embedded software has been a process that checks software application execution against requirements extracted from the user's requirements document.

Government planned testing is normally conducted at a system or major component level with the software and hardware having been integrated. The goal of this type of testing is to demonstrate that the system provides adequate performance and characteristics to meet the thresholds associated with the operational performance parameters and critical technical parameters. Current literature (a good reference is the Air Force *Guidelines for Successful Acquisition and Management of Software Intensive Systems)* on software development emphasizes that this type of testing will not produce quality software nor can it verify correctness. This type of testing only confirms the presence (as opposed to the absence) of software defects. It is now recognized that correcting software defects is a fix, not a solution. Also, software defects are usually symptoms of more fundamental defects in the development process.

Best practices for software development emphasize that software testing has evolved into an integrated set of software quality activities covering the entire life cycle. Software testing can be divided into unit testing, integration testing and systems testing.

Unit testing is normally accomplished in an incremental design/code/test fashion, where more and more of the completed system is progressively tested during each increment. Results of unit tests are then analyzed to see if any defects have occurred, and a debugging process is performed to remove them. The purpose of unit testing is to remove all (at least as many as possible!) defects from the unit under test. Unit testing is described in the contractor's software development test plan and should be briefly summarized in the system TEMP.

Integration testing is conducted to determine how the individual software units or modules perform together as a computer software configuration item. Integration testing also involves placing the code on the intended hardware components for testing.

System testing is where hardware and software components are tested as an integrated whole and ultimately as the finished product (total system). Unit, integration and system testing is developmental and is planned and executed with oversight from the government systems engineer and test manager.

Software metrics are used to track the development progress, schedule, quality, cost and software maintainability. Software metrics can be divided into the following categories:

- Management metrics help determine progress against a development plan. Examples include cost, schedule and design requirements stability.
- Quality metrics measure product attributes affecting performance, user satisfaction, supportability, and ease of change. Examples include complexity of code and reliability.
- Process metrics measure organizations, tools, techniques, and procedures used to develop and deliver software procedures. Examples include the amount of training for programmers, programmer experience and type of programming methodologies.

While all of the preceding categories of metrics are valuable in managing a software development and provide information that is useful in certifying that a system is ready for operational testing, *they are normally not appropriate for specification as a CTP in the TEMP.* Software metrics serve primarily to provide a tool for the software developer to effectively manage a software development. What to test parameters, such as the operational performance parameters (MOEs and MOSs), have the primary purpose of measuring how well a system provides required capabilities in an operational environment. The other major what to test parameter, the critical technical parameter, is primarily for measuring technical performance essential in supporting the mission essential tasks.

When combined with software metrics, CTPs and their source, technical performance measurements from the systems engineering management plan, provide valuable tools for the system engineer to track the progress of the system development toward the milestone three thresholds.

Conclusion

For software intensive systems, the test manager must take care to ensure that the critical technical parameters provide an adequate assessment of software performance and maturity. Those software metrics that meet the TPM selection criteria should be considered for specification as a CTP. The tester and engineer need to have the capability to determine whether a software or hardware deficiency caused a failure to meet a CTP threshold. It is important that the test manager uses all available tools to assess whether a software intensive system is ready to enter operational testing. Software metrics and properly specified TPMs and CTPs provide the tools to enable adequate assessments of both software performance and maturity.

LTC EDWARD D. JONES is a professor of engineering at the Defense Systems Management College. He holds a B.S. degree from the U.S. Military Academy, West Point, NY, and an M.S. in chemical engineering from Vanderbilt University.

THE ROLE OF THE ARMY ACQUISITION EDUCATION AND TRAINING OFFICE

By Diane M. Schaule

Members of the Army Acquisition Education and Training Office, front row, left to right, Jim Welsh, C. LaVerne Jones, and Carolyn D. Hinson; back row, left to right, Randall L. Williams, Diane M. Schaule, Sue Winkler, and Careka C. Squire.

The Defense Acquisition Workforce Improvement Act (DAWIA), enacted as part of the Fiscal Year 1991 Defense Authorization Act, focused heavily on a systematic approach to professionalize the acquisition workforce and included specific requirements for experience, education and training. The Director for Acquisition Career Management is responsible for implementation of these DAWIA requirements within the Army and is assisted in this effort by C. LaVerne Jones, who serves as Chief of the Acquisition Education and Training Office. (See sidebar article on LaVerne Jones on page 32.) This office is charged with establishing, implementing, and maintaining high quality education, training, and other career broadening programs to enhance the Army Acquisition Workforce (AAW) and Army Acquisition Corps (AAC) technical competencies and leadership skills.

Thus far during FY96, the Acquisition Education and Training Office has provided training for approximately 10,600 civilian and military AAW employees. Defense Acquisition University (DAU) mandatory training quotas account for over 9,000 of these students. The remainder apply for a variety of long- and short-term training opportunities, as well as tuition assistance programs of varying lengths to meet DAWIA requirements.

Long-term training programs offered by the Acquisition Education and Training Office to AAC members encompass both full- and part-time graduate programs in the disciplines of business, engineering, sciences, and contracting. Schools include the Naval Postgraduate School at Monterey, CA, the University of Texas at Austin and San Antonio, the University of Pennsylvania, and the IC2 Institute, affiliated with the University of Texas at Austin. School of choice programs, normally conducted within the student's geographic area, can accommodate individuals whose needs can best be met by an individually-tailored program of instruction. In addition, senior Army Acquisition Corps members may compete for the 10-month Senior Acquisition Course presented by the Industrial College of the Armed Forces (ICAF), located at Fort McNair in Washington, DC. The ICAF program is centrally administered by the Assistant Secretary of the Army (Manpower and Reserve Affairs) and nominees are evaluated by an HQDA selection board.

In addition to long-term training programs, Corps members may compete for various executive development seminars offered by this office, such as the Harvard Senior Fellows Program, the Josephson Institute of Ethics, Weapons System Management Workshop, and other seminars that are announced periodically during the year.

In order to evaluate and select candidates for these programs, this office convenes competitive selection boards twice a year in April and October. Boards are comprised of senior acquisition professionals who review all AAC applications for long-term, part-time and seminar education and training programs. Board recommendations are forwarded to the convening authority, Director, Acquisition Career Management (DACM) for approval. Selected and non-selected individuals are notified in writing by the Deputy Director, Acquisition Career Management (DDACM).

Both long- and short-term training opportunities available to AAC and AAW members are announced in a catalog published annually by this office. This catalog provides detailed information on curriculum, eligibility criteria, registration information, and course dates.

In addition to these training opportunities, this office also manages mandatory training required for certification as well as other professional development programs for the acquisition workforce. They are:

Defense Acquisition University (DAU) Mandatory Training. Each fiscal year, this office receives approximately 10,000 Defense Acquisition University quotas from DOD to provide AAW employees with the mandatory training required for certification. This office provides policy and oversight on behalf of the Director, Acquisition Career Management for 74 courses offered by the 14 DAU consortium schools to train Army acquisition workforce employees. The Research

ABOUT LAVERNE JONES...

The success of the Army Acquisition Education and Training Office in providing quality programs to members of the Army Acquisition Corps (AAC) and acquisition workforce is due largely to the dedication, leadership, and expertise of C. LaVerne Jones, who has served as chief of the office since February 1992.

In a recent letter to Deputy Director, Acquisition Career Management Keith Charles, John Moore, Chief of the Contracting Division, Japan Engineer District of the U.S. Army Corps of Engineers, praised Jones by stating, "*The type of customer care attitude she displayed is something I am constantly trying to instill in my office. People like Ms. Jones truly bring credit to all federal workers and deserve to be recognized for their contributions.*" This letter typifies Jones's professional dedication.

Serving under the purview of the Director for Acquisition Career Management, Jones has a strong civilian personnel management background which, combined with extensive experience as an employee development specialist, forms a solid foundation for her responsibilities relative to education, training, and career development for the acquisition workforce. She is complemented with a staff of two program analysts, two employee development specialists, one education specialist, and one budget analyst.

For approximately five years prior to her selection as Education and Training Chief, Jones managed a variety of professional development programs for acquisition personnel. As a member of the Officer Personnel Management Directorate of the U.S. Total Army Personnel Command, she provided expertise on the life cycle personnel management of civilian employees in the AAC. At Headquarters, U.S. Army Materiel Command from October 1987 to November 1988, Jones administered several key training programs for the command, including the Logistics Acquisition Management (LOGAMP) Program.

Between August 1983 and October 1987, Jones increased her breadth of experience by working for activities in the Washington, DC, area at HQDA, major commands and installation organizations. Working in the field from March 1978 until August 1983, Jones developed and executed programs in support of personnel management programs at White Sands Missile Range, NM. Prior to that assignment, she served eight years as a legislative aide and congressional caseworker in the U.S. House of Representatives.

Jones holds a master's degree in management and development of human resources, and a bachelor's degree in management and organizational behavior.

We applaud Jones's dedication and committed work ethic which characterizes the accomplishments and reputation of the Army Acquisition Education and Training Office.

and Development Acquisition Information Systems Activity (RDAISA) manages the Army quotas and funding for these mandatory courses. They slate students who register via the Army Training Requirements and Resources System (ATRRS) against available Army quotas for each class; determine the student's eligibility to attend the requested training; notify the student's organization when the student is approved; and provide the fund cite for preparation of travel orders.

Defense Acquisition Scholarship Program. One method to ensure that future acquisition staffing needs are met is through planned intake of entry- and mid-level personnel with high-potential. Toward that end, this office screens and selects the Army candidates from among all those who compete for the DOD Defense Acquisition Scholarship Program. These individuals are provided scholarship support and are placed in acquisition positions upon program completion.

Advanced Program Management Course. Application suspense dates and submission requirements for the 14-week Advanced Program Management Course taught at the Defense Systems Management College (DSMC) are announced by the Acquisition Education and Training Office. Candidates are evaluated by this office and applications of those selected to attend are forwarded to DSMC. Civilian AAC employees, as well as Corps Eligibles, may apply for this premier program management course. Military AAC officers are nominated by their respective career branch at the U.S. Total Army Personnel Command.

Army Tuition Assistance Program. This office currently funds tuition for approximately 780 AAC and AAW employees participating in the Army Tuition Assistance Program (ATAP). Students in this program are either seeking tuition assistance to satisfy the mandatory DAWIA requirements for 12 or 24 semester hours of business-related study or 24 semester hours of study related to an individual's acquisition career field. Students may also enroll in this program to pursue an undergraduate degree to qualify for AAC membership or a master's degree (AAC and Corps Eligible employees only).

Reengineering Initiatives

In addition to the existing education and training programs, this office is actively involved in the AAC reengineering effort. With the implementation of the Corps Eligible (CE) Program, this office published an Education and Training Portfolio for CEs that offered master's degrees under the Army Acquisition Tuition Assistance Program, and opportunities to compete for the Advanced Program Management Course and the Materiel Acquisition Management Course. Non-competitive training opportunities are currently being developed for CEs for FY97. This training will be decentralized to civilian personnel training offices at selected regional sites. Personnel at these sites will administer a Managerial Assessment of Proficiency to each employee to assess individual development needs. Managerial, leadership and ethics courses will be offered based on the results of the assessment.

For the Competitive Development Group (CDG), which is another major AAC reengineering initiative, this office will provide an orientation at the start of their three-year program and monitor their progress during the training portion of the program. CDG selectees will be introduced to the senior acquisition leadership and their philosophy and be provided a forum of current initiatives of interest to the acquisition community. An integral part of the orientation is development of an Individual Development Plan. This will be an assessment of prior education, training, and experience to arrive at an appropriate training plan for the duration of the CDG's program. Education, training, career development, or a combination of opportunities will be offered to these individuals to complement their professional development.

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Figure 1.
Vehicular Intercommunication System tanker helmet.

ENHANCED ARMOR USING THE VEHICULAR INTERCOMMUNICATION SYSTEM

By Georges R. Garinther
and B. Wayne Anderson

Introduction

An article in the January-February 1990 issue of *Army RD&A Bulletin* presented data which showed that poor communication in armored vehicles results in prolonged mission times and more operational errors. That article indicated that the use of active noise reduction (ANR), which reduces noise at the ear, might improve speech intelligibility, thereby increasing operational performance.

Recognizing the need for improved speech communications and greater hearing protection in armored vehicles, the Army began work in 1991 to produce a new tank intercom that included a tanker helmet with ANR (see Figure 1). This system, called the Vehicular Intercommunication System (VIS), began to be fielded early in 1996.

VIS is actually a modular system that includes a protective helmet and a family of headsets that provide communication and hearing protection for armor, mounted infantry, towed and self-propelled artillery, and command and control personnel. The technological improvements of the VIS include: active noise reduction, voice-activated circuitry, high attenuation seals, improved circuitry and shielding, improved noise-canceling microphone, additional helmet adjustments, and talk-through circuitry (some headsets). A brief discussion of each of these improvements follows.

• ***Active noise reduction*** is an electroacoustic system that samples the noise of the tank and presents an out-of-phase signal to the ear that reduces low-frequency noise at the ear by as much as 25 decibels (dBA). Since the passive attenuation of the tanker helmet is sufficient at frequencies above 1,000 hertz but is insufficient at lower frequencies, ANR provides complementary attenuation at those low frequencies where greater attenuation is required to reduce the total noise level below 85 hertz. The addition of ANR is more desirable than double hearing protection, which provides excessive attenuation at those frequencies above 1,000 hertz where auditory cues must be heard for proper operation of the vehicle. This reduced noise level at the ear of tank crew members prevents excessive auditory damage, reduces voice level at the ear, improves speech intelligibility, and increases permissible operational time.

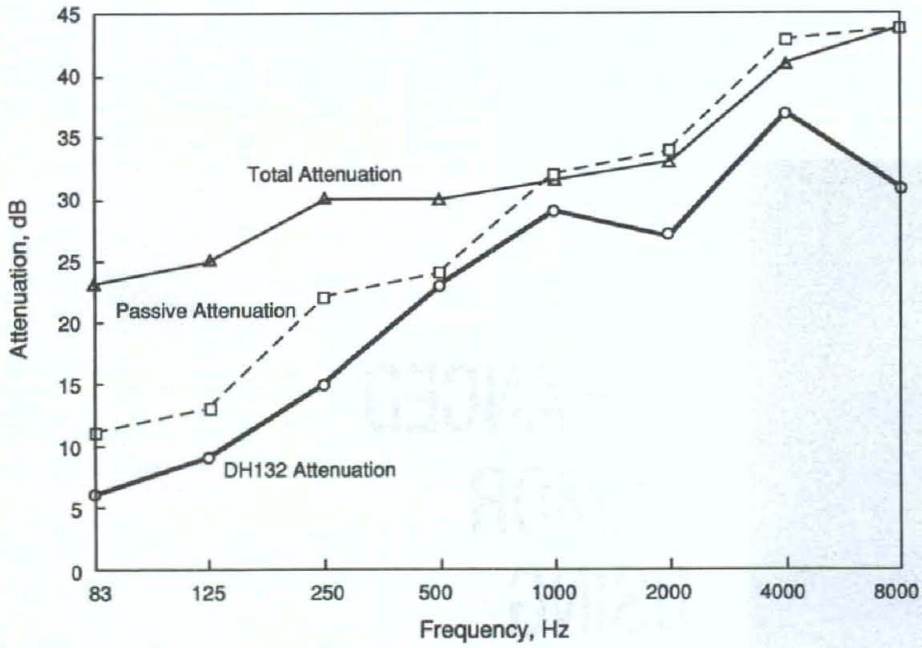

Figure 2.
Total and passive attenuation for the VIS helmet compared to the attenuation of the DH132 helmet.

• ***Voice-activated circuitry*** provides the crew with the option of either activating the microphone by talking or using the push-to-talk switch. This frees the hands of crew members to accomplish other tasks.

• ***High-attenuation ear seals,*** which include two rings of molded medical grade silicone, provide greater attenuation and comfort.

• ***Improved circuitry and shielding*** eliminates extraneous electronic noise such as that produced by generators, hydraulic pumps, slip rings, etc.

• ***Improved noise-canceling microphone (M162)*** provides greater low frequency cancellation than the old M-87 microphone.

• ***Additional helmet adjustments*** provide greater comfort and sizing for a broader range of heads.

• ***Talk-through circuitry*** includes two microphones outside the headset, allowing the wearer to communicate with nearby personnel without removing the headset. This system also has an electronic circuit that limits impulse noise, at the ear, to 90 decibels.

Since most VIS systems produced will be the tanker's helmet, the following discussion concentrates mainly on this system. Extensive measurements have been made of both the attenuation and the speech intelligibility afforded by the VIS in comparison to its predecessor, the DH132.

Attenuation

The noise of armored vehicles at interior crew member positions is typically in the range of 105 to 115 dBA. When operating at about 30 mph, the M109 howitzer (Paladin) is 108 dBA, the M1 tank is 110 dBA, and the Bradley is 115 dBA when measured at the ear. When the DH132 helmet is worn in the Bradley, levels at the ear are typically 100 dBA.

Attenuation measurements of the VIS were made at the Armstrong Laboratory, Wright Patterson Air Force Base. The measurements were made in a reverberant chamber using MIL-STD 912 (microphone in a human ear method) in a 115 dBA pink noise. Figure 2 shows the total attenuation (passive and active) and the passive-only attenuation for the VIS compared to the attenuation of the DH132 helmet. Based upon these attenuation values, current hearing conservation guidelines state that exposures to interior operating noise of Bradley at the commander's location should not exceed about 20 minutes per day when the current DH132 is worn, VIS extends the allowable exposure time to 12 hours.

Noise Levels at the Ear

Measurements were also made under the VIS helmet at the ear of personnel using a simulated 114 dBA Bradley noise produced in the reverberant chamber. The values obtained from this test were also verified by measurement in an actual Bradley vehicle traveling at 30 mph. These measurements showed that the VIS helmet reduced noise at the ear to 83 dBA when the intercommunication system is not keyed. However, when a talker's microphone is keyed, vehicle noise enters the intercommunication system through this microphone and raises the noise level at the listener's ears to 90 dBA. When the system is keyed and a person is talking, the level of the speech at the listener's ears is further raised to 94 dBA. It is evident, therefore, that hearing hazard is determined by the length of time that any one of the crew members has a microphone keyed and, to a greater extent, by the length of time that any crew member is talking. Since many situations occur where personnel keep their microphone keyed, voice-activated circuitry can minimize hearing hazard by reducing the time that the intercom system is on.

Speech Intelligibility

Speech intelligibility tests of the helmet were conducted, via the Modified Rhyme Test (MRT) using a 114 dBA Bradley and a 108 dBA Paladin (155mm self-propelled howitzer) simulated noise produced in the reverberant chamber. The Army's requirement for speech intelligibility is that an MRT score of 91 percent should be achieved at normal operating speeds. These tests showed that the VIS helmet provided 89 percent speech intelligibility in the Bradley and 92 percent in the Paladin.

Tests conducted when personnel were wearing the standard DH132 helmet using the same Bradley simulated noise produced a speech intelligibility score of about 68 percent. Experiments conducted by the U.S. Army Research Laboratory (ARL) indicated that poor speech intelligibility reduces the number of targets correctly hit, increases mission time, and increases the probability of fratricide.

Crew Performance

Crew performance in armored operations is critically dependent upon communications. To determine the extent to which performance depends upon speech intelligibility, the Human Engineering Laboratory (now a part of ARL) conducted a series of studies. This was done using the Simulation Network (SIMNET) simulator to measure performance effects in armor operations using scenarios ranging from simple to very complex. The studies quantified, as a function of speech intelligibility, performance parameters such as time to identify a target, time to hit a target, time to navigate to a checkpoint, number of targets missed, number of reports correctly transmitted, etc.

The results are summarized in Figure 3 and show performance effects for simple scenarios (stationary gunner) and for complex scenarios (navigation, reporting, and

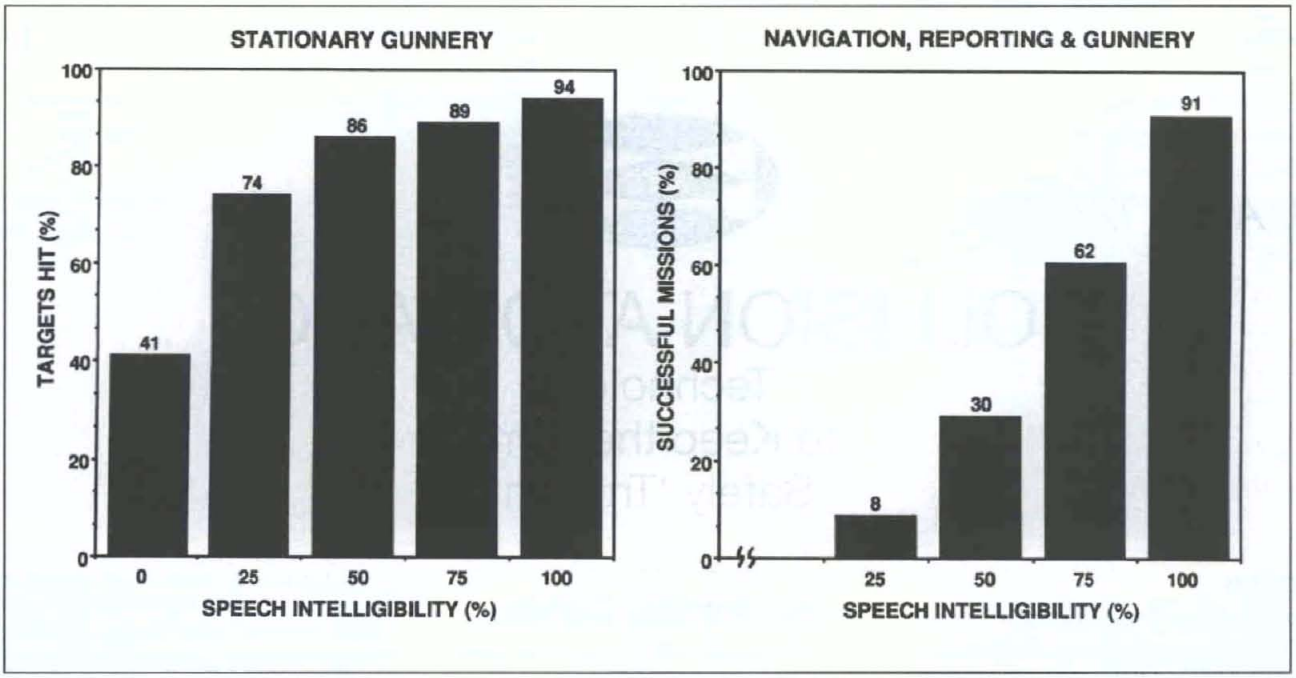

Figure 3.
Performance of armor crews for simple and complex scenarios as a function of speech intelligibility.

gunnery). These results show that for simple scenarios, performance is maintained fairly well until speech intelligibility drops below 50 percent, at which point, performance drops dramatically.

For complex scenarios, however, performance drops almost linearly as a function of speech intelligibility. In other words, for every 10 percent improvement in speech intelligibility, there is an approximate 10 percent improvement in performance for complex armor operations. Since testing of VIS in the Bradley vehicle showed that speech intelligibility improved by 21 percent over that obtained in the standard DH132 helmet, computations show that successfully accomplished missions would increase by 25 percent for complex missions similar to those conducted in the ARL studies.

Future Work

Before VIS was developed, the introduction of noise into the wearer's ears was mainly controlled by noise entering through the earcups and around the earcup seals. Noise entering the communication system through the lip microphone was secondary. With the dramatic reduction of noise entering the earcups, further improvement of both noise reduction at the ear and speech intelligibility must be accomplished by improving the speech signal-to-noise ration (SNR) entering the communication system at the lip microphone. Efforts to accomplish this are being addressed by the following four programs presently underway at ARL and other laboratories:

- *Adaptive critical bands* that simulate the filters that are present in the hearing mechanism, thus enhancing the listener's ability to hear speech in noise.
- *Neural network theory* which predicts the speech SNR in each critical band, allowing these bands to be optimized for maximum speech intelligibility.
- *Active noise reduction microphones* that improve the speech SNR entering the system at the lip microphone by means of phase cancellation similar to that accomplished at the earphone by ANR.
- Regeneration of voicing components in speech by combining lip and laryngeal microphone signals.

An additional technological area presently being pursued by ARL is the use of 3-D audio displays that improve spatial awareness and enhance speech intelligibility in headsets by separating and causing each talker's voice to be heard at that location outside the helmet where the talker is actually situated.

Summary

The Army has developed and is fielding an intercommunication system, including a tanker's helmet, that dramatically reduces hearing hazard, improves speech intelligibility, and increases tactical performance. Studies are currently underway to further improve the performance of armor crews through 3-D audio displays and other advanced auditory technologies.

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U.S. Army TACOM . . .

COLLISION AVOIDANCE

Technology to Keep the Army Safely 'Truckin'

By Anthony Comito

Overview

"Looks like we've got ourselves a convoy!" That's what officials at the National Automotive Center (NAC) said when they made plans to employ collision warning sensors on vehicles to demonstrate safety benefits to the Army and the rest of the country. After years of evaluating how commercial collision warning technologies benefit both the military and commercial sector, the NAC decided to demonstrate collision avoidance technologies to the Army and the public. This effort will accelerate acceptance, reduce costs, and quantify the safety aspects for early technology insertion into military tactical wheeled vehicles. The three-week Collision Warning Safety Convoy was a new venture for the NAC and its parent organization, the U.S. Army Tank-automotive and Armaments Command (TACOM).

The National Automotive Center put together a six-vehicle convoy comprised of two High Mobility Multi-Purpose Wheeled Vehicles (HMMWV), one M915 line haul tractor, one M916 engineer equipment tractor, one M1070 Heavy Equipment Transporter (HET), and one heavy expanded mobility tactical truck. (See Figure 1.) Equipped with collision warning and/or headway control, each vehicle was driven in a military convoy by soldiers from the Michigan National Guard. Stops were made at the Combined Arms Support Command (CASCOM), the Transportation School, Ordnance Center, Aberdeen Proving Ground, the Pentagon, and National Guard units along the route. (See Figure 2.) Led by a police escort, the convoy also stopped at Capitol Hill so that congressional representatives, senators, and staffers could view the commercial technologies applied to Army vehicles.

Collision Warning

Collision warning systems employ a forward-looking Doppler radar that warns the driver when he is overtaking a slower vehicle. The warning is a visual and/or audio alarm that notifies the driver to take action. Collision warning systems consist of front and/or side (blind-spot) warning systems. The front warning systems track range and range rate to vehicles in their radar beam width. Typically, the systems have a range of 100 meters with a four-degree beam width. If a target vehicle is closing in on a vehicle enhanced with the collision warning system, the driver is alerted with visual and audio tones at four, three, and 1 1/2-second intervals. With the collision warning system, it is the driver's responsibility to avoid the collision with only the system providing an alert. The side warning radar sensors are mounted on the primary vehicle to detect target vehicles in its blind spot. This sensor has a range of two lanes of traffic. When a target vehicle is detected in the blind spot for more than one second, a visual warning mounted on the "A" pillar is illuminated. (See Figure 3.) If a driver engages the turn signal in the direction of the target vehicle, an audio alert is also sounded. Collision warning systems represent an emerging product in the commercial sector. These systems are now available for class eight over-the-road trucks as well as intercity and school buses. The technology will likely emerge on the automotive market within two to three years.

Headway Control

Headway control systems are an extension of the front collision warning systems, providing an intelligent cruise control function. The front collision warning sensor outputs are used as control inputs to the primary vehicle's cruise control function. For example, if the cruise control on the primary vehicle is set at 55 mph and it approaches a slower target vehicle, the cruise control electronics slows down the vehicle and provides warning lights to the driver. The driver's range control is used to adjust the headway between the primary and tar-

Figure 1.
Collision Warning Safety Convoy.

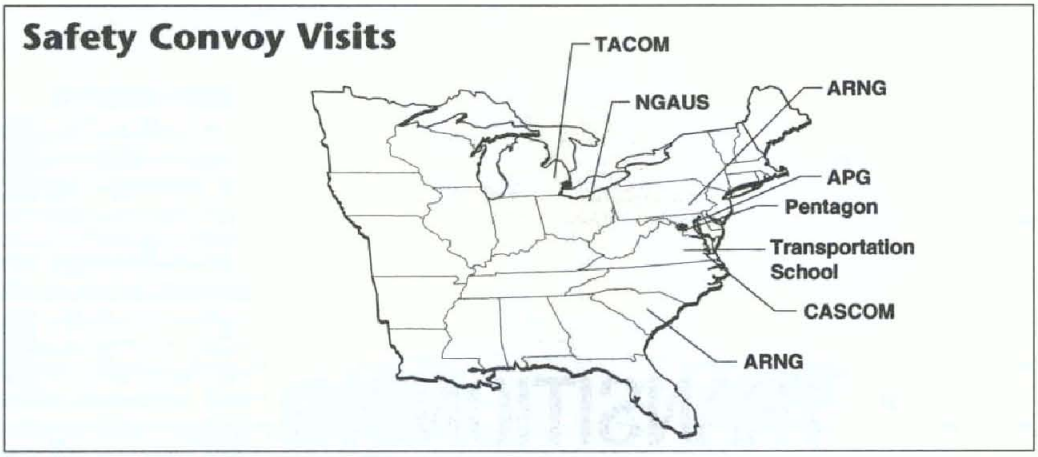

Figure 2.

get vehicles. When the slower vehicle is no longer in the radar beam, the primary vehicle resumes its 55 mph speed.

Improved Safety

Recent National Highway Traffic Safety Administration studies estimate that with an additional one-half second warning to the driver, 60 percent of rear-end collisions can be eliminated. With a one-second warning, 90 percent of rear-end collisions can be reduced or eliminated.

The application of these safety systems to Army convoys will help maintain spacing and minimize traffic accidents even in benign expressway scenarios. In cases of dust, fog, rain, or blackout conditions, these systems will provide even greater advantages over unaided vehicles. These advantages would save lives, reduce the human suffering of injuries, reduce loss of personnel time due to accidental injury, and improve readiness by raising the probability of accident-free mission completion.

Cost Benefits

Army tactical vehicle accidents cost the Army approximately $25 million a year in materiel damages and medical injuries. Over the past five years, 460 soldiers have been injured and 49 killed. Among the general public, the statistics are even worse.

According to the Army-wide accident data base, the three families of tactical vehicles that had accrued the highest accident costs per vehicle were the M915, HEMTT, and the M939. These are obvious candidates for initial installation of the CW systems. Relative to cost, the Army can incorporate blind side sensor systems in its M915, HEMTT, and M939 families of vehicles starting as early as 1996 and front sensor systems in 1999, with a very positive benefit-cost ratio (as high as 2.3). With CWS technology maturation proceeding rapidly, Army procurement action for military vehicle configuration, engineering change proposal and modification work order development could be conducted in parallel, so that these efforts will near completion simultaneously.

Summary

The U.S. Army Tank-automotive and Armaments Command's National Automotive Center specializes in exploiting commercial technology for military application. The NAC is working with U.S. automobile manufacturers to accelerate CWS technology and will host an industry joint working group to develop a common CWS specification. The NAC is also investigating leasing a CWS for military application. Applying an economical CWS to military vehicles will maximize soldier safety, reduce accidents, reduce O&S costs, and increase Army unit readiness.

Figure 3.
Collision Warning Visual Crew Display.

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TRANSITIONING PROJECT MANAGEMENT OPERATIONS INTO ELECTRONIC COMMERCE

Using CALS Concepts And Products to Reinvent the Business

By COL Jack M. Paul
and Nancy Moulton

Introduction

Continuous Acquisition and Life-Cycle Support (CALS) is a government and industry initiative to reduce acquisition lead time and improve readiness of weapon systems. These objectives are accomplished through the integration and standardization of digital technical information. The Office of the Secretary of Defense (OSD) established the CALS Office to manage the implementation of these policies through information standards, technology, information systems, and acquisition program oversight. Through the CALS initiative, a business environment has been created to use these standards and applications to automate the management and exchange of information.

Over the years, these concepts have matured into a set of standard OSD functional applications for the various acquisition and logistic support processes, and two major automated information systems, to provide the infrastructure needed for the acquisition, manipulation and storage of digital data. Included in this framework are a number of specialized automated applications to support the work processes of government and industry partners.

Background

The Project Manager, Combat Mobility Systems (PM-CMS) is a fully chartered element of the Program Executive Office, Armored Systems Modernization (PEO-ASM) collocated with the U.S. Army Tank-automotive and Armaments Command (TACOM) at the Detroit Arsenal in Warren, MI.

PM-CMS is responsible for developing and fielding three weapon systems:

- Breacher (Grizzly);
- Heavy Assault Bridge (Wolverine); and
- Improved Recovery Vehicle (Hercules).

CALS initiatives existed for the three programs but they were not fully integrated nor were policy and procedures in place to support the conversion to a paperless environment. Typically, new work from the contractor reflected a mixed bag of digital information that was not necessarily in alignment with DOD standards. Legacy data was primarily provided in hard copy. Although the contractors were operating in a digitized environment, there was no assurance the information conveyed to the PM would be in digital format (e.g., e-mail exists to the PM but Contract Data Requirements Lists and correspondence were conveyed in paper format).

PM-CMS proposed an initial pilot program to implement CALS concepts and products in an acquisition environment. The project, initially proposed in December 1994, was approved by the Deputy Under Secretary of Defense (Logistics) in April 1995. The PM's goals for the project focused on three key elements:

- Establishing the infrastructure necessary to receive, store and share data needed for acquisition management;
- Establishing a paperless configuration management program for all product data; and
- Reducing downstream operation and support costs for the Army.

Developing an IDE

A key feature of the CALS initiative is the Integrated Data Environment (IDE) which includes the Joint Computer-aided Acquisition and Logistic Support (JCALS) system as the information infrastructure, WorkFlow Manager and Global Data Manager. These elements are integrated with the Joint Engineering Data Management Information and Control System (JEDMICS) to store digital data and several government-owned applications, such as the Configuration Management Information System (CMIS) and Multiuser Engineering Change Proposal Automated Review System (MEARS). Together, with other commercial off-the-shelf (COTS) and government off-the-shelf (GOTS) applications, these capabilities provide the tools needed to work effectively in the digital data environment.

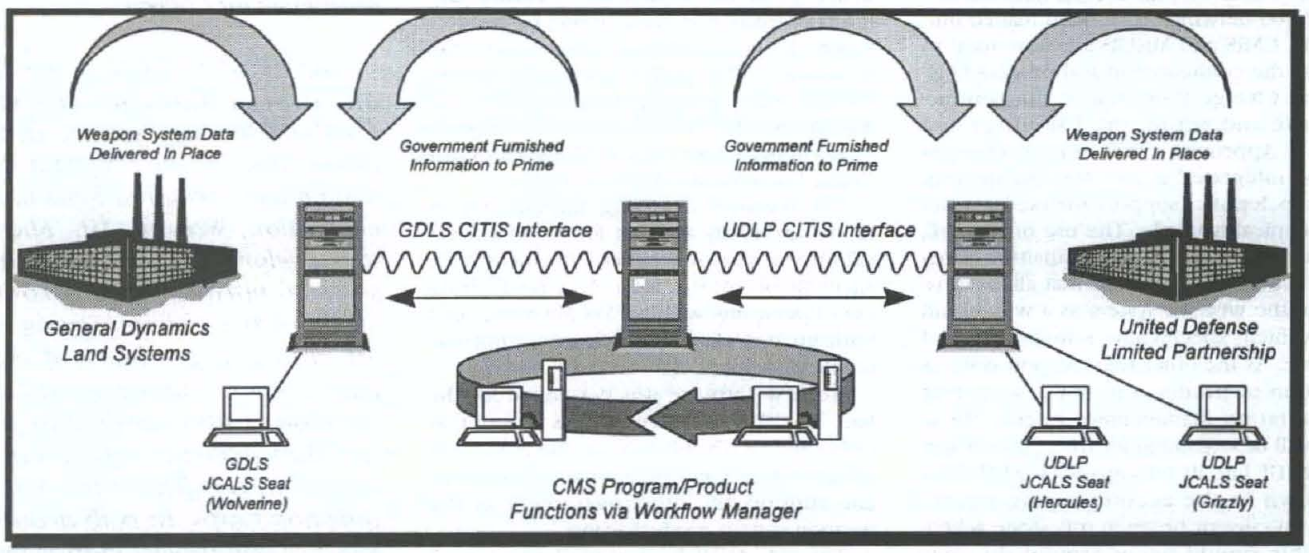
As an initial step in developing the prototype IDE proposal, PM-CMS documented the existing "state of CALS" and focused on some key requirements for successful implementation in the acquisition community. The existing CALS initiatives had been independently developed by the Army, Navy, and Joint Logistics Systems Center. The initiatives had never been fully integrated and plans for implementation in the acquisition community were incomplete. Planned fielding was very limited, focused on the technical manual and engineering drawing retrieval only, and required the use of dumb "X-terminals."

To support the PM-CMS concept, the JCALS infrastructure interfaces, communications and applications would have to be integrated into the desktops of the PCs already available to the PM staff. Since the staff relied on data generated from earlier equipment buys, the PM identified additional requirements driven by the fact that the legacy weapon system data were often not digitized or current. The CALS effort would have to bring all the data for the three weapons up to modern digital standards. Doing this would provide additional, immediate benefit to the legacy weapon system managers who could use the data in their ongoing logistics work.

The PM-CMS established four objectives for the implementation of the IDE. These were structured in a prioritized manner that recognizes the building block relationship among the objectives. The first objective was the implementation of the IDE for the three weapon systems. The second objective supported the "modernization" of the product data from the legacy weapon systems. The third objective is to use the data in the IDE, together with the diagnostics embedded in the new weapons, to implement the modern Interactive Electronic Technical Manuals capabilities. The fourth objective is to use the IDE to support the U.S. Marine Corps (USMC) requirements for the weapons.

The PM-CMS IDE concept is based on using COTS and GOTS tools and products already owned by the government for the purpose of performing digital CMS project

One of the key successes of the PM-CMS IDE project was the ability of PM-CMS to obtain OSD, Army and PEO level commitment and support necessary to initiate and sustain the IDE implementation effort.



Mature PM, CMS IDE.

management operations. The IDE automated workflow management tool maximizes efficiency and provides an operational baseline for follow-on business improvements. Data is created once and is made accessible to authorized users through the use of a global data management system as it is released into the IDE, regardless of location.

Implementing the IDE

Implementing the PM-CMS IDE required converting the existing technical environment to a JCALS infrastructure; creating the automated WorkFlows to support all elements of daily digital operations; obtaining all key data in prescribed digital formats; and revising polices and procedures to support operating in the IDE. Since the IDE would also require connectivity to remote Army and USMC sites, the Defense Information Systems Agency joined the planning effort and provided technical analysis and integration services.

The initial operational capability was achieved on Sept. 30, 1995, and provided both IDE infrastructure and connectivity between PM-CMS and its prime contractors. In addition, the first 35 WorkFlows to support PM staff actions during the engineering, manufacturing and development phase of acquisition were implemented. The next phase of implementation was completed in June 1996, and included the connection of the designated Army remote users, and connectivity to a JEDMICS repository for storage and retrieval of Army-managed technical data.

The PM assumed configuration management of the Hercules data in June 1996. Production WorkFlows have been initiated and over 2,000 drawings have been loaded into the IDE. CMIS and MEARS are now used to manage the configuration and process Engineering Change Proposals at the contractor's site and within the PM Office and TACOM. Approved configuration changes will be integrated across the engineering drawings, logistics support analysis data and the technical manuals. The use of the IDE, with data shared across acquisition functional activities, will ensure that all information on the weapon system as a whole, and each vehicle specifically, is up-to-date and accurate. As the other two weapon systems transition to production, and government configuration management begins, these areas will be expanded for them, thus bringing the IDE into its full capacity for PM-CMS, as shown in the accompanying figure. Based on current program milestone schedules, this should occur around the year 2000.

The PM-CMS IDE effort has had the positive effect of motivating the prime contractors to accelerate internal initiatives to improve operational efficiency.

Lessons Learned

One of the key successes of the PM-CMS IDE project was the ability of PM-CMS to obtain OSD, Army and PEO level commitment and support necessary to initiate and sustain the IDE implementation effort. As a result, CALS concepts were validated in the field, and it was quickly confirmed the CMS experience could be applied to enhance Army-wide IDE implementation.

PM-CMS communicated the vision of a "Paperless Project Management" through the early development of the Government Concept of Operations (GCO). The GCO articulated the "To-Be" vision for the organization, identified IDE requirements, provided high-level implementation planning guidance and established a milestone schedule for project completion. This document has become the "defacto" standard for other Army project offices to follow.

As the trailblazer for Army IDE implementation, PM-CMS has experienced extraordinary levels of frustration while trying to discover where in the government bureaucracy the solutions to daily problems could be found. PM-CMS was able to bypass most of the CALS naysayers who would study IDE requirements in perpetuity and found advocates that shared the solutions-oriented vision.

The business modeling and analysis intended primarily as input for WorkFlow development also served as a business management diagnostic tool. As a result, business operations within PM-CMS were seen with greater clarity and process improvements were made.

No new software was developed for the IDE. The PM-CMS IDE effort has proven that COTS and GOTS software can be effectively integrated into an operational environment and support the functional needs of the weapon system product teams.

The PM-CMS IDE effort has had the positive effect of motivating the prime contractors to accelerate internal initiatives to improve operational efficiency. While under no obligation to do so, each prime contractor has taken an active role in the establishment of IDE capabilities within their own corporations and improving those with the TACOM community.

Additional Benefits

As a result of the PM-CMS effort, the Army acquisition and logistics communities have been able to streamline follow-on IDE deveopment and implementation. Lessons learned at PM-CMS are being applied at the Army Missile Command in Huntsville. The Lead AMC Integration Support Office (LAISO) at Redstone Arsenal is currently extending the CMS IDE concept to more weapon systems. In addition, PM-Multiple Launch Rocket System has assisted PM-CMS in the development and documentation of the production phase WorkFlows that are needed to support Hercules.

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GETTING THE MOST OUT OF YOUR TRAINING WITH INDUSTRY TOUR

By MAJ Brian C. Winters

Introduction

The purpose of this article is to share observations and lessons learned from my Training With Industry (TWI) experience. To put my comments in perspective, let me tell you a little about my background. Where you have been and where you are headed has a lot to do with your expectations of the program. My basic branch is Transportation Corps and I am in the Army Acquisition Corps (AAC). My acquisition experience prior to this assignment is the Materiel Acquisition Management Course and 26 months in a program management office for an acquisition category 1C truck program. Generally speaking, I subscribe to the policy that you learn best by doing. Prior to joining the AAC, I was in an armored cavalry regiment and an armored division.

I was fortunate to go to a company that manufactures a product I know something about and has an established TWI program. Oshkosh Truck Corporation, known for the heavy expanded mobility tactical truck, the palletized load system, and the heavy expanded mobility tactical truck, has participated in the TWI program for longer than 10 years. The program mentor, a corporate senior executive, is a retired Army officer. The company also believes it is "your" program. The company has established a basic format for the program that focuses on learning the business in a hands-on environment. You may deviate, however, and establish your own agenda and training plan. The program is not based solely on what the company wants to show you or what the last guy did.

Keys to a Successful TWI Experience

One's success in the TWI program obviously depends on a number of factors. However, I believe that the following basic criteria can substantially improve an individual's chances of having a successful and enjoyable TWI tour.

• ***Put yourself in the driver's seat.*** Don't be a passenger. Find out as much as you can about the company before you arrive. Make a tentative outline of what areas in the company you want to observe/work. Find out who the incumbent TWI officer is. At a minimum, contact the officer by telephone or e-mail. Ideally, if you plan to take a temporary duty trip for house hunting purposes, do so before he or she leaves. This will give you a chance to get a first hand report and help with the introductions.

• ***Decide up front whether you want to be a generalist or a specialist.*** Do you want to get just a general overview of all aspects of the operation, or do you want to concentrate in one area? You may want to combine the two approaches. I wanted to concentrate on one area so I spent a little over 60 percent of my time there. I spent the remaining 40 percent in seven different areas. My experience was that anything less than four weeks in an area gives you a "one over the world" perspective.

• ***Have an orientation period.*** You may think this is a blinding flash of the obvious, but think of this as more than a walk around to each area in the company to meet people and find out where they are located. Use this opportunity to find out what activities they have scheduled and the time frames of those activities. Build your training schedule around the planned activities that interest you.

• ***Make sure the trainer in each program area knows exactly what your expectations and interests are in his or her area.*** Yes, you will make a training plan and yes, you will have a "welcome to the company" office call with the program mentor. I recommend that you provide more specific guidance, pertinent to the specific area, in writing at least two weeks before you arrive in each area. Don't assume they know what you want. Just like in the military, information doesn't always get where it needs to go, people forget over time, and sometimes people are just overwhelmed with what they have going on and need to have their efforts refocused.

• ***TWI is a two-way street.*** The old sayings, "The more you give, the more you receive," and "You get out of it what you put into it," are even more true here. It is just human nature. Don't always focus on just what you can learn. Keep your eyes open to what you can contribute. You are a different, independent set of eyes to the company. Your Army experience will give you a unique insight into some of the challenges facing the company. You will see things about the way the company operates that, in your opinion, could use some improvement.

The Palletized Load System.

While it may seem obvious to you, they either can't see it because of their internal bias, someone thinks they see it yet need confirmation from another source, or management is aware but may have another approach in mind.

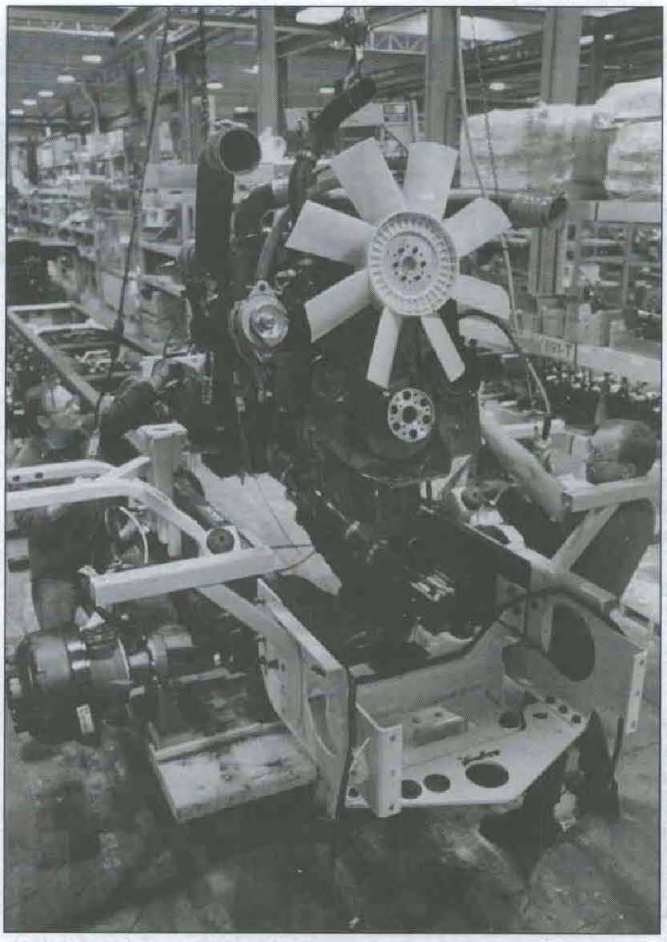
• ***Find out how to stay informed.*** One of the biggest challenges is staying informed of all the staff meetings, design reviews, program reviews, and activities that could help you accomplish your training objectives. I have found that attending these meetings is an effective way to get up to speed on what is going on in the company and to learn how they operate. Find out who in the department is responsible for sending out meeting notices (calls, e-mail, memos) and get yourself put on the distribution lists. Don't assume that because you are in the area people will remember to include you. Remember the pace as a company commander; you don't always have time to think about such things when you are juggling all those glass balls.

• ***If things aren't going the way you envisioned, let the program mentor know.*** Give him or her a chance to fix it. Don't be afraid to change your training plan. I had to make some changes and I know others in the TWI program have had to as well. Planning a year out, things are bound to change.

• ***If you are wondering how things are going and you are not sure, get in touch with some of your contemporaries at other industry locations. (You may have some unrealistic expectations.)*** A bright, forward-thinking officer in my TWI cycle established a "TWI Network." Those who were interested shared mailing addresses, phone numbers, and e-mail addresses. It was a great forum to share information and also provided a place for a "reality check."

• ***Try to be as much of a "company man" as the firm and the law will allow.*** If you expect to have any contact with people outside the company, get a business card. This probably sounds either vain or ridiculous, but I have two reasons for it. First, you won't feel like an outsider or a second-class citizen when everybody else is passing around cards like it's a poker game. Most importantly, it will help you immerse yourself in the culture. This also includes respecting the company's confidentiality. When you demonstrate confidentiality they will include you in nearly everything that goes on and this will substantially enhance your learning experience.

• ***Relax and have fun.*** The men and women in industry are not Goliaths. Your military education and experience will put you in good stead. With few exceptions, you are as smart and work as hard as they do. Their experiences provide for a different perspective and they are more than willing to respect you and include you as part of the team.



Installation of an engine at Osh Kosh's assembly plant, known as the South Plant.

Share Your Experience

You owe it to those who follow you to let them know what worked and what didn't. I would encourage you to leave something like this in your continuity book for the next officer if you don't get a chance to meet with him or her before you leave. I would also suggest that, using your best military tact, you should pass on your feedback to the program mentor and, where appropriate, to the trainer in each program area. Maybe they think they met your expectations and objectives. Maybe they don't really know or understand what is expected of them. Maybe they need to re-evaluate their participation in the program. And by the way, don't forget to tell them the good stuff, too. If you honestly feel like you just wasted a year of your life, let the U.S. Total Army Personnel Command know. Given the current competitive nature of our business, we can ill afford a year of unproductive time.

Conclusion

The TWI program can be a great learning experience if you jump in with both feet, set realistic objectives, and stay alert for midcourse corrections. It is just like every mentor you ever had told you, "No one manages your career like you do." Following these few principles will help to ensure a win-win situation for the officer and the industry. When the tour comes to an end you will wonder where the year went and you will have a lot of valuable experiences to look back on.

MAJ BRIAN C. WINTERS has a bachelor of business administration from Midwestern State University and a master of science in transportation engineering from the University of Washington. When this article was written he was participating in the Training With Industry program, assigned to Oshkosh Truck Corporation in Oshkosh, Wisconsin.

EFFECTIVE ACQUISITION OF SOFTWARE THROUGH AWARD-FEE CONTRACTS

By MAJ Scott C. Dolloff

Introduction

In his concluding remarks to the 1995 Software Technology Conference, LTG Otto J. Guenther, Director of Information Systems for Command, Control, Communications and Computers, made the following comments concerning the important role that software will play in fulfilling the Army's Force XXI vision.

> *We have tremendous work ahead of us. The Army's Force XXI—the vision for the next century—requires a paradigm shift, a change in the way we do business. Information technology—and specifically software-intensive systems—will drive us. Quality software is absolutely critical to our war fighters in the Army and each of the other Services.*

One of the greatest challenges in making Force XXI a reality will be overcoming the historical problems and risks associated with the development of large software intensive systems. Among these problems and risks are: a lack of defined requirements; a lack of an overall system perspective; systems which cannot adapt to change; a lack of adequate system integration testing methods; and finally and perhaps most important—a lack of adequate software management methods and practices.

While recent advances in software engineering technology will help solve some of these problems, most would agree that the key to fielding quality software intensive systems is effective management. One way to immediately improve the software acquisition process at the project level is to select a contract type which supports the specific goals of the program, one which enhances rather than impedes effective project management. Some programs have found that the use of a cost-plus-award-fee contract (CPAF) fulfills this requirement.

This article examines the use of the CPAF contract type in software acquisition. It provides a description and the official guidance concerning the contract type, describes how the contract is administered, and also summarizes the results of research involving five CPAF contracts used for software acquisition.

Description and Guidance

Use of the CPAF contract type was pioneered by NASA during the 1960s when it purchased complex hardware and services in support of the space program. According to the NASA *Award Fee Contracting Guide,* it remains the preferred pricing arrangement for most of that agency's major programs.

According to the *Federal Acquisition Regulation (FAR)* part 16.404-2, the CPAF contract is a cost-reimbursement type contract which provides for the payment of a two-part fee. The first part, called the base fee, is fixed at the inception of the contract and does not vary. The second part, called the award fee, is a pool of funds available for award to the contractor based on the government's subjective evaluation of the contractor's performance. The amount of the award fee paid to the contractor is determined unilaterally by the government based on factors such as quality, timeliness, technical performance, or cost control, and is not subject to the disputes clause.

The *Defense Federal Acquisition Regulation Supplement (DFARS)* part 216.404-2 outlines the situation in which a CPAF contract may be appropriate:

- The work to be performed is such that it is neither feasible nor effective to devise predetermined objective incentive targets applicable to cost, technical, performance, or schedule;
- The likelihood of meeting acquisition objectives will be enhanced by using a contract that effectively motivates the contractor toward exceptional performance and provides the government with the flexibility to evaluate both actual performance and the conditions under which it was achieved;
- Any additional administrative effort and cost required to monitor and evaluate performance are justified by the expected benefits; and
- The cost-plus-award-fee (CPAF) contract is also suitable for level of effort contracts where mission feasibility is established but measurement of achievement must be by subjective evaluation rather than objective measurement.

As a cost type contract, the CPAF contract is subject to the limitations found at FAR 16.301-3 which refer to the adequacy of the contractor's cost accounting system,

Numerical Ratings	Adjective Rating
71-100%	Exceptional
41-70%	Good
1-40%	Marginal
0%	Unacceptable

Figure 1.
Adjective and Numerical Ratings.

CRITERIA	Contract 1	Contract 2	Contract 3	Contract 4	Contract 5
MANAGEMENT	X	X			
TECHNICAL	X	X	X		
COST	X	X		X	
SCHEDULE	X	X			
REPORTING			X		X
RESOURCE MGT			X		X
QUALITY				X	
TIMELINES				X	
TQM					X
RESPONSE TO PROBLEMS					X
PERFORMANCE ON SELECTED TASKS					X

Figure 2.
Evaluation Criteria.

the government's ability to provide surveillance, and that use of the contract must be documented by the contracting officer with a determination and findings. Additionally, the total fee, base plus award is subject to the following limitations (FAR 15.903(d)):

- Fifteen percent of the estimated cost for experimental, developmental, or research;
- Six percent for architect-engineer services; and 10 percent for all other types of work.

Additionally, the DFARS limits the base fee to 3 percent of the negotiated estimated cost.

Administrative Procedures

The CPAF contract is administered in accordance with an award fee plan. This plan establishes the evaluation criteria, the evaluation periods, the distribution or weighting of award fee between the various criteria and award fee periods, defines the numerical and adjective ratings, and lays out the administrative organization of evaluators, Performance Evaluation Board, and fee determination official.

The evaluation criteria are fair and reasonable measures of key areas of contractor performance. They are subjective in nature and may include areas such as technical, quality, management effectiveness, and cost control. The criteria may be further sub-divided, but care must be exercised not to diffuse the focus of the award fee evaluation and its motivational effectiveness over too many factors.

Award fee evaluation periods may be established by regular intervals—every four to six months, or by key milestones in contract performance. The total amount of award fee available for a particular evaluation period may be evenly distributed over all evaluation periods, or in proportion to the criticality of events which occur during a particular period.

The total award fee available during an evaluation period is also distributed among the evaluation criteria by weights assigned to reflect the relative importance of the criteria during that period. The government may change the relative weights of the criteria in subsequent evaluation periods to emphasize different areas of performance as the effort progresses.

A common approach to rating the contractor's performance is a system which involves both adjective and numerical ratings, such as those shown in Figure 1. The award fee plan defines the adjective ratings with examples of performance which would warrant that rating. The numerical ratings are the portion of the available award fee for the particular criteria which will be paid to the contractor.

Determining the amount of award fee which the contractor has earned during a

END OF EVALUATION PERIOD	% OF FEE POOL AVAILABLE
Five Months after Contract Award	5%
Completion of Software Specification Review (SSR)	15%
Six Months after Final SSR	20%
Build 1 Released to Contractor Independent Test Organization	20%
45 Days after System Software Test (SST)	35%
30 Days after Completion of Independent Operational Test/Evaluation (IOTE)	5%
Total	100%

Figure 3.
Contract 1 and 2 Evaluation Milestones.

particular evaluation period is a three-step process. In step one of the process, award fee evaluators, knowledgeable business or technical personnel who routinely monitor the contractor's performance, submit periodic performance reports to the Performance Evaluation Board (PEB). During this first step, the contractor may also submit its own performance reports to the PEB.

In step two of the process, the PEB, a panel of more senior-level technical and business managers, reviews the input from both the evaluators and the contractor and develops a recommendation for the amount of the award fee for that period. During this step, the contractor may be allowed to submit a self-evaluation or to review and comment on the PEB's draft evaluation report. The PEB is, however, under no obligation to change its evaluation based on contractor input.

Finally in step three, the fee determination official (FDO), a senior manager, perhaps the program manager or the contracting officer in smaller programs, uses the PEB's report to decide how much award fee will be paid to the contractor. As stated previously, the FDO's decision is not subject to the disputes clause.

While this process may seem burdensom, it is this evaluation process which fosters the more open communication, and deeper government management involvement and insight which is required when dealing with the complexities of software development.

Summary of Research

As part of thesis research in software acquisition, the author of the article examined the award fee plans of five CPAF contracts. Additionally, interviews were conducted with officials who dealt directly with the administration of these contracts.

Of the five contracts (see Figure 2), only contracts 1 and 2 are exclusively for new software development. Contract 3 is an engineering services contract supporting a single system, but also includes services other than software. Contract 4 provides task order type support for a variety of systems at a DOD software support activity (SSA), and contract 5 provides similar support at another government agency. Keeping in mind that these contracts differed in ultimate purpose, Figure 2 shows the range of evaluation criteria used.

Contracts 1 and 2 illustrate how evaluation criteria can be effectively sub-divided to emphasize the program manager's specific priorities. These contracts divide the technical area into nine categories, some of which are: use of common hardware and software; implementation of the Ada programming language; software reusability; and software quality and testing.

Each of the five contracts incorporated a rating system with both numerical and adjective ratings. The contracts differed in the number of different ratings, and also in the minimum score required to earn award fee. In the case of contract 4, the contractor begins earning a fee for a score of 65 percent while, in the case of contract 1, the fee is earned beginning at a rating of 1 percent.

With the exception of contracts 1 and 2, each contract employed a six-month evaluation period. Contracts 1 and 2 employed a milestone based evaluation scheme as shown in Figure 3.

In terms of the fees, contracts 1 and 2 employed a 3 percent base fee with a 12 percent award fee. These contracts also include a "roll over" provision which allows the contractor a second chance to earn the remaining fee based on his performance in correcting errors in the delivered software product. The other three contracts have base and award fees at 2 and 8 percent, respectively.

Each of the contracts employed some form of the PEB. The FDOs in these contracts are senior managers, one is a contracting officer and, in the case of contracts 1 and 2, is the program manager. Each contract allows contractor input to the PEB either by a self-evaluation or by appearance before the board.

Interviews with the managers responsible for these contracts generally show that the CPAF contract is effective in motivating excellence in performance. These managers see that the advantages of the CPAF contract type are the government's flexibility in shifting emphasis among the evaluation criteria, the improved responsiveness of the contractor, and that the evaluation system increases (demands) better government-contractor communication. A disadvantage however, is the additional administrative time devoted to developing meaningful evaluation criteria and conducting the evaluations.

Conclusion

This research shows that the CPAF contract type can be an effective tool for use in software acquisition. While the contract places additional administrative requirements on the government, it is this additional administration which so effectively brings the vitally needed increase in the government's knowledge, involvement, and insight into the software development process. It is clear that the advantages of increased flexibility, enhanced government management, and effective contractor motivation, outweigh the disadvantages.

MAJ SCOTT C. DOLLOFF is a Functional Area 97 infantry officer with a B.S. degree in political science. He was attending the Army's Systems Acquisition Management curriculum at the Naval Postgraduate School in Monterey, CA, when he wrote this article.

During The Next Decade, What Areas of Technology Should Be Emphasized to Provide Maximum Benefit To Our Individual Soldiers?

Dr. A. Fenner Milton
Deputy Assistant Secretary for Research and Technology and Chief Scientist
Office of the Assistant Secretary Of the Army (Research, Development and Acquisition)
The Pentagon

The outcome of the Gulf War is a dramatic example of how intelligent application of superior technology by highly trained and well led soldiers can provide an overwhelming combat advantage. American casualties, expected to number in the thousands, were limited to a few hundred. We were fortunate in that the technology developed for the European theater was appropriate for the Gulf and we had time to deploy. This experience has, however, raised the expectation of our soldiers and the citizens they serve.

Our challenge now is to provide the technology needed for decisive victory with minimum casualties across the spectrum of operations that the Army may confront in the future. The political acceptability of the use of military force may well depend upon our success.

Examination of lessons learned from the Gulf War and, more recently, Bosnia, reveal much about our strengths and weaknesses. The lessons guide our modernization planning and help us prioritize technology investments for the benefit of our soldiers.

Over the next few years we will emphasize technology programs to reduce our vulnerability to land mines and to provide an affordable solution to combat ID. We will extend digitization to all echelons, including the individual soldier and improve our command and control capability. The Army's Science and Technology Program is developing the technology for Rapid Battlefield Visualization for enhancing the warfighting capability of our early entry air deployed forces. Improved sensor-to-shooter timelines for counterbattery fire are also being provided.

Over the longer term, dramatic improvements in capability for all levels of conflict are expected through the introduction of modern electronics technology to the dismounted soldier. For the individual, we will develop individual communication and navigation devices, individual mobility night vision sensors and head-mounted displays, and more capable individual weapons based on airbursting munitions. Our 21st Century Land Warrior will be protected with advanced body armor, chemical/biological resistant clothing, and individual combat identification devices. He or she will be connected to the digital battlefield with miniature radios, GPS receivers, cameras, sensors, and displays. He or she will be armed with multi-purpose weapons with integrated laser range finders, thermal sights, and optics. Intra-squad situational awareness and the capability for automated target hand-off to non-line-of sight weapons will be provided.

Thus, maximum benefit to the individual soldier will be achieved by systematic investment in a variety of promising technologies and integration of these technologies into a modular, expandable soldier system. Casualties will be reduced by improving our defensive systems, enhancing combat support systems, and by giving our soldiers the capability to engage the enemy before they see "the whites of their eyes."

BG(P) Roy E. Beauchamp
Deputy Chief of Staff For Research, Development And Engineering
Headquarters, Army Materiel Command

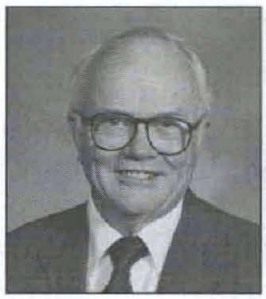
We are in an era of exploding technology ... in almost every discipline and field of investigation. This phenomena will not abate and will most likely continue to accelerate in the next decade. Our challenge is to harness this technology to give us a more effective Army and an affordable Army. The individual soldier is the heart of our Army. We must make technology work for soldiers.

One of the first and most important requirements to maximize the benefit to ... and effectiveness of the individual soldier, is to keep him or her alive on the battlefield. A battlefield that will expose the individual soldier to more accurate and effective munitions, possible chemical or biological agents, and continuous operation in a wide variety of climates and operating conditions.

One of the most important programs for the individual soldier is the Land Warrior Program. This program combines a suite of technologies that will provide the individual soldier, in selected units, an integrated computer/radio, enhancements to protective clothing and individual equipment, integrated headgear with a helmet mounted display and image intensifier, a modular weapon system with a thermal weapon sight, infrared aiming light, laser rangefinder, digital compass, video camera, and close combat optics. This suite of integrated technologies will make the American soldier the world's most survivable, lethal and effective soldier on the modern battlefield. In addition, these sophisticated technologies will provide unsurpassed situational awareness and will enable more effective integration of small unit operations at the fire team, squad, platoon, and company level.

These technologies are already available. The next decade will see their full integration into a single system that will keep the American soldier the most effective and most survivable soldier in the world. That's making technology work for the soldiers ... and our Army.

SPEAKING OUT



Dr. John W. Lyons
Director
Army Research Laboratory
Adelphi, MD

Clearly, the revolution in computers, communications systems, and sensor technology will have a significant impact on our soldiers. These technologies will affect all aspects of military operations. We can see this in Force XXI and the 21st Century Land Warrior Program. The Force XXI experimentation results to date confirm that these technologies will increase the lethality, survivability, and operational tempo of our soldiers. Simultaneously, advancements in new and novel materials will provide lighter, stronger composites and other materials for increased soldier protection and survivability. Combining efforts in materials and ballistics will give us better control of the weapons and weapon systems, ranging from rifles to main guns for heavy platforms. Advances in biotechnology could reduce the logistics burden through Bio-Production. The combination of fast, stand-off detection of chemical/biological agents, telemedicine, personal health monitors, and instantaneous knowledge of soldiers' positions on the battlefield could dramatically reduce the number and severity of casualties. Finally, we must continue to study the psychology of individual soldiers and decision makers on the battlefield. Improving our understanding of vision, hearing and the cognitive processes involved in absorbing battlefield information, converting it into intelligence, and rendering better decisions faster will enhance our ability to win more decisively.

For these technical advances to have any impact on the soldier, the Army must continue to recruit high quality individuals, maintain high levels of training, provide superior leadership, and continue to research, develop, and field world-class equipment based on these technological advances.

COL Richard Ross
Commander
U.S. Army Soldier Systems Command
Natick, MA

Perhaps the most challenging "technology" of all is the integration of the multitude of technologies under investigation into technologies appropriate for the soldier. The ability to effectively integrate complicated and diverse technologies into effective, integrated and modular soldier systems is an important challenge that the Army has only recently undertaken. Some examples of these technologies include: microelectronics that enable secure, high-speed processing, multimode/multiband communications to support the full range of individual soldier command and control needs that link soldiers to the digitized battlefield; novel power supplies and power management techniques such as new primary battery chemistries, improved rechargeable battery chemistries, and fuel cells that increase power efficiencies, reduce power consumption needs and reduce weight of electronics; improved display technologies for integration into high performance, low weight/center of gravity, head-mounted vision systems that have improved resolution and provide a more "natural" field of view; near-real time imagery transmission in terms of improved algorithms or faster data rates; improved survivability materials such as lighter helmet shells to partially offset weight of helmet mounted electronics, improved body armor to improve survivability against emerging threats, and materials suitable for use in Military Operations in Urban Terrain (MOUT) areas. These technological advances and their integration into soldier systems will further soldier effectiveness and morale, and will, in turn, serve as a true force multiplier, helping to redefine ground combat not only during the coming decade, but well into the 21st century.

ATTENTION AAC CIVILIANS AND CORPS ELIGIBLES

The Army RD&A Editorial Office is currently in the process of updating distribution of the magazine to *civilian members of the Army Acquisition Corps* and to those individuals who have been identified as *"Corps Eligible."* Our distribution list is based on data drawn from the Army Civilian Personnel System (ACPERS). As such, if you are an AAC civilian or a Corps Eligible and want to continue or start receiving *Army RD&A* magazine, you should immediately contact your civilian personnel office to ensure that your home address is accurate in the ACPERS database.

CAREER DEVELOPMENT UPDATE

IMPORTANT ANNOUNCEMENT

SUBJECT: Topics for the Army Acquisition Corps (AAC) Personnel Functional Assessment (PFA), Nov. 13, 1996

On Nov. 13, 1996, the Director, Acquisition Career Management will meet with the Deputy Chief of Staff for Personnel to assess the health of the Army Acquisition Corps (AAC). We will assess both our civilian and military membership. In preparation for the assessment, we solicit topics for discussion at the PFA. Topics may be any issue or concern that affects current or future AAC members. Topics will be fully considered at working level meetings prior to the actual PFA.

Please send your topics with the name and phone number of a knowledgeable point of contact to COL Thomas V. Rosner, Director, Army Acquisition Corps Policy, ATTN: SARD-ZAC, 103 Army Pentagon, Washington, DC 20310-0103. E-mail to rosnert@sarda.army.mil is encouraged. We would like your topics as soon as possible.

ATTENTION AAC CIVILIANS AND CORPS ELIGIBLES

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From The AAC Career Manager...

Frequently Asked Questions

The Q&A section is designed to answer questions from the members of the Army Acquisition Corps (AAC) and workforce regarding acquisition career management initiatives. Questions should be e-mailed to walkerk@sarda.army.mil Answers will be published in the following edition of the Army RD&A magazine.

Q. ***Can a GS-12 or a major be certified at Level III?***

A. Yes, if he/she is Level II certified. Individuals are encouraged to continue their professional development by achieving certification above their current level. However, priority for quotas for courses will be given only to individuals requiring the course for Level III certification. If you are Level II certified, Level III courses should be included on your Individual Development Plan (for civilians). Officers should work through their assignments officer to request course quotas.

Q. ***Is there an Army policy outlining the certification requirements?***

A. The policy is founded in the Defense Acquisition Workforce Improvement Act (DAWIA) and its implementing certification guidance, DoD 5000.52-M, Acquisition Career Development Program, to ensure the acquisition workforce meets the established experience, education and training requirements for specific position categories and levels. These requirements are determined by OSD Functional Boards for each acquisition career field.

Q. ***Can non-certified employees be considered for critical acquisition positions?***

A. Yes. However, these individuals must be able to achieve the required level of certification within 18 months after assignment to a critical acquisition position.

Q. ***When is the next application period for Senior Service College?***

A. Application periods for Army-wide Senior Service Colleges and Fellowships are normally announced in July and August by the Office of the Assistant Secretary of the Army (Manpower and Reserve Affairs), Civilian Personnel Management Directorate. Application deadlines usually fall in October. If you are interested in applying for one of these Army-wide Senior Service Colleges (SSC), contact your training office for the deadline for application receipt.

The Army Acquisition Corps (AAC) announces application process and procedures for the SSC Fellowship Program at the Center for Professional Development and Training, University of Texas, during the November timeframe in the Civilian Training Opportunities catalog. Civilian AAC members interested in applying for the program should contact their training office for a copy of the application and deadlines for application receipt. Applications are required to arrive at the Army Acquisition Education and Training Office no later than 120 days prior to course start date. The selection board is held in April and the course start date is August.

Army officers are board-selected to attend SSC. Boards are normally held in March and selections are published in the August-September timeframe.

Q. ***How long can I stay in my position?***

A. DAWIA requires a rotation review be conducted, no later than five years after a person is assigned to a critical acquisition position, to determine whether the government and the person would be better served by reassignment to a different critical acquisition position. While rotation is not required upon completion of five years in a critical acquisition position, it is encouraged on a case-by-case basis. Rotational assignments include promotions, as well as lateral, long-term developmental assignments, long-term training, cross-command and cross-functional assignments, which may or may not require geographic relocation.

Q. ***What constitutes a change in position?***

A. A change in position occurs when an individual is assigned a new position code (Civilian Position Control Number/Military Acquisition Position List) and job description. When this occurs for individuals occupying critical acquisition positions, the clock for the five-year rotational review begins with the effective date of assignment to the position.

Q. ***How long does the AAC Tuition Assistance Program last?***

A. The AAC Tuition Assistance Program for the acquisition workforce is currently scheduled to end in FY01. It is unknown at this time if Congress and OSD will extend this program beyond FY01. All acquisition workforce members are encouraged to take advantage of this program. If you are interested in becoming a participant of the Tuition Assistance Program, contact your local training coordinator for a copy of the *Army Acquisition Education and Training Catalog,* which includes application procedures, forms and suspense dates.

Q. ***Will the AAC Tuition Assistance Program pay for a degree?***

A. Yes. Members of the AAC and the acquisition workforce, and Corps Eligibles may compete for funding for undergraduate degrees. AAC members and Corps Eligibles may also compete for funding of master's degrees. Funding is limited to tuition costs only. Individuals are encouraged to participate in this program to meet degree and semester hour requirements for AAC membership or to further their education to become more competitive for positions of increased responsibility.

DAU FY97 Course Prerequisites and Predecessor Courses

To assist individuals applying for Army Acquisition mandatory training, a list of courses and thier prerequisites and a list of predecessor courses are provided. To apply for a course, contact your local CPO or Training Coordinator for class dates and procedures. Individuals having INTERNET access can obtain the FY97 schedule through the Army Acquisition Corps home page at http://www.sarda.army.mil/rdaisa/atrrs/aaedau.htm.

Course Number	Prerequisite(s)
ACQ 201	ACQ 101
BCE 101	ACQ 101
BCE 204	BCE 101
BCE 206	BCE 101
BCE 207	BCE 101
BCE 208	BCE 101
BCF 301	ACQ 201 or (BFM 102, BCE 101 & BFM 201)
BFM 102	ACQ 101
BFM 201	ACQ 101
BFM 203	ACQ 201 or (BFM 102 & BCF 202)
BFM 204	ACQ 201
BFM 209	ACQ 201
BFM 210	BFM 209
CON 104	CON 101 or CON 102 or CON 103
CON 105	CON 101 or CON 102
CON 106	CON 101 or CON 103
CON 201	CON 101, 102, or 103 & (CON 104, 105, or 106)
CON 211	CON 104 or CON 105 or CON 106
CON 221*	CON 104 or CON 105 or CON 106
CON 222*	CON 104 or CON 105
CON 223	CON 104 or CON 106
CON 231	CON 104 or CON 105 or CON 106
CON 232	CON 104 or CON 105 or CON 106
CON 233	CON 231
CON 234	CON 101 or CON 102 or CON 103 or PUR 101
CON 241	CON 104 or CON 105 or CON 106
CON 301	One Course (CON 201, 211, 221, 222, 223 or 231)
IND 103	IND 101
IND 201	IND 103
IND 202	IND 201
IRM 101	ACQ 101
IRM 201	IRM 101 & ACQ 201
IRM 303	IRM 201
LOG 101	ACQ 101
LOG 201	LOG 101 & ACQ 201
LOG 203	ACQ 201 & LOG 201
LOG 204	ACQ 201
LOG 205	ACQ 201 & LOG 201
LOG 304	ACQ 201, LOG 201 & LOG 203 and (LOG 204 or LOG 205)
PMT 302	ACQ 201
PMT 303	PMT 302
PMT 305	PMT 302
PMT 341	One Course (CON 201, 211, 221, 222, 223 or 231)
PQM 101	ACQ 101
PQM 201	PQM 101 & ACQ 201
PQM 301	PQM 201
PUR 201	PUR 101 or PUR 102
SAM 101	ACQ 101
SAM 201	SAM 101 & ACQ 201
SAM 301	SAM 201
SYS 201	ACQ 201
SYS 301	SYS 201
TST 101	ACQ 101
TST 202	TST 101 & ACQ 201
TST 301	TST 202

* Prerequisites for Industrial/Contract Property Management Lvl 2 are CON 101 or CON 102 or CON 103

FY97 Course Number	Predecessor Course(s)
ACQ 101	PMT 101 or PMT 301 or DSMC-26
ACQ 201	PMT 201 or PMT 301 or DSMC-37
BFM 102	BCF 202 or DSMC-6
BFM 201	BCF 201 or DSMC-9
CON 101	8D-4320
CON 103	CTC-142
CON 104	QMT-170 or PN
CON 106	PN
CON 201	PPM 302 or CTC 302
CON 211	8D-F12
CON 221	PPM 304
CON 223	CTC-542
CON 231	QMT-340
CON 232	PPM 355
CON 241	ALMC-ZX
CON 301	ER
IND 101	PPM 151
IND 103	PPM 251
IND 201	PPM 300
IND 202	PPM 077
LOG 201	SYS 225, ALMC-IT or DSMC-24
LOG 203	LOG 301, 8A-F30 or QMT-020
LOG 204	SYS 028 or AMEC-12
LOG 205	ALMC-AH or LOG 260
PMT 302	PMT 301 or DSMC-3
PMT 341	PMT 301
PQM 101	S89, PRD 101 or QUA 101
PQM 201	DSMC-13, PPM 305, PRD 201, QUA 201 or S81
PQM 301	DSMC-38 or PRD 301
PUR 101	ALMC-B3
SYS 201	DSMC-28 or 4A-F7
TST 202	DSMC-11 or TST 201

25 July 1996

Source: DAU FY97 Catalog

CAREER DEVELOPMENT UPDATE

On the Horizon...

AAC Tuition Assistance Program

The Army Acquisition Corps (AAC) Tuition Assistance Program (ATAP) is currently a high priority. Concept and funding have been approved, and implementation details are being worked out at this time. Contact the Acquisition Education and Training Office at commercial (703)805-4041 or DSN 655-4041 for additional details.

Military Acquisition Position List

The FY 97 MAPL has been approved and released to all MACOMs. A printed copy of the approved MAPL was published in the July-August 1996 issue of *Army RD&A* magazine. For additional information on the MAPL, contact LTC Bill Gavora via e-mail at gavoraw@sarda.army.mil. Also, we are rapidly approaching the MOC Window (July 1-Sept. 30) for TDA changes. MACOMs should concurrently be thinking about their FY98 MAPL submissions. No board date is set, but it is expected in February 1997.

AAC Playbook

A new playbook is currently being distributed. It was revised and edited by the Military Acquisition Management Branch (MAMB) at the U.S. Total Army Personnel Command and the AAC Proponency Office. This provides additional guidelines for career development for AAC officers. Copies may be requested by contacting MAJ Nick Guerra at PERSCOM's MAMB at commercial (703)325-2800 or DSN 221-2800.

28 Graduate From MAM

On May 10, 1996, 28 students graduated from the Materiel Acquisition Management (MAM) course held at the U.S. Army Logistics Management College, Fort Lee, VA. Research and development, testing, contracting, requirements generation, logistics and production management are examples of the materiel acquisition work assignments being offered to these graduates.

Keith Charles, Deputy Assistant Secretary for Plans, Programs, and Policy, Office of the Assistant Secretary of the Army (Research, Development and Acquisition), gave the graduation address and presented diplomas. The Distinguished Graduate Award was presented to Nora Devries, of the Tank-automotive and Armaments Command's Picatinny Arsenal, NJ.

The eight-week MAM Course provides a broad knowledge of the materiel acquisition function. It covers national policies and objectives that shape the acquisition process and the implementation of these policies and objectives by the U.S. Army. Areas of coverage include acquisition concepts and policies; research, development, test, and evaluation; financial and cost management; integrated logistics support; force modernization; production management; and contract management. Emphasis is placed on developing mid-level managers so they can effectively participate in the management of the acquisition process.

PERSCOM Notes...

Year Group 1989 Acquisition Candidate Accession Board

The Year Group (YG) 1989 U.S. Total Army Personnel Command (PERSCOM) Acquisition Candidate Accession Board (PACAB) was held June 3-7, 1996, at the Software Development Center—Washington's Decision Technology Center, Fairfax, VA.

This board consisted of six senior members of the Army Acquisition Corps (AAC) from various backgrounds, including current product managers, a former acquisition commander, a commander of a defense contracting management office, and a member of the AAC Proponency Office.

The PACAB reviewed more than 325 records from various YGs with the primary focus on YG 89. One hundred and nine officers were accessed from YG 89 into the AAC, 10 officers from YG 88, one officer from YG 87, and one officer from YG 90. For the second year, all files reviewed by the PACAB were from volunteers.

The 1996 PACAB goal was to access 80 percent of the overall requirement of YG 89 officers. By accessing only 80 percent, the Army retains flexibility to later access high quality, field grade officers with increased operational experience.

All officers selected were notified by the Military Acquisition Management Branch of their accession and functional area assignment. The following is a list of officers selected for accession into the AAC.

NAME	PGRAD	FSA	BABR	FA
ABRAMSON ALFRED FORBES III	CPT	1989	CM	51
ADOMATIS DENNIS PAUL	CPT	1989	AD	51
AMERSON ANTHONY EUGENE	CPT	1989	IN	97
ARCHAMBAULT BRUCE ALBERT JR	CPT	1989	FA	51
ARDREY EDWARD PAUL	CPT	1989	MI	97
ARMSTRONG SCOTT CHARLES	CPT	1989	AD	51
ARNER JUSTINE ARLETTA	CPT	1989	SC	51
ARRINGTON VANCE RUSSELL	CPT	1989	FA	53
ASCURA MICHAEL AGULTO	CPT	1989	FA	51
BARBER CREIGHTON ROTH	CPT	1989	EN	53
BARNES JAMES ROBERT	CPT	1989	AV	51
BERG DAVID CHRISTOPHER	CPT	1989	MI	53
BHE JEFFREY ALLEN	CPT	1989	SC	53
BLACK MICHELLE ANDREAMARIE	CPT	1989	AG	53
BOSTON ANTONIO	CPT	1989	MP	53
BRICE WILLIS DEAN	CPT	1988	TC	97
BRIGHAM DAVID RALPH	CPT	1989	SC	97
BROWN CHRISTOPHER LLOYD	CPT	1989	QM	51
BRUCE JEFFREY ALLEN	CPT	1990	SC	53
BUHL HAROLD ALLEN JR	CPT	1989	AR	51
BURKE MICHAEL	CPT	1989	TC	51
BURNETT PATRICK ANTHONY	CPT	1989	EN	51
BUSH BRENT DALE	CPT	1989	OD	97
CANTER BRYAN ERIC	CPT	1989	SC	51
CARR JAY THOMAS	CPT	1989	FA	97
CARRNS JOHN BERNARD JR	CPT	1989	AR	51
CARTER CHARLES ALLEN	CPT	1988	MI	51
COLE DANIEL MARTIN	CPT	1989	IN	51
COLE JOHN AVERY	CPT	1989	FA	51
COOPER JEFFREY RONALD	CPT	1989	MI	97
CORRIGAN SEAN JOSEPH	CPT	1988	SF	97
CROSS ROBERT GLENN	CPT	1989	TC	97
CULLEN JEFFREY LEONARD	CPT	1988	SC	53
CURETON DARRYL GENE	CPT	1989	SC	51

CURTIS TODD VERNON	CPT	1989	AR	53
DEAKINS THOMAS ANDREW	CPT	1989	AR	97
DODGE RONALD CLEVELAND JR	CPT	1988	AV	53
DUNLAP ERNEST LEE JR	CPT	1989	MI	53
DUPONT JOSEPH PETER	CPT	1989	SC	51
DWYER GERALD LAWRENCE JR	CPT	1988	AV	51
ECKHART JAY LAKE	CPT	1989	EN	51
EMERSON CHARLES JACKSON JR	CPT	1989	FA	51
EPPS WAYNE EVERETTE	CPT	1989	AD	97
GARLAND WILLIAM ANTHONY	CPT	1988	IN	51
GEDULDIG TERESA MARIE	CPT	1989	QM	51
GLENN ERIC SEAN	CPT	1989	IN	51
HALE TIMOTHY MORGAN	CPT	1989	SC	51
HARRISON JOHN MICHAEL	CPT	1989	IN	51
HARVEY KEITH DOWNING	CPT	1989	SC	51
HAUG GREGORY MELVIN	CPT	1988	AV	97
HILL RONALD EDWARD	CPT	1989	OD	53
HOLLAND GEORGE ARTHUR JR	CPT	1989	QM	97
HOLSTEIN CHARLEY DELBERT JR	CPT	1989	AG	53
HOWARD TERRENCE LAVALE	CPT	1989	AD	53
IRWIN DANIEL BIGBEE	CPT	1989	EN	51
JAYNES HOWARD RICHARD JR	CPT	1989	AV	51
JERNIGAN LAFONDA FAYE	CPT	1989	TC	97
JOLLEY EDWARD ROBSON	CPT	1989	SF	51
JONES JAMES EDWARD	CPT	1989	TC	51
JONES MICHEL GERALD	CPT	1989	AR	51
KACZMARSKI DAVID MATTHEW	CPT	1989	QM	97
KASEBERG DERON ROBERT	CPT	1989	IN	51
KEMMERER DAVID ALAN	CPT	1989	OD	97
KISER DOUGLAS JEROME	CPT	1989	SF	97
LAMB TODD FRANKLIN	CPT	1989	OD	51
LEATH DONALD WAYNE	CPT	1989	AR	97
LEE JONATHAN D	CPT	1989	SC	97
LEONARD KEVIN LLOYD	CPT	1989	IN	53
LEWIS DARIN EDWARD	CPT	1989	CM	51
LONG JONATHAN DOUGLAS	CPT	1989	SC	97
LOZIS PETER PAUL III	CPT	1989	EN	51
LUKER MARK DOUGLAS	CPT	1989	FA	51
MANZO JENNIFER JENSEN	CPT	1989	AV	97
MENZIES WILLIAM JAMES	CPT	1989	MI	51
NASSAR MICHELLE	CPT	1989	SC	53
NYDAM DAVID ALAN JR	CPT	1988	OD	53
OBRIEN THOMAS JOHN	CPT	1989	OD	53
ODONNELL MARK GERALD	CPT	1989	SF	97
ORANGE TERRY MARK	CPT	1989	AV	97
OSBORNE SHAWN PATRICK	CPT	1989	EN	53
OYLER DOUGLAS LAYNE	CPT	1989	CM	51
PETERS JEFFREY LELAND	CPT	1989	AD	97
PETERSON KEVIN WILLIAM	CPT	1989	FA	53
PICKERING RAYMOND D	CPT	1989	MI	51
PIERCE STEVEN MICHAEL	CPT	1989	AD	53
PILGRIM ALLEN MORRIS	CPT	1989	AV	51
RAUER SCOTT JOSPEH	CPT	1989	AV	51
REAM RUSSELL GLEN	CPT	1989	MI	51
REEDY DONALD MARK	CPT	1989	AV	53
RICHARDS CLYDE EZEKIEL JR	CPT	1989	QM	51
RIMRON PATRICK LAWRENCE	CPT	1989	AR	51
ROBBINS JASON WILLIAM	CPT	1989	FA	51
ROBINSON WILLIE EARL	CPT	1989	AD	53
ROMERO ALEX VINCENT	CPT	1989	IN	53
ROMERO JAMES SAMUEL	CPT	1989	IN	51
SEACORD CHRISTOPHER ROBERT	CPT	1988	EN	53
SHAFFER GERALD HENRY	CPT	1989	CM	53
SIMONSON ERIK JOHN	CPT	1989	AG	97
SIMPKISS KENNETH C III	CPT	1989	QM	51
SMITH MARK ADAM	CPT	1989	AR	51
SOSINSKI MARGARET ANNE	CPT	1989	SC	53
SPARAGES ERNEST ARTHUR	CPT	1989	MI	53
SPENCER MARC ANTHONY	CPT	1989	TC	51
STALLINGS RICHARD ROBERT	CPT	1989	AR	51
STALLWORTH CHARLETTE	CPT	1989	SC	51
STAROSTANKO TIMOTHY ALLEN	CPT	1989	MI	97
SWEETSER NATHAN VOSE	CPT	1989	FA	53
THOMAS BRENT ALLEN	CPT	1989	OD	51
THURSTON MICHAEL JAY	CPT	1989	SC	53
TISDALE RILEY OLIN	CPT	1989	MI	53
TULL PHILIP FORTUNE	CPT	1989	IN	51
VANNEDERVEEN KRISTINA E	CPT	1987	SC	53
WAILD THOMAS LEE JR	CPT	1989	OD	51
WALLACE MELISSA JANE	CPT	1989	MI	53
WEGLER MICHAEL KARL	CPT	1989	AD	97
WILEY DEAN EDWARD	CPT	1989	FA	51
WILLHELM STEPHEN TAYLOR	CPT	1989	MP	53
WILSON ISAIAH III	CPT	1989	AV	97
WITTGES CHARLES EDWARD	CPT	1989	AV	51
ZRIMM MICHAEL PAUL JR	CPT	1989	OD	51
ZYBURA MARTIN ADAM	CPT	1989	FA	53

FY98 Product Manager, Acquisition Command Board

A Department of the Army selection board will convene Dec. 10, 1996, to consider eligible lieutenant colonels and promotable majors for projected Product Manager and Acquisition Command (PM/AC) FY98 vacancies.

Officers who meet the following criteria will automatically be considered by the PM/AC Board:

- Be in the grade of major (promotable) or lieutenant colonel and not have completed 21 years (252 months) active federal commissioned service as of Oct. 1, 1997.
- Be a member of the Army Acquisition Corps.
- Not have a projected separation or retirement date.
- Not previously declined PM/AC command after being selected.
- Not be a centrally selected product manager, acquisition commander, or designee.

In August, the U.S. Total Army Personnel Command (PERSCOM) sent out pre-board packets to the home addresses of officers being considered by the PM/AC board. This packet included a board ORB, Microfiche, and a checklist. Eligible officers should carefully review their files using the checklist provided, and resolve problems early. Officers who meet the consideration criteria above and have not received a pre-board packet should contact their assignment officer immediately.

Officers may decline Product Manager and/or Acquisition Command consideration without prejudice prior to the convening of the PM/AC Board by submitting a letter of declination to: U.S. Army PERSCOM, ATTN: TAPC-OPB-E (Mr. Yager), 200 Stovall Street, Alexandria, VA, 22330-0411. Declination of consideration for the FY98 PM/AC Board does not eliminate an officer from future PM/AC Boards for which the officer is eligible.

FY 96 Major Promotion Board Results

The fiscal year 1996 Major Promotion Board results were released June 20, 1996. For the first time, the Army Acquisition Corps (AAC) fell below the Army average for promotion to major. The purpose of this article is to explain why the AAC selection rate for promotions was low, and to analyze the results of the Major's Board.

The AAC was formed in 1990 with a requirement for 250 officers. DCSPER did a review in 1994 and reduced this requirement to 215. The result left an excess to requirements in certain year groups (1979-85). The DSCPER staff takes the requirements into account when they publish the board guidance, which includes career field and skill selection requirements, goals and floors. This promotion board had an AAC minimum selection goal of 105 majors. The goal was achieved and surpassed, with a total of 112 officers selected from all three zones of consideration. The good news is that our quality drove selections above the required minimum. The bad news is that our current year group overstrengths no longer support higher than average promotion rates.

Overall Acquisition Corps Results

Board members reviewed the files of 146 AAC officers in the primary zone. From this population, 104 were selected by the board. The resulting primary zone selection rate of 71.2 percent was below the Army competitive category primary zone of 73.3 percent. In addition, seven officers below the zone and one above the zone were selected for promotion for a total of 112 officers. AAC officers continue to be competitive with basic branch officers; however, AAC requirements for majors have been reduced. Acquisition Corps results by functional area are as follows:

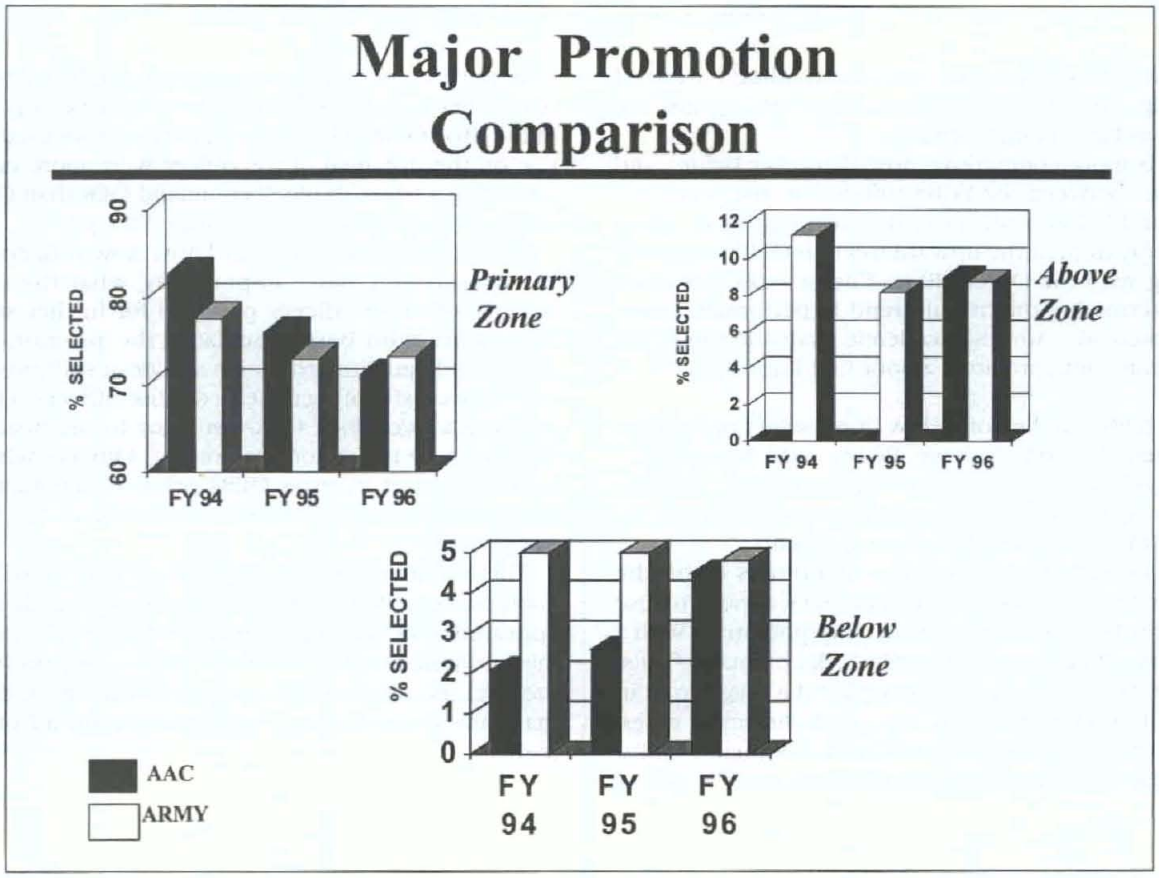
Functional Area	Primary Zone Considered	Primary Zone Selected	Primary Zone Percent
51	85	63	74.1
53	35	21	60.0
97	27	21	77.7

What was the trend for those selected?

After the assignment officers re-reviewed the files of all AAC officers considered for promotion to major, the following trend or "formula" emerged:

MAJ = Above Center of Mass (ACOM) Command + COM (+) File (Overall)

Selection to major is a reflection of how an officer performed in his or her basic branch assignments. Most AAC officers have few, if any, officer evaluation reports (OERs) from acquisition assignments in their file when they are considered by the Major's Board. Many officers are still completing basic branch assignments, reserve officer training corps/re-



FY 96 Major Promotion Board Analysis

Selected		Non- Selected
94%	CAS3 Graduate	98%
25% Masters	Civilian Education	24% Masters

Non-Selects ⟶	42 Total
COM Command / ACOM File	10
COM Command / COM File	30
ACOM Command/COM File	2

cruiting or AC/RC assignments, or are attending advanced civil schooling. Thus, the AAC officers are judged against the same criteria as basic branch officers.

The Army is more competitive now than ever before, and the differences between the YG85 (officers in last year's primary zone) and YG86 (officers in this year's primary zone) were readily apparent in the upward trend in OER ratings. All OERs, starting with the Officer Basic Course (OBC), became critical in determining the overall trend in performance and evaluation potential. Adverse Academic Evaluation Reports, particularly from OBC, provided a poor first impression of an officer's file.

We had a high number of below zone selections which nearly matched the Army average. Below zone files (YG87) had a clear track record of excellence commencing with the basic course. Again, these officers were chosen for their excellent performance in basic branch assignments.

The most important discriminator continues to be the company command OERs. Board members appear to use command reports as the mark of leadership potential. With a majority of the officers receiving one block command OERs, the words written by the senior rater played a bigger role in determining if an OER was truly top block. In many cases, the officer's only top block reports were command OERs. OERs that quantified an officer's performance in the senior rater portion sent a clearer picture to the board on the "true" block check. (i.e., best officer in a command, top 1 percent, 1 out of 10). OERs where the senior raters focused their narrative on the potential of the officer were more critical in determining a true top block command OER than OERs that focused on how the officer performed the job.

Board members wanted to know how officers performed as captains and, more importantly, what the senior rater thought of those officers' potential for further success. Senior raters who best articulated the promotion, military school and battalion executive officer or staff position potential of successful officers helped those officers. Officers who received a two block OER just prior to the board were not likely to be selected for promotion. Officers who had a majority of center of mass OERs prior to command and who only peaked on the last two OERs prior to the board were not selected.

This was an extremely tough board and we will lose some good officers. Performance in the basic branch assignments appeared to be the board's focus. Officers who had center of mass command OERs were not selected for promotion. The message is clear—seek company command, do well and maintain a high level of performance on all other assignments.

From The Acquisition Reform Office...

Empowering the Workforce

Following are actions the Army has taken to remove/lower approval thresholds, or to otherwise "power down" authority to the lowest level possible. These initiatives are contained in the Army Federal Acquisition Regulation Supplement (AFARS) effective June 1, 1996. The AFARS is cited following each entry.

- The Principal Assistant Responsible for Contracting (PARC) can approve individual deviations to the Federal Acquisition Regulation, Defense Federal Acquisition Regulation Supplement, and AFARS. Also, the method of assigning control numbers to deviations is no longer mandated by the AFARS. (AFARS 1.403)
- Business clearance procedures are no longer mandated but may now be established by the Head of Contracting Activity (HCA). (AFARS 1.602-1)
- Legal reviews are no longer dictated by dollar thresholds. HCA establishes procedures. (AFARS 1.602)
- Dollar thresholds for authority to approve ratifications have been raised. (AFARS 1.602-3)
- Justification and Approval format only mandatory at $50 million and above. (AFARS 6.303-2-90)
- HCAs can now appoint Special Competition Advocates and their alternates. (AFARS 6-501)
- PARCs can approve use of the "Four-Step" source selection procedures. (AFARS 15.613-70)
- Contracting officers can approve Determination and Findings for time-and-materials contracts. (AFARS 16.601)
- PARCS can approve the use of options that extend contracts beyond the five-year regulatory limit. (AFARS 17.204)
- The Agency Senior Procurement Executive can now waive cost accounting standards. (AFARS 30.201-5)
- PARCs can approve performance-based payments. (AFARS 32.1006)
- The Deputy Assistant Secretary of the Army (Procurement) granted authority to HCAs to exempt an alternate source contractor from essential performance warranty requirements until first 10 percent anticipated total production quantity is manufactured for all items and the program executive officer (PEO) grants exemption for PEO-managed items. (AFARS 46.770.5)
- PARCs can now approve modifications to the Subcontracting Plan Evaluation Guides. (AFARS CC-104)

Army Hosts SPI Conference

On June 13, 1996, Deputy Assistant Secretary of the Army (Procurement) Dr. Kenneth Oscar hosted an Army Single Process Initiative (SPI) Conference in Springfield, VA. In attendance were senior acquisition professionals, who were nominated by their program executive officers (PEOs) or MACOM commanders, to be their single focal points for the SPI. In this capacity, many of these individuals will represent the Army on management councils as Army component team leaders.

In remarks to the conference attendees, both Dr. Oscar and BG Harry D. Gatanas, the Army Director for Contracting, emphasized the pivotal role that points of contact play in the process. They are the primary Army spokespersons for SPI at the local management council level and they have the best opportunity for early interface with industry. In this capacity, they set the tone for the entire SPI process that follows.

The conference also featured an informal panel discussion moderated by Marilyn Harris Harpe, the HQDA point of contact for the Single Process Initiative. Panelists included CDR Bob Petroka, U.S. Navy; Ryan Bradley, U.S. Air Force; MAJ John Econom, Defense Contract Management Command; Curtis Hagan, Defense Contract Audit Agency, and Veronica Harvey, Office of the DOD Inspector General. The panelists discussed a variety of successes and issues related to Office of Secretary of Defense's (OSD) 120-day Block Change Process Cycle. The vigorous participation of the audience provided an excellent forum for the panelists and participants to share lessons learned. The diversity of the panel also afforded the opportunity for the audience to see how the other Services have integrated SPI and to see how other agency participation has enhanced the process.

Billy Bentley, Office of the Program Executive Officer-Tactical Missiles, shared lessons learned from his experiences with management councils in implementing SPI at Raytheon. In the afternoon, conferees assembled in working groups to address specific SPI issues and reported the results and recommendations to the conference attendees.

For information concerning the Army and the SPI, contact Marilyn Harris Harpe on commercial (703)681-7561, or DSN 761-7561, or via e-mail at harrism@sarda.army.mil.

Simplifying The Uniform Contract Format

The Army and Air Force jointly propose to revise the Uniform Contract Format (the standardized format to structure government solicitations and contracts) to make it more "user friendly." The revised format, which consists of six sections, focuses on usefulness to customers at all levels, is more flexible, less piece-meal, and more logically organized. It clearly focuses on improvements that will effectively communicate contractual information and significantly reduce confusion and the need for extensive cross referencing. The joint Service effort was initiated as a result of concerns expressed by industry for a shorter and simpler solicitation, an end to recycling clauses and sections, and reducing duplicative information. More information will follow as this initiative proceeds.

Acquisition Reform Acceleration Stand-Down Day a Success

The Under Secretary of Defense (Acquisition and Technology) declared May 31, 1996, as a day dedicated DOD-wide to increasing awareness of our best acquisition reform initiatives and ideas. It was designed as a day to frankly discuss which of these initiatives were working well in our organizations and which ones needed some help. The goal was to accelerate reform and institutionalize the continuous process improvement that they represent. All around the world, Army acquisition personnel took a respite from daily operations to concentrate on how to make Army acquisition reform "be all that it can be."

Initial feedback indicates that a highly successful day of brainstorming and critical analysis occurred—thinking "outside the box" about ways to use acquisition reform to maintain the technological superiority of our military forces. Assistant Secretary of the Army (Research, Development and Acquisition) Gilbert F. Decker has asked that all Army acquisition organizations provide feedback concerning their Stand-Down Day activities and he expects that important new proposals (as well as significant refinements to existing ones) will be the result. Formal feedback to DOD was provided on July 1, 1996. Stay tuned for further updates!

Land Warrior Prototype.

Land Warrior Agreement Signed

Equipping soldiers for the digital battlefield of the 21st century is a challenge faced by the U.S. Army Soldier Systems Command, Natick, MA. When necessary, programs are re-evaluated to meet the developing and changing needs of the Army. Earlier this year, two important programs—Land Warrior and the Generation II Soldier—were combined, and new development strategy was signed at Fort Benning, GA.

Attending this ceremony were representatives from the Soldier Systems Command, the Army Infantry School, Office of the Assistant Secretary of the Army for Research, Development and Acquisition, the Training and Doctrine Command, as well as members of the contract teams including Hughes and Motorola. Working together, these organizations will develop and field Land Warrior—the first integrated soldier system—by fourth quarter FY 2000.

Designed to enhance the warfighting capabilities of the individual soldier, Land Warrior relies on five subsystems: computer radio, protective clothing/individual equipment, software, integrated helmet assembly and weapon system.

The Land Warrior engineering, manufacturing and development contract, with a base value of $52 million, was originally awarded to Hughes in July 1995. Using several subcontractors, Hughes will be leading the Land Warrior contracting team.

Components being developed by Motorola represent potential technology insertions to the Land Warrior system. These components will be integrated into prototypes for field testing. If the technological need is validated, these items will transition to engineering, manufacturing and development. Ultimately, new technologies will be inserted into production.

By combining these two programs, both the Soldier Systems Command and the Army Infantry School will develop and field an advanced integrated fighting system in the near future. Land Warrior will ensure that soldiers are ready to meet the battlefield challenges of the 21st century.

Video Teleconferencing Aids Physicians

A portable video teleconferencing center (VTC) that enables physicians to treat patients thousands of miles away is being used by U.S. peacekeeping forces in Bosnia. The center is based on a commercially available system and components that were reconfigured by technologists at the Army Research Laboratory's (ARL) Adelphi Laboratory Center in Maryland to withstand rough handling and use in forward area medical facilities. It was developed for the Medical Advanced Technology Management Office (MATMO) at Fort Detrick, MD.

Among the users of the portable VTC in Bosnia were First Lady Hillary Clinton and her daughter, Chelsea, who both took part in a telemedicine demonstration during a morale-building visit earlier this year.

Medical personnel working in a field hospital in Europe or elsewhere often find patients with infections or medical conditions they aren't familiar with or have limited experience in treating. The VTC permits field hospital personnel to confer with specialists at major medical centers and hospitals in the United States or elsewhere.

"Its range is worldwide since it uses satellite communications," according to Francis "Pete" Fisher, an electronics engineer in ARL's Information Sciences and Technology Directorate.

The mentoring capability afforded by the VTC not only means faster treatment for patients, but can result in considerable cost savings since the patient doesn't have to be transported to a major medical center to be diagnosed and treated. Fisher said it can cost thousands of dollars to transport a soldier from Europe to Walter Reed Army Hospital, for example, to be evaluated. In addition, there are evacuation risks and the immeasurable cost of lost experience due to field replacements.

"The commercial system was intended for office use and would not function well if subjected to military deployment conditions," said Fisher.

Reconfiguring the system to make it rugged enough for forward area use involved redesigning the mechanical layout and selecting containers for the equipment that provide sufficient protection against shocks and vibrations, Fisher explained. It was also reconfigured so additional medical equipment could be added.

The system consists of a steerable camera, a computer that runs the system, a microphone and a monitor to which ARL added a satellite modem, a hand-held camera and a document camera.

Engineers and technicians at ARL have put together 15 VTC units for MATMO so far, Fisher said. Two units are in Bosnia and one more is likely to go there.

CCM Selected for ARL Materials Center of Excellence Program

The University of Delaware Center for Composite Materials (UD-CCM) has been selected as one of three partners in the development of an Army Research Laboratory (ARL) Materials Center of Excellence. Established via a cooperative research agreement, the new Composite Materials Research (CMR) Collaborative Program at CCM will support ARL's mission to promote and advance research and development of composite materials and assist transition of composites technology for Army applications. The other two programs will focus on advanced materials characterization at The Johns Hopkins University, and dendrimer polymers at Michigan Molecular Institute.

Dr. Gary Hagnauer, ARL Materials Directorate senior research scientist, is directing the overall Materials Center of Excellence effort as the Cooperative Agreement Manager. Each of the three contributing programs is directed by an ARL program manager and a recipient program manager, who represents the organization working with ARL through the cooperative agreement. For the program at Delaware, MAJ Rick Brynsvold, Chief, ARL Materials Directorate Composites Development Branch, is the ARL Program Manager; CCM Technical Director John W. Gillespie Jr. is the Recipient Program Manager.

According to Gillespie, the agreement is a "new paradigm for university/government collaboration that combines the best attributes of both to create an open-lab environment for University and Army researchers."

The multidisciplinary CMR program, which comprises collaborative research, scientific exchange, and facilities sharing, will initially involve 11 ARL co-investigators (primarily from the Composites Development Branch), 11 UD-CCM co-investigators, five ARL graduate fellows, five ARL postdoctoral fellows, and 14 summer interns, including nine undergraduate researchers. Students and postdocs will be co-advised by University and Army personnel.

"The program management structure of the collaborative program has been designed with a high level of responsiveness, accountability, and flexibility to maximize research productivity and benefits to the Army," Gillespie says. "A joint management structure has been created so that the two organizations are working together at every stage—identifying the research needs and milestones to meet them, conducting the research, and advising the students."

"This program is very different from a typical government grant to an academic institution," says Hagnauer, "in that we expect substantial interaction between ARL and the University. Our overall goal is to create a seamless, synergistic, cooperative environment where the two organizations share resources—including people, equipment, and knowledge—without compromising the University's academic integrity and educational goals. Our goal will be to promote coordination and integration of UD and ARL programs and thereby maximize research productivity and benefits to the Army."

The initial focus will be on multifunctional hybrid composites for integral armor. "We're aiming at optimizing hybrid materials and processes for the special requirements of armor—ballistic protection, damage tolerance, minimum weight, signature management, and flexibility—while maintaining structural integrity," said Gillespie. The research program is currently organized into four theme areas (processing science, microstructure and bonding, mechanics and durability, and composite materials assessment), but the program content will be reassessed annually by the Army jointly with CCM and revised to meet future requirements.

The facilities exchange component of the program is aimed at minimizing facilities duplication and promoting synergy, coordination, and integration of research projects. ARL scientists in residence have full access to CCM facilities and equipment, and CCM researchers have begun using ARL testing equipment at the Army's Chestnut Run facility in nearby Wilmington, DE, including mechanical and impact testing equipment, Raman spectroscopy, and environmental chambers. Finally, the Army has located some of its own equipment—including a SMARTweave setup, a Resin Transfer Molding press, and equipment for X-ray photoelectron spectroscopy (XPS)—at CCM to support collaborative research.

Educational opportunities will include annual workshops and symposia, seminars, research focus groups, and joint external seminars at the University of Delaware and Chestnut Run. ARL employees will have the opportunity to participate in the University's continuing education programs, including Engineering Outreach and the FOCUS distance learning program. Three ARL employees are currently taking courses at the University, and more are expected to participate over the next year once the program is further underway.

The program will also access and involve innovative research efforts of Historically Black Colleges and Universities (HBCUs). CCM is building on an existing link with several HBCUs through the Tuskegee University Research Consortium. These institutions—which include Prairie View A&M and North Carolina A&T, in addition to Tuskegee—are currently involved with UD and ARL researchers in the area of intelligent RTM for integral armor. For the summer of 1996, six jointly-advised student interns are in residence at CCM working on the program.

"CCM's status as a U.S. Army Center of Excellence and a pioneer in university-industry partnerships has enabled the establishment of a premier technology transfer network to transition research accomplishments both to Army labs and their supporting industry base," says Gillespie. "These relationships have evolved to the point where research and technology transfer are done in 'real time' with the full participation of several Army scientists and engineers in residence at CCM."

"Basic research programs like the CMR are critical to the health of our nation's science and technology base," Brynsvold says. "The program focus on integral armor is timely, and the research will help to meet a very real need faced by the Army. CCM has demonstrated the capability to transition science base efforts into key technologies for ARL and other Army labs."

The preceding article was written by Diane S. Kukich, an editor at the Center for Composite Materials at the University of Delaware.

DTIC Announces 1996 Users Meeting

The Defense Technical Information Center (DTIC) will hold its annual Users Meeting and Training Conference Nov. 4-7, 1996, in Arlington, VA. The theme is "Meeting the Challenges of Changing Technology." For additional information contact Julia Foscue at (703) 767-8236 or e-mail at jfoscue@dtic.mil.

Bosnia Telemedicine Support Upgraded

The U.S. Army Medical Research and Materiel Command's Medical Advanced Technology Management Office is upgrading telemedicine support to Operation Joint Endeavor, the NATO peacekeeping mission in Bosnia. The joint service effort projects medical center expertise to the front lines, providing first class medical care to the 20,000 U.S. soldiers, sailors, airmen and Marines in Bosnia.

The upgrade will introduce advanced specialty care to forward operating bases in Bosnia. When the project is complete, 10 to 18 Army hospitals and clinics throughout Hungary and Bosnia will be linked by satellite to hospitals throughout the United States and Europe.

The enhanced capabilities include teleradiology, teledentistry, medical command and control systems, and hardware and software that allow clinical consultation and clinical e-mail. The new equipment is smaller, faster, and costs about one third as much as the older hardware.

According to Army Captain Scott Ehnes, project manager for Phase II of Operation Primetime III, "The cost savings are attributable to our use of commercial off-the-shelf technology, and reflect the general trend in faster, cheaper computer hardware and software available today."

The first phase of Operation Primetime III began in February 1996, with the establishment of communication links between field hospitals in Bosnia and Hungary and the Landstuhl Regional Army Medical Center in Germany. A multifunctional team of clinical and technical specialists from Fort Detrick and other sites traveled to Germany, Hungary and Bosnia to install equipment and train the on-site personnel to operate and maintain it. The technicians and clinicians will again deploy to upgrade the sites and install the additional equipment.

Operation Primetime began in 1993 with telemedicine support to U.S. medical units in Macedonia and Croatia. The operation was upgraded to Primetime II in late 1995 with a 30-fold increase in communications bandwidth and the use of asynchronous transfer mode technology to provide increased diagnostic capabilities. Primetime III is an extension of the previous operations.

The upgraded capabilities will allow specialists to see and talk to physicians, and their patients, in the forward areas. A recent case illustrates the value of telemedicine. An Army aviator was grounded due to a cyst in his ear canal. The physician on-site had not treated such a case before, so she dialed the medical center in Landstuhl on her video-teleconference unit. With an otoscope, a device that allowed her to see inside the ear, attached to the unit, she projected an image of the cyst to an ear, nose and throat surgeon in Landstuhl. The surgeon talked her through removing the cyst. The aviator was returned to duty, avoiding an evacuation. The surgeon stated enthusiastically, "Another cure for modern medicine!"

The options for medical treatment in Bosnia are limited. The tactical scenario does not permit easy transport of ill or wounded soldiers. Anytime a soldier has to be moved it is expensive and dangerous.

"There are 1.5 million land mines in an area the size of the District of Columbia," according to LTC John Hagmann, clinical director for Primetime III. With medical experts predicting 400 to 500 clinic visits a day, the need to bring medical care to the troops becomes obvious.

PERSONNEL

Caldwell Directs Army Digitization Office

BG John S. Caldwell Jr., former Assistant Deputy for Systems Management, Office of the Assistant Secretary of the Army (Research, Development and Acquisition), has assumed new duties as Director of the Army Digitization Office, succeeding MG Joe W. Rigby, who has retired.

Backed by more than 29 years of active commissioned service, Caldwell has also served as Military Assistant, Major Weapons Systems Acquisition, Office of the Under Secretary of Defense (Acquisition Reform); Project Manager, Abrams Tank System, Warren, MI; and Strategy and Policy Planner, Directorate of Strategic Plans and Policy, the Joint Staff, Washington, DC. He has commanded tank and armored cavalry units through battalion level.

Caldwell holds a B.S. from the U.S. Military Academy, and an M.S. in mechanical engineering from Georgia Institute of Technology. His military education includes the Armor Officer Basic and Advanced Courses, the U.S. Army Command and General Staff College, the Industrial College of the Armed Forces, and the Program Management Course at the Defense Systems Management College.

Caldwell is the recipient of numerous badges and decorations including the Silver Star, the Defense Superior Service Medal, the Legion of Merit with oak leaf cluster (OLC), the Bronze Star Medal, the Meritorious Service Medal with OLC, the Air Medal, the Army Commendation Medal with OLC, the Army Achievement Medal, the Ranger Tab, the Joint Chiefs of Staff Identification Badge, and the Army Staff Identification Badge.

O'Connor Named CERL Director

Dr. Michael J. O'Connor has been appointed Director of the U.S. Army Construction Engineering Research Laboratories (CERL), Champaign, IL, succeeding CERL's first director, Dr. L.R. Shaffer, who died in May 1994. O'Connor, who had served as technical director since Shaffer's death, joined CERL in 1974, following five years employment with the Air Force. Prior to his assignment as CERL Technical Director, O'Connor was Chief of CERL's former Infrastructure Laboratory.

The Office of Personnel Management certified O'Connor as a member of the Senior Executive Service on July 21. As the top CERL civilian, he will direct a staff of 587, consisting of 361 federal and 226 University of Illinois faculty, students, or other contract employees.

O'Connor received his Ph.D. in mechanical engineering from the University of Illinois at Urbana-Champaign (UIUC) in 1986 and bachelor's and master's degrees in industrial engineering from UIUC in 1969. He has also authored more than 30 technical papers and reports.

A member of Tau Beta Pi National Engineering Society, he also serves as secretary of the International Council for Building Research Studies and Documentation Working Commission W65—Organization and Management of Construction. Other professional memberships include the Construction Research Council and the Awards Committee of the Construction Division of the American Society of Civil Engineers.

Weidell Named Tester Of the Year

Retired CW04 Lawrence E. Weidell, a test officer at the U.S. Army Test and Experimentation Command (TEXCOM), was recently named the Army Military Tester of the Year at the joint American Defense Preparedness Association/International Test and Evaluation Association annual symposium held in Nashville, TN.

Weidell was recognized for his efforts in planning and executing the largest and most complex Army aviation operational test in history—the AH-64D Longbow Apache. The test covered seven states, involved 2,000 military and civilian personnel, 20 aircraft, 400 pieces of ground equipment and three battalion-sized units.

Among those present at the symposium was COL D. I. Smith, head of TEXCOM's Aviation Test Directorate. Smith emphasized the size and complexity of the test by pointing out that it included 1,410 flight hours, 123,421 tactical vehicle miles, the firing of 36 Hellfire missiles, and 15,000 rounds of 30mm cannon.

In order to complete the test, Weidell and his team had to overcome numerous obstacles, including a 44-inch rainfall that flooded the Fort Hunter Liggett test site. To meet this challenge, a 16-day, around-the-clock, maintenance operation was put in place and the test was completed on time with a $5 million savings of taxpayer money. Following the test and a Milestone III review, the formal Defense Acquisition Board was waived and full production of the AH-64D was approved.

While keeping the planning and testing processes on track, and preparing numerous briefings up to the Secretary of Defense level, Weidell also managed to keep the Longbow Apache Program in the forefront of the acquisition process. Weidell, who has since retired, spent 22 years in Army aviation, including six years coordinating and planning Longbow Apache tests and experiments.

"His selfless dedication to the Longbow Apache test program was remarkable," Smith said. Instead of retiring on schedule, Weidell "determinedly focused on completing the tests at great expense to his future employment and personal life," said Smith.

"Weidell's determined work led to a phenomenal success that will guarantee the U.S. Army receives a premiere weapon system—the most modern attack helicopter in the world—for the 21st Century," Smith said.

Army Research Institute Receives 2 Awards

The Army Research Institute for the Behavioral and Social Sciences (ARI) recently received two awards in recognition of its service to higher education and its contributions to psychology and society.

• ***Consortium of Universities of the Washington Metropolitan Area Commendation.*** In a ceremony on June 12, 1996, Dr. Monte Shepler, President and Chief Executive Officer of the Consortium of Universities of the Greater Washington Area, presented a plaque to LTG Theodore Stroup, the Army Deputy Chief of Staff for Personnel, commending ARI for its leadership and outstanding service to higher education. In 1981, ARI entered a partnership with the consortium to sponsor a fellowship program that has brought the best graduate students and faculty in the behavioral sciences into its research program. Through this partnership, more than 300 graduate fellows have worked in close, mentored relationships with ARI's senior scientists with mutually beneficial and productive results in a farsighted, cost-effective project that has united the universities in the Washington region with the Army scientific community, and that has resulted in a significant number of scientific accomplishments for the Army and the universities.

• ***American Psychological Association Presidential Citation Shared By ARI.*** At its June 1996 meeting of the Board of Directors, the American Psychological Association (APA) formally recognized the Armed Services for their "enormous contributions to the behavioral and social sciences." Sharing the citation were the Army Research Institute, the Navy Personnel Research and Development Center, and the Air Force Human Resources Laboratory. The Services' contributions in the field of testing, psychometrics, statistical methodology, training and education, and personality and social psychology were recognized by the APA as "instrumental in the development and application of many of psychology's most important concepts and techniques." According to the citation, "the contribution of these three laboratories to psychology and to society is probably unmatched by another public or private agency." Dr. Edgar M. Johnson, Director, ARI, received the award for ARI and the Army.

IEW Directorate Wins National Intelligence Award

"The Intelligence and Electronic Warfare Directorate is proud of its contributions to the intelligence community in the protection of our Nation's defense. It is our great honor to be publicly recognized by our peers and customers. This award is a testimony to the Directorate's capabilities and successes which reinforces our continuing commitment to deliver our special, high-quality technologies to our customers. I only wish all our employees could have been present to share in this fitting tribute," stated Douglas S. Wood, Director of the Intelligence and Electronic Warfare Directorate (IEWD), as he accepted the Director, Central Intelligence (DCI) National Intelligence Meritorious Unit Citation award during formal ceremonies at CIA Headquarters, McLean, VA, earlier this year. IEWD was the only military service organization of the six units recognized. The others were from the Central Intelligence Agency and National Security Agency.

IEWD is an element of the U.S. Army Communications-Electronics Command (CECOM), Research, Development and Engineering Center (RDEC). Its headquarters are at Vint Hill Farms Station, Warrenton, VA, with elements located at McLean, VA; Fort Monmouth, NJ; Fort Huachuca, AZ; and Augsburg, Germany.

This award recognizes the collective performance of the Intelligence and Electronic Warfare Directorate's civilian, military, and contractor support personnel that has resulted in achievements and contributions of a clearly superior nature and significant benefit to the U.S. intelligence community.

During the last 18 months, IEWD rapidly developed, acquired, and fielded systems that greatly enhanced the nation's ability to collect, disseminate and display critical imagery and signals intelligence information from national assets to deployed joint forces in the field and to move collected information from the field to national command authorities. IEWD's specialized technologies and their close collaboration with the Army and sister Services, as well as Department of Defense intelligence agencies, significantly advanced the nation's ability to efficiently conduct signals intelligence operations against an expanding threat signal environment. The IEWD systems and products responded rapidly to critical tactical and strategic intelligence requirements. IEWD played an active role in significant Army, joint and international operations and exercises, including the Bosnia Peace initiative, Operation Uphold Democracy, Strong Resolve, Atlantic Resolve, and Valiant Warrior.

IEWD's excellence in technology has been known since the 1960s when it was part of the U.S. Army Security Agency. Since then, the directorate has undergone numerous name changes and transfers within U.S. Army commands. Working closely with other Department of Defense and national level activities, IEWD has continued to develop and field important systems to the intelligence community that have been able to collect and disseminate intelligence data to decision makers, battlefield commanders and soldiers in the field. In 1990-91, IEWD technologies were part of the major successes in Operation Desert Storm. One particular product was delivered in 39 days to meet special, urgent, intelligence needs. IEWD utilizes a team approach, through in-house resources, contractors, other government expertise, and leverages as much commercial-off-the-shelf technology as possible in delivering quality products to the field quickly.

BOOKS

Nuclear Coexistence: Rethinking the U.S. Policy To Promote Stability in an Era of Proliferation

By William C. Martel and William T. Pendley Air War College Studies in National Security No. 1 Montgomery, AL 1994

Reviewed by J. Michael Brower, an analyst in the Luevano Outstanding Scholar Program with the Office of the Administrative Assistant to the Secretary of the Army, and a student in Georgetown University's National Security Studies Program.

Note: William C. Martel and William T. Pendley are associate professors of international relations at the Air War College. Pendley was deputy assistant secretary of Defense for East Asian and Pacific affairs and served as acting assistant secretary of Defense for international security affairs during the Clinton Administration transition.

In the April 24, 1995, edition of the *Journal of Commerce,* Trudy Rubin wrote that "the nuclear genie can't be squeezed back into the bottle"—this is one of the important truisms articulated by William Martel and William Pendley in their book on the problem of the militarization of technology and the atom.

The study by Martel and Pendley will interest a wide arena in the Defense Department and in other agencies engaged in the debate raging over dual-use technology transfer and extant and contemplated nuclear nonproliferation regimes. Acquisition, procurement, counterproliferation and arms control export analysts will all appreciate the plain language endemic in this Air War College study and the straightforward analysis and conclusions. The authors of Nuclear Coexistence propose a rather bold brand of nuclear Realpolitik that centers on the recognition that "Nuclear weapons will be one of the enduring fixtures of international politics for the foreseeable future. As long as states believe that nuclear weapons serve to enhance their security, the permanent role of nuclear weapons is assured." Proposing that not all nuclear technology proliferation is inherently destabilizing, these authors see three choices confronting the policymaker on this issue:

- Continue the "current policy of attempting to slow or stop the proliferation of nuclear weapons;"
- Renounce counterproliferation as an exercise is futility; and
- "Manage" the cases of irrepressible foreign nuclear weapons programs and attempt to avert proliferation in high-risk instances (e.g., nuclear programs orchestrated by "rouge" nations).

Opting for the third choice, the authors assemble a wide array of supporting arguments by evaluating the atomic ambitions of the Ukraine, Pakistan, North Korea, and Iran. Martel and Pendley encourage a Weltannstauug that recognizes the difference between "stabilizing and destabilizing cases of nuclear proliferation." These authors are not particularly hostile to the contrarian views of Kenneth Waltz of the University of California at Berkley who posits that nuclear weapons can make war too dangerous a game to play. Consequently, controlled nuclear weapons dissemination, if orchestrated perspicaciously by possessor nations, might actually reduce the risk of military confrontation. Martel and Pendley, in questioning "carte blanch opposition to nuclear ownership" by non-possessing nations, write that in "some cases nuclear proliferation can have a stabilizing effect on the international system."

Other interesting elements of the Air War College study include a thoughtful attack on the notion that nuclear weapons possession by rivals India and Pakistan is ineluctably detrimental to peace in South Asia. Pendley and Martel muse that the equalized balance of terror between the two antagonists "mirror[s]...the U.S.-Soviet nuclear balance that served as a model for restraint on the part of the superpowers during the Cold War." The authors also analyze the Nuclear Nonproliferation Treaty (NPT), Japanese thinking on the question of super-weapons, and conclude with a slew of recommendations which include creating a cabinet-level position to oversee all nuclear proliferation policy.

Like Gary Gardner's *Nuclear Nonproliferation: A Primer (1994)* and William D. Nartung's insightful work *And Weapons for All (1994)*, Martel and Pendley acknowledge that the spreading of atomic weapons-grade material and concomitant technology have deep economic roots. "The desire to use civilian nuclear power to support economic and industrial development has been a powerful incentive," write the authors.

The reader can conclude from this important book that nuclear proliferation cannot be successfully resisted—but it may be effectively managed. As David Mussington indicated in *Arms Unbound* and John L. Boies pointed out in his outstanding study *Buying for Armageddon (1994),* the authors of Nuclear Coexistence similarly remind us that, in the last analysis, economics drive policy—we must plan with this precept in mind. These books will be invaluable aids to export control and foreign affairs analysts and to all participants in nuclear technology acquisition and transfer issue.

Special Note: Brower gratefully acknowledges the assistance of Debbie Reed and Patricia Tugwell, research librarians, Pentagon Army Library, in preparing this article.

Book Reviews

If you have read a book which you feel may be of special interest to the RD&A community, please contact us. The editorial staff welcomes your literary recommendations. Book reviews should be no longer than two double-spaced typed pages. In addition, please note the complete title of the book, the author's name, and your name, address and commercial and DSN phone numbers. Submit book reviews to: DEPARTMENT OF THE ARMY, ARMY RDA, 9900 BELVOIR RD SUITE 101, FORT BELVOIR VA 22060-5567, Phone: (703) 805-4215 or DSN: 655-4215; Fax: (703) 805-4218 or DSN: 655-4218.

CONFERENCES

Army Operations Research Symposium

The 35th annual U.S. Army Operations Research Symposium (AORS XXXV) will be held Nov. 13-14, 1996, at Fort Lee, VA. Registration will be the evening of Nov. 12. Three hundred government, academic, and industrial leaders are expected to participate.

This year's theme is "Responsive, Relevant, Real-World Analysis." Concurrent special sessions will include the following areas: force development, modernization, and requirements analysis; information warfare and battlefield digitization; force application modeling and analysis (conventional and operations other than war); readiness and sustainment analysis; analysis supporting Force XXI, advanced warfighting experiments, and advanced concept technology demonstrations.

The symposium will be an exchange of information and experiences on significant Army analyses, with a view to enhancing these efforts, and, in general, broadening the perspective of the analysis community. Attendance is by invitation only. Papers are being solicited which address the session topics listed above.

The U.S. Army Materiel Systems Analysis Activity (AMSAA), directed by John J. McCarthy, is responsible for the overall planning and conduct of AORS XXXV. Co-hosts are the U.S. Army Combined Arms Support Command and Fort Lee and the U.S. Army Logistics Management College.

For additional information, write to Director, U.S. Army Materiel Systems Analysis Activity, ATTN: AMXSY-SL, Aberdeen Proving Ground, MD 21005-5071, or call Glenna Tingle, DSN 298-6576, or commercial (410) 278-6576.

Applied Statistics Conference

A forum regarding technical exchange on statistical applications between Department of Defense personnel and their university and industry associates will be held Oct. 23-25, 1996, in Monterey, CA. This Army Conference on Applied Statistics was initiated in 1995 with joint support from several activities under the leadership of the Army Research Laboratory (ARL). A special session celebrating 40 years of experimentation at Fort Hunter Liggett will be held Oct. 24. A number of leaders in the applied statistics arena will discuss advances in experimentation methods and analysis.

The three-day conference will be preceded by a tutorial Oct. 21-22 titled "Simulation: A Modeler's Approach." James R. Thompson of Rice University and Malcolm S. Taylor of ARL will present topics ranging from classical to contemporary approaches to simulation modeling.

For more information, write Dr. Barry Bodt, ARL, ATTN: AMSRC-SC-S, Aberdeen Proving Ground, MD 21005-5067, or e-mail babodt@arl.army.mil.

Upcoming Conferences

• The Portable Computer Components 1996 Seminar and Exhibition will be held Sept. 16-19, 1996 in Boston, MA. The meeting will provide a comprehensive review of advances in componentry leading to improvements in portability and communications, and the broadening of application capability and overall performance of notebook and hand held devices. Specific topics will include displays, storage media, CPU architectures, processors, integrated chips, modems, batteries, power management, software and system integration and application.

• The Eighth International Seminar on Battery Waste Management will be held in Boca Raton, FL, Oct. 28-30, 1996. This forum will cover manufacturing and user wastes of the important primary and secondary battery systems with the focus on lead acid, nickel cadmium, metal hydride, alkaline manganese, lithium and lithium ion and others such as sodium, sulfer and polymers, potentially important for use in electric vehicles.

• The Sixth International Seminar on Double Layer Capacitors and Similar Energy Storage Devices will be held Dec. 9-11, 1996 in Boca Raton, FL. The seminar will provide an update on the current status and future promise of high energy storage devices. The research, development and application of double layer capacitors and similar energy storage devices will be discussed.

For additional information on any of the above conferences, contact Dr. S.P. Wolsky, 1900 Cocoanut Road, Boca Raton, FL 33432; (407) 391-3544; fax (407) 750-1367. For seminar brochures, contact Florida Educational Seminars Inc., 2300 Glades Road, Suite 307 East Tower, Boca Raton, FL 33431; (407) 338-8727; fax (407) 338-6887.

Conference Proceedings Available

The proceedings of an April 1996 conference titled "Technology Showcase on Integrated Monitoring, Diagnostics and Failure Prevention" are available for purchase from the Society For Machinery Failure Prevention Technology (MFPT), Haymarket, VA. The conference, held in Mobile, AL, was sponsored by the DOD Joint Oil Analysis Program's Technical Support Center, the University of Wales, Swansea, and the MFPT Society. The 836-page case-bound book of proceedings contains nearly 80 technical papers on topics such as machinery diagnostics and prognostics, general monitoring technology, lubricant condition monitoring, particulate/wear debris analysis, online condition diagnosis, microelectromechanical sensors technology and applications, signal analysis, and Russian technology. For information on purchasing a copy of the proceedings, contact Henry C. Pusey, Executive Director, MFPT Society, 4193 Sudley Road, Haymarket, VA 22069-2420; (703)754-2234; fax (703)754-9743.

LETTERS

Dear Sir:

The facsimile machine is a great improvement over the U.S. Postal Service. Likewise, the Internet is a great improvement over the fax. With all the propaganda, informational, and command philosophy articles that appear in the many magazines published on behalf of the military Services promoting digital communications, one would think those same publications would include their electronic addresses in their publications.

E-mail service has grown from small stand-alone net systems to the present Internet connectability. The next step is to develop the individual universal address. A universal address would give the individual the ability to receive e-mail at any location in the world at any time. We would be secure in that our actual location need not be known and our e-mail could be routed to our current location by one of the many service providers that now exist.

Until the universal address is adopted and becomes a subscript to our names, it would be helpful to have the e-mail address of the editor or other responsible individual for the many publications included in the forward of the magazine or in the article bylines.

Thank you for your time.

Steve Baugh, DAC
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