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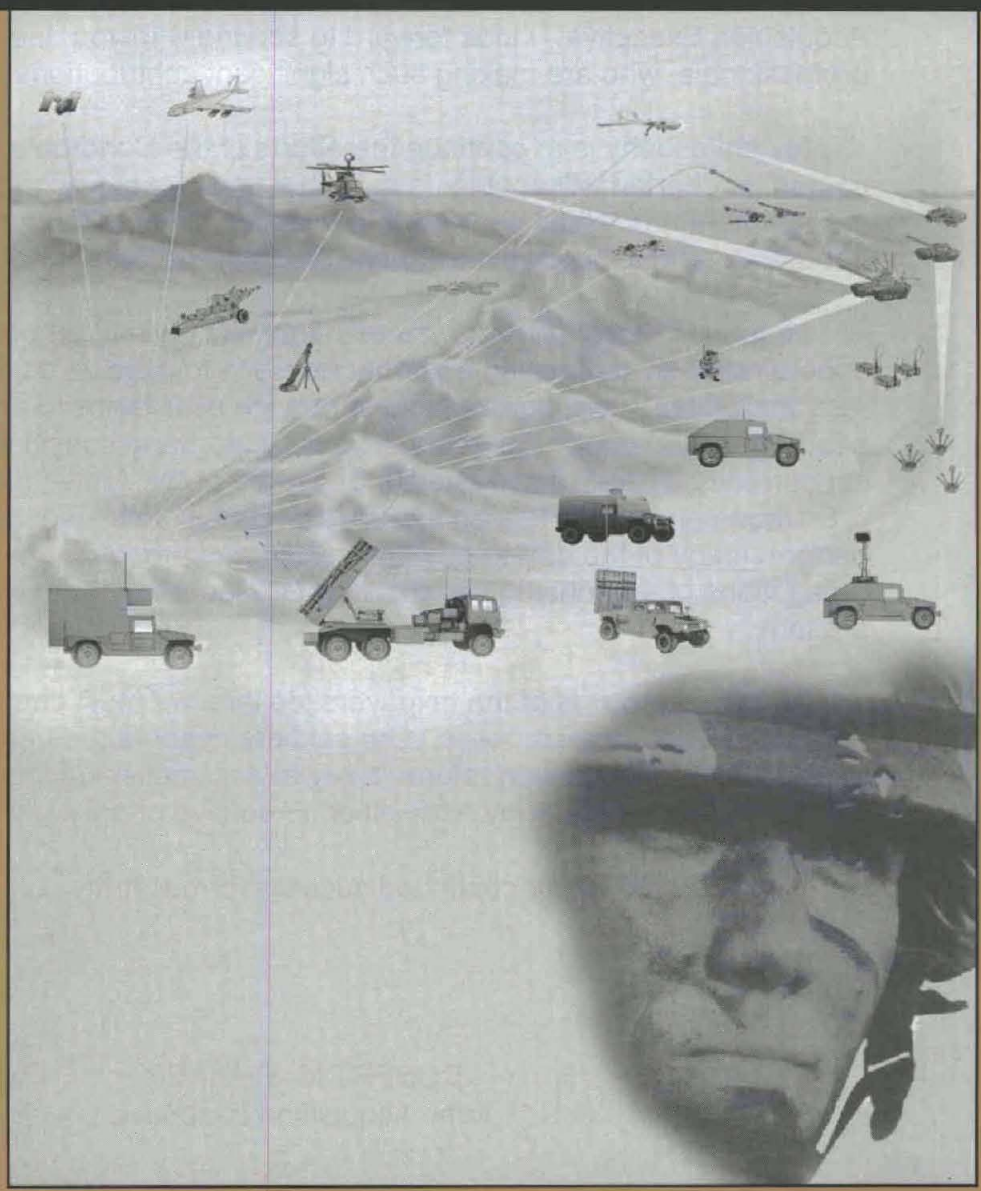
ARMY RD&A

JULY - AUGUST 1997

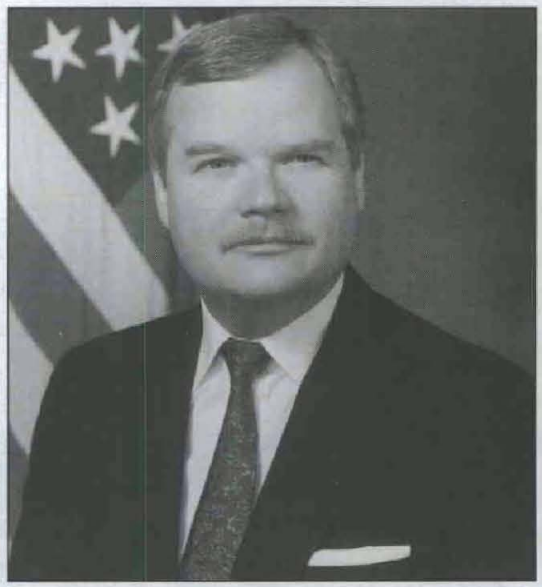
ARMY ADVANCED CONCEPT TECHNOLOGY DEMONSTRATIONS

...The Inside Story

- ★ Precision/Rapid Counter-Multiple Rocket Launcher
- ★ Rapid Force Projection Initiative
- ★ Joint Countermine
- ★ Combat Identification
- ★ Joint Logistics
- ★ Tactical High Energy Laser
- ★ Rapid Terrain Visualization
- ★ Military Operations In An Urban Terrain



FROM THE ARMY ACQUISITION EXECUTIVE



On 28 May 1997, the Secretary of the Army designated me to be the Army Acquisition Executive. I look forward to serving with you, the acquisition professionals, who are making such significant contributions to our Army.

My philosophy is to continue the efforts of the Honorable Gil Decker. The course he charted will enable us to further improve our acquisition and procurement processes and result in the acquisition of the most effective, affordable, and supportable weapons and materiel for our soldiers.

I intend to mirror Gil Decker's management style of empowering subordinates by delegating authority requisite to execute assigned responsibilities. I will be available to provide assistance to any member of the acquisition community, but request your support and consideration of my serving concurrently as AAE and Assistant Secretary of the Army (Installations, Logistics & Environment). I will rely on the SARDA Deputy Assistant Secretaries to perform many of the day-to-day acquisition and procurement functions. The AAE delegations of authority in place during Gil Decker's tenure will continue for the present.

As good stewards of the taxpayers' dollars, we must continue our efforts to reform the acquisition process. Our soldiers deserve the best equipment we can possibly field. Acquisition reform is key to accomplishing this vital mission and will continue to be an Army Acquisition Executive priority.

I look forward to our continued success for our Army.

ROBERT M. WALKER
Army Acquisition Executive

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Research Development Acquisition ARMY RD&A

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FEATURES

DEPARTMENTS

COVER

Army Advanced Concept Technology Demonstrations are establishing new paradigms for rapid transitioning of technologies to meet the warfighter's critical military needs.

THE INSIDE STORY ON ARMY ADVANCED CONCEPT TECHNOLOGY DEMONSTRATIONS

By Irena D. Szkrybalo
and Dr. A. Fenner Milton

Introduction

In the 1990-91 Gulf War, past investments in Science and Technology (S&T) in the areas of stealth, night vision devices and precision munitions resulted in a remarkably brief and successful battle with great cost to the aggressor. A Department of Defense (DOD)-wide assessment performed at the end of that war, however, identified serious warfighting deficiencies applicable to the post-cold war environment. To address these deficiencies, DOD formulated seven S&T thrust areas of focus for development of next generation advanced capabilities. These thrust areas were: Global Surveillance and Communications; Precision Strike; Air Superiority and Defense; Sea Control and Undersea Superiority; Advanced Land Combat; Synthetic Environments; and Technology for Affordability. In 1994, DOD initiated the Advanced Concept Technology Demonstration (ACTD) process as a way to more rapidly transition technology to the warfighter through the use of fieldable prototypes. Three Army S&T demonstration activities which had evolved from DOD S&T thrust areas—Joint Precision Strike, Rapid Force Project Initiative and Joint countermine—were among the first set of DOD-approved ACTDs (10 total) in FY95.

Background

The Office of the Secretary of Defense (OSD) initiated ACTDs to permit the warfighter to properly evaluate new technology for military effectiveness, especially in cases where new doctrine and tactics, techniques and procedures (TTPs) are needed. ACTDs offer the opportunity to evaluate the suitability of these technologies by providing a limited go-to-war capability to an operational unit. ACTDs are often large-scale demonstration programs involving new but relatively mature technology, are approximately two to three years in duration, and are usually sponsored by a commander-in-chief (CINC) or Service component. At the conclusion of the large-scale demonstration, a residual or leave-behind capability is provided to troops for their experimentation and evaluation for an additional two-year evaluation period. During this period, the ACTD program provides support for the novel equipment. At the end of this evaluation period, a decision is made whether or not to proceed with acquisition, based on results of this assessment and, of course, ultimately on prioritization by the Service. A product of the demonstration could also be a better understanding of what is needed and improved specifications for future acquisition programs.

In the Army S&T program, ACTDs have become a cooperative venture between the technologist and the warfighter. The U.S. Army Training and Doctrine Command (TRADOC) has recently updated TRADOC Pam 71-xx with Section 8-7 which describes the purpose and principal participants of ACTDs and provides general guidance for the nomination, coordination, approval, execution, and disposition of Army ACTDs. TRADOC also develops Future Operational Capabilities (FOCs) that identify operational needs upon which ACTDs can be based.

The Goal

The primary goal of an ACTD is to evaluate the military utility of new technology and to develop the concept of operations that is needed to make effective use of this technology. ACTDs are designed to provide residuals that respond to a critical military need identified by the warfighter. The residuals incorporate technologies of sufficient maturity such that the new capability can be delivered with low risk in a configuration that can be used by an operational unit within the timeframe of the ACTD. Safety testing is included for novel systems that incorporate explosive materials. The residual period ensures that suitability issues (supportability, etc.) are addressed as part of the program.

The Army's approach to ACTDs is somewhat different from that of the other military departments and DOD agencies. What distinguishes the Army approach is the em-

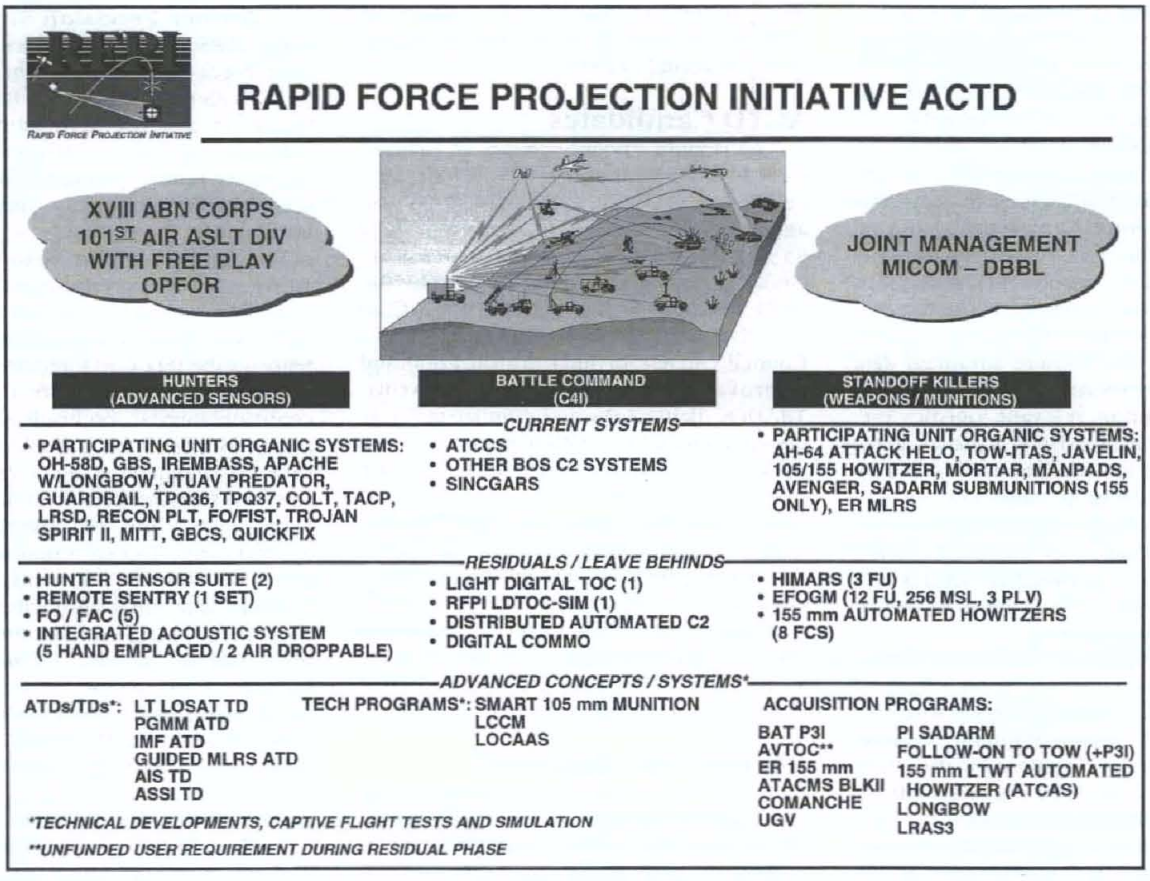


Figure 1.

phasis on system-of-systems integration in a particular warfighting environment with extensive user involvement through the TRADOC Battle Labs and CINC/field commanders. As a combined land force, the Army uses a myriad of individual platforms and systems to carry out its mission effectively and efficiently. Insertion of new technologies on the battlefield, therefore, requires careful consideration by the warfighter of the impact of integrating new capabilities with current systems/capabilities and the subsequent effect on doctrine and TTPs.

The ACTDs

The ACTDs which the Army is currently conducting or has recently completed are:

• **Precision/Rapid Counter-Multiple Rocket Launcher.** Completed in October 1996, this ACTD addressed the problem posed to U.S. Forces Korea (USFK) by the North Korean 240mm Multiple Rocket Launchers. The ACTD demonstrated and left behind, as residuals, enhanced automation between sensors and shooters that serves to improve the commander's ability to call for timely supporting fires from various sources to include Army, Navy, Air Force and coalition forces. The residual capability is currently being evaluated by the 2nd Infantry Division, USFK.

• **Rapid Force Projection Initiative (RFPI).** (See Figure 1.) The objective of this ACTD is to improve the effectiveness and survivability of air deployed early entry forces. In a brigade-sized live/virtual field experiment in 4Q FY98, RFPI will demonstrate real-time targeting from forward sensors to lightweight lethal standoff weapons systems with the capability to engage high value targets, including heavy armor, beyond traditional direct fire ranges. The ACTD has a goal of improving the survivability of a light force attacked by a much larger heavy force. At the conclusion of the demonstration, RFPI residuals will be provided for a two-year period to the XVIII Airborne Corps.

• **Joint Countermine.** This ACTD is evaluating the capability to conduct seamless amphibious and ground force mine countermeasure operations. In FY97, the demonstration (Army lead) focuses on near shore capabilities with emphasis on instride detection and neutralization of mines and obstacles. In FY98, the demonstration (Navy/USMC lead) will address technologies for clandestine surveillance and reconnaissance. Early identification of minefield location and the disemination of that information to the relevant commanders is at the heart of this ACTD.

• **Combat Identification.** The goal of this ACTD is to demonstrate an affordable system architecture that can enhance the capability of our combat forces to positively identify friendly platforms during air-to-ground and ground-to-ground operations in order to maximize combat effectiveness and to reduce fratricide due to misidentification. Residual capability was provided to the Experimental Force for the U.S. Army Task

Force XXI Advanced Warfighting Experiment in FY97. This brigade-sized force was comprised of operational units from the 4th Mechanized Infantry Division at Fort Hood, TX. Residual systems were also provided to the Special Purpose U.S. Marine Air Ground Task Force (Experimental) for further USMC evaluation and to the Arizona Air National Guard for U.S. Air Force experimentation.

• **Joint Logistics.** Phase I of this ACTD, also known as Logistic Anchor Desk (LAD), provides operational users such as CINCs and Joint Task Force Commanders with increased capability to rapidly plan and execute more responsive and efficient logistics support to military operations. The focus of LAD is decision support tools with core functionalities that include advanced data distribution and visualization techniques to provide a common, relevant logistics picture. Integration of existing logistics analysis models with knowledge-based tools provide powerful decision support to leaders. This capability is a plus to the total asset visibility effort. Phase I of the ACTD, which was Army lead, concluded in April 1997. Phase II lead will be the Defense Advanced Research Projects Agency.

• **Tactical High Energy Laser (THEL).** This OSD-directed demonstration is focused on negating the Katyusha missile threat to northern Israel. A memorandum of agreement for joint development of the THEL demonstrator has been signed by both countries and represents the fastest agreement of this type ever negotiated. Funding for this program has been provided to the Army by Congress.

• **Rapid Terrain Visualization.** This ACTD will integrate and demonstrate capabilities to rapidly generate, disseminate, and exploit high resolution digital terrain elevation and feature data sets. This will allow a comprehensive visualization of the battlefield to support mission planning in crisis force projection situations where the battlefield has not been previously mapped. The ACTD will provide, as leave behinds, computer workstations and applications software to the XVIII Airborne Corps under cognizance of the U.S. Atlantic Command.

• **Military Operations In An Urban Terrain (MOUT).** This ACTD has been judged essential because urban terrain is a very likely and difficult battlefield of the 21st century where much of our traditional technology advantage may be rendered ineffective. Warfighter dismounted capabilities and operational TTPs for urban terrain are critically in need of modernization. The MOUT ACTD will meet this deficiency by providing soldiers and Marines the TTPs and integrated technologies such as advanced communications, precise geolocation and navigation, and sensors, along with upgrades to soldier systems, lethal and non-lethal weapons/munitions, individual protection, and mobility enhancements needed to effectively fight in urban terrain. Residuals will be provided to CINC Special Operations Command in FY00.

ACTD Candidates

The Deputy Under Secretary of Defense for Advanced Technology (DUSD(AT)) recently invited military departments and agencies to identify candidates for DOD FY98 ACTDs. The selection process includes review and recommendation by the DOD Advanced Technology Breakfast Club and the Joint Requirements Oversight Council (JROC) for final prioritization and approval by DUSD(AT). In the Army, TRADOC Battle Labs and combat developers, in conjunction with a materiel developer, identify Future Operational Capabilities which address a critical military need and technology concepts which could bring a solution to that need. The CINC/user sponsor support is enlisted during ACTD concept development or during the ACTD approval process. The materiel developers identify Army Budget Category 6.3 resources which could be applied to a demonstration of the concept.

Review And Approval

The ACTD proposal is reviewed and approved by the Deputy Commanding General, HQ TRADOC, the Deputy Assistant Secretary of the Army for Research and Technology, and the Assistant Deputy Chief of Staff for Operations and Plans - Force Development. After a proposal is approved as an Army ACTD candidate, any remaining funding shortfalls are resourced from within the Army S&T budget and/or requested from OSD. The DUSD(AT) has agreed to provide up to 20 percent of total ACTD program costs for residual support or system integration activities.

As an Army ACTD candidate, the proposal must compete with other Service and DOD agency proposals which are initially reviewed and prioritized by the military departments and DOD agencies, reviewed by the DUSD(AT) and joint staffs, the JROC, and the ACTD Breakfast Club which is comprised of Service S&T executives and user representatives and chaired by the DUSD(AT). Final selection is reviewed and prioritized by the Vice Chairman, Joint Chiefs of Staff, and decision for final approval is made by the DUSD(AT). Review and approval for a new ACTD is a challenging and arduous process that requires articulation of a critical military need and a mature technological solution to that need which is affordable.

FY 98 Candidates

Army FY98 ACTD candidates submitted to DUSD(AT) that are currently undergoing the DOD ACTD selection process are:

• **Theater Precision Strike Operations (TPSO).** This ACTD will provide the Joint Force Land Component Commander (JFLCC) an enhanced capability to conduct theater counterfires and other operations throughout his area of responsibility across the entire Korean peninsula through a joint sensor-to-shooter solution including: joint intelligence, surveillance, and reconnaissance; rapid targeting; shared situational awareness; enhanced command and control; and responsive weapons delivery. The ACTD will leave behind an enhanced capability for the JFLCC to forecast, plan and execute operations and more fully integrate coalition forces. Technologies to be explored in these areas will include wide area sensors, enhanced artillery radar, acoustic sensors, smart/precision munitions, long-range indirect fires, expanded interoperability with Army Tactical Command and Control and Global Command and Control Systems, data links, automated correlation and platform cross cueing and interaction with coalition partners. TPSO will seek to integrate these technologies as a solution for precision strike problems impacting the Commander-In-Chief, United Nations Command (CINCUNC). The capabilities demonstrated in the ACTD will be applicable to multiple theaters worldwide.

• **Line-Of-Sight Anti-Tank (LOSAT).** The recent reconfiguration of the LOSAT Weapon System for use on the High Mobility Multipurpose Wheeled Vehicle (HMMWV) provides an affordable early entry air droppable system with lethality to overmatch current and projected armor threats, active protection systems and other hardened high-value targets. The velocity of the kinetic energy missile will provide a significant increase in lethality, reduced exposure timelines, and rapid rate of fire at engagement ranges beyond the effective range of tank main guns. A limited residual capability will be fielded in FY03-04.

• **Aerostat.** This ACTD will address a low-risk, cost-effective solution to elevated surveillance and fire control to counter the rapidly emerging cruise missile threat which may include low-altitude threats masked by terrain from ground based sensors. In support of the wide-area Land Attack Cruise Missile Defense concept, this ACTD is considering various architectures to provide over-the-horizon engagement capability for U.S. Army, Navy and Air Force weapon systems, expand the battlefield commander's capability to support broad-area defense against land attack cruise mis-

siles, and provide combat identification of potential targets.

Although the brief descriptions above provide a general overview of the goals and objectives of Army ACTDs, they do not fully communicate the challenges associated with conducting this dynamic process for rapid transition of new technologies into the hands of the warfighter. A more detailed description of the RFPI ACTD Operational and Organizational concept provides a better understanding and appreciation of the degree of the operational complexity involved in integrating current and advanced capabilities into an ACTD system-of-systems scenario.

RFPI Description

Early entry forces are usually built around light infantry task forces. The elements have inherent strategic mobility but are vulnerable to heavy, armored forces. The RFPI ACTD was designed to address the vulnerability of early entry forces to armored overrun and indirect fire during the early days of a deployment and before follow-on forces can be brought into the area of operations. Specifically, the demonstration seeks to expand battlespace, increase early entry force survivability, lethality, target acquisition, and control of battle tempo against heavy armor in ranges out to 60 km beyond the forward edge of the battlefield.

The demonstrated solution to the problem is the hunter-standoff killer concept which focuses on extending close combat battlespace beyond direct fire range so that a potential armored force can be defeated before it can engage in a close battle. To extend the battlespace, RFPI uses forward deployed sensors at the edge of the battlespace with digital command, control, communications, computers and intelligence (C^4I) systems linked to non-line-of-sight fires for increased situational awareness, decreased sensor-to-shooter timelines, and significantly increased effectiveness and efficiency in long-range acquisition and engagements. The RFPI systems are designed to be airlanded and sling loaded. The Enhanced Fiber Optic Guided Missile (EFOGM) will be airdroppable also.

The systems planned for use in the 1998 field exercise and for the two-year residual period with the exercise force are comprised of hunters (forward sensors) (See Figure 2), battle command (C^4I), and standoff killers (weapons/munitions) which are current systems, and residuals/leave behinds. Advanced concepts will be evaluated in separate tests and in simulation. The forward sensors provide situational awareness and targeting information. The information is sent through the tactical wide area network back to the tactical operations center

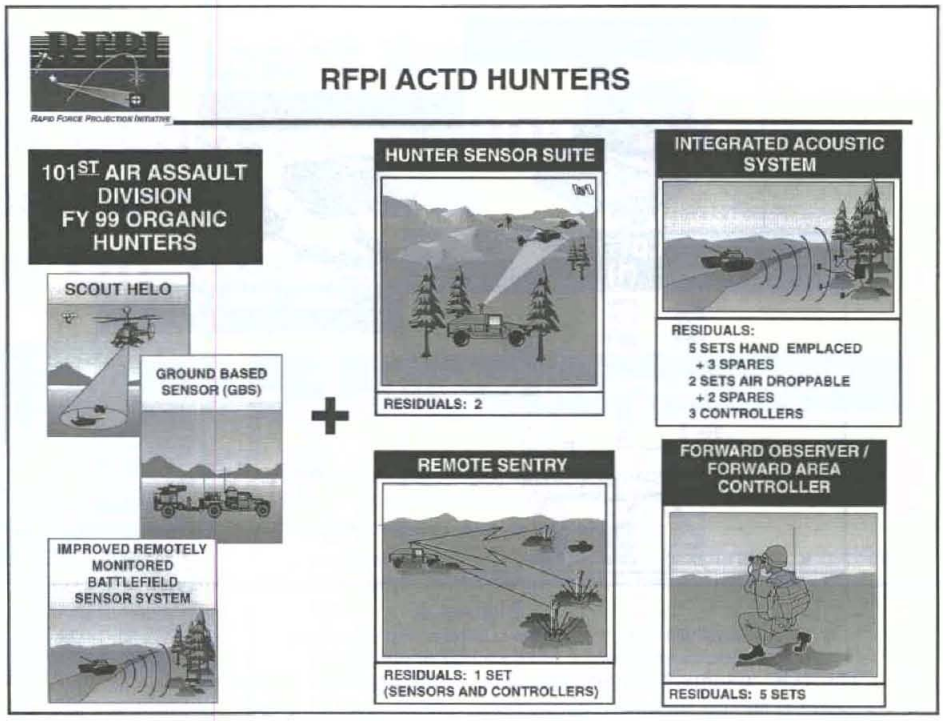
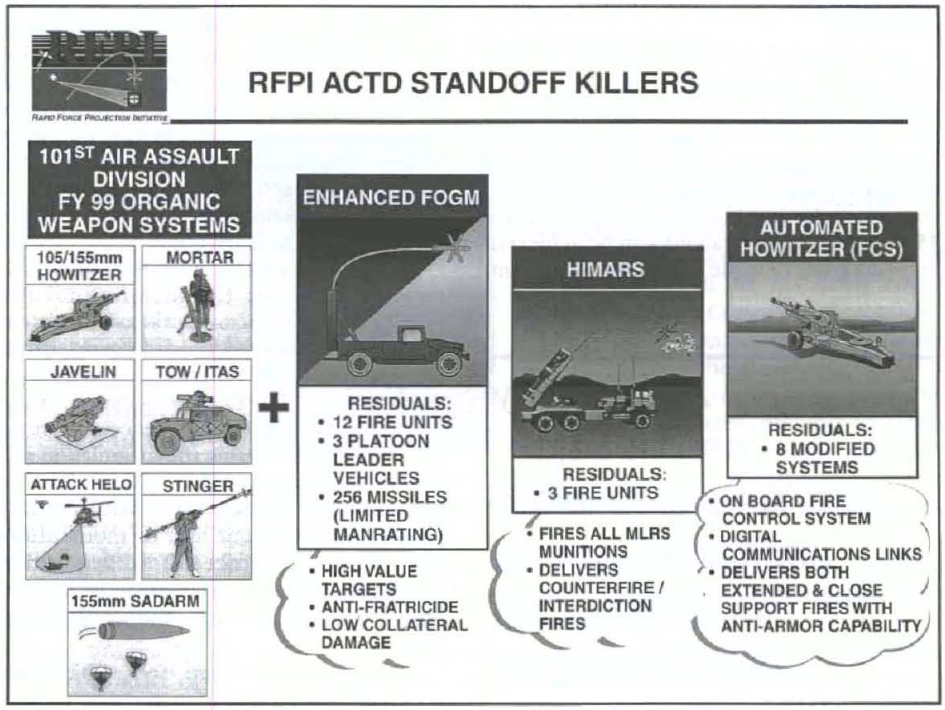


Figure 2.



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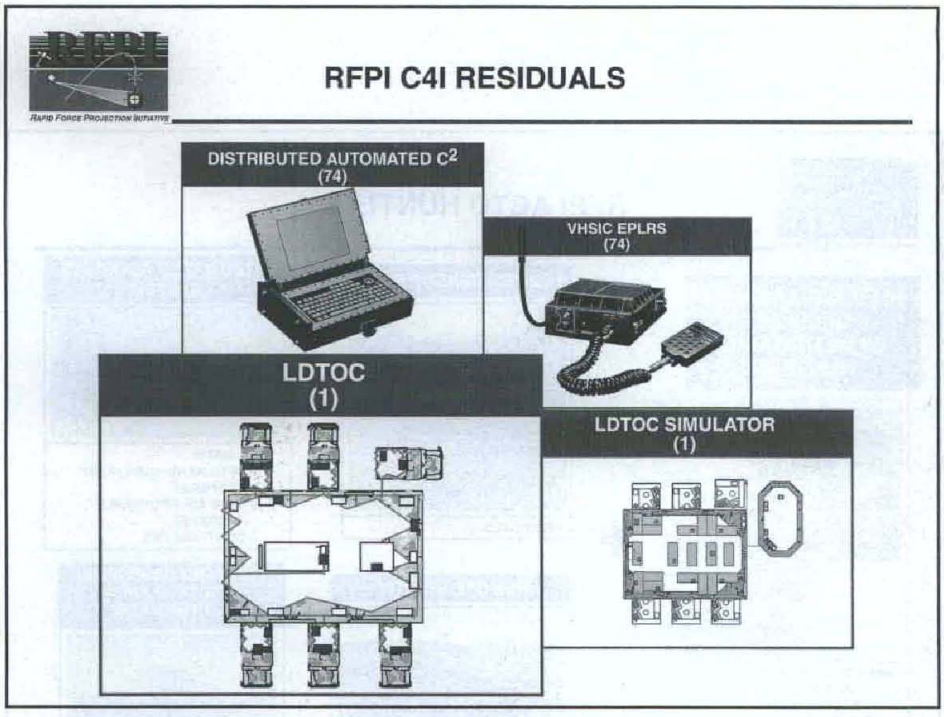

Figure 4.

(TOC). The TOC assigns fires through fire control systems to the standoff killers (See Figure 3) for specific targets. The combination of RFPI capabilities, cued by advanced sensors through responsive integrated digital C^{4}I (See Figure 4), achieves a system-of-systems synergy that dramatically multiplies the capability of a lift-constrained early entry force.

An important residual capability of the RFPI ACTD is EFOGM, a highly lethal, HMMWV-based precision strike teleoperated missile which will give light forces the ability to engage and destroy threat armored combat vehicles, stationary and moving helicopters, and other high-value targets out to 15 kilometers. Survivability can be achieved by firing from defilade. The EFOGM system consists of a gunner's station/launch platform, tactical missile, and a fiber optic data link. The data link affords the gunner the ability to guide the missile to the target using both a Global Positioning System-based inertial measurement unit and manual procedures and provides a large footprint useful against moving targets. The gunner views the target via a passive infrared seeker on the missile linked to the gunner's video console. In December 1996, the Chief of Staff of the Army issued a decision memorandum stating that an EFOGM company will be formed at Fort Bragg as an XVIII Airborne Corps asset.

As with any new initiative, ACTDs are covering uncharted ground in establishing new paradigms for the rapid transition of technology to the warfighter.

An ACTD becomes a candidate for acquisition after the military utility of the capability is demonstrated. A transition strategy is developed during the planning for the ACTD. If a significant level of transition preparation is needed, the Army participates with OSD in an ACTD Transition Integrated Product Team (TIPT). The purpose of the TIPT is to ensure that the necessary preparations are made during the formulation and execution of an ACTD to allow effective transition into the next phase with a quality product and without loss of momentum. The decision to proceed into acquisition will be based on the assessment of military utility, Service priorities and available resources.

Since their initiation in 1995, ACTDs have generated a good deal of material, to include a number of articles devoted to the ACTD process in *Army RD&A* magazine. DUSD(AT) has responsibility for ACTD oversight in DOD and has established a web site at http://www.acq.osd.mil/at/actd.html which provides information about the ACTD process and on individual ongoing military department/agency ACTDs. In addition, the Office of the DUSD(AT) publishes a quarterly newsletter, *ACTD Times,* copies of which can be obtained by calling Mary DeAngelis at (703)695-8044.

Conclusion

As with any new initiative, ACTDs are covering uncharted ground in establishing new paradigms for the rapid transition of technology to the warfighter. To work on an ACTD is not an easy task, but it has proven to be challenging and exciting as voiced by COL Paul Wolfgramm, Director, Joint Precision Strike Office, and Emily Vandiver, Technology Program Manager for RFPI, in the accompanying "Speaking Out" article on page 7 of this issue. The powerful impact of a successful ACTD on the warfighter was made evident in a recent message received in DOD from CINCUNC/CFC at the completion of the P/R CMRL ACTD in Korea in October 1996. CINCUNC/CFC praised the conduct and results of the P/R CMRL ACTD for its "great assistance in resolving a tough part of the fight" in the CINC's theater. In the Army, ACTDs represent a dynamic and flexible new way of doing business. They provide an opportunity to achieve acceleration of mature technologies and integration of advanced capabilities in system-of-systems linkages on the battlefield to meet the warfighter's critical military needs.

IRENA D. SZKRYBALO is the Deputy Director for Technology for Missiles, Aviation and Precision Strike, Office of the Assistant Secretary of the Army for Research, Development and Acquisition (OASA(RDA)). She holds a B.S. degree in aeronautical engineering from Wayne State University in Detroit, MI, and an M.S. in science and technology commercialization from the University of Texas at Austin.

DR. A. FENNER MILTON is the Deputy Assistant Secretary for Research and Technology, OASA(RDA). He holds a Ph.D. in applied physics from Harvard University.

What Impact Are Advanced Concept Technology Demonstrations Having On Your Mission?

Dr. A. Fenner Milton
Deputy Assistant Secretary Of The Army (Research and Technology)
The Pentagon

Advanced Concept Technology Demonstrations (ACTDs) have had a large and very positive impact on the Army S&T program. For FY98, approved ACTDs constitute 37 percent of the Army's Advanced Development (6.3) budget and have made a tremendous difference in the way the Army does business largely because of the residual (leave behind) aspect of the program. The most important impact has been to provide an opportunity to deal with new technology in a system-of-systems context early in the technology development cycle. The residuals are usually provided in sufficient quantity to do operational-style field testing, often with an opposing force to obtain realistic evaluations. System-of-systems issues invariably involve the development of new concepts of operations/tactics, techniques and procedures (TTPs) and require the allocation of significant military user (TRADOC/CINC) resources to resolve.

In an ACTD, these scarce resources are allocated to the program because of the realization by everyone involved that new equipment will actually be left with an operational unit and they must be in a position to use it effectively. Thus, ACTDs have encouraged a true user/developer partnership. The fact that the immediate customer (CINC/User sponsor) fights in a joint environment has also made it easier to motivate joint Service system-of-system efforts and many ACTDs are joint. The chart below identifies characteristics of technology appropriate for an ACTD.

In many cases, the residuals themselves, though limited in quantity, can provide a niche capability important to the warfighter, but in many Army ACTDs, the residuals have not been the only product. ACTDs have been focused on obtaining a new capability not just on a particular technology and to that end advanced concepts evaluated through simulation and off line technical testing have been included as part of the overall program. These concepts are often not mature enough to be included as residuals but may form part of the long-term solution. In that way, the information gained from the ACTD is used to guide future technology development efforts as well as acquisition decisions.

WHAT MAKES A GOOD ACTD?

A new technology is particularly appropriate for an ACTD if one or more of the following conditions apply:

- **The technology is very promising but:**
  - **new and unconventional concepts of operation or tactics, techniques and procedures will be needed to make it work**
  - **a large scale field experiment with multiple systems (including in some cases a free play opposing force) is needed to truly assess military utility**
- **A limited quantity of affordable residuals can fill an urgent military need**
- **Significant value added can be obtained through joint service experimentation**

ACTDs are used to guide future technology development efforts as well as acquisition decisions.

LTG John E. Miller
Deputy Commanding General
U.S. Army Training And Doctrine Command Fort Monroe, VA

GEN Dennis J. Reimer, Chief of Staff of the Army (CSA), in the *U.S. Army Training and Doctrine Command (TRADOC) Black Book 3—Requirements Determination,* charged the Commanding General of TRADOC to approve all Army warfighting requirements and to establish procedures to determine and document requirements. GEN Reimer stated, "Our goal is to speed up the requirements determination process while at the same time improving its product."

Advanced Concept Technology Demonstrations (ACTDs), like Army warfighting experiments and battle lab experiments, have substantial potential as one means to meet the CSA's goal. ACTDs permit experimentation and refinement of requirements across the entire range of Doctrine, Training, Leadership Development, Organizations, Materiel, and Soldiers (DTLOMS) within the joint environment. History teaches that change in technology requires consideration of change across all the DTLOMS domains. It's important to note the word "concept" within Advanced Concept Technology Demonstrations. As an example,

experimentation with new technology requires development and experimentation with alternative tactics, techniques, and procedures (TTP). Insights derived from experimentation may require new doctrine or changes to field manuals. The same insights may well impact organizational TO&E structures, programs of instruction, military occupational specialties, and provide for refinements to mission needs statements and operational requirements documents.

ACTDs, like Army warfighting experiments and battle lab experiments, conduct the experimental process via an integrated teamwork construct that combines the combat development, the user, the materiel development, and the test and evaluation communities. To this end, an Army ACTD process has recently been published within TRADOC Pamphlet 71-9, The Requirements Determination Guide.

ACTDs provide an excellent opportunity to accelerate the fielding of important new capabilities. A hallmark characteristic of ACTDs is the residual capability left with the sponsoring warfighting CINC. Additionally, successful ACTDs can compete within the Army's Warfighting Rapid Acquisition Program to accelerate initial acquisitions beyond the ACTD residual capability. Properly selected and structured ACTDs are excellent tools within the requirements determination business and offer great potential to fulfill the CSA's goals of speeding up the process and improving the product.

Emily Vandiver
Technology Program Manager
Rapid Force Projection Initiative ACTD
Huntsville, AL

The objective of the RFPI ACTD is to improve the capabilities of early entry forces. As the RFPI ACTD Technology Manager, my mission is to oversee RFPI technology development activities, integrate the RFPI elements with organic assets, and deliver the resulting System of Systems to my TRADOC operational counterpart. ACTDs require a close user/developer relationship from the beginning of the program through the residual period. This blending of operational concepts and mature technologies will support early assessment of military utility for potential transition into a streamlined acquisition process. Working with the user, XVIII ABN Corps, and the user representative, TRADOC, has given me a unique opportunity to better understand the operational requirements of early entry units.

The RFPI ACTD large-scale field experiment, 4Q FY98, will provide developers a mechanism for rapid feedback from participating soldiers concerning the application of RFPI technologies in an operational environment. ACTDs include a two-year residual period that offers the user opportunities to further refine operational requirements. RFPI provides a limited quantity of mature sensors and weapon systems with sufficient C2 and digital fire control capabilities configured into operationally significant sets for early entry scenarios. At RFPI, we are achieving our mission to provide advanced technologies to our ultimate customer, the soldier.

COL Paul E. Wolfgramm
Director
Joint Precision Strike
Demonstration Project Office
Fort Belvoir, VA

ACTDs have provided the Joint Precision Strike Demonstration (JPSD) Project Office the flexibility to use new program approaches. Our primary function has become that of managing Army-assigned ACTDs. With two ongoing ACTDs, Precision/Rapid Counter-Multiple Rocket Launcher (CMRL) and Rapid Terrain Visualization (RTV), and a third one, Theater Precision Strike Operations (TPSO), proposed for FY98, we have acquired some unique experience and have applied it to refine the way we do business.

One of our objectives has been to improve the process for leveraging and integrating mature technology and transitioning supportable, enhanced or new products to the warfighters. The method that has worked best for JPSD is the building block approach. Its value is in providing the user an enhanced capability at the earliest time, while reducing risk in complex programs. The concept requires a strong teaming approach between the demonstration manager, operational manager, the user, and supporting project managers and laboratories in all phases of the program. It is based on streamlined techniques, such as rapid prototyping or skunk works, to integrate and test ACTD products, with the introduction of those initial products to the user organization during an early exercise or demonstration. The initial products provide an enhanced or new capability, but may only be a 65 percent solution. Incremental improvements are then added and demonstated annually, achieving full operational capability over a two- to three-year period.

Fielding ACTD products early provides feedback on features that are then improved prior to the next demonstration, enables the concurrent development of tactics, techniques and procedures, and permits the user to take advantage of an improved operational capability at the earliest opportunity. This approach for ACTDs, coupled with a sound plan for training, sustainment and transition, has proven to be an extremely effective method for supporting the warfighters.

COL Sammy L. Coffman
Deputy Director, Depth and
Simultaneous Attack Battle Lab
Fort Sill, OK

Our recent participation in the Counter Multiple Rocket Launcher ACTD was very enlightening. First, it was an excellent opportunity to examine doctrine, training, and materiel requirements in an enhanced simulated environment, coupled with soldiers operating tactical equipment and prototypes of new technologies. As we looked at how we do business today locating and defeating enemy systems, the ACTD provided a robust tool for future requirements determination that has not been available in the past. Secondly, the requirement to provide "leave behind" capabilities to a warfighting CINC required that we work through training, continuity, and interoperability issues for an operational system. The lessons learned by soldiers working in a "leave behind" system provide an opportunity to refine these systems prior to making a final acquisition decision.

ARMY HONORS 50 ENGINEERS AND SCIENTISTS WITH R&D ACHIEVEMENT AWARDS

By Dr. Marilyn M. Freeman

One of the highest honors the Assistant Secretary of the Army for Research, Development and Acquisition can bestow on members of the engineering and scientific community is the Department of the Army Research and Development Achievement (RDA) Award. This prestigious award recognizes outstanding achievements or leadership by Army engineers and scientists in research and development that have resulted in improved U.S. Army capabilities and contributed to the nation's welfare.

Each year, every major Army R&D command nominates individuals or small teams who have conducted outstanding R&D efforts during the previous year to be considered for this honor. Evaluation of the nominations is conducted by an RDA Evaluation Committee, composed of highly qualified members of the Army science and technology community and headed by the Director for Research and Laboratory Management. Nominations are evaluated on overall quality, technical merit, importance to the Army and contribution to the national interest. For nominations representing the combined efforts of a team, the contribution of each individual is also evaluated. Those nominations which represent truly outstanding achievements by the individuals conducting or leading the R&D efforts receive the award.

The 1996 RDA Evaluation Committee selected 50 Army scientists and engineers to receive RDA awards for work conducted in 1995. Through their efforts in conducting high quality, relevant R&D research and engineering projects designed to enhance the capabilities of our soldiers and the systems they use on future battlefields, these scientists and engineers have brought great credit to themselves, the Army, and their respective commands and organizations. Below, grouped by command and organization, are the names of the award winners and the subject areas in which they distinguished themselves. Each individual will receive an official letter of commendation and an award plaque.

U.S. ARMY MATERIEL COMMAND

U.S. Army Research Laboratory

Melanie Will Cole, Weiyu Han and *Dr. Kenneth Jones* were recognized for outstanding research efforts leading to improved reliability for gallium arsenide/aluminum-gallium arsenide heterojunction bipolar transistors (HBTs). HBTs are of immense importance to future Army systems which rely on microwave and digital electronics. In this project, the individuals utilized their expertise to develop a new contact technology that will greatly increase the lifetime of HBTs, improve the current-voltage characteristics of HBT devices, and reduce variation in parameters from device to device.

Dr. T. Richard Jow and *Dr. Jian Ping Zheng* received awards for achievements in the development of high-power electrochemical capacitors for 'burst' communications and vehicle applications. These researchers developed a new form of metal oxide composite electrode material with a specific capacitance at least two times higher than the highest value reported for any other capacitive-type electrode material. Tests of a prototype capacitor revealed that the energy density and power density of the new device were extremely high. Through this effort, Jow and Zheng have made significant contributions to the development of the type of high energy electrochemical capacitors which are being sought for application in high pulse wireless communications systems and the next generation hybrid vehicles.

Dr. Tristan J. Tayag and *Dr. David M. Mackie* were recognized for significant efforts resulting in advances in waveguide beamsplitter technology. These individuals devised and demonstrated a technique for implementing Talbot effect beamsplitters in diverse waveguide material systems. The devices fabricated using this technique exhibited notable improvements over other splitter techniques in splitter uniformity, insertion loss and polarization crosstalk. Both the Army and commercial firms are interested in applying this new technology for improved optical control of phased array antennas and for lithium niobate waveguide devices.

David M. Hull received the award for conducting a demonstration of electrostatic sensing technology. Hull conceived and implemented an analytical and experimental program that established the scientific basis which will allow the Army to adequately consider electrostatic fuzing concepts, design-effective elecrostatic sensors and evaluate their expected performance. This achievement will have significant impact on the armaments community by offering the potential to utilize extremely simple, low-cost, low-power, mechanically rugged, sensors for future munitions fuzing applications.

Dr. Lang-Mann Chang was awarded for innovative ignition systems for Army cannon weapons. Chang devised and demonstrated new ignition systems for both the 155-mm Crusader Cannon and an upgraded version of the 120-mm Tank Gun. Use of these new ignition systems will allow both cannons to deliver maximum performance with greater safety for the crew.

Dr. Jubaraj Sahu, Charles J. Nietubicz and *Karen R. Heavey* received awards for their outstanding work which led to the development and application of time-dependent navier-stokes computational capability for multibodies in relative motion. Through the research efforts of these individuals, the Army now has the capability to more accurately predict the effects of aerodynamic interferences for multibody problems of the type encountered in the design and evaluation of multibody projectiles.

U.S. Army Armament Research, Development and Engineering Center

Dr. Rao Surapaneni and *Brian E.C. Travers* were awarded for development of a new more powerful explosive, 1,3,3 trinitorazetidine (TNAZ). These individuals developed a new high yield, low polluting synthetic route for synthesizing TNAZ which is a very powerful melt-castable explosive. This synthetic process uses no halogenated solvent and significantly reduces the amount of waste generated during synthesis.

Dr. Ernest L. Baker, Gerard P. Voorhis and *Joseph Orosz* were recognized for significant achievements in research on highly ductile molybdenum for anti-armor warheads. Through the efforts of these researchers, a new technology for processing a molybde-

num liner for shaped charges was very rapidly developed. In addition, they demonstrated that, with this liner, there is a significant increase in ductility of the shaped charge jet. This finding will enable the development of a new family of shaped charge warheads with enhanced performance.

Dr. Tung-Ho Chen and *Dr. Edward Hochberg* received recognition for developing a state-of-the-art analytical scheme for primer composition quality control applications. The efforts of these individuals included development of several new analytical methodologies and the integration of these into an efficient analytical scheme which reduced the total elapsed time for analyzing a specific primer composition in production at an Army ammunition plant from three days to a few hours. The method, which eliminates the need to handle the extremely sensitive dry primer and minimizes the use of highly corrosive acids currently required for compositional analysis, will also result in improved laboratory safety and reduced adverse environmental impacts.

Dr. Suryanarayana Bulusu was recognized for discovery of a generic reaction common to all cyclic nitramines including RDX and HMX: Formulation of a Nitrosamine with initial cleavage followed by reformation of the nitramine nitrogen-nitrogen bond. Bulusu obtained, in extraordinary detail, the reaction pathways, bond-breaking steps, rate-controlling processes and catalytic species involved in the decomposition of nitramine propellants. His efforts will be extremely valuable to the Army for molecular engineering of future, more efficient advanced explosives and propellants.

Dr. Sabrina L. Lee received an award for research on residual stress and texture techniques for materials characterization. Texture causes directional properties in materials which often affects their performance under conditions of stress. Lee developed improved methodologies, procedures and techniques for characterizing the stress and texture of materials using X-ray diffraction and applied these to the study of residual stress in weapon system components, textured refractory bore coatings and semi-conductor thin film devices. Lee's work will enable the Army to design and produce more reliable, more durable weapon systems in the future.

Dr. Shih C. Chu received recognition for development of a more rational nonlinear approach to lighter armament design. Chu devised an effective incremental nonlinear thermoplastic theory for analyzing and designing modern weapon structural components. Utilization of this theory will result in the capability to design lighter weapon systems with not only a definite increase in mobility and deployability of light forces, but also a reduction of manufacturing and transportation costs.

DEPARTMENT OF THE ARMY RESEARCH AND DEVELOPMENT ACHIEVEMENT AWARD FOR 1996

Assistant Secretary of the Army (Research, Development and Acquisition)

U.S. Army Aviation Research, Development and Engineering Center

Dr. Roger Strawn was awarded for developing new computational methods for the prediction and analyses of helicopter rotor noise. Strawn devised and executed a research program in acoustics that included algorithm development, validation, computer implementation and audio-visual analysis of helicopter noise. This effort established a strong scientific basis for using high-performance computing capability to effect improvements in design of military and civilian helicopters.

Dr. Earl Duque, Susan Althoff Gorton and *Dr. John D. Berry* were recognized for outstanding achievements in the field of advanced interactional aerodynamics. These individuals devised and implemented an innovative methodology to rotorcraft research incorporating interdisciplinary and virtual testing concepts. The resultant capability to better understand and predict aerodynamic phenomena of rotorcraft before a new platform is flown will save the Army a great deal of time and cost.

U.S. Army Communications and Electronics Research, Development and Engineering Center

Dr. John A. Kosinski received the award for discovering a breakthrough in understanding the fundamental nature of acceleration sensitivity in phase coherent signal sources. This breakthrough will have a wide effect on Army electronic systems. The results of this program are applicable not only to bulk acoustic wave, surface acoustic wave and surface transverse wave resonators, but also to novel microwave/millimeter microwave monolithic integrated circuit compatible thin film resonators currently under development. Programs which have been or are expected to be impacted are the Army Advanced Threat Radar Jammer, Longbow Missile, and Patriot PAC-3 Upgrade. A number of Air Force and Navy programs will also benefit.

Jim Galanis, Almon Gillette and *Carl Klatsky* were awarded for their efforts which led to asynchronous transfer mode (ATM) technology insertion into tactical communications systems. These individuals developed the required enhancements to commercial ATM switching, mobile subscriber equipment architectures and global broadcast satellite systems to permit Army and joint commanders to access resources on the terrestrial ATM network. As a result of their efforts, it was demonstrated that it is possible to have dynamic exchange of information in split base operations through multimedia video teleconferencing. This achievement will have a significant impact on the Army's future battlefield communications requirements.

U.S. Army Edgewood Research, Development and Engineering Center

Dr. James O. Jensen was recognized for

theoretical predictions of spectra of chemical and biological agents in fluorescence and infrared absorption. Jenson's accomplishment was to develop new and improved models of theoretical chemistry for spectral predictions of biological and chemical agent compounds, essential for calculating the fluorescence and infrared absorption of very complex molecular species. This project gave the Army a capability to provide spectra of chemical and biological agents using advanced computational chemistry rather than by hazardous, expensive experimental testing.

Dr. Mark L.G. Althouse, Steven J. Kolodzey and *Dr. William M. Lagna* were awarded for their individual efforts toward warfighter survivability enhancement: development and transition of the joint Service lightweight standoff chemical agent detector system. The contribution of these individuals significantly advanced the state of the art in open-path Fourier transform infrared detector technology. The specific device developed is capable of detecting nerve and blister agents while the soldier is on the move at distances up to five kilometers. The results of their work will be used to improve survivability on the battlefield by affording automated wide-area early alarm in the event of chemical attack.

U.S. Army Missile Research, Development and Engineering Center

Dr. Jonathan P. Dowling received the award for work on a new mathematical method for modeling electromagnetic wave emission and propagation in photonic bandgap materials. Dowling's study of photonic band edge effects led to several new optoelectronic device applications, such as the band-edge laser, the nonlinear band-edge optical limiter, the non-linear optical diode, and the band-edge delay line.

U.S. Army Natick Research, Development and Engineering Center

Martin Katz and *Dr. Donald Rivin* were recognized for their efforts to develop lightweight, stretchable chemical protective fabric. Using their individual scientific and engineering expertise, Katz and Rivin developed a family of fabrics which significantly reduces heat stress on and allows freer movement of the individual soldier garbed in protective clothing. One version of this new fabric may be used to line the gloves of firefighters.

Dr. Masato Nakashima and *Brian S. Kimball* were awarded for study and characterization of the nonlinear optical effects in metallo-meso-tetrabenzporphyrin molecules. Increased understanding and accurate measurement of the behavior of nonlinear optical materials are vital to development of tunable laser eye protection for the soldier. The individual efforts of the awardees resulted in development of new nonlinear materials with significantly improved performance which has been applied to tunable laser protective eye wear.

Dr. Joseph A. Akkara received the award for development of multifunctional materials by enzyme-based technology for survivability and sustainability. Polymer materials are used in a wide variety of Army applications and the cost of high quality, special-purpose polymer materials is often high. Akkara demonstrated that synthesis and modifications of polymer materials by enzyme-catalyzed reactions is feasible, practical and cost-effective when compared to the standard synthesis processes involving inorganic metal catalysts. Applications for the novel materials which can be produced with enzyme-based technology include laser eye protective gear, fire resistant and retardant fabrics or coatings, rechargeable batteries, photoresist materials, and moisture/oxygen resistant protective food packages.

U.S. Army Tank Automotive Research, Development and Engineering Center

Dr. Francis B. Hoogterp and *Mikell K. Eiler* were awarded for their individual efforts in active suspension research for off-road vehicles. The individual researchers evaluated commercial active suspension systems and identified special needs for off-road suspension control. They also developed a computer-aided design software package to assist in evaluation of control algorithms, designed a mathematical model of the active suspension of an off-road vehicle, and designed a variety of active suspension controllers. Their research resulted in a controller design which is predicted to enable an Army off-road vehicle to achieve an increase in cross-country speed of 50 percent.

ARMY CORPS OF ENGINEERS

U.S. Army Cold Regions Research and Engineering Laboratory

Dr. Donald G. Albert was awarded for development of physical theories associated with acoustic and seismic propagation in cold regions. Previous theories and models addressed transmission of signals over unfrozen ground and did not include the effects of frost or snow which can dominate the acoustic and seismic propagation of signals received by military sensors used to detect, classify and track ground targets. This work will significantly improve the Army's capability to build smart weapons with the ability to maintain reliability even in harsh winter environments.

U.S. Army Waterways Experiment Station

Dr. Ernesto R. Cespedes, Dr. William M. Davis and *Jeff F. Powell* received awards for development of a cone penetrometer-deployed sensor for subsurface explosives detection. This sensor was developed for use as a rapid site screening tool to characterize soils which have been contaminated by explosives. The scientific innovation and engineering skills which the awardees applied to this project resulted in the Army's new capability to perform characterization of explosive-contaminated soils in situ, thereby decreasing the time and cost required for remediation of contaminated sites.

Jerry Miller, Evelyn Toro and *Dr. Mark E. Zappi* were awarded for their individual achievements while developing a process to use peroxone oxidation for treating explosives-contaminated groundwaters. The peroxone process has been demonstrated to have many advantages over more traditional treatment processes. The technology developed through the achievements of the recipients has been adopted by the U.S. Army Environmental Center and applied by several Corps of Engineer Districts. The benefit to the Army lies in the increased treatment effectiveness at a greatly reduced cost.

ARMY MEDICAL RESEARCH AND MATERIEL COMMAND

U.S. Army Research Institute of Environmental Medicine

LTC Ronald L. Shippee received the award for identifying deficiencies in immune function of soldiers under various adverse/stress conditions. Shippee conducted a series of comprehensive studies using physiological indicators of stress, nutritional status and task performance measures to determine the immune system response to physically and mentally stressful environments. This achievement may lead to a methodology for reducing the soldier's susceptibility to infections in the field.

DR. MARILYN M. FREEMAN received her Ph.D. in materials science and engineering at The University of Texas at Austin in 1996. She is an employee of the U.S. Army Research Laboratory, Weapons and Materials Technology. Freeman is on a developmental assignment in the Office of the Director for Research and Laboratory Management, Office of the Assistant Secretary of the Army (Research, Development and Acquisition).

WORLD-CLASS RESEARCH AND DEVELOPMENT

By Dr. Joseph F. Soukup
and Bruce Braun

Introduction

The U.S. Army intends to conduct world-class research to help maintain its superiority in land warfare. But what does "world-class" research mean, especially for organizations within the Army? To answer this question for one Army organization, the National Research Council, through its Board on Army Science and Technology, recently completed a report for the Natick Research, Development and Engineering Center (RDEC). That report, which defines the characteristics of a world-class research, development, and engineering (RD&E) organization, was intended to assist the Natick RDEC in achieving its vision of being a world-class RD&E team. But, the value of the report doesn't stop with Natick. The report, especially its 25 characteristics and 100 metrics for world-class performance, contains valuable guidance for Army organizations other than the Natick RDEC.

In the words of the committee of experts that wrote the report, "These concepts, characteristics, and metrics should be considered by the Army or outside reviewers for use in assessing other Army RD&E organizations." The committee went on to say that "Army RD&E organizations should consider using these concepts, characteristics, and metrics for self-evaluation."

What about research and development organizations outside the Army, or even in the private sector? The committee recommended that the concepts be considered by RD&E organizations in general, both for assessments and self-evaluations. (Sizable dissemination of the report suggests that at least some RD&E organizations are taking this recommendation to heart.) However, the committee offered the following caveat. "Some tailoring of the characteristics and metrics will probably be needed to suit specific organizations, be they inside or outside the Department of Defense."

Highlights of the report, published in September 1996 by the National Academy Press, are summarized in this article.

Background And Approach

The Natick RDEC is an element of the U.S. Army Soldier Systems Command, which is a major subordinate command of the Army Materiel Command. The technical director of the Natick RDEC requested the assistance of the National Research Council in shaping the RDEC's future role and direction. The Board on Army Science and Technology's Natick Standing Committee was asked to: define and identify the major components of world-class research, development and engineering; and determine measurable qualitative and quantitative characteristics (and associated metrics) that must be met in order for an Army RDEC to declare itself world-class. The characteristics and metrics were to be used later by the committee for an assessment of the Natick RDEC. The results of this assessment are scheduled to be reported in September 1997.

The committee recognized that the phrase "world-class" is widely used and has different meanings for different people. Although providing a general definition of "world-class" is relatively easy, defining the term for a research and development organization, particularly an Army RDEC, is more difficult. The committee attempted to develop a definition that takes into account the Army's mission and the RDEC's role in fulfilling that mission.

An Army RD&E organization has unique features (e.g., it exists principally to serve the Army) that distinguish it from academic and industry research and development centers. Nevertheless, the committee found that research and development centers that are considered world-class share similar, measurable characteristics.

Definition Of World-Class R&D

To define world-class research and development (R&D), the committee drew on material from general discussions with representatives of industry, academia, and government. The committee also examined relevant literature and four examples of widely respected organizations (i.e., Motorola, Milliken & Company, Intel, and FedEx).

The committee determined that a world-class R&D organization is one that is recognized by peers and competitors as among the best in the field on an international scale, at least in several key attributes.

The committee observed that world-class R&D organizations maintain performance by creating and sustaining certain critical competitive advantages (e.g., a strategic focus on unique competencies of the *organization*). These competitive advantages result from excellence in five key attributes, which are often called pillars. The pillars are: customer focus; resources and capabilities; strategic vision; value creation; and quality focus. These pillars are founded, in turn, on a demonstrated commitment to achieving world-class performance.

Figure 1 depicts the major components of a world-class R&D organization, which are demonstrated commitment, the five pillars, and the competitive advantages. Of these, the committee believed that the base—a demonstrated commitment—is the most important. Without it, aspirations to

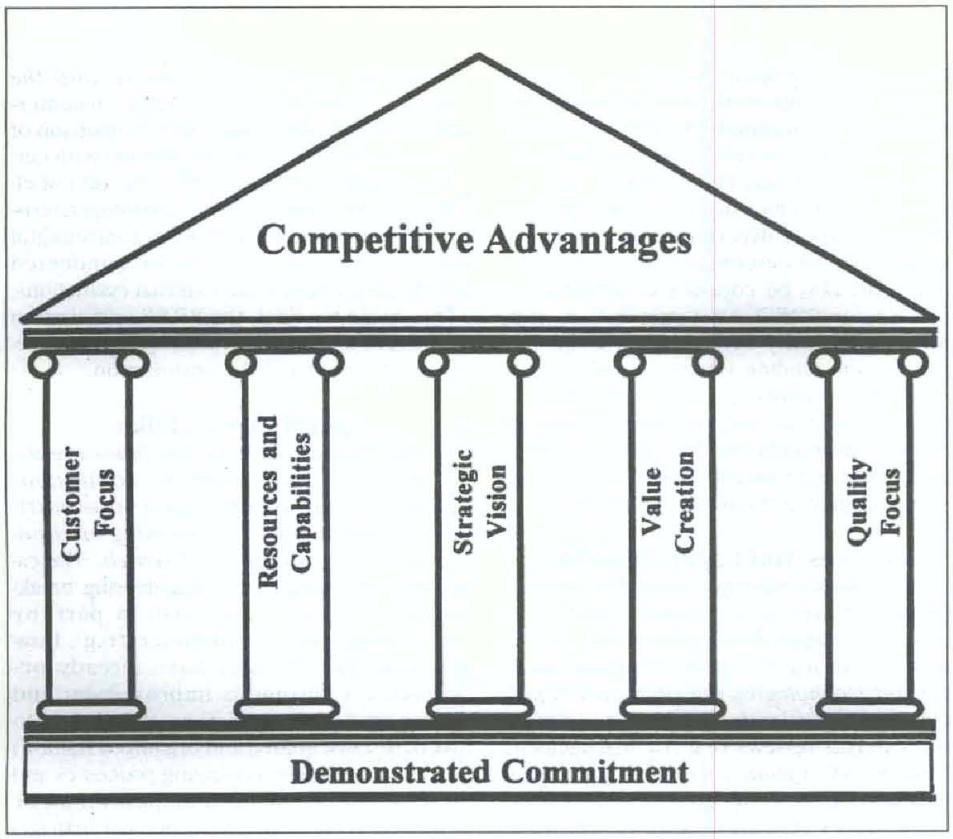

Figure 1.
Relationship Of The Components Of World-Class R&D Organizations.
This figure shows the relationship of the components that the committee judged to be mandatory considerations for a world-class R&D organization; It is not meant to convey organizational structure. The central components were considered by the committee to be absolute, rigid supports for world-class performance and, therefore, were deliberately portrayed as pillars. Portrayal of these components as pillars clearly does not preclude their implementation through a flexible, open, productive, and supportive organizational structure. In fact, the metrics for assessing the strength of each pillar reflect the committee's understanding and validation of an organizational structure that achieves the world-class objective. (Reprinted with permission from World-Class Research and Development. Copyright 1996 by the National Academy of Sciences. Courtesy of the National Academy Press, Washington, DC.)

achieve world-class performance will be doomed.

World-Class Army RD&E

The uniqueness of an Army RD&E organization makes it difficult to find similar peer and competitive organizations on which to base performance comparisons. Therefore, a definition of a world-class Army RD&E organization must also recognize the unique aspects of an organization's vision, mission, and strategy.

For example, the Natick RDEC mission, which flows from its vision of becoming a world-class organization, is to:

• Maximize the soldier's survivability, sustainability, mobility, combat effectiveness and quality of life through the research, development, and engineering of items such as rations, clothing, shelters and airdrop systems;

• Provide the necessary research, development, and engineering to integrate several combat-essential elements (e.g. survivability, sustainability, and mobility) into the soldier system; and

• Perform similar, related functions for other Department of Defense Services and federal agencies (e.g., be the center of excellence for food science and technology).

The Natick RDEC strategy includes developing highly-skilled personnel, acquiring quality equipment and facilities, and establishing consistent and stable funding. However, this strategy—and ultimately the vision—are necessarily influenced by the current environment, which includes shrinking budgets and levels of personnel.

Taking the factors listed above into account, the committee determined that a world-class Army RD&E organization is one that excels in several attributes by matching core competencies to its mission, thereby fulfilling the needs of soldiers as well as, or better than, similar organizations anywhere in the world.

To achieve and maintain world-class performance, an organization must identify and develop the necessary core competencies. For an Army RD&E organization, these include the ability to move quickly from developing to fielding new, applied technologies. The technological capability must encourage continued development of new, superior products.

The committee believed that the pillars of a world-class R&D organization (see Figure 1) provide the most convenient means of articulating the prominent aspects of world-class performance. The five pillars are also applicable to Army RD&E organizations. The pillars are described below.

• Customer focus is the ability to identify, anticipate, and respond to customer needs, both now and in the future. The focus is on internal customers as well as external customers.

• Resources and capabilities are the assets and talents with which the organization creates value for the customer.

• Strategic vision is a mental view of the type of organization that senior-level management would like the enterprise to become. This vision must be communicated indelibly to all personnel and translated into key elements that will make the vision a reality.

• Value creation is the ability to produce or increase benefits perceived by customers so they feel they are getting more value than they expected or previously received.

• Quality focus is the ability to continue striving for higher quality. The commitment to quality often results in breakthroughs.

Characteristics

The characteristics of a world-class RD&E organization are derived from the five pillars. The committee judged that 25 characteristics are most relevant to an Army RD&E organization. These characteristics are discussed below according to the pillar under which they fall.

Customer Focus Pillar

The characteristics of this pillar are customer satisfaction, customer involvement, and market diversification. Both types of customers (e.g., internal product development teams and soldiers external to the RD&E organization) can be surveyed to ascertain how satisfied they are with the technological solutions and products delivered. Customer involvement in setting program objectives and following progress can also be evaluated. Although an Army RDEC must

The uniqueness of an Army RD&E organization makes it difficult to find similar peer and competitive organizations on which to base performance comparisons. Therefore, a definition of a world-class Army RD&E organization must also recognize the unique aspects of an organization's vision, mission, and strategy.

focus on the primary markets it serves, some market diversification is proper for any RD&E organization. Indeed, in the private sector world-class RD&E organizations seek to exploit fully the results of their research and product development. The extent of market diversification by Army RDECS can be determined; but diversification must also be considered carefully because Army RDECs exist primarily to support their Army missions and rely on government funding, which is usually authorized only to satisfy specific needs. Satisfaction, involvement, and the nature of market diversification indicate how well an RDEC is connected with and focused on the long-term and short-term needs of customers.

Resources And Capabilities Pillar

The characteristics of this pillar are the quality of personnel; facilities and infrastructure; budget; RD&E capabilities, skills, and talents; use of external resources; important technologies; information technology; and organizational climate. Internal and external reviews (e.g., by management of the RD&E organization or by higher headquarters) can be conducted to assess the organization's resources and capabilities. These reviews may include analyses of the core technical programs, evaluations of employee morale and the research climate, and assessments of the ability to reach "make versus buy" decisions. The quality and quantity of the human, physical, and financial resources and core capabilities of the RD&E organization indicate the ability and power to achieve world-class results. A positive organizational climate usually correlates with high productivity.

Strategic Vision Pillar

The characteristics of this pillar are alignment of vision and mission, anticipatory strategic planning, stakeholder buy-in, and leadership. Internal and external (e.g., peer) reviews can determine if the strategic vision of the RD&E organization and the mission are aligned and whether anticipatory strategic planning is sufficient to develop future Army and joint Service products rapidly. To assess stakeholder buy-in, the stakeholders must first be identified. Assessments of strategic vision should include the organizational leadership to ensure that the organization's vision is understood by staff and stakeholders alike. The quality of the strategic vision will give a reading of the enduring capability of the organization to plan and achieve world-class results.

Value Creation Pillar

The characteristics of this pillar are a proper portfolio, product performance, cycle time and responsiveness, and the value of work in progress. Value creation is often a perception based on a comparison of previous products (or lack thereof) with current products. Reviews of the breadth of effort (i.e., the portfolio) and other characteristics are important for making a meaningful assessment. Reviews can be conducted using both internal and external evaluations. The extent to which the RD&E organization produces outstanding, meaningful results reflects the impact of the organization.

Quality Focus Pillar

The characteristics of this pillar are the capacity for breakthroughs, continuous improvement, commitment to quality, structured processes, a learning environment, and the quality of research. The capacity for scientific and engineering breakthroughs can be assessed, in part, by reviewing past performance (e.g., how many breakthroughs have already occurred). Continuous improvement and structured processes (i.e., the ability to work in a disciplined and organized fashion) can be assessed by reviewing processes and results. The commitment to quality must be assessed at all levels, from topmost management down. Reviews can determine the ability of the staff and the organization as a whole to learn and use knowledge to achieve outstanding results. Finally, research quality can be assessed by expert review. Measurements of all these characteristics can give an overall assessment of the focus on quality in an Army RD&E organization.

Metrics To Measure The Characteristics

Metrics can be developed to measure various aspects of input, processes, output, and outcomes in the past, present, and future. Using the wrong metrics may limit performance or lead to inappropriate results. For an RD&E organization, the metrics should foster improvement and be related to the vision and mission.

With these factors in mind, the committee developed a set of metrics that can be used as part of an assessment of the Natick RDEC. Beyond measuring the extent to which the RDEC exhibits world-class performance, the metrics can also be helpful for self-evaluation or for evaluations of other RD&E organizations by higher-level Army commands.

To describe adequately the many facets of RD&E performance, the committee chose metrics with qualitative descriptors for four levels of performance. These levels are poor, adequate, good, and excellent. The committee believed that a predominance of excellent performance is necessary for an

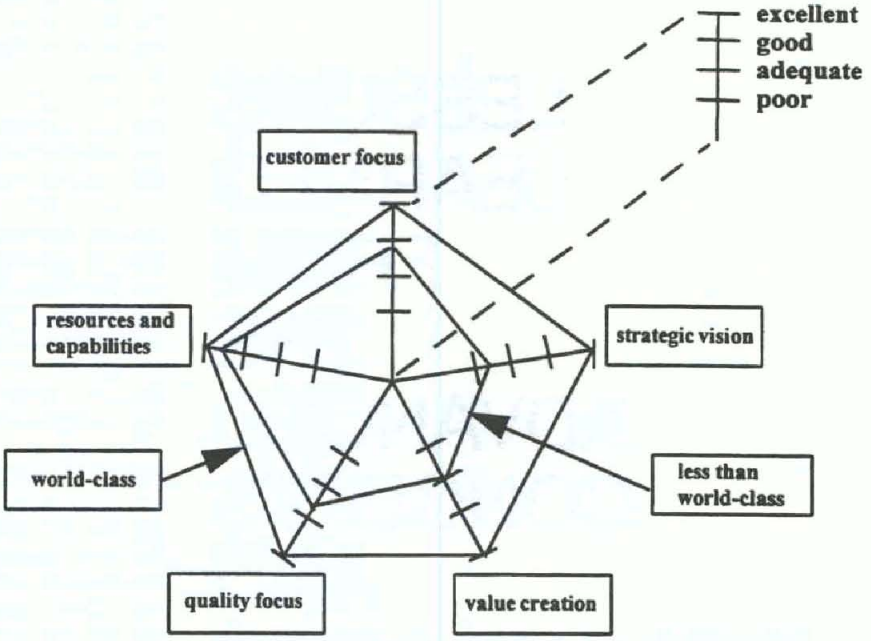

Figure 2.
Spider Diagram.
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organization to be deemed world-class. The committee also considered the concept of best in class, which is the level of performance beyond excellent. This level is not included in the metrics because descriptors would apply to unique situations.

Although not contained in this article, the 100 metrics (i.e., 25 characteristics, with four metrics each) are tabulated in Tables 4-1 through 4-5 according to the characteristics to which they belong. They are sorted by pillar (e.g., there are 12 metrics for the customer focus pillar, four for each of the three characteristics). Assessment results can be summarized in Table 4-6 (also not included in this article) or in a spider diagram, such as that shown in Figure 2 of this article. Tables 4-1 through 4-6 appear in the NRC report. Limited copies of this report are available from the National Academy Press, Box 285, 2101 Constitution Ave., N.W., Washington, DC 20055, or by calling: (800)624-6242 or, in the Washington metropolitan area, (202)334-3313.

It should be noted that the committee implicitly gave equal weight to all five pillars. Under some circumstances, it may be appropriate to assign greater weight to one pillar or another. Other adaptions (e.g., for self-assessment) could also be considered.

Conclusions And Recommendations

Among the committee's many conclusions and recommendations, the following are some which are highlighted here for emphasis.

- The phrase "world-class" is widely used to describe products and services. This phrase, however, can reasonably mean different things to different people. Therefore, if the phrase "world-class" is to be useful as a vision, it must be defined, tailored, and characterized in detail.
- Efforts to reach or maintain world-class performance require the demonstrated commitment of the full chain of command, from topmost management to the lowest level.
- Good or excellent performance for each of the 25 characteristics, and excellent overall performance for all five pillars, are believed to be necessary for an organization to be judged world-class.
- The concept of a world-class organization should be used principally as an internal focusing mechanism for achieving excellence rather than as an external mechanism for advertising the virtues of an organization.

DR. JOSEPH F. SOUKUP is a group Senior Vice President at Science Applications International Corporation and Chair of the National Academy of Sciences' Natick Standing Committee. He holds a Ph.D. in pharmacology and physiology from Duke University and served as vice lead expert for the committee's Biotechnology and Biochemistry Technology Group of the National Research Council's study, Strategic Technologies for the Army of the Twenty-First Century, STAR 21.

BRUCE A. BRAUN is the Director of the Board on Army Science and Technology at the National Academy of Sciences. He holds a bachelor's degree from Purdue University and three master's degrees in management, administration, and military strategy. He is also a retired Army officer with 27 years of service.

Looking Back. . .

LESSONS LEARNED FROM THE ADVANCED CONCEPTS AND TECHNOLOGY II PROGRAM

By MAJ Larry D. Hollingsworth

Introduction

The Army Advanced Concepts and Technology (ACT II) program solicits innovative mature and maturing technologies through an annual Broad Agency Announcement (BAA). Solicited concepts address U.S. Army Training and Doctrine Command (TRADOC) pressing requirements as identified by BAA topics developed by the TRADOC Battle Labs and Combat Development Centers. In response to these topics, contractors submit specific two-page concepts which, if ultimately selected in the proposal stage, may be demonstrated within a year of contract award with a budget not exceeding $1.5 million each.

The selected year-long projects are awarded contracts through the Army Research, Development and Engineering Centers and labs within the Army Materiel Command, the Army Corps of Engineers, the Army Medical Research and Materiel Command, and the Army Research Institute. These organizations provide not only technical evaluations of concepts and proposals, but also contract administration and technical monitoring of each executed project. In addition to making the final selection of awarded projects, the TRADOC Battle Labs provide the contractors with the required Government Furnished Equipment and assets needed to demonstrate the respective projects. Battle Lab Demonstration Managers coordinate the activities of the contractor and the materiel developer team on each of the ACT II projects.

Managing an ACT II contract exposes the project officers to the entire acquisition process in a very short period of time, and allows them to work daily with cost, schedule and contract performance. However, the short duration offers little rebound opportunity to adjust for schedule delays and unexpected budget challenges.

As the Senior Project Officer for WARLAB XXI and a member of Battle Command Battle Lab, I managed the development of a 21st century prototype advanced learning environment at the Command and General Staff College (CGSC). The primary goal of WARLAB XXI was to apply commercial off-the-shelf information and battlefield visualization technology to the military decision-making process (MDMP) to determine potential efficiencies over the manual process currently taught at CGSC. The project included a myriad of diverse tasks. The WARLAB was designed to allow Army educators and leaders a capability to quickly work through the time-consuming but essential steps of mission analysis and course of action development and focus on wargaming and rehearsal. Additionally, the application of visualization technology allows students to see the battlefield and ask the right questions in a controlled classroom setting, otherwise experienced only in the field.

The project consisted of two phases. Phase I included the design and construction of an actual classroom facility in Bell Hall at Fort Leavenworth. The classroom required an automation configuration that accommodated both a local internal network and a fiber optic feed for connectivity outside the college. Phase II concentrated on MDMP developmental software integrated into the Maneuver Control System/Phoenix and a prototype visualization tool called Mission Planning and Rehearsal Training System (both projects were also developed through ACT II). During the contract, two performance demonstrations were conducted: an interim demonstration in late October 96 and the final contract close-out demonstration in February 97. The diverse nature and complexity of WARLAB presented numerous challenges and learning opportunities. The following is a list of WARLAB lessons learned that one can apply to almost any ACT II program.

• ***LESSON 1. Make the initial investment and prepare for the Pre-proposal Conference.*** The Pre-Proposal Conference (PPC) is the best opportunity to articulate the government's desired deliverables prior to contract award. Each TRADOC battlelab briefs their topics to industry. BAA topics are developed from high priority Future Operational Capabilities (FOCs). Well-prepared briefs and discussions facilitate this step in the evaluation process. Take the time to wargame what will be briefed and the plan to deliver topics at the PPC. If topics are too broad they will not communicate the intent to address a particular FOC.

Take the time to do a thorough review of both the offerors' concept papers and, eventually, their proposals. Let the research, development and engineering center technical staff lead the review process to ensure technical feasibility. Investigate each proposal to ensure it addresses a Battle Lab FOC and does not duplicate other ongoing efforts. If a contractor's deliverable requires signifi-

cant support from a developmental product, ensure the product is mature enough to adequately support the contract. Don't rely on unproven developmental technology as a critical component of the program. Determine the desired performance requirements of that component and then investigate proven alternatives.

• ***LESSON 2. Define performance expectations early in the process and develop an execution plan.*** ACT II contracting officers and technical representatives may delay this critical step. The short duration demands a strategy be mapped and specific performance objectives be defined within the first month. Contract modifications can occur. However, failure to develop objectives and establish milestones early will force playing catch-up during the execution phase of the contract. Bring the contract team together immediately. Include the prime contractor, any sub-contractors, the procurement contracting officer (PCO), the contracting officer's technical representative (COTR), the Battle Lab demonstration manager and an active representative from the user community. The strategy should address how the contractor is expected to demonstrate the deliverables at the end of the contract. At the first meeting, ensure review of the contract modification process with the prime contractor, the COTR and the PCO. Contract modifications may occur, and a clear understanding of the procedures early on will alleviate potential problems later in the contract. Clearly define how progress and performance will be documented. Database development, hardware configuration and software integration details are often missed because of limited time and resources.

There are several ways to showcase contractor deliverables. We developed a tactical scenario modeled after the CGSC core tactics course C320, "Corps and Division Combat Operations" that simulated receipt of a Corps operations plan and the execution of the MDMP to develop a division order. Whatever platform is chosen, ensure the scenario supports what is showcased. Be cautious about interim demonstrations. The display of a partial or incomplete capability may hinder or negate user support. Define the roles and responsibilities for all the players. As much as possible include the user community. They will play a key role in user-interface design for both hardware and software.

• ***LESSON 3. Plan for a realistic budget.*** Desired budget expenditures should focus on hardware and software development. However, support costs such as travel and performance reviews are often under budgeted. In most cases the contractor's facility is separate from the project officer's location. With WARLAB, the classroom facility was located at Fort Leavenworth and the two contractor locations were in Raleigh-Durham, NC, and Manassas, VA. The geographic challenge forces the development of alternative procedures that closely monitor contract progress. The few thousand dollars spent on travel to the contractor's facility will more than make up for the challenges created from lack of program supervision. Use caution when planning for interim reviews. They are time-consuming and expensive. The plan developed in February may not adequately support needs in October. Additionally, formal progress reviews take away from the momentum of the program. As a general rule, plan for one formal interim review in September or October, and a final program demonstration at the end of the contract in late February or early March. Use your travel budget to frequently visit the contractor's facility instead of providing high overhead formal productions.

Our experience on this project suggests that most contractor cost accounting practices include a delay in reporting; thus, it is critical to incorporate an informal system for at least bi-weekly cost updates from the contractor program manager. Frequent informal cost reviews may identify unexpected budget alternatives that would otherwise go unnoticed. Clearly define a logical stopping point that allows for a thorough program and funding review to provide a detailed close-out report to the customer.

• ***LESSON 4. Develop a program review strategy.*** It is critical for the contractor to understand the implied tasks associated with the statement of work. The initial kickoff meeting will only identify high-level goals and objectives. What is critical to the success of the contract is for the contractor to possess the requisite operational insights that allow him to continue work in the absence of the user or the government's project officer. The project officer will have to make an assessment of the contractor team early on to determine what degree of management oversight is appropriate.

Plan a contractor site visit immediately after contract award to gain an appreciation for the contractor's facility, technical capabilities and limitations, and their military insight into the project. The short duration of ACT II programs does not allow for long lead-time discovery learning. Plan for weekly performance updates. As WARLAB progressed we realized the need for weekly teleconferences to discuss software development, user interface issues and overall program status. Try to keep discussions informal and include the technical staff. We regularly used the file transport protocol site to transfer software updates from the contractor sites to the WARLAB. Video-teleconferencing and teleconferencing are both adequate alternatives to traveling. The submission of timely budget reports is critical.

Again, because of time constraints, it is necessary to keep close track of engineering labor hours and travel expenses. Without exception, the budget or spending plan will be modified, either to apply additional labor hours on a successful task, or to divert resources from an unnecessary task. Understand what the contract allows and don't hesitate to change direction to pursue success in a particular area. Contractors are sometimes hesitant to exercise the flexibility needed to make the program a success. Remember that the project leader's goal is to act in the best interest of the program.

• ***LESSON 5. Government Furnished Equipment (GFE) configuration.*** ACT II programs usually require some level of GFE to compensate the program spending cap. A robust GFE package provides leverage that otherwise would require development dollars spent for hardware and software. The concern for GFE use is to ensure differing hardware systems are configurable and that software and operating systems are compatible. Further, ensure all required GFE software source code is government controlled and available to the contractor immediately after award. Identify the configuration manager at the kickoff meeting and determine exactly what the GFE requirements are and the integration challenges associated with that GFE. Finally, ensure that the configuration manager stays abreast of and documents all software changes and updates throughout the contract.

Summary

ACT II contracts provide Battle Labs and other TRADOC organizations a valuable opportunity to confirm or deny the application of industry technology towards Army FOC requirements. The ACT II experience provides future program managers an excellent opportunity to manage the acquisition triad: cost, schedule and performance. WARLAB was an extremely successful contract. The educational and training innovations discovered certainly define the academic focus into the 21st century. These few lessons learned only scratch the surface in describing the valuable education the ACT II experience provides. I hope my lessons learned assist you as you manage your ACT II contract.

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EMBEDDING SENSORS IN WEAPON SYSTEMS TO PREDICT FAILURE

New Opportunities For Program Managers And Logisticians

By Emmanuel J. Nidhiry and Dr. Gary L. Anderson

Introduction

The Army's procurement appropriation is the lowest in 50 years. Consequently, the Army is forced to keep older systems well past their expected life. This means a larger expenditure in Operation and Maintenance (O&M) funds. However, our O&M outlays are also being reduced to an unprecedented level.

Potential ways to mitigate the problems associated with this predicament can be found in the recent advances of sensor technologies. Of particular interest is the Department of Defense (DOD)-sponsored micro-electro-mechanical systems (MEMS) research effort. The MEMS effort is accomplishing the monolithic merger of sensors, actuators and microprocessors to build closed-loop feedback components for gathering and processing information, deciding on a course of action and controlling the outcomes. These sensor devices can be embedded in equipment to predict and isolate failure with higher levels of confidence, thereby, reducing the manpower and resources associated with diagnostics and repair.

Army Research Office Efforts

U.S. Army Materiel Command's (AMC's) Army Research Office (ARO) is leading Army efforts to develop sensors to detect failures in structures and systems. On-going efforts to enhance and optimize available sensor technologies towards this goal are:

• **Health Monitoring of Planetary Geartrain Damage Using Piezo-electric Sensors.** This effort will develop piezo-electric sensors and methods to identify damage in helicopter planetary gear train transmission systems. These sensors will provide input to a neural network algorithm that includes rotation, geartrain casing temperature, and mechanical strain data. Damage to be detected includes chipped gear teeth, cracked gears, worn bushings, dirty lubricants, and faulty bearings. In helicopters, the gear train system is in the critical path to the rotor head and rotor blades. Since it must operate reliably during long periods of time, real-time health monitoring can help to improve the reliability by detecting faults and alerting pilots to take appropriate action. An on-line health monitoring system can maximize the time between inspection intervals. Prototypes of these sensors suitable for field use are expected to be available in three years.

• **Fiber Optic Sensors for Smart Structures.** The objective of this effort is to develop a fiber optic sensor that provides information regarding the structural health of laminated composite structures used in helicopters and land vehicles. In addition, an embedded metal coated fiber optical sensor will be developed for impact and overload damage, temperature, and internal strain state measurements. These sensors are being developed to accommodate low velocity impact events and simultaneously measure temperature and strain. They can detect internal structural damage that cannot be detected under visual inspection or with surface mounted strain gages. Prototypes of these sensors suitable for field use are expected to be available in two years.

• **Controlled Vibratory Response of Damage in Composite Structures.** The objective of this effort is to develop piezo-electric-based sensors for real-time monitoring of the manufacturing curing process and quality control of composite structures and for diagnosing damage in composite structures while in service. The sensor detects changes in the propagation characteristics of waves impinging upon and reflected from damaged areas of the structure. These sensors will be used to monitor in-situ the curing process during the manufacture of laminated composite structures, avoiding external mechanical testing and leading to faster and less costly curing processes of components that will maintain their structural integrity. These sensors can also be used to detect impact load and impact damage in laminated composites while in service, identifying the location and extent of the damage Applications of these sensors are foreseen in the curing and quality control of missile casings. Prototypes of these sensors suitable for field use are expected to be available in three years.

• **Cross-Over Monitoring of a Traversing Bridge.** The objective of this effort is to develop a new class of distributed wire sensors to monitor the crossing-over operations over the span of a full-scale traversing bridge during controlled field tests. These sensors will be used to determine the transverse deflections and twist over the bridge span and to monitor the instantaneous and spatial distributions of the strains over the entire span. They can be easily embedded in new structures or bonded to existing structures and can be manufactured very easily from shape memory alloy or constantan wires in a form which is very similar to strain gages. They will be, in effect, long strain gages. Hence, all the existing and familiar strain gage Wheatstone bridges can be used to process its signal. Therefore, these sensors can be easily used in both military and civilian bridges. They can be easily made in various forms and shapes. Prototypes of these sen-

sors suitable for field use are expected to be available in one year.

• **Impedance-Based Qualitative Health Monitoring.** The objective of this effort is to develop a health monitoring technique that would provide structures, through highly integrated actuators/sensors, with the ability to monitor themselves and provide a warning when damage is initiated. Bonded piezo-electric sensors combined with an impedance based technique that will detect changes in the dynamics response resulting from a damage will qualitatively identify structural anomalies. This technique might be applied to a wide variety of complex structures, such as light aircraft, rotorcraft, bridge joints, piping systems and precision gears, to detect a large array of types of damage (cracks, loose connections, corrosion, debonds, etc.). It should be capable of sensing damage at a very early stage, when it can be repaired easily and cheaply. Prototypes of these sensors suitable for field use are expected to be available in two years.

• **MEMS-Based Smart Gas Turbine Engines.** This program is focused on the development of highly integrated and distributed sensor/actuator arrays, using MEMS technology, for application to gas turbine engines. Pressure and temperature sensor arrays, and micro-valve control actuator arrays are being developed. Technology for fabricating these arrays in high temperature materials, such as silicon carbide, is also being developed. In addition to the basic sensor/actuator systems, the research program is also studying optimal methods for communication and control among large, dispersed arrays and integration of the array control with the total system controller. Prototypes of these sensors suitable for field use are expected to be available in three years.

• **Application of MEMS Technology to Intelligent Turbine Engines.** Under this effort, passive array sensors are being developed for application to gas turbine engines. Specific applications being addressed include ultimate pressure sensors, crack sensors and blade position or strain sensors. Micromachining materials/technologies are being developed for fabrication of MEMS devices capable of withstanding high temperature, high pressure and high vibration environments. Prototypes of these sensors suitable for field use are expected to be available in three years.

Embedding Sensors In Legacy Systems

The benefits of embedding sensors for prognostics and diagnostics purposes are well recognized by Army weapon systems developers. In fact, newer Army weapon systems such as the Crusader and Comanche will be heavily populated with this kind of sensor. However, for legacy systems, many of which are unlikely to have readily available design data, the following questions must be answered before any embedded sensor is undertaken:

The benefits of embedding sensors for prognostics and diagnostics purposes are well recognized by Army weapon systems developers. In fact, newer Army weapon systems such as the Crusader and Comanche will be heavily populated with this kind of sensor.

- What kind of system parameters must be monitored?
- What kind of sensors should be used?
- Where do we place the sensors?
- What is the minimum number of sensors necessary?
- What are the costs vs. benefits and/or return on investments associated with embedding the sensors?

Advances in real-time data acquisition and processing combined with the availability of low-cost microprocessors with large on-board memory make it possible for the development of software-based analysis tools to determine the location of tests (or sensors) and to isolate problems to a particular fault. The Diagnostic Analysis and Repair Tool Set (DARTS) is an example of a tool developed by AMC's prognostics/diagnostics technology base effort. DARTS allows accurate diagnosis of faults so that expensive tests can be significantly reduced or eliminated. A prototype of DARTS has been embedded to demonstrate automatic and rapid diagnostics with the elimination of costly test program sets and external test equipment. With additional information (parts reliability, parts degradation data, failure modes data, etc.) integrated with DARTS, a prognostics/diagnostics health monitoring capability can be implemented.

Conclusion

The technology exists to embed sensors in weapon systems for predicting failure. The challenge is to identify opportunities and resources to insert this technology into systems. Initiatives such as AMC's Operation and Support Cost Reduction (OSCR) program are providing seed money for these types of efforts. The recent expansion of DOD's Dual-Use Program to include OSCR initiatives is encouraging and a clear indication of the high level interest and commitment for efforts such as these. In addition, a DOD program, called Commercial Operations and Support Savings Initiative, seeks industry partnership and investment for efforts to reduce weapon system O&M costs. Finally, the acquisition and logistics communities, working together, must identify which systems will provide the Army the maximum returns on its investment.

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Bosnia. . .

MINES: REAL PROBLEMS, REAL SOLUTIONS

Figure 1.
A HMMWV severely damaged by a mine. Crew received only minor injuries due to the vehicle's mine protection features.

By Richard Weaver and Cyndi Gay

The Army Countermine Task Force (ACTF) provided new countermine tools and technology in support of U.S. soldiers in Bosnia. GEN Ronald H. Griffith, Vice Chief of Staff of the Army (VCSA), appointed MG Roy Beauchamp, Deputy Chief of Staff for Research, Development and Acquisition, U.S. Army Materiel Command, and MG Clair F. Gill, Commander, Army Engineer Center, as co-chairs of the task force established in February 1996. While the focus was on short-term needs for Bosnia, the VCSA also charged the task force to build a solid foundation to resolve the Army's longer term countermine problems.

Working with priorities established by the field commanders in Bosnia, the ACTF established an integrated product team (IPT) to address short-term countermine needs. In addition, ACTF solicited industry and academia for new ideas. The immediate response equipment included remote controlled tanks, trucks, and small vehicles (mini-flails), equipped with countermine attachments.

Specially designed armor kits were provided for High Mobility Multi-Purpose Wheeled Vehicles (HMMWVs), trucks, bulldozers, and M113s. Improved mine probes, body armor suits and blast protective boots have increased protection for individual soldiers involved in countermine operations. (See Figure 1.)

The ACTF also evaluated and tested several new systems. Not all areas in Bosnia are suitable for heavy tanks. Consequently, Bradley Fighting Vehicles are used in certain areas. The ACTF tested lightweight surface mine plows and mine rollers for the Bradley. The ACTF procured and fielded 17 lightweight roller and 17 plow kits to Europe for use in Bosnia. (See Figure 2.)

Similarly, the ACTF tested specially designed, mine-resistant, wheeled vehicles. These vehicles are designed to protect crew members from blast effects during an encounter with an anti-vehicle mine. After extensive testing, five vehicles were procured for Bosnia, although they were later diverted to U.S. forces serving in another theatre, such as the South Afican RG-31 Mine Resistant Vehicle shown in See Figure 3.

Our soldiers need better mine detecting equipment. The ACTF conducted extensive testing of emerging mine detection equipment. Based on contractor demonstrations, ACTF selected two different multi-sensor

Figure 2.
Left, an expandable roller fitted to the Bradley Fighting Vehicle; and right, a lightweight surface mine plow.

Figure 3.
South African RG-31 Mine Resistant Vehicle.

handheld mine detector prototypes. Two contractors each built five prototype detectors that combined metal detection and ground penetrating radar sensors.

Soldiers tested these prototypes at Aberdeen Proving Ground, MD, in December 1996. Test results are encouraging and the prototype detectors will be offered for potential use in Bosnia. (See Figure 4.)

U.S. Forces in Bosnia need to accurately and rapidly track mine and minefield locations. In accordance with the Dayton Peace Accord, the former warring faction provided vast amounts of hand-drawn minefield location sheets to peace-keeping forces. The data sheets consisted of thousands of sketches with various scales and in different languages. Implementation Forces (IFOR) established a Mine Action Center (MAC) to deal with the mine incidents and minefield data problems. Initially, the data had to be manually tracked and posted.

Working with personnel in the MAC, the ACTF sponsored work leading to the design, development and delivery of a Personal Computer (PC)-based minefield data system to Bosnia. The system consists of IBM ThinkPad computers with software on a Compact Disk Read Only Memory (CD ROM) containing minefield data. (See Figure 5.) This part of the system is the Digital Map Reconnaissance System (DMRS). The software allows soldiers to pull up minefield information and display minefield locations on an approximately scaled map background. Printers are provided to allow the data to be printed and distributed. Seven DMRS units have been provided to Bosnia.

At the Mine Action Center, the database will be connected to a multi-spectral image processor (MSIP) workstation. (See Figure 6.) The MSIP is a powerful computer coupled with a large plotter which can print large scale color maps and overlay informa-

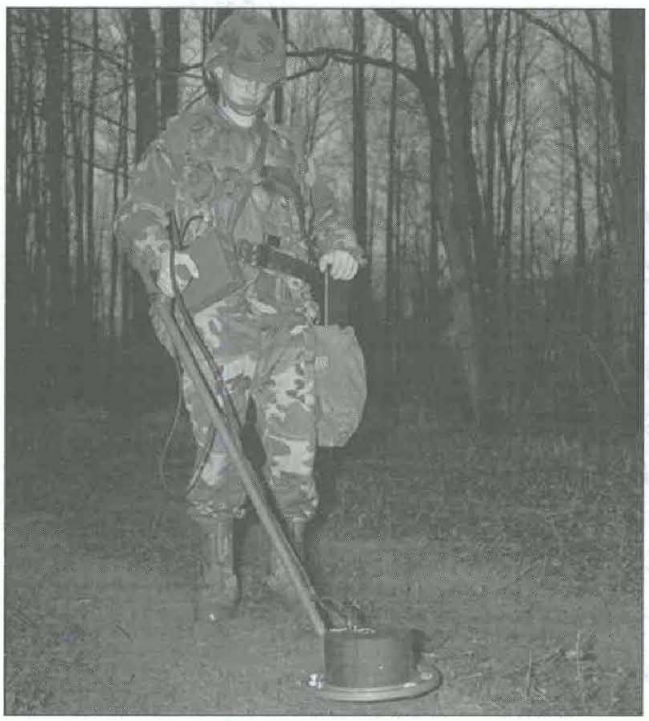

Figure 4.
Soldier testing handheld mine detector prototype at Aberdeen Proving Ground.

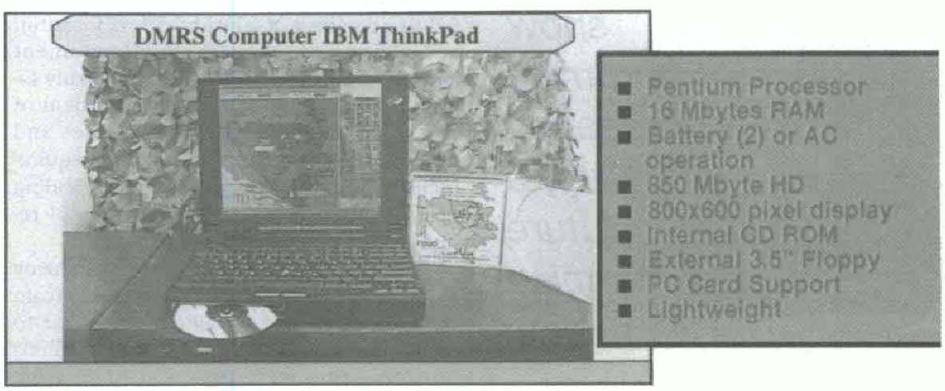

Figure 5.

- Produces CD-ROM's with minefield data.
- Manipulates and updates data on CD-ROM..
- Prints maps, overlays, and data records..
- Scans new minefield data sheets.

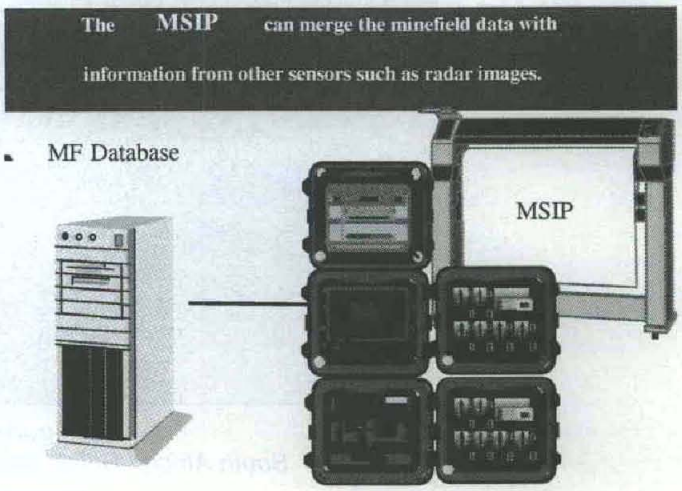

Figure 6.

Beyond the immediate successes in Bosnia, the Army Countermine Task Force brought to the surface emerging technologies and capabilities that show promise of meeting the Army's future countermine needs.

tion. The MSIP workstation displays high resolution imagery and produces, 3-D color imagery maps, plastic minefield map overlays, and color coded minefields on paper maps. The MSIP will permit the MAC to import imagery, foreign maps, and data from various sources and to print on-site military maps based on new information. Revised map products can then be provided to NATO or Army Central Production Facilities for reproduction. At the time this article was written, the MSIP for the MAC was scheduled to arrive in theatre in April 1997.

The MAC is also equipped with a CD writer that can produce new CDs with the latest minefield information. The updated CDs can then be provided to units with DMRS equipment. Further improvements to this Mine Field Database System are under evaluation. A digital camera and laser rangefinder coupled to a Global Positioning System are being considered. This package, termed a Digital Reconnaissance System, would permit accurate surveying of minefield locations that could be automatically fed to a database at a headquarters location.

Fielding new countermine equipment and capabilities to Bosnia presents many logistical challenges. The logistics element of the ACTF tailored existing processes and procedures to meet supportability requirements while still maintaining timely fielding of equipment to meet the operational requirements of soldiers in Bosnia.

By adapting procedures outlined in Army Regulation 700-142, the ACTF logistics team used concepts and terminology familiar to all the commands involved. Memorandums of notification were provided to all commands along with tailored materiel fielding plans and materiel fielding agreements. Teamwork among the developing, fielding, and gaining commands is essential. This team approach allowed the fielding to proceed with all parts of the chain of command fully involved and committed.

The ACTF moved quickly to meet the urgent operational needs of Army forces in Bosnia. Much of the equipment provided will ultimately be placed in contingency stocks so that the Army is better prepared for future countermine operations. Beyond the immediate successes in Bosnia, the ACTF brought to the surface emerging technologies and capabilities that show promise of meeting the Army's future countermine needs.

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ORDNANCE MAINTENANCE ENABLERS

Making Technology Work For The Soldier

FOREWORD

By MG Roy E. Beauchamp

There is a tendency to think of technology in terms of exotic weapon systems which provide new capabilities on the battlefield. We have seen the results in our tanks and infantry fighting vehicles and in our missiles and aircraft. But technology is also important in other dimensions. With a smaller Army and fewer dollars to spend on either modernization or maintenance of our equipment fleets, we have to find new ways to make maintenance soldiers more productive. We have to make technology work for soldiers in our motor pools, supply rooms and orderly rooms, if we are going to maximize our capability with a smaller Army. This article showcases some important technologies that can dramatically improve operations in our motor pools and maintenance shops. This article is about making technology work for soldiers—soldiers for whom every day is a high intensity event as they work to ensure our equipment is ready to go to the range, NTC...or to war. The Combined Arms Support Command is working with the Tank-Automotive Research and Development Center on some exciting technologies that can make that job a little easier and a lot more efficient and effective.

By CW3 Dave Slaughter

Many people, at many different agencies are working on concepts to move the Army maintainer into the 21st century. To help illustrate some of the concepts the Combined Arms Support Command is working on, we have decided to demonstrate our concepts using the daily routine of two motor sergeants. One motor sergeant has the advantage of technology in his maintenance shop and the other is doing business the same old way. Both motor sergeants begin work at the same time and have the same equipment densities and assets to support their maintenance mission. Their day begins at 7:30 a.m. and both have to conduct the Army Oil Analysis Program (AOAP) sampling on one platoon's compliment of vehicles. Both plan on accomplishing this during the morning command maintenance period. Samples must be accomplished today, because both units are deploying to the field tomorrow. Command maintenance is going well and Motor Sergeant Burden is in the process of dispensing AOAP bottles and tubing to conduct samples. Motor Sergeant Goodday walks to the tool room to retrieve his portable unit level oil analyzer (PULOA), so he can walk down the vehicle line to conduct his samples. (See Figure 1.)

Motor Sergeant Goodday completes all his samples and downloads his data from his reader to his computer to conduct a comparative analysis from previous samples. He discovers one vehicle with a slightly elevated copper content, so he directs the engine oil to be changed and makes a note to resample after four hours of use, once he's at the field site. Note that Motor Sergeant Goodday did not change the oil filter, because he's using Life-Time Oil Filters (LOF); all that's required is to purge the exterior housing of contaminants. (See Figure 2.)

Meanwhile, Motor Sergeant Burden has collected all his sample bottles, except for one, so he has his clerk generate paper work for lab submission. However, two sample component serial numbers do not match with serial numbers on sample bottles. He will personally verify the component serial numbers after lunch. Hopefully, the last sample will be in by then. Motor Sergeant Burden also remembers that he's still waiting on the lab to provide results from two resamples last week. He makes a mental note to check on them. Both motor sergeants begin to review this morning's command maintenance results. Motor Sergeant Goodday downloads data from the Digital Data and Prognostics (DDAP) device which is located on every vehicle, while Motor Sergeant Burden attempts to organize his inspection results in bumper number sequence, so he can begin to review and prioritize maintenance problems. (See Figure 3.)

Motor Sergeant Goodday has downloaded his data to his computer and learns that one vehicle has a power loss of 10 percent on an engine (cylinder four) and another vehicle has low fuel pressure. Meanwhile, Motor Sergeant Burden discovers he's missing two inspection sheets, can't read one, because of oil stains and not sure about two more, because the bumper number could be either a four or a nine. Motor Sergeant Goodday verifies both problems and directs the fuel pump to be replaced in one vehicle and an injector to be replaced in the other vehicle. Meanwhile, Motor Sergeant Burden figures he'll start reviewing inspection results after lunch, once all the remaining inspection results get turned in. Motor Sergeant Burden is just alerted to a couple of problems; the battalion logistics and maintenance (S-4) shop just dropped their 3kw generator out of the back of their truck and it fell on top of their 1.5kw generator: Now the S-4 is without a source of power for their TOC. Motor Sergeant Goodday does not have this problem; all his HMMWV's are equipped with the FAS-C, a

Figure 1.
The Portable Unit Level Oil analysis (PULOA) is a concept that will provide continuous and instantaneous oil analysis replacing present laboratory methods based on scheduled time or interval. PULOA technology is a portable unit that provides units the ability to continually monitor oil health and will alert the maintainer to immediate contamination. The primary advantage of PULOA over current laboratory methods is its ability to continually monitor oil health providing analysis at any time. Too often, components fail because of the time involved between samples or re-samples. PULOA will give us the ability to have portable oil analysis allowing us the opportunity to stop using equipment as soon as a problem is indicated; reducing rebuild costs. With this increased ability, we will be able to identify component deficiencies immediately; opposed to the current method of identification using laboratory sampling.

Figure 2.
The Life-Time Oil Filter (LOF) is a replacement concept for traditional canister or spin-on oil filters. The manufacturer can make an adapter plate for the installation of this filter on any equipment. Filters have the ability to filter contamination down to the 10-micron level. The goals of LOF are: Primary filtering of oil in engines, transmissions and hydraulic systems; Reduction in time and effort expended replacing oil filters; and Elimination of costs associated with replacing and stocking oil filters and reduction of hazardous waste. LOFs are a canister-based filter that use centrifugal force and normal engine pressures to keep the inner filter free of contamination. The outer portion of the canister collects and isolates waste for each discharge and disposal of contaminated material.

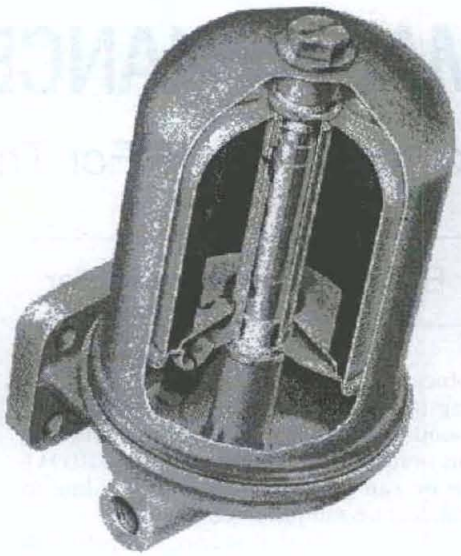
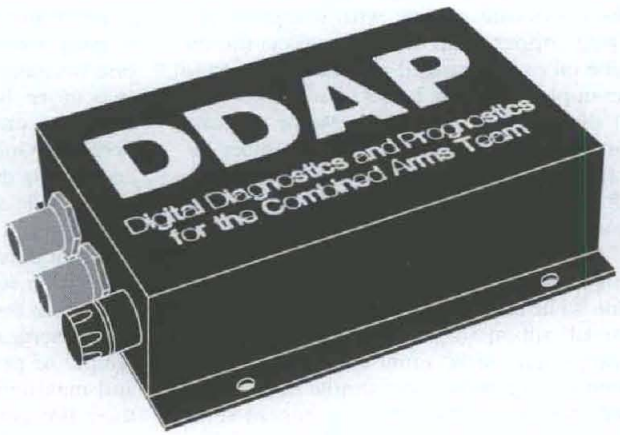


Figure 4.
The Flywheel, Alternator and Starter - Combination (FAS-C) is a combination flywheel, alternator and starter concept that will replace all three components with one. Moreover, the alternator will produce multiple sources of power; 24 volts to operate the equipment and 110 or 220 volts to operate auxiliary or attached equipment; such as, computers, GPSs, air compressors or welders, etc. FAS-C can produce 20 kw of AC voltage and simultaneously produce 500 plus amperes of 24 DC voltage. FAS-C can generate power on the move or in a stationary location. FAS-C will eliminate the need for alternators and starters and the continuous changing of batteries; thus, reducing the enormous O&S cost we experience now. FAS-C is capable of charging lead acid, NiCad or NiMH batteries. FAS-C technology can be applied to any equipment in the Army's inventory; initially the application of this technology will be tested in command and maintenance vehicles (HMMWV configuration). Furthermore, FAS-C will eliminate our dependency on small inefficient power generators and APUs.

Figure 3.
Digital Data and Prognostics (DDAP) will provide commanders and logisticians, at all levels, immediate real-time readiness, ammunition and fuel status. All maintenance and logistical requirements will become planned and scheduled. DDAP is a digital memory unit that continually collects and processes real-time engine, fuel and ammunition diagnostic and consumption data. Additionally, DDAP is capable of analyzing diagnostic data and formulating prognostic advice. Data is read using interactive software to PC, CTS-3 or SPORT via RS-232 cable. Future developments will provide for the transfer of data to in-vehicle communication systems (CSS Appliqué) DDAP is designed to recognize established engine operating parameters and identify and record operator errors in start-up and shut-down procedures. DDAP can analyze collected data and establish trends for future prognostic capabilities. Besides its diagnostic capability, DDAP is capable of tracking and analyzing fuel and ammunition consumption data and forwarding status through the logistic pipeline. DDAP will provide commanders confidence in their actual (real-time) readiness and operational status.



combination flywheel, alternator and starter. It produces both AC and DC power. Plus, he hasn't changed a battery in a HMMWV since installing the Flywheel, Alternator and Starter - Combination (FAS-C), because he has all of the power he needs, both AC and DC, where and when he needs it. (See Figure 4.)

Motor Sergeant Burden just learned that the Commander's HMMWV starter burned up and the battalion operations officer's (S-3) HMMWV's batteries are dead again and the generator isn't charging. Motor Sergeant Burden recalls, that's the third starter this month for the commander's vehicle, and the second generator and fourth set of batteries for the S-3's vehicle in less than three months. Again, because Motor Sergeant Goodday's HMMWV is equipped with the FAS-C, he won't have this problem. Motor Sergeant Burden receives a call from his commander asking why two vehicles are being held at the division roadside inspection site—one for missing a dispatch and the other has a major deficiency. Motor Sergeant Goodday has PM Minder installed on all his vehicles, so he's alerted to these problems before a vehicle can depart the motor pool area. PM Minder will track all maintenance operational activity plus provide diagnostics for all equipment with electronic data bus bars. (See Figure 5.)

Both Motor Sergeants get a call from the G-4 shop. They want to conduct a 100 percent inventory of general mechanics' tool boxes for units deploying to the field. Motor Sergeant Burden is forced to stop work on the commander's vehicle and several others, so mechanics can get their tool boxes laid out for inspection. Motor Sergeant Goodday has all his tool boxes and tool sets equipped with the tool identification and inventory (TI&I) system, using Balluff Bis C 103-02-A embedded sensors (See Figure 6), so his inventory can be accomplished using a hand-held sensor scanner. The scanner results are updated and recorded in his ULLS-G computer.

As the day comes to a close, Motor Sergeant Goodday takes a tour of the motor

Figure 5.

PM Minder is a programmable radio frequency-based ordnance maintenance enabler, that offers automatic preventive maintenance data collection using a combination of monitors, vehicle tags, readers and software. The PM Minder is a digital memory processing unit that interfaces and communicates using radio frequency technology. The unit weighs one pound and is approximately 5 inches X 4 inches and 2 inches deep. It is equipped with a 30-day back-up battery, but normally runs off vehicle power. PM Minder will provide an efficient method to monitor operator level maintenance operations and activities. PM Minder can be programmed to record and report vehicle operational data, dispatch information and load data information. PM Minder should accomplish the following: Capture and report operator Preventive Maintenance Checks and services data and capture and report vehicle identification data; communicate vehicle information data using a "smart pole" via wireless connectivity. Furthermore, PM Minder will interface with diagnostic/prognostic computers and J series data bus bars, effectively communicating and interfacing with Standard Maintenance System (SMS) hardware and software.

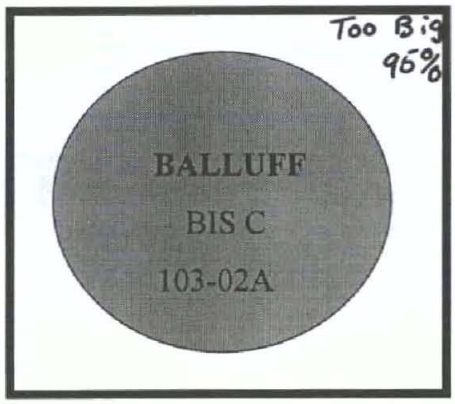


Figure 6.

Tool Identification and Inventory is a concept programmable identification tagging system for inventorying of tools. Embedded sensors are smaller than the average fingertip and are resistant to grease, coolants and dirt. Plus, they are shock and vibration resistant. They hold 256 bytes of information and are re-programmable up to 500,000 times. Coding software is Windows-based and can be operated on any PC. The processor unit to link data from computer to tag interfaces using RS-232 protocols. Readers and scanners are small hand-held devices that interpret tag data and download information to the processor and computer. The purpose of using programmable tags for tool identification is the elimination of wasted man-hours by commanders and supervisors inventorying and accounting for tools; thus, eliminating paper inventories—saving countless man-hours and providing an avenue for error-free inventories and total accountability of tools. Accountability can be accomplished on demand, merely by waving a scanner. The cost associated with wasted man-hours will pay to implement this program.

pool, is satisfied that his equipment is ready for deployment in the morning and departs for the day. Lunch never came for Motor Sergeant Burden and he is still waiting for one more oil sample, the starter still needs to be put in the commander's HMMWV and two vehicles need to be picked up at the division road side inspection site. Plus, the S-4 is without a generator, command maintenance results need to be reviewed and the tool inventory still needs to be completed.

Some of the maintenance actions described above are not typical maintenance actions performed in a motor pool environment. However, they were used to illustrate the enablers. The scenario format was used to demonstrate the effectiveness of maintenance enablers and the positive effects they will have towards the maintenance mission, regardless of level. The enablers described above are active concepts at the Combined Arms Support Command, Directorate of Combat Developments - Ordnance, Maintenance Division, Fort Lee, VA. All are real technologies available today through commercial industry. Pending funding approval, Concept Evaluation Program (CEP) testing will begin third quarter of FY 97. Comments or questions regarding this article should be directed to the Combined Arms Support Command, Directorate of Combat Developments—Ordnance, Maintenance Division at commercial (804)734-0595, DSN 687-0595, or email: slaughtd@lee-dns1.army.mil.

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GLOBAL TECHNICAL DATA SUPPORT TO THE 21ST CENTURY MILITARY

By Henry N. Younger
and Earl W. Barrett

Introduction

Technical data is the foundation of the Army's warfighting arsenal. From the time a threat is identified and an Army system is fielded to counter the threat, technical data describes the system requirements, prototype/production designs and logistics support tools. This technical data fuels the business processes that maintain the operational readiness of our soldiers from the motor pools to the flight lines, from industry manufacturers through military depots. Our global inventory of materiel is supported by millions of records of technical data that must be accurate and available on demand anytime, anywhere in the world.

Background

System managers make difficult business decisions early in the weapon system development/acquisition process on allocation of resources, deciding what level of technical data to buy, considering the logistics support concept selected. Wise managers have utilized a percentage of precious research and development funds to buy technical data to lower the cost and increase the effectiveness of the Operations and Support (O&S) phase of their weapon system. To a varying degree, the military agencies charged with the O&S mission have been able to capitalize on this investment, using Engineering Data Management Systems (EDMS) tools such as the Army's Technical Data/Configuration Management System (TD/CMS), and Digital Storage and Retrieval Engineering Data System (DSREDS) to make accurate and timely major item and spare parts buys. Decreases in procurement funding, increases in inter-Service, industry, and international weapon system support, and field-level uses for data beyond traditional technical manuals, have emphasized the need to further improve the accessibility to this data. Functional areas requiring this improved access are shown in Figure 1.

Automation Managers

Under the direction of MG Roy E. Beauchamp, Deputy Chief of Staff for Research, Development and Acquisition, Army Materiel Command (AMC), the EDMS Office is carrying out AMC charter responsibilities to "exercise control over the design, development, acquisition, testing, installation, and support of all hardware and software intended to receive, convert, store, manage, locate, retrieve, reproduce, and distribute approved engineering drawings and associated data."

AMC has also designated the U.S. Army Missile Command (MICOM) as the lead command responsible for the Integrated Data Environment (IDE). Within MICOM, the Lead AMC Integration Systems Office (LAISO) has been charged with the responsibility for development of a strategic plan for data integration across systems, establishment of an infrastructure for demonstration, testing, training, and, whenever possible, accelerated deployment of emerging systems/capabilities. The LAISO supports designated business process managers who are responsible for providing coordinated functional area guidance on system requirements to the appropriate program managers, and reporting back to their areas the system development and fielding status.

The EDMS Office, working with LAISO, other Army, Joint Service, industry and international partners, will leverage the value of technical data support to military operations into the 21st century. This support will come from the IDE, either in the form of modern replacements for legacy EDMS tools, or as new tools that will assist the spectrum of technical data users in improving weapon system supportability.

What Is The Integrated Data Environment?

The IDE concept is a philosophy and methodology which ensures that data, in a digital format with a high degree of quality, is available to all users. The program improves upon the functional applications and technical data already being exploited by personnel responsible for the weapon system O&S phase and extends those capabilities for personnel on the weapon system acquisition Integrated Product Teams (IPTs). The emphasis of the new technical data systems, following the Continuous Acquisition and Life-Cycle Support (CALS) philosophy, is the digitization of data in standard formats, to enable worldwide electronic retrieval and sharing of that data. This access is illustrated in Figure 2.

Automation Initiatives

Numerous Department of Defense, Army, and AMC legacy and emerging automation systems have been proven to provide critical support to the technical data

support mission. The managers of EDMS applications, including legacy applications where feasible and permitted by policy, are responding to requests for user friendly interfaces by upgrades to accommodate worldwide web access. The worldwide web interfaces should increase the availability and usage of data resident on their systems, which also drives the need for the higher capacity application servers and networks being acquired by IDE. The descriptions below provide a quick look at the scope of capabilities available:

Configuration Management (CM) System. The Army relies on the TD/CMS, in use at the various major subordinate commands, to maintain accurate weapon system CM data, including tracking change release data until drawing revisions incorporate approved design changes. The TD/CMS is a target for replacement by either a DOD or Army standard CM system. The EDMS Office, working with MICOM and LAISO personnel, is evaluating commercial off-the-shelf applications against Army requirements. Even in the age of acquisition reform, closely tracking the configuration can pay off by identifying the potential for performance specification replacement of military specification callouts, and providing the ability to tailor out ozone depleting chemicals and hazardous materials. An automated interface to the repository system (either DSREDS or Joint Engineering Data Management Information Control System (JEDMICS)) allows assembly of accurate technical data packages for competitive procurements.

Repository System. The JEDMICS is a Navy-led program to implement a DOD standard technical data repository, replacing three Service unique systems. It will support the acquisition/engineering, materiel management, and depot maintenance business areas by providing the following functions:

- Repository for electronically captured engineering drawings and related technical data;
- Storage of Native Computer Aided Drafting and Design formats;
- Automated management and distribution of engineering drawings and technical data; and
- Application Program Interface to external systems.

Remote users include front-line maintenance personnel who have pioneered methods to improve weapon system readiness by augmenting their technical manuals with immediate access to detailed design data. Using this data in consultations with depot engineers, they are frequently able to overcome the unusual repair problems to return systems to operational status days sooner.

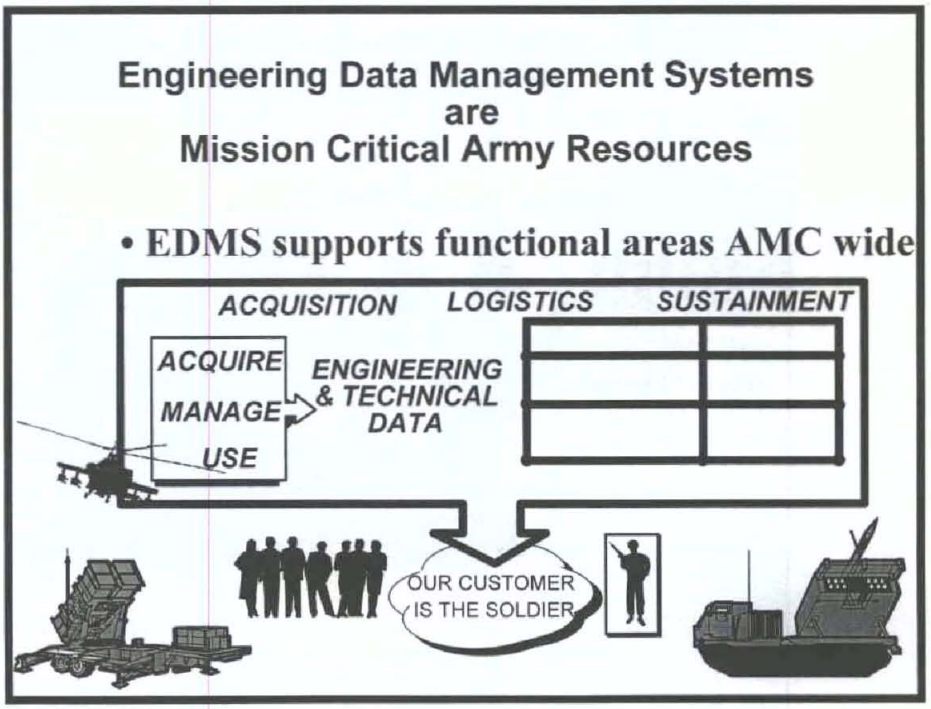

Figure 1.

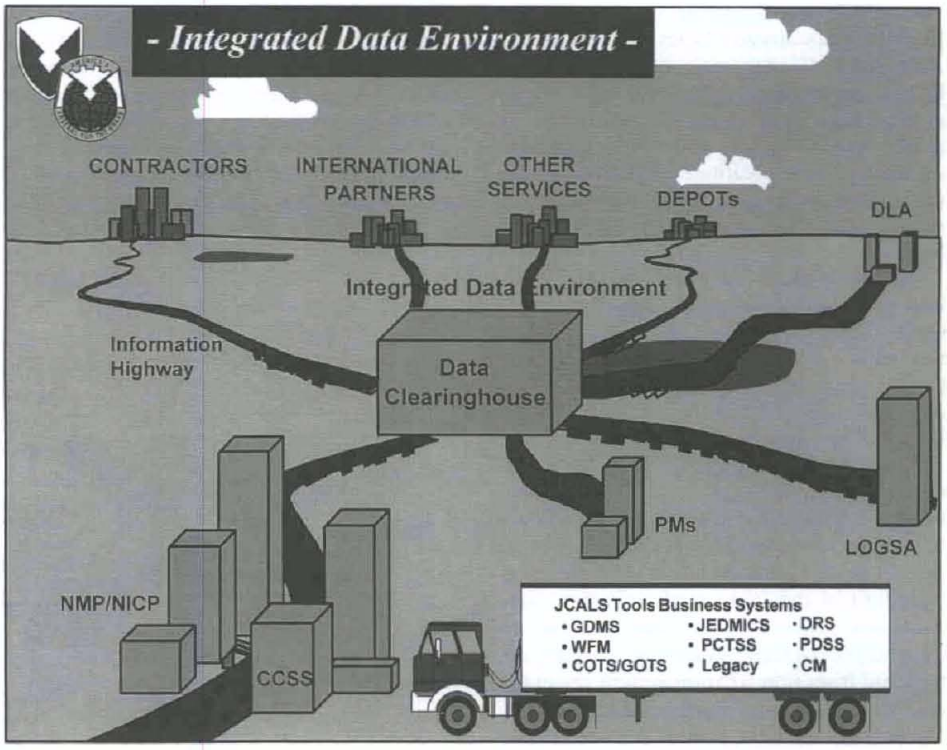

Figure 2.

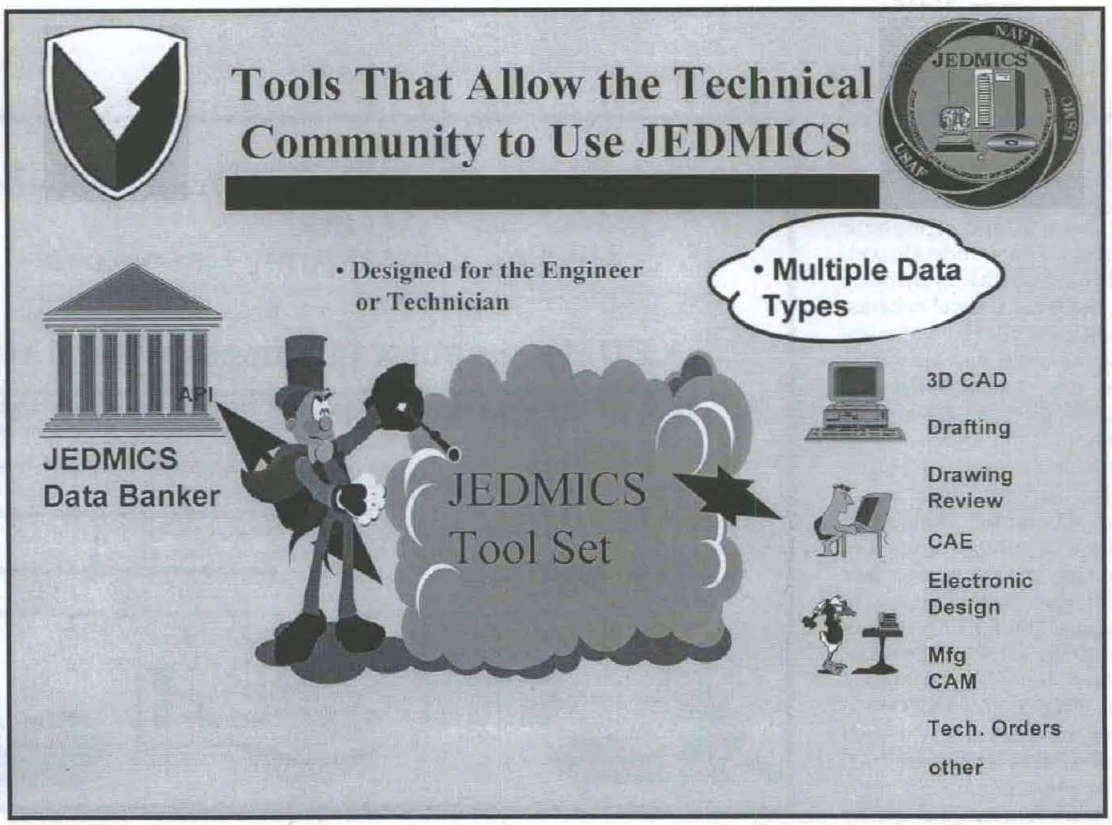

Figure 3.

The JEDMICS is the critical "data bank" component of IDE providing the functions shown in Figure 3. With the inputs and controls shown, JEDMICS also delivers the benefits which are illustrated in Figure 4. The JEDMICS has already been fielded to five Army depots and successfully replaced DSREDS at Rock Island Arsenal. It is undergoing Initial Operational Capability testing at five more Army sites and will be fielded to 23 joint Service locations. The program includes a technology refresh program to improve capabilities and prolong the system lifecycle.

Technical Data Locator System. The Military Engineering Data Asset Locator System (MEDALS), managed by the Defense Logistics Service Center, Battle Creek, MI, will be the master index for locating data stored on any of the 34 JEDMICS sites, until the Global Data Management System is fielded.

Compact Disk Engineering Data Exchange (CDEX) Project. The CDEX project linked to JEDMICS will be the first to offer a CD production capability. This feature is expected to be in demand by traditional users of technical data sets, such as Army spare parts buy teams, foreign military sales customers, the Defense Logistics Agency Centers, and front-line weapon system maintainers. Anyone with a Compact Disk-Read Only Memory (CD-ROM)-equipped personal computer (PC) can enjoy the benefits of carrying several thousand aperture card equivalents on one CD, with a built-in image viewer and index of all resident images.

JEDMICS Tool Set. The EDMS Office is managing the development and fielding of both user access tools and system level tools which augment the functionality of JEDMICS within an organization's business process. (See Figure 5.) User access tools include PC_JEDMICS/X_JEDMICS, ImageR, and IndexR which allow local and remote users direct access to JEDMICS for viewing, importing/exporting data, and local management of exported data from a JEDMICS site. System-level tools include CALS I to C4 converter, bulk importing of standard raster and native vector file types to JEDMICS, CDEX index file editors and utilities, and a world-wide web interface to JEDMICS Data. These products and a technical support help desk will be provided free of charge to government users and are considered part of the JEDMICS baseline.

Security. To ensure the data security, integrity and availability in the face of sophis-

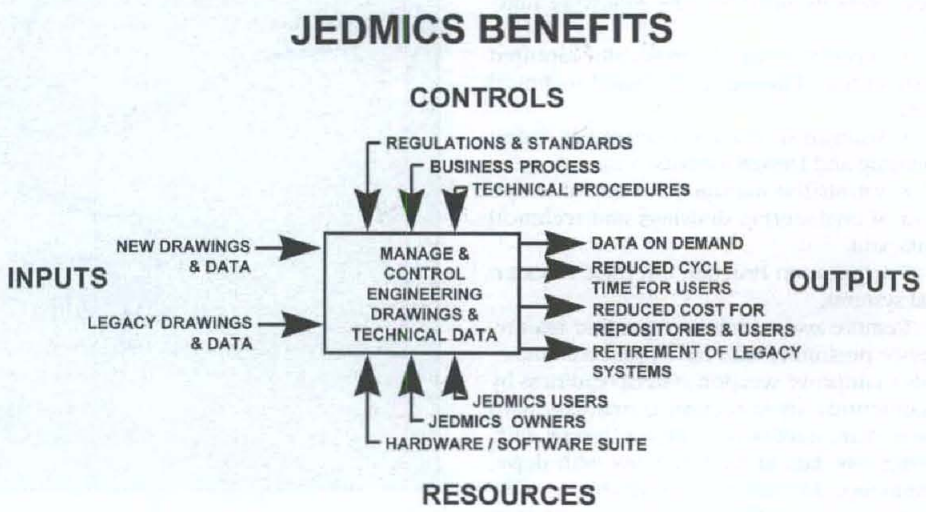

Figure 4.

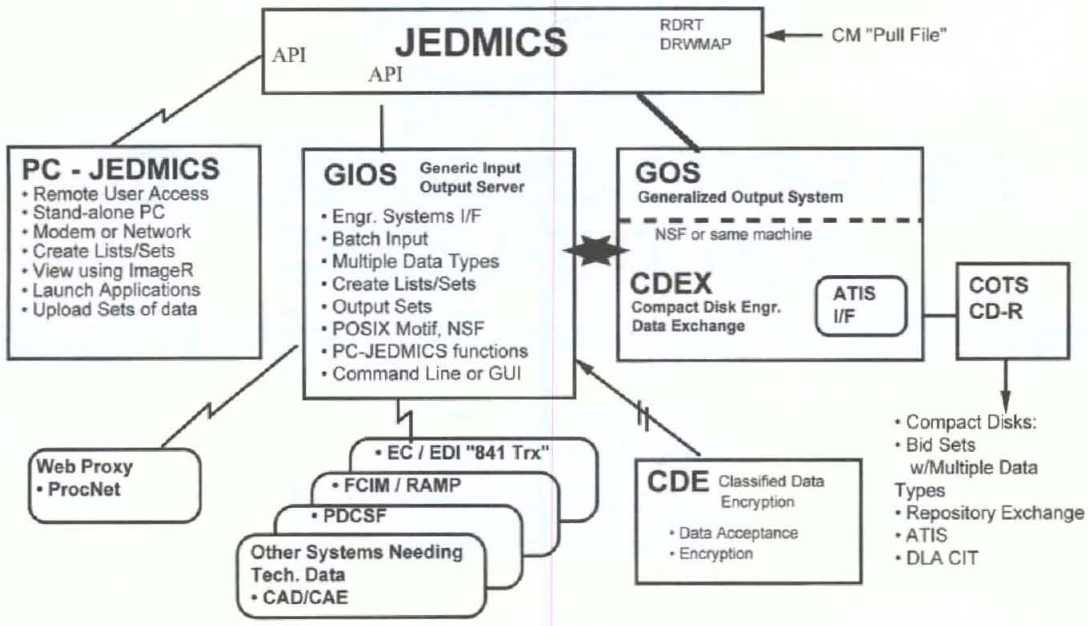

Figure 5.
JEDMICS Tool Set.

ticated, often subtle, system attacks, the EDMS Office is working various proof-of-concept projects under the Land Information Warfare Initiative designed to safeguard both networks and systems.

Measuring Success

The CDEX project will have demonstrated a 350 percent return on investment by the end of the first year of operations on media costs alone and also reduced the hazardous waste production inherent to the aperture card process. The JEDMICS, by virtue of scanners capable of digitizing data that previously required aperture cards, has placed thousands of pieces of data immediately accessible. The instant access to engineering data, such as computer numerically controlled machining tapes, is being explored by organic repair/rebuild facilities to produce "parts on demand" for the soldier in the field.

Future Plans

Bringing technical data support into the 21st century is full of challenges. Acquisition reform initiatives are sweeping the DOD and, in many cases, are changing technical data as we know it. The move to performance specifications to improve competition, facilitate use of commercial items, and minimize development provides new paradigms for providing detailed sustainment information to the Army community. Technology changes including the Internet and the Worldwide Web will continue to provide opportunities we didn't think possible only months ago. The Army is participating in concept exploration for the Strategic Military Advantage from Repository Technology (SMART) to address the overall plan to bring technical data management into the 21st century. The SMART project is being coordinated with Digitized Battlefield and Force XXI initiatives and is aimed at fielding a virtual repository, integrating contractor and government databases. This integration will make the storage location transparent to the end users. The Global Data Management System will be a component of this architecture.

Conclusion

The legacy and future investment in technical data can offer a return on investment, not only to the traditional users increasing competition on spare parts buys, but to any and all technical data users around the globe supporting Army readiness. For the military of today, and for the 21st century, the return on accurate, shared technical data can be shown in improved weapon system readiness and mission accomplishment.

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HUMRAAM: MICOM'S AIR DEFENSE INITIATIVE FOR THE USMC

Today's Technology for Tomorrow's Threat

By Ron Hulsey,
Dr. Eugene E. Paro,
and Emily Vandiver

Introduction

The Army Missile Command (MICOM) has developed an innovative concept to enhance the operational capability of the U.S. Marine Corps' (USMC) Short Range Air Defense (SHORAD) units. At the heart of the concept is the High Mobility Multipurpose Wheeled Vehicle mounted Advanced Medium Range Air-to-Air Missile (HUMRAAM). The idea utilizes the High Mobility Multipurpose Wheeled Vehicle (HMMWV) as a launch platform for the Air Force/Navy's highly effective Advanced Medium Range Air-To-Air Missile (AMRAAM). HUMRAAM is an excellent candidate for insertion into the USMC's Expeditionary Air Defense System (EADS) which reflects the Navy's warfighting doctrine of Operational Maneuver From The Sea (OMFTS).

Background

Norway developed the surface-launched AMRAAM for air defense applications and is in the process of fielding the Norwegian Advanced Surface to Air Missile System (NASAMS). The NASAMS launcher carries a six missile load and fires the missiles from canisters. The launcher is not suited to the high transportability and mobility requirements of the USMC. MICOM has been working with ground-launched AMRAAM since February 1994, when the HAWK/AMRAAM (HAMR) concept was initiated. For HAMR, AMRAAM is a high-firepower complementary missile. The successful integration of AMRAAM and HAWK was successfully demonstrated at SAFEAIR 95 in August of 1995 at Fort Greely, AK. MICOM investigated several other launch platforms for integration into a SHORAD's application before selecting the HUMRAAM.

HUMRAAM was developed at MICOM and is a joint effort between the Army (MICOM), the Air Force (AMRAAM Joint Systems Program Office at Eglin AFB, FL), and industry (Hughes Missile Systems Company, Kongsberg of Norway, and Raytheon).

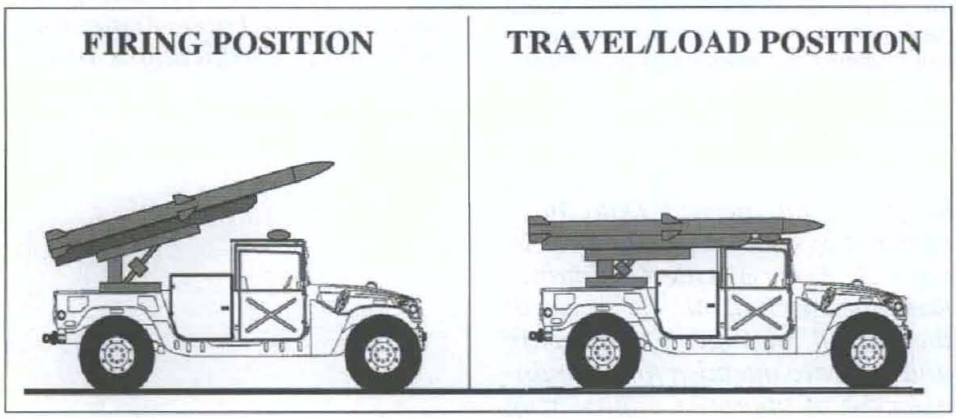

Figure 1.
HUMRAAM launcher in travel and firing positions.

The Concept

HUMRAAM's design philosophy is simple—Take advantage of AMRAAM's active seeker capabilities and sophisticated signal and data processing in order to keep the launcher design the essence of simplicity. To date, the Air Force and Navy have invested more than $11 billion in the development and production of the missile. HUMRAAM leverages heavily off of this investment. For instance, AMRAAM's active seeker, lock-on-after-launch, and command inertial guidance capabilities allow the missile to fly toward a target's position without requiring accurate pointing. This eliminates the need for any complex electro-mechanical system to provide launcher slewing. The launcher does include a simple drive motor to elevate the launch rails to a fixed elevation for firing, but the launcher does not slew in azimuth. (See Figure 1.) Even with no launcher pointing, AMRAAM's sophisticated guidance still provides an extremely wide engagement zone.

Other design guidelines were considered as well. Cost was considered an independent variable and was a primary driver in the development of HUMRAAM. Non-developmental items were identified and an open architecture design was implemented in order to enable future upgrades. The launcher must integrate directly with the Marine Corps' EADS and must operate within existing force structure constraints.

The launcher, shown fully-loaded in Figure 2, is designed to fit in a HMMWV (M1097 A2 Heavy) and consists of relatively few elements. The major functional elements of the HUMRAAM launcher are shown in Figure 3. The five AMRAAM missiles are fired from launch rails taken directly from existing fighter aircraft inventories. They are completely compatible with

fighter aircraft, and can be utilized to fire AMRAAM, as well as the AIM-9 Sidewinder family. A lower cost USMC specific rail is being investigated and trade studies will be conducted. This rail would not contain some of the aircraft specific features.

The rails are attached to a launch structure which is the only developmental item on the launcher. Missile interface equipment is included to provide direct linkage to the missile for both prelaunch and midcourse modes. A land navigation system will also be utilized to provide launcher position and attitude information. A remote terminal unit (RTU) and Single Channel Ground and Airborne Systems (SINCGARS) radio are required for command, control, and communications. An on-board power converter is planned which will preclude the need for a separate generator. Projected hardware cost for the HUMRAAM (less missiles) is $559K. If existing assets (vehicle, RTU, and radio) could be utilized, the hardware cost is projected at $429K.

USMC Warfighting Philosophy

The Navy's warfighting doctrine is now driven by the OMFTS concept for the projection of naval power ashore. OMFTS will utilize techniques such as sea-based logistics, sea-based fire support, and sea-based tactical and operational movement. Thus, landing forces will move directly from their ships to their objectives, without the need for large logistic tails. This concept reinforces the need for lightweight, highly mobile systems.

The USMC's EADS is composed of modular, distributed components either sharing a common air picture or operating autonomously. The air picture is provided by the USMC ground-based data link (GBDL). The autonomous air picture is provided by the USMC continuous wave acquisition radar (CWAR). Common air picture sources include the CWAR and also the Navy's Cooperative Engagement Capability (CEC) communication network.

Potential USMC Architectures

HUMRAAM would insert and function in USMC forces in much the same way Avenger does today. HUMRAAM's flexibility would lend itself to several force constructs, such as:

• For the USMC Littoral/Expeditionary Warfare Level One, the HUMRAAM launcher, with no dedicated sensor, could be inserted ashore and be netted, via GBDL to the CEC network. This network will integrate naval surface and air sensors and provide engagement instructions from AEGIS cruisers to launchers ashore.

• At Level Two, a CWAR-based sensor ac-

Figure 2.
Fully-loaded HUMRAAM launcher.

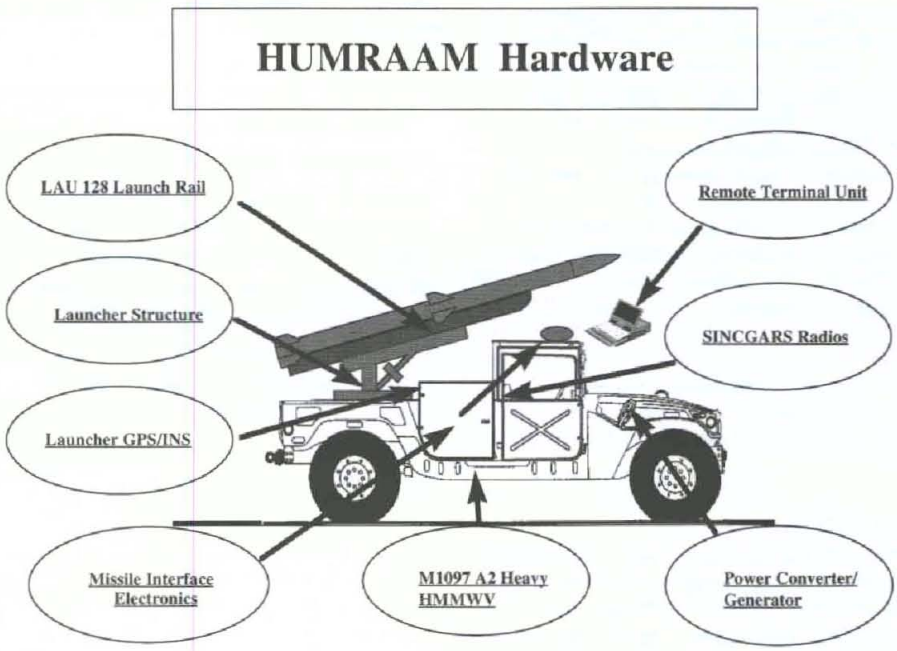

Figure 3.
HUMRAAM launcher major functional elements.

quisition section is brought ashore, providing a second source for air picture information and providing the USMC with an autonomous fire unit capability.

• At Level Three, USMC HAWK assets, along with the TPS-59 (V3) radar and land-based CEC are brought ashore. Level Three provides a robust air defense capability from tactical ballistic missiles (TBMs) to Cruise Missiles (CMs) and Unmanned Aerial Vehicles (UAVs).

At each level, the HUMRAAM plugs into existing BM/C3I architectures and utilizes existing combat identification capabilities.

Integration/Testing Activities

The initial AMRAAM firings from HUMRAAM were ballistic shots at Eglin AFB, in August 1996. (See Figure 4.) These shots successfully verified the safe separation of the missile from the launch platform, as well as blast effects on the launch platform and adjoining missiles. Software for the RTU is being developed by the industry team and will be available to support several events during FY 97.

Integration of HUMRAAM, via GBDL, into the Navy's CEC net is scheduled to take place at Dam Neck, VA, during late July 1997. This will be the first opportunity for integration into CEC and will be utilized to verify the system configuration and assess system readiness prior to participation in future events.

HUMRAAM is participating at the September 1997 All Services Combat Identification Evaluation Team (ASCIET) exercise at Gulfport, MS, and Camp Shelby, MS. At Camp Shelby the exercise will emphasize the way today's USMC's SHORADs fight. At Gulfport, HUMRAAM will once again net with CEC for final verification prior to missile firings at Eglin AFB. ASCIET participation will allow the USMC to evaluate HUMRAAM in a field exercise environment.

The first intercept of targets with an AMRAAM fired from the HUMRAAM launcher is scheduled in September 1997 at Eglin AFB's test range. Two shots are planned, one with a CWAR cue, as in the USMC Littoral/Expeditionary Warfare Level Two employment, and the second shot with a CEC cue, such as a Level One employment.

Conclusion

MICOM has developed the HUMRAAM concept as a highly effective force multiplier for the USMC's EADS and has conducted the initial testing. HUMRAAM meets tenets dictating acquisition streamlining for today's force. It maximizes use of non-developmental items and is a clear example of horizontal technology integration. It is a developmental effort with high interest from all four military Services and affords the opportunity to provide warfighters with a greatly enhanced capability in an extremely efficient and cost effective manner. The USMC will continue to work with MICOM through the planned testing activities during 1997.

Figure 4.
HUMRAAM ballistic test firing at Eglin Air Force Base, FL.

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EMILY VANDIVER is the MICOM Research, Development and Engineering Center's Technology Manager of the Rapid Force Projection Initiative (RFPI) Advanced Concept Technology Demonstration (ACTD). She holds a degree in electrical engineering from the University of Alabama in Huntsville.

LINKING SIMULATIONS TO IMPROVE EXERCISE TRAINING SUPPORT

By COL Ronald S. Mangum (USAR)

The Army family of simulations is a loose confederation of software products that provide training to soldiers and units from squad to theater level. Unfortunately, not all simulation models talk to each other, and not all provide seamless integration of training at different levels. The current simulations are scheduled to be replaced by Warrior Simulation 2000 (WARSIM 2000), but that will not be fielded until 2003.

The challenge, then, in a resource-constrained environment is to develop a simulation exercise driver that will provide a robust exercise for CS/CSS Corps level brigades and battalions. Linking BBS with the Variable Intensity Computerized Training System (VICTORS) in a "swivel-chair" mode is an interim solution until WARSIM 2000 is fielded.

Until then, we must adapt the current simulation models to fit the training audience because acquisition of new simulation models is too expensive. Adapting current simulations is not always easy or satisfactory to the training audience. For example, the U.S. Army Reserve (USAR) is composed primarily of combat support (CS) and combat service support (CSS) units that operate in support of corps and theater level requirements. These USAR units are usually not collocated with their higher headquarters and many are only assigned to a higher headquarters upon mobilization.

The Army's primary simulation trainer for CS/CSS units is the Combat Service Support Training Simulation System (CSSTSS) developed by the Combat Service Support Command, Fort Lee, VA. CSSTSS has been used to drive major logistics exercises such as LOGEX and FPLEX (Logistics Exercise and Forward Projection Logistics Exercise) and has been linked to confederation exercises like Prairie Warrior through an aggregate level simulation protocol. CSSTSS is a very detailed logistics exercise driver, but since the Army runs it on only two IBM computers (National Simulation Center (NSC), Fort Leavenworth, KS, and Fort Lee, VA), it is not readily available to USAR units for weekend training and it is difficult to coordinate USAR unit drill schedules for enough units to make CSSTSS cost effective for the USAR.

USAR exercise division (DIV(EX)) battle projection groups (BPG) have been fielded with the Brigade/Battalion Battle Simulation (BBS) and also have the capability to conduct limited Corps Battle Simulation exercises. Both simulations were developed to exercise combat arms maneuver units, and both offer only limited exercise support for CS/CSS units.

VICTORS was developed by NSC to train any type of military unit from squad through corps. It is run on any MS-DOS personal computer (PC), and lets the user custom build a database to replicate any exercised unit and its equipment. When the database is built, operating conditions, supplies and locations are entered into the PC, and VICTORS produces a stochastic (random) result that causes the exercised unit to react. In a sense, VICTORS is just a highly sophisticated pair of dice.

While BBS primarily replicates combat arms maneuver units and equipment, VICTORS can replicate almost any type of equipment, unit or unit activity (Figure 1). The 85th Div (Ex) has developed a linkage between BBS and VICTORS (BBS-V) that provides a robust CS/CSS exercise. We call it a "swivel-chair" exercise linkage because the simulations are not linked electronically; rather VICTORS is run concurrently in support of BBS. We have validated this concept with corps combat heavy engineer battalions and hospital units, and are continuing to develop exercises with other types of CS/CSS units.

Before a BBS-V exercise, the exercised unit's table of organization and equipment is first built in BBS. A VICTORS equipment database is then built to replicate equipment organic to the unit that is not replicated by BBS. When the unit is given a mission, its staff decides what equipment is needed to accomplish the mission, breaks the mission into its component tasks and computes the time required to accomplish each task. If the task requires the use of equipment that is not in BBS, such as an asphalt plant used by engineers in horizontal construction, that portion of the mission is passed to VICTORS. To this point, our use of VICTORS is similar to any simulation software "workaround." The difficulty with most manual or parallel computer workarounds, however, is that the using unit often forgets that the workaround is being used, and completes the simulation mission either without the workaround solution, or

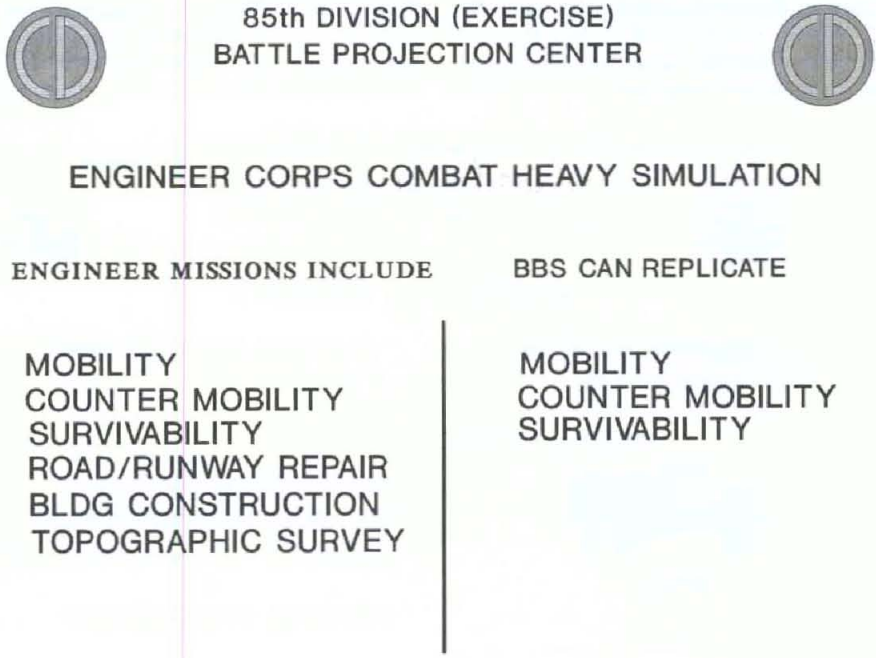

Figure 1.

worse yet, uses workaround information that contradicts other simulation data.

To prevent a disconnect between the simulation and the workaround, our solution is to build an "icon" in BBS that emulates the movement of the asphalt plant (Figure 2). The unit loads the icon onto a BBS replicated prime mover, and moves it on the BBS screen to its appropriate location before the mission is handed off to the VICTORS operator. The BBS movement is in "real time," and tracks the expenditure of fuel and the maintenance status of the plant's prime mover. The icon is labeled "asphalt xfer" so that the unit at the BBS workstation knows what is on the screen. When the icon reaches its work location, the BBS keyboard operator "swivels his chair" to hand off the play to VICTORS. The VICTORS PC operator is given data as to the location and status of the asphalt plant, as well as the planned time it will take to complete the mission. VICTORS then "operates" the asphalt plant.

At the end of each VICTORS game turn (usually one hour), VICTORS produces the results of asphalt plant operations on its printer. That information includes the consumption of expendables, output and equipment failures. The information is "swivel-chaired" back to the unit at the BBS workstation, which evaluates the data, and passes it on to its higher headquarters as appropriate. When VICTORS data indicates that the mission is complete, the unit at the BBS workstation re-loads the "asphalt xfer" icon on its prime mover and moves it in BBS to a new location.

The benefit of this type of linkage is that the unit at the BBS workstation gets the BBS time/space planning benefit of moving the equipment while maintaining visual accountability for it. Some VICTORS effects, however, such as operator wounds, must be disabled since VICTORS will produce personnel injuries that will not be tracked in BBS and would confuse the BBS simulation players if relayed from VICTORS. In this way VICTORS supplements BBS in a complementary fashion and does not run the risk of contradicting BBS by running parallel exercise play.

We have validated the BBS-V concept for engineer and hospital units, and we are continuing to validate the concept for other types of CS/CSS units. In maintenance exercises, for example, BBS replicates the recovery of damaged equipment reasonably well, but it magically repairs the equipment once the equipment reaches a repair facility. Linking BBS to VICTORS, on the other hand, we can replicate the actions necessary in the maintenance shop to repair the equipment, while appropriately consuming repair parts, tools and other expendables. Similarly, BBS does an excellent job of modeling wounded soldiers on the battlefield by forcing units to evacuate soldiers to appropriate medical facilities, and taking the appropriate length of time to repair the wound and let the patients convalesce. It does not, however, deal with the functions of running a hospital. VICTORS can model the soldier's wounds, the necessary medical equipment and supplies, the surgeon and the operating room, thereby providing an appropriate exercise to train a medical unit in its wartime mission.

The only drawback which we have experienced using this linkage is the naming of various functions in VICTORS. For example, when we use VICTORS to replicate operating on a patient, VICTORS does not deal with the medical casualty in medical terms. Instead the BBS medical casualty which VICTORS replicates is handled by VICTORS as an engineer mission and equipment. Using this concept, VICTORS can model nearly any type of activity as long as the data base builder has a reference for the time frames involved and the rates of consumption of supplies. But, since the VICTORS printout will identify results in engineer terms, the VICTORS operator must have a key which identifies the engineer terms on the printed VICTORS report as medical items, e.g. fuel consumption equals blood use. Either the VICTORS operator or the BBS operators must then translate the VICTORS results into BBS language. If we had access to the source code for VICTORS, we could create modules with appropriate names which would be less confusing to the exercise players.

One other caution must be used. VICTORS is an Army-developed software system. Many computer "hackers" can write software programs to replicate U.S. Army tactics and equipment. Using anything other than an approved Army system runs the risk of "rogue" programs, the parameters of which are known only to the software developer. The purpose of using computer simulations is to train to the Army standard and, as a result, only approved Army programs should be used. VICTORS is such an Army program. It is widely available, and has been developed to the Army standard. Unfortunately, funding has been cut for further development of VICTORS, but the versions which are currently in use provide the support currently needed. Additional development of VICTORS for specific CS/CSS modules would clearly be an enhancement to the suggestions in this article.

In conclusion, it is clearly better either to develop a seamless computer interface between simulations, or to modify software to model all necessary exercise situations. That is expensive and time-consuming, and not likely to happen soon in the current resource-constrained environment. Workarounds will continue to be necessary, but creatively linking simulations like BBS and VICTORS, as supporting simulations, can provide an interim solution until major new simulation systems, such as WARSIM 2000, are fielded.

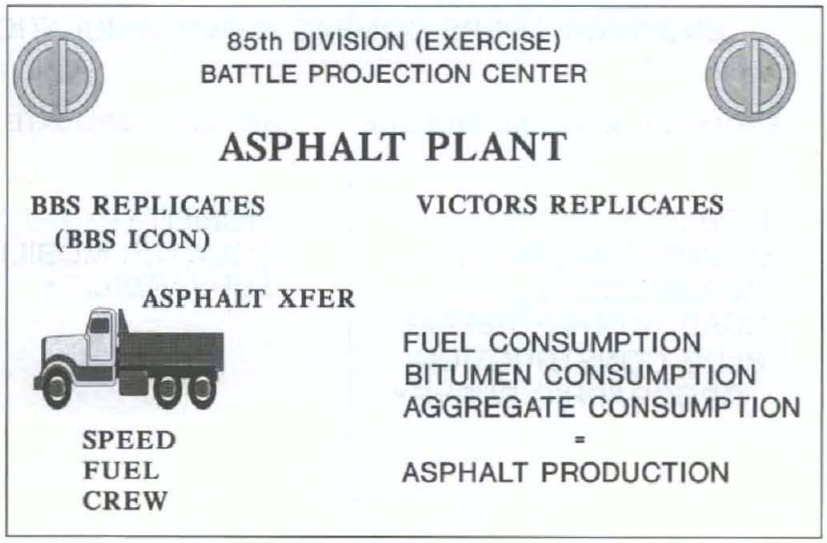

Figure 2.

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THERMAL MANAGEMENT OF THE CRUSADER XM297E2 ARTILLERY CANNON

By MAJ Scott Campbell
and Jeffrey W. Haas

Crusader, the Army's next generation self-propelled howitzer, is expected to achieve an unprecedented level of performance in terms of range, rate, and duration of fire. Present operational requirements are for 10 to 12 rounds per minute for three to five minutes and up to five rounds per minute sustained. Range is expected to exceed 40 km.

Excessive barrel temperatures present a major obstacle in achieving such high sustained rates of fire. The increase in capability brought about by fully automated loading and enhanced resupply will, without doubt, exceed thermal limits of conventional cannons. The effective management of thermal issues related to the armament will be of critical importance for Crusader and future artillery systems.

Gun Thermal Limits

When temperatures in the gun chamber exceed 350 degrees Fahrenheit, the gun may become unsafe to fire. At such elevated temperatures, premature ignition of the propellant or "cook-off" is an imminent possibility. Cook-off, should it occur before corrective action is taken by the crew, could result in undetermined ballistics, damage to the gun and, in the worst case, crew injury or death. At temperatures above 450 degrees Fahrenheit, there is a high likelihood of the charge igniting immediately upon loading. If this should occur before the breech can be closed, the results would be catastrophic.

Closely related to cook-off, yet often overlooked, is projectile exudation. A projectile which has been allowed to sit in a hot chamber for any length of time may result in the high explosive melting and "exuding" from the projectile. If an attempt is made to fire, the result could be a premature inbore detonation of the projectile.

Furthermore, it has long been noted that in rapid fire weapons, the wear rate near the origin of rifling increases dramatically. The mechanism of cannon wear is complicated and not fully understood. However, elevated bore temperatures due to extended, high rates of fire is a major factor.

The above issues have been of concern in past and present artillery systems as well. For future systems such as Crusader, effective thermal management of the armament will be crucial.

Operational Capability—the XM297E2 Cannon

Based on ballistic and thermal codes developed specifically to support Crusader, the thermal limits of the cannon (i.e., propellent cook-off) were regularly and routinely exceeded for typical Crusader battlefield day scenarios. Cook-off limits were reached sometimes as early as the second or third mission of the day.

In response to the challenge of meeting Crusader operational requirements, the 155mm XM297E2 Advanced Artillery Cannon was designed by Benet Laboratories, a part of the U.S. Army Armament Research, Development and Engineering Center (ARDEC), located at Watervliet Arsenal, NY. Developed specifically for Crusader, the cannon features an Integral Midwall Cooled (IMC) barrel. The IMC portion of the XM297E2 Cannon consists of a series of coolant channels extending axially through the midwall of the barrel for approximately the first third of its length. In operation, a glycol and water coolant mixture is continuously circulated through the channels. Surplus heat is dissipated by means of a radiator. The cannon is expected to meet all Crusader requirements without exceeding thermal limits.

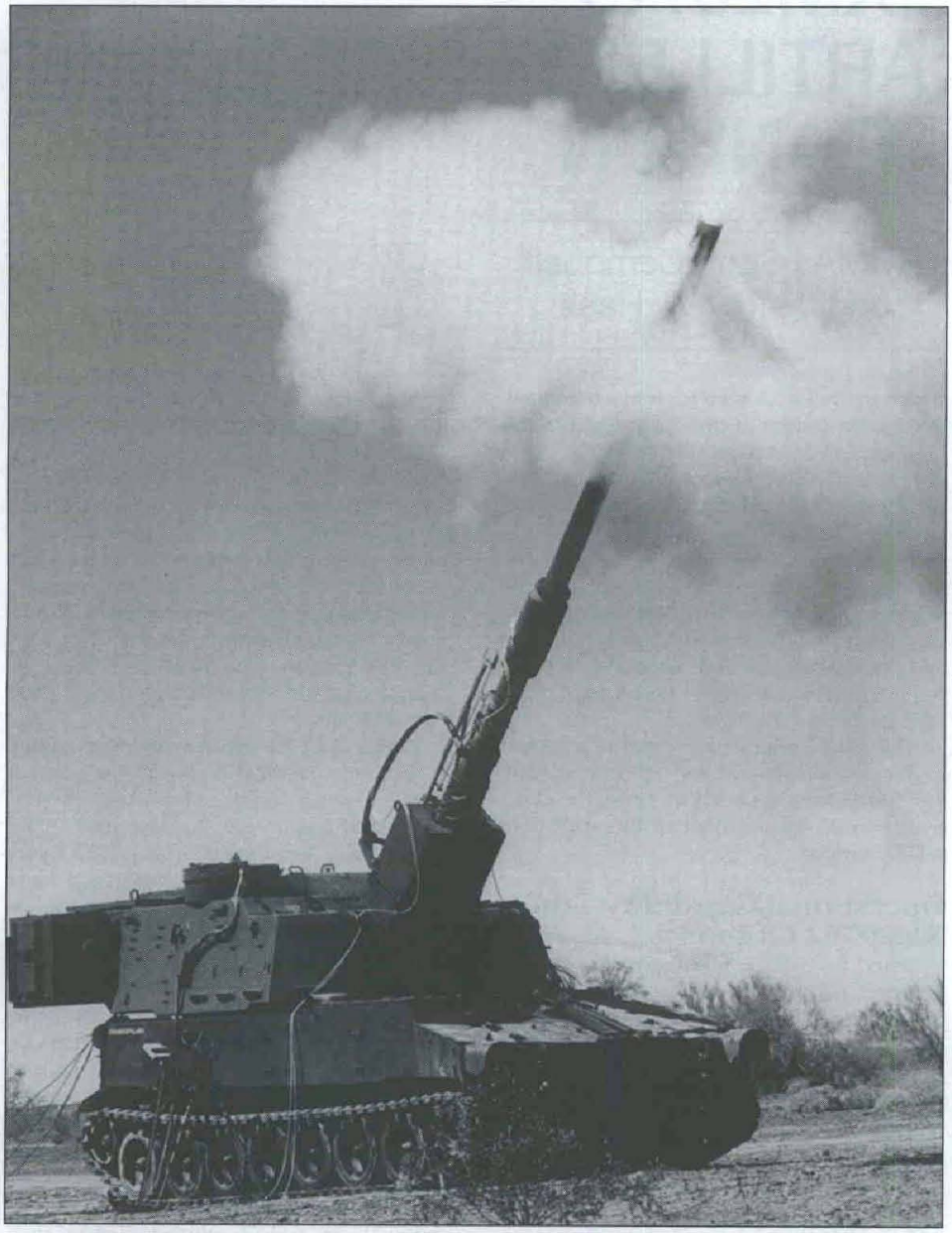
Surprisingly, the incorporation of cooling channels in a critical region of the cannon does not result in an unacceptable loss of strength of fatigue life. To date, over 1,300 rounds have been fired on XM297E2 cannons—60 percent of these being top zone charges. Tube fatigue life is expected to exceed wear life by a factor of at least two.

The impact a midwall cooled cannon would have on the operational capability of the Crusader system is enormous. In battlefield operations, a conventional monoblock tube would need to severely curb its missions in rate of fire and number of rounds fired as the day progressed. Eventually, the cannon would become too hot to deploy safely and would need to cool for a period of several hours before it would be fully operational. An actively cooled cannon, such as the XM297E2, would retain full operational capability throughout the day.

The increase in fire capability by actively cooling the chamber region, will undoubt-

edly result in overheating at the muzzle. Most gun steels begin to lose strength above 600 degrees Fahrenheit. As temperatures increase, there is a danger that the autofrettage—the pre-stress built into the tube—will begin to relieve itself, resulting in loss of strength and bore closure. Other issues related to elevated muzzle temperatures are thermal expansion of the bore resulting in projectile instability and decreased muzzle velocity, increased thermal droop, muzzle wear, loss of accuracy, and increased thermal signature. The conclusion from all this is that thermal management must involve the entire cannon, including the muzzle.

To maintain optimum performance, muzzle cooling will be featured on the XM297E2 cannon and is, at present, undergoing testing. Coolant exiting the IMC portion of the cannon is conducted the full length of the barrel by a cooling sleeve ending just behind the muzzle brake. As an added benefit, active cooling at the muzzle should provide a significant degree of thermal stability obviating the need for costly muzzle reference systems.



The XM297 Cannon undergoing testing at YUMA Proving Ground. The cannon, shown here mounted on a M109 testbed vehicle, features mid-wall cooling of the barrel as well as a laser ignition system and an integral perforated muzzle brake.

Conclusions

The requirements of modern self-propelled artillery systems, such as Crusader, with high sustained rates of fire will place severe thermal burdens on the armament. With present emphasis on greater range and firepower, this trend is expected to continue into the next century with systems of even greater performance. Moreover, the increase in capability in ammunition resupply coupled with fully automated loading will, undoubtedly, want to be fully exploited by commanders and their crew. Thermal limits of conventional cannons severely impede the full use of these capabilities.

Active armament cooling, such as the XM297E2 cannon, represents an effective and practical solution to this problem commensurate with improvements in ammunition handling and fire control.

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JEFFREY W. HAAS is a mechanical engineer with the U.S. Army Armament Research, Development and Engineering Center located at Benet Laboratories. He holds B.S. and M.S. degrees in mechanical engineering from Clarkson University and Rensselaer Polytechnic Institute respectively.

ABERDEEN TEST CENTER SETS SIGHTS FOR THE ABRAMS FLEET

Strict Quality Control Is The Key To The Process

By David C. Zupko

Introduction

An individual M1A1 or M1A2 tank is likely to encounter any number of battlefield situations and real-world conditions during a combat operation. That is why the technical testing done at the Tank Warfare Range Complex at the Aberdeen Test Center at Aberdeen Proving Ground, MD, uses a method of calibration that encompasses the full spectrum of variables a tank may encounter. This calibration method precisely measures the "jump" or difference (error) of the projectile's actual point of impact from the expected point of impact.

Background

Experts in the armor community have been debating for years about the best way to calibrate or "zero" tank fire control systems. Three primary ways offer varying degrees of cost and accuracy: individual zero, tube zero and fleet zero.

"Individual zero" means that, prior to battle, the tank crew locates a target about 1,200 meters distant, boresights the gun with the primary and auxiliary sights, fires three zeroing rounds, estimates the center of impact of those three rounds, adjusts the sights to the center of impact and fires two final rounds. If the two final rounds hit near the aid point, the tank is zeroed. If not, the crew must repeat the procedure. This is not only time-consuming and expensive, but it raises some important questions. Does a tank crew on the battle line have time for this? Will the weather (rain or snow) distort the zero determined on a clear day? Will firing the zeroing rounds give away your position? How many tanks need to be zeroed? How often is often enough, especially with changing weather conditions or extended operations? Prior to M1A1 production, each U.S. tank was "individually zeroed."

Another method, called "tube zero," is less expensive and has been popular with the German army. This method requires range firing every gun tube with every type of ammunition. Following the firing (using a standard procedure), the zero numbers are stamped on the gun tube. These zero numbers stay with each gun tube for its life, regardless of the tank being used.

"Fleet zero" has several cost and readiness advantages and is the current practice used by the Army. This approach requires firing a sampling of tanks, gun tubes and ammunition lots using a mixture of real-world battlefield variables, such as ammunition type and lot, temperature, gun tube lot and age, vehicle, turret offset, cant and pitch. This method results in a calibration number, or "zero" for the entire fleet of M1A1 and M1A2 tanks for each type of ammunition. This systematic approach adjusts the calibration factors as production continues for tanks, gun tubes and ammunition. "Fleet zero" uses far less ammunition resulting in tremendous cost savings for the Army. It provides a specific calibration number for each type of ammunition while taking into consideration a vast array of real-world conditions.

Quality Is The Key

Using instrumentation on the range and on the tank, the highly skilled Tank Warfare Test Team at Aberdeen Test Center performs periodic test firings to set the sights consistently for the entire Abrams fleet.

"Erroneous calibration numbers could ruin a tanker's day," said Rita A. Koerner, mechanical engineer and Team Leader of the Tank Warfare Cell at ATC.

Her most critical duty is providing strict quality control for the massive amounts of test data generated for all tests including the "fleet zero" tests. She graduated from Drexel University in 1988 with high honors before coming to work at ATC.

Koerner assures quality on-the-spot thanks to a quick, computerized calculation of "jump" along with observations from the tank crew and instrumentation operators. Typically, within five minutes of firing a test round, the impacts are video scored at four discrete ranges. The velocity radar, through-sight camera and gun-tube camera, transmit data to the computer for the automatic calculation of the error.

Koerner checks the myriad of inputs, looking for hardware problems of human error before firing another round. Her oversight of operator logs ensures consistent documentation of test groups as a critical back-up to the hours of live video-scoring data.

The Tank Warfare Complex is a popular stop on the ATC demonstration tour where Koerner briefs visitors and shows the "fleet zero" process firsthand.

Conclusion

ATC's "fleet zero" fire control tests of the Abrams fleet mean big cost and ammunition savings for the Army. More importantly, though, ATC's calibration numbers mean that tank crews go into battle with a high probability of a first-round hit.

DAVID C. ZUPKO is an engineer in the Advanced Concepts Division at the Aberdeen Test Center. He holds a B.S. degree in mechanical engineering from the New Jersey Institute of Technology. Zupko is a member of the Army acquisition workforce.

CONSTRUCTION VEHICLE NAVIGATION AND AUTOMATION

By Jeffrey Walker

With the improved performance of Computer-Aided Design and Drafting and other automated surveying means, users are able to accurately and efficiently design and construct in the virtual world of computers.

Introduction

Most construction activities require some form of earth movement, whether it be grading, clearing, cutting and/or filling. Before, during and after these construction activities, site surveys are performed to verify that the project area is consistent with the engineering design. In years past, these designs were drafted by hand and interpreted by surveyors in the field as to whether the proper quantities of soil were being excavated and/or deposited. With the improved performance of Computer-Aided Design and Drafting (CADD) and other automated surveying means, users are able to accurately and efficiently design and construct in the virtual world of computers. Until now, that automation stopped when moved from the office computer to the project site. In other words, earth moving equipment operators relied on experience and wooden stakes accurately placed by surveyors to communicate the proper design surface.

In April 1993, the U.S. Army Topographic Engineering Center (TEC) and Caterpillar Inc. signed a three-year Construction Productivity Advancement Research Program Cooperative Research and Development Agreement (CPAR-CRDA) to develop a Global Positioning System (GPS) based construction vehicle positioning and navigation system that could be adapted to various construction equipment platforms. The final system combined the latest GPS technology with a variety of CADD tools. This combination offers the equipment user computer-generated views to display and continuously update the topography during normal construction activities. The system also produces as-built drawings of the construction site that can be electronically transferred back to the design engineer for verification.

Automation of any earth moving activity requires continuous tracking of the equipment's position in relation to the project area (see Figure 1.). This information must also be graphically relayed to the equipment operator and to the field office for monitoring the machine's progress. Therefore, for the CPAR-CRDA to be considered successful and result in a marketable product, the positioning system and the CADD interface must operate without failure and be economically feasible in a construction environment.

Positioning System

The system developed in this CPAR project provides the equipment operator with positioning information based on GPS. NAVSTAR GPS is an all-weather, 24-hour, worldwide, three-dimensional (3-D) satellite-based positioning system developed by the Department of Defense (DOD). Each satellite broadcasts coded messages (the P-code and C/A code) on two frequencies, L1 and L2. Both the carrier frequency and their coded messages are used to obtain positioning information. Differential GPS (DGPS) techniques process signals from two GPS receivers operating simultaneously and determines the 3-D vector between them. This technique can be used with the code phase information transmitted by the GPS satellites to obtain meter accuracy or the carrier information to obtain accuracy to a few millimeters.

In the past, a significant restriction to using GPS technology has been the ability to position accurately in real time. Until recently, the ability to position a moving platform with DGPS (to a few centimeters) required very strict operational constraints and procedures that were not feasible in a construction environment. In 1988, under funding from the U.S. Army Corps of Engineers (USACE) Dredging Research Program (DRP), TEC began developing a real-time GPS-based positioning system capable of delivering 3-D positions accurate to a few centimeters over a range of approximately 20 kilometers. To obtain "centimeter" level positions in real time, the integer ambiguities (whole number of integer wavelengths) between the receiver and the observed satellites must be solved while one receiver is in motion, termed On-The-Fly (OTF), and another is located over a known control point. For every common epoch (one measurement of GPS carrier phase data) measured by the receivers, a 3-D vector is calculated between them establishing the position of the moving receiver relative to the reference receiver.

The OTF real-time system requires dual frequency (L1/L2) geodetic GPS receivers

capable of receiving full wavelength carrier phase measurements during Anti-Spoofing (AS). A base/reference receiver is placed over a known control monument. The raw carrier phase measurements are formatted using a computer and broadcast over a telemetry link to the roving unit of moving platform. The rover setup requires a telemetry link (to receive reference station measurement), a computer, and a GPC receiver. The raw carrier phase measurements from both the reference and rover receivers, combined with the OTF algorithms, are used to compute the rover's position in real time.

The high-precision positioning is available from the OTF system once the software resolves integer ambiguities. Before initialization can occur, both the user and reference station must be tracking five common satellites in which the L1 and L2 carrier signals are being measured. As long as both the reference and rover receivers remain locked on at least four common satellites, real-time "centimeter" level positioning in three dimensions will continue to be available at the rover.

Under this CPAR-CRDA, the OTF system was extensively tested and modified to work with Leica SR399 GPS receivers. Many tests of the OTF system have occurred since August 1993. The results of these tests have shown that the OTF system can provide a horizontal and vertical accuracy of approximately three centimeters in a robust manner. The OTF system offers a very powerful tool to position accurately in real time, which results in reduced costs of construction and earth moving projects for USACE and the private sector.

CADD Interface

The Caterpillar Computer Aided Earth moving System (CAES) uses high-accuracy GPS receivers in conjunction with computers and displays mounted on earth moving equipment to provide machine operators and site managers with a variety of real-time information regarding the execution of the earth moving task. On-board information systems provide the machine operator the information he needs to correctly and accurately accomplish the earth moving task. There are three basic colors representing earth moving operations depending on the machine type. For example, a dozer operator will see areas to be cut in red, to be filled in blue and areas on grade in green. Generally, the information includes the engineering plan, the current status of the job, the machine location, the job site, and specific information for controlling the machine's working tool, i.e., the blade, bucket, etc. As the machine accomplishes the tasks, the onboard information system records that accomplishment for real time or later transmission to site management and engineering facilities.

The On-The-Fly system offers a very powerful tool to position accurately in real time, which results in reduced costs of construction and earth moving projects for the U.S. Army Corps of Engineers and the private sector.

Figure 1.
Dozer operation with the automated system.

Field Testing

Several experiments tested the effectiveness and feasibility of the positioning system and CADD interface. Practical tests were performed to test the integrated GPS/CADD system under typical construction conditions. Repeatability tests were also performed to test the validity of the OTF positioning system with different types of GPS receivers.

The first practical test was performed in December 1993 at Caterpillar's Peoria Proving Grounds in Peoria, IL. The objective of this test was to combine TEC's positioning software with Caterpillar's SDP/CAES and test its functionality on board a Track-Type Tractor (dozer). A second objective was to determine the best possible location on the dozer to mount the GPS antenna, on the cab or on the blade.

The dozer operator prepared a section of a highway construction site without grade stakes or a survey crew, relying only on the geographical display on the machine. Simultaneously, the dynamic construction site

Figure 2.
Repeatability Testing.

data was broadcast via a radio link to a remote location (in this case, a notebook computer at the project site) to provide a current topographic model of the site. The cab appeared to be the optimal location for the antenna, until a process can be developed to prevent modification of the as built (terrain model) caused by raising the blade and moving to different sites.

The second practical test of the joint system was to evaluate the static and dynamic performance of the positioning hardware and software with the CADD interface. Acquisition, reacquisition and repeatability were evaluated under simulated "deep open pit mining" conditions where satellites were intermittently shaded. The tractor operated for a period of two weeks in various conditions, including areas with few obstructions and low multipath environment, as well as areas with partial to total satellite blockage with high multipath environment. The position computations of the various receivers agreed within the constraints imposed on the solution when each receiver system had resolved its ambiguities.

The repeatability tests (See Figure 2) were performed at Caterpillar Inc. Technical Center, Peoria, IL, in December 1993, March 1994 and March 1996. The objective of this testing was to determine the repeatability of the OTF positioning software over known baselines using different manufacture's GPS receivers (Trimble 4000SSE and Leica SR399). These tests were conducted on a known test course with each point repeatedly observed during different GPS satellite constellations. During each of the three tests, the OTF system was operated within two kilometers of the reference station providing positions at one-second intervals. The initialization time was set to attempt a solution after 15 epochs had been recorded of L1 and L2 data for five satellites.

The performance of the OTF system yielded a positional (horizontal and vertical) difference of 0.0183 m + 0.0101 (95 percent confidence interval). These repeatability tests demonstrate the positional accuracy and precision of the OTF system.

Conclusions and Recommendations

Today, most of the engineering design work is being done in a CADD environment. However, some benefits of CADD design work are lost when drawings are plotted and taken to the field as 2-D sheets. Extending this electronic automation (CADD) to the field allows the equipment operator to view and update the design/terrain information during normal construction activities. This automation eliminates the need for grade stakes on the construction site. Combining OTF positioning and CADD demonstrates the viability of bringing this construction navigation and positioning system to a truly production level system. CAES improves the quantity, quality and frequency of the information that flows to and from the office and field. This information is available, upon demand, from either the field or the office.

Based on the test results from the OTF positioning system, combined with the CAES, an on-machine dynamic data base coupled with GPS provides the machine operator instantaneous feedback of his performance and provides management timely progress information during site development. In addition, site design information can be reliably transmitted to the machine and presented to the machine operator on a daylight readable color screen. Also, the position of the machine tool can continuously be measured and compared to the spatial coordinates of the site to generate and maintain as-built site data files. The machine, using geodetic quality GPS equipment, continuously performs the surveying operation while simultaneously shaping the site to conform to the planned design.

The results achieved under this CPAR-CRDA support the continued development of the OTF positioning software utilizing commercial suppliers of GPS hardware to provide enhancements for evolving commercial and military products. The further development of the CAES technology will allow the smooth transition from the current terrain to the site design. This scenario creates an optimal relationship between the machine operator, the work site and technology.

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ENHANCING SPECIAL FORCES

A Different Kind Of Technology Demonstration

By Dr. Michelle M. Zazanis

In September of 1996, the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) presented a demonstration of the technology we have developed to assist in the recruitment, prescreening, selection, training, and development of Special Forces soldiers. While technology demonstrations are very common for research and development in the arena of Defense hardware products, they are unusual for manpower and personnel research, and presented a particular challenge. When compared to physical hardware, personnel research produces less tangible products such as databases, statistical relationships, assessment tests and tools, surveys, and handbooks. The challenge is to demonstrate how these kinds of products impact the Army.

While this research contributes to the theoretical development of manpower and personnel science and is often communicated within the professional community, the applied products and recommendations from the research must also be clearly communicated to our customers. Demonstrating the research products and recommendations enhances their utility to others by encouraging the application of the research findings and products to other relevant situations. This article briefly reviews the development and accomplishments of our Special Forces (SF) program of research, and describes the demonstration we developed to communicate this research to our sponsors and the Army and R&D community.

A Partnership With Special Forces

The collaboration between ARI and Special Forces began in the mid-1980s when the U.S. Army John F. Kennedy Special Warfare Center and School's Commander, BG James A. Guest, and Deputy Commander, COL Richard Potter, established a program to assess and select soldiers who were most suitable for Special Forces training. They enlisted the help of ARI in developing this program and thus, began a partnership to use scientific theory and methods to select and train soldiers for SF.

In 1991, a five-year memorandum of agreement between U.S. Army Special Operations Command (USASOC) and ARI created a scientific coordination office at Fort Bragg, which enabled ARI to support the SF community. ARI conducted a needs analysis to identify important manpower and personnel issues that could be addressed through research, and developed a research framework which included six key areas of the Special Forces "life-cycle": recruitment, selection, assignment to a military occupational specialty, training, job performance, and soldier retention. (See the May-June 1995 issue of *Army RD&A*.)

The MOA was renewed this year, and ARI produced a technology demonstration as a milestone to describe the scope and content of our research, and the technologies we developed in the past five years to enhance aspects of SF assessment, training, and development.

The Technology Demonstration

The ARI technology demonstration, Enhancing Special Forces, was held on Sept. 19, 1996, at the Fort Bragg Officer's Club, Fort Bragg, NC. It was attended by members of the special operations community, including LTG Peter J. Schoomaker, Commanding General, USASOC; and MG Kenneth R. Bowra, Commanding General, Special Forces Command (Airborne). Upon arrival, attendees watched a five-minute video which provided an overview of our research with Special Forces. They then proceeded through five display areas. At each area, an ARI researcher gave a brief presentation, supported by various materials, including video, audio, and graphic materials, example handbooks and forms, and fact sheets. The demonstration format encouraged attendees to ask questions and discuss issues with researchers. Several military personnel assisted with the demonstrations to provide further insight into the practical use of the research in the field.

Content Of The Presentations

The displays and presentations highlighted SF research in five specific domains: Recruitment and Manpower Planning; Prescreening; Assessment; Training; and On-the-job performance.

Recruitment And Manpower Planning

Our research in this domain has monitored recruits through the Special Forces Assessment and Selection (SFAS) and Special Forces Qualification Course (SFQC) by developing a longitudinal database which links background information, test scores, and performance records from SFAS with performance records from SFQC. At the technology demonstration, photographs and graphics depicted the steps along the "Road to Special Forces." Additionally, an ARI researcher discussed the importance of prior experience factors in determining recruit performance, as well as how changes in the pool of entering students would subsequently impact attrition. Handbooks that ARI developed based on research in this domain were displayed—including the *Physical Training* handbook, which guides recruits preparing for SFAS, and the *Career Information* handbook, which provides recruits with information about a career in Special Forces. The first sergeant from the Special Operations Recruiting Detachment discussed the application of ARI research in recruitment.

Prescreening

To better select soldiers who have the

abilities and motivation required to succeed in SFAS, ARI developed new measures of the physical, mental, motivational, and background characteristics necessary for success. Using photographs and graphics to identify the six basic domains under investigation, an ARI researcher described psychological measures that have predicted performance in SFAS, such as adaptability, autonomy, and spatial ability. One of the highlighted graphics illustrated an example item from the spatial abilities test to help attendees understand how test responses could be related to SFAS performance. Given consistent and definitive patterns of prediction, these new measures could potentially prescreen soldiers for SFAS, saving time and money.

Assessment

Since our original contribution to the development of SFAS, ARI has continued to provide research and products that fine-tune the SFAS program. This research included development of an assessor training program, improving the *Assessor Handbook*, revising peer evaluation methods, examining candidate attitudes, and reviewing historical trends in candidate performance. The demonstration focused on the Assessor Training Program, and used photographs and graphics to identify its key features. An ARI researcher described the development of the program and the rationale behind program components, which included training videos, workbooks, and other manuals and documentation. The Senior Assessor from the SFAS program provided an enactment of the training process, playing excerpts from the training video and showing corresponding workbook exercises.

In the domain of manpower and personnel, as with Defense hardware, technology demonstrations stimulate thinking and can promote more wide-spread utilization of research information.

Training

ARI has also provided research-based recommendations that fine-tune SF training, including the development of computerized language training software, a template for intercultural communications training, advanced peer evaluation forms to improve student feedback in SFQC, and a standardized course evaluation form for SFQC. The demonstration focused on peer evaluations, and used copies of the revised peer evaluation form to illustrate critical revisions made to the system. Photographs and graphics described key dimensions of peer assessments in SFQC, and an ARI researcher discussed the development and implementation of the forms.

On-The-Job

The final demonstration described the process ARI used to identify and define the critical dimensions of successful performance in the SF job. By asking SF soldiers to write detailed descriptions of incidents they had witnessed on-the-job, ARI was able to analyze the performance dimensions relevant to these incidents, and develop a list of the job dimensions critical to SF. An audio tape played at the demonstration reenacted examples of the incidents used in this process, and photographs and graphics listed the corresponding job dimensions. An ARI researcher described the process of using these incident descriptions to develop the list of performance requirements, and explained how this could be used to assess soldier performance in the field. In addition, a warrant officer from the training company displayed the counseling handbook he had developed based on the ARI list of job dimensions, and described the process he used to translate the job dimensions into a counseling handbook for training SFQC students.

Communicating Results Using A Multimedia Presentation

Using this type of multimedia presentation to demonstrate research promotes an emphasis on the practical utility of R&D findings, and has greater potential than the typical briefing to capture interest in the research findings. The variety of media used in the demonstration, including audio, video, graphics, briefings, and fact sheets, provided both a method to match different learning styles in the audience, and a way to emphasize key points through multiple informational inputs.

Having multiple facets to the demonstration can also help to match the needs of audiences who have varying depths of interest and varying amounts of time. The demonstration can shift from formal to more informal, and from pure browsing and self-led tours to in-depth briefings. With videos and/or fact sheets available, the demonstration can even reach personnel who were unable to attend.

While an initial investment is required to purchase structural materials for graphic displays, these materials are completely reusable, resulting in diminished long-term costs. In addition, the Army has in-house support available through Defense Administrative Support, which employs an energetic and competent staff to format written materials, develop graphic displays, produce audio and video programs, and accomplish the emplacement, removal, and storage of display materials. Even with their assistance, the demonstration is a challenge, and the lessons learned in our After Action Review would be useful to those considering such a demonstration.

Applying SF Research To Other Areas

Demonstrating R&D technologies in this manner provides an opportunity for attendees to consider applying the research to other situations, although caution must always be exercised in applying research from one setting to another. In the domain of manpower and personnel, as with Defense hardware, technology demonstrations stimulate thinking and can promote more wide-spread utilization of research information. Potential applications which are already arising from the SF technology demonstration include employing revised peer evaluation forms in the Ranger Training Battalion and Reserve Officer Training Corps programs.

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COMBINED TEST TEAMS STREAMLINE TESTING

By Charles A. Block

Introduction

During the last several years, many of us who work in the Department of Defense have felt the impact of "right sizing." When it all started, the proposed cuts generated fear that the readiness of the Armed Forces would be adversely impacted. This was also true in the test community. The paradigm that independent technical testing was the only way to ensure fielding of the best equipment possible had to change. That paradigm has now changed in the Army aviation test community through the coordination and initiatives of the U.S. Army Aviation Technical Test Center (ATTC) at Fort Rucker, AL.

Background

Understanding the impact of what has happened requires examination of the way things used to be at the ATTC. Let's look at the example of the OH-58D Kiowa development. This aircraft was developed and tested by the prime contractor over a period of several months. By the time the Army flew it for the first time, the aircraft was mature and had accumulated several hundred flight hours. The next step was a preliminary airworthiness evaluation (PAE) by the Army. This entailed flights by Army experimental test pilots before non-experimental test pilots could fly the aircraft. This added a few more months and additional flight time. The PAE was followed by a production qualification test that added three or four more months and another hundred flight hours. After all of the developmental testing was completed, the operational test started. This traditional process was very costly and time consuming. The experience with the AH-64A and UH-60A was similar. Budget constraints and acquisition streamlining initiatives required examination of alternative methods for testing.

The Combined Test Team

About the same time that Defense spending reductions began, funds for developing the RAH-66 Comanche helicopter were also reduced. The original program had called for the two competing contractor teams to have a "fly off" with actual hardware. However, budget cuts quickly eliminated that option, and the "fly off" was accomplished through simulation (an example of virtual testing by ATTC, but that is another story). During various test-related meetings, the developmental test community recognized a need for major changes in the way it "conducted business." Out of these deliberations, the Combined Test Team (CTT) was born. The concept called for one test that would answer both contractor and government requirements. In general, the concept appeared to have merit and was widely accepted by the developers, but not the test community. Some of the counter arguments were:

- *The government won't control the flow of information when anomalies occur that are very normal for early test flights.* Contractors felt that there may be a "Chicken Little the Sky is Falling" reaction from the government when problems are identified.
- *The government test community must have its own data collection and analysis system to ensure that the contractor doesn't cheat.*

The Comanche experience has been so positive that the Combined Test Team approach has been extended to other programs.

• *Government and contractor personnel have such diverse goals that they will hide things from each other. Communication will never be open.*

• *We've always had dedicated government testing.*

After much discussion, the test team developed a CTT Charter that spelled out the "rules of the road." The charter clearly identified responsibilities, defined duties, and addressed the control and distribution of test data. The team also had the foresight to include the CTT Charter in contractual documents.

Current Status

Where are we today? With the Comanche, the CTT is a success story. We have an ATTC pilot permanently assigned to the contractor flight test facility, who participates in test flights on a rotational basis with the contractor pilots. The technical test community provides input to contractor test plans to ensure the government-unique requirements are satisfied and participates in documentation and review of test results. ATTC also has full-time test coverage at the contractor facility where equipment is being developed.

As a member of CTT, ATTC has developed several CTT test plans that were presented to the contractor team for review and then executed as combined tests. Initial mistrust has been overcome, and the contractor now welcomes our expertise and the Army perspective that our military test pilots bring to the table. Additionally, we now have greater trust in contractor data, realizing that the contractor wants to field a quality product just as much as we do.

Other Programs

The Comanche experience has been so positive that the CTT approach has been extended to other programs. ATTC is participating in a combined test of the OH-58D Kiowa Warrior R-3 engine test at the contractor facility. This experience has been as positive with this contractor as it was with the Comanche team. We are also planning a CTT effort for the Mission Enhanced Little Bird in concert with the fourth major helicopter manufacturer. This is still in the early planning stages but also appears to have potential as another success story. Finally, we plan to apply the CTT approach to a non-aircraft development. The Air Warrior suite of aviation life support equipment, being developed by the Program Manager, Aircrew Integrated Systems, will also use combined testing.

Dollars that would otherwise be spent for testing are now being used to procure hardware that will improve the warfighting capability of the Army aviation community.

Conclusion

It is clear that CTTs will be the model for future testing. Some of the "Lessons Learned," thus far, are:

• *The CTT concept must be included in contractual documents, and a charter developed that clearly defines responsibilities and access to information.* The document should also define a process for conflict resolution.

• *Government presence in the contractor facility is mandatory early in the development program to assist the contractor in developing detailed test plans and procedures.* Face to face contact is the only way to build the trust necessary for the CTT to be a success.

• *There will be a significant increase in the requirement for extended travel by government personnel to contractor facilities.* This must be planned for and the required number of personnel must be allocated in advance of the test. If not correctly planned, extended travel can have a negative impact on the morale of the test personnel and/or the test.

• *Don't be afraid to jump in and roll up your sleeves and get elbow to elbow with contractor personnel.* You won't become a "company person." You will be able to remain objective in your evaluation.

In summary, the initial concerns about CTT operations have been resolved. Combined testing is resulting in millions of dollars of government cost avoidance. Dollars that would otherwise be spent for testing are now being used to procure hardware that will improve the warfighting capability of the Army aviation community.

Test Above the Best.

CHARLES A. BLOCK is a test coordinator at the U.S. Army Aviation Technical Test Center, Fort Rucker, AL. He holds a B.S. in aviation management from Auburn University and an M.S. in systems engineering from the University of Southern California. Block is a distinguished graduate of the Naval War College and a member of the Army Acquisition Corps, Level III-certified in test and evaluation.

From The Director, Acquisition Career Management Office (ACMO)

These are exciting times in the Acquisition Career Management Office! We've completed the first Acquisition Workforce Support Specialist (AWSS) training workshop and are conducting the first Competitive Development Group (CDG) Orientation for Year Group 1997. See articles summarizing both in this issue. Mr. Charles continues his briefings to update the Army Acquisition Workforce (AAW) all over the country. Consult our Army Acquisition Corps (AAC) homepage under "DACM on the Move" for future schedule information.

The new AAC exhibit, featuring members of the AAW and AAC, focuses on the questions and issues raised in the field. The display accompanies Mr. Charles on his visits to the workforce, and will be staffed by members of the ACMO so that you can continue to provide us with the valuable feedback you've provided in the past. Your input to the process is crucial in helping our office develop the kinds of programs required to make the Army's acquisition professional the best in the business.

Congratulations to the three AAC graduates of the Naval Postgraduate School (NPS). I encourage you to read the article about NPS on page 47 to find out more about the benefits of this educational opportunity. I encourage you to consult the article on the value of long-term training by Gail Stenger. Congratulations also to the 23 graduates of the Materiel Acquisition Management (MAM) Course.

Regarding the topic of Advanced Civil Schooling (ACS) for officers. . .Recently, we met with action officers from the Office of the Deputy Chief of Staff for Personnel and the U.S. Total Army Personnel Command (PERSCOM) to determine how we might meet the educational needs of AAC officers and still be fair to the rest of the officer corps. Our solution is three-fold. First, to reduce the time it takes to get an advanced degree needed to fill a valid Army Educational Requirements System (AERS) position, officers selected for the fully funded ACS programs will be directed to enroll in credible programs of moderate duration, nominally 12-18 months in length. We will continue to work with the Naval Postgraduate School to reduce the overall length of their curriculum and identify other schools for possible AAC affiliation which are willing to structure degree programs to meet our AERS needs. Second, the business hours required for AAC membership will be met in various ways (i.e., up to 24 graduate hours, depending upon the officer's undergraduate field of study). Officers can attend Army- and DOD-funded business courses on a TDY and return, or TDY enroute, basis. For example, several business courses are already offered at the Army Management Staff College, Army Logistics Management College, and Defense Systems Management College which might be suitable. Moreover, some of these business hours may be obtained during resident Command and General Staff College as part of the AAC Focus Program. Finally, when it is our only option, we will use short-course training procedures for educational courses that are necessary to perform present duties and/or meet AAC membership requirements (i.e., short-course training under Section IV, AR 621-1). The AAC leadership will closely monitor this method of education to ensure it is not used above the minimum required business hours or to obtain an advanced degree. By restructuring our approach to ACS, using available Service school courses, and judiciously using short-course training, we believe the AAC will be able to further reduce the time necessary for our officers to meet educational requirements.

Recent Product Manager selection board results indicate that officers who complete at least two years in a program office are competitive for PM selection. With limited positions in the program offices, PERSCOM will rotate captains and majors at 24 months to ensure a sufficient pool of experienced branch qualified officers for future PM positions. Also, many officers working in PM matrix support organizations are getting experience equivalent to that gained by officers assigned and working in a PMO.

Make sure your job description and your rater/senior rater comments address your duties in support of the PMO so that your PM-related experience is clear to anyone reading the efficiency report. This is equally important for both military and civilian members of the AAC.

The Army and the Army Acquisition Corps bid farewell to two of its senior leaders and staunchest advocates. Mr. Gil Decker, the Army Acquisition Executive and Assistant Secretary of the Army for Research, Development and Acquisition (ASA(RDA)), returns to the civilian business sector. (See article on the inside front cover of this issue.) He also intends to pursue his lifelong goal of reducing his golf handicap. LTG Ron Hite, the Director, Acquisition Career Management and Military Deputy to the ASA(RDA), retires after 33 years of active duty. LTG Hite also intends to launch a new career in the civilian sector after a long and well-deserved visit to his home state of Tennessee. On behalf of all of the members of the Army Acquisition Corps and workforce, I want to express our appreciation for everything they have done for the Army, for acquisition, and for its members. We wish them the very best of luck in their future endeavors.

Once again, these are exciting and busy times in the Army Acquisition Corps. Don't miss the opportunity to participate in workforce briefings and provide feedback to our office. Also, don't miss the article on a new education and training program which will combine a Master's of Science degree and a Training-With-Industry tour for both military and civilian AAC and AAW members. Check it out and call for more information.

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Acquisition Workforce Support Specialist Training

A training workshop for the newly established Acquisition Workforce Support Specialists (AWSS) was held May 12-15 in the Washington, DC area. Acquisition Career Management Advocates (ACMA) were present the first day to receive a briefing from Keith Charles, Deputy Director, Acquisition Career Management, and an overview of training for the AWSS. The AWSS attendees and several other members of the personnel community were also briefed by Charles on his vision for the Army Acquisition Corps (AAC). They received training in the following areas: Customer Support, the Defense Acquisition Workforce Improvement Act, Organizational Overview, the AAC, Certification, Career Development, Education and Training, Military and Civilian Career Management, Information Technology, Central Management, and Position Management. The workshop concluded after case studies were conducted, providing the AWSS with examples of issues they may be confronted with in their new positions. The AWSS will support ACMAs in the field, and will interface with the personnel community to service acquisition workforce employees.

AWSS members (left to right) Sharon Clodfelter, U.S. Army Missile Command, and Kelly Irvin, Fort Monmouth, NJ, discuss some issues with Tom Evans, Customer Support Assistant to the Acquisition Career Management Office, OASARDA.

1997 Competitive Development Group Orientation

Year Group 1997 Competitive Development Group (CDG) selectees participated in the first CDG orientation May 19-21, 1997. The orientation was held in the Washington, DC, area and was attended by Keith Charles, Deputy Director, Acquisition Career Management (DDACM), representatives from the Acquisition Career Management Office (ACMO), Functional Chief Representatives (FCR), Functional Acquisition Specialists (FAS), Acquisition Career Management Advocates (ACMA), and CDG supervisors and sponsors. Members of the original process action team—chartered to define the strategic vision of the Army Acquisition Corps—were invited to attend a ceremonial dinner.

New Competetive Development Group selectees (left to right), Rusty Weiger, Lenora Clark-Evans, Carlton Brewer, Myra Gray, Wayne Bruno, Carolyn Lucas, Virginia Thompson, Julie Hanson, Pamela Lock, Jean Matlock, Shirley Hornaday, Susan Chiu, Ann Scotti, Robert Szerszynski, Jennifer Chew, Scott Crosson, Alvin Hopkins, Catherine Doolos, Kay Griffith-Boyle, Anthony Subrizi, Mark Cope, Robert Longtain, William Pekny, Glen Berg, and Craig Spisak.

The orientation began with a workshop where CDGs conducted self-assessments of leadership and management competencies, and discussed the ideal competencies of future acquisition leaders. Charles presented the attendees with a briefing which summarized the vision, philosophy and expectations of the CDG program. Jerry Lee, from the ACMO, presented an organizational overview. Pat McNabb, the Management and Reserve Affairs Liaison in the ACMO, enlightened the CDGs on the Civilian Career Management Process. Tom Drinkwater, from the ACMO, offered a presentation on the policies and procedures of the CDG program. After the briefings, the CDGs participated in a communications workshop, which was designed to present the CDG with some tools to better prepare them for their new assignments. While the CDGs participated in their workshop, a roundtable discussion of the CDG program was conducted for the other attendees, where expectations, roles and responsibilities were discussed. Finally, the CDGs, sponsors, supervi-

Competitive Development Group selectees (left to right) Virginia Thompson, Shirley Hornaday, and Kay Griffith-Boyle discuss some of the details of the CDG process.

CDG selectees (left to right) Lenora Clark-Evans, Myra Gray and Susan Chiu listen intently to one of the presentations at the CDG orientation.

sors, ACMO proponency officers and FASs worked to formulate the CDGs Individual Development Plans (IDPs). The IDP serves as a roadmap of training and experience which, when executed, best facilitates a successful acquisition leadership career progression.

A ceremonial dinner was followed by a speech by Charles, and the CDGs were presented with certificates and pins to honor their achievement and selection to the program. The Year Group 1997 Competitive Development Group selectees are shown in the accompanying photograph on page 46.

Charles Briefs Acquisition Workforce

In the second of a series of ongoing briefings, Keith Charles, Deputy Director for Army Acquisition Career Management, spoke May 12, 1997, at the Pentagon to a gathering of members of the National Capitol Region Army acquisition workforce. He addressed the subject of "Building Acquisition Leaders for the 21st Century." Personnel from the Acquisition Career Management Office were on hand to conduct "sensing sessions" and answer questions posed by the workforce attendees. The purpose of these briefings is to update the Army acquisition workforce on the status of Army Acquisition Corps initiatives and future strategies.

In addition to the first NCR briefing, which was held at Fort Belvoir, VA, in April, Charles presented briefings at the U.S. Army Simulation, Training and Instrumentation Command in Orlando, FL, and at the annual Military Traffic Management Command, Principal Assistant Responsible for Contracting Conference in Kissimmee, FL. Local Acquisition Career Management Advocates were presented with certificates at all of the briefings.

3 AAC Members Graduate From Naval Postgraduate School

Three Army Acquisition Corps (AAC) civilians graduated from the Naval Postgraduate School in Monterey, CA, on March 27, 1997. David Henningsen, Christopher Newborn and Gail Stenger, all members of the AAC, completed the school's 21-month graduate program in systems acquisition.

The 175 graduating students were addressed by VADM Alexander J. Krekich, Commander, Naval Service Force, Pacific Fleet. Krekich emphasized the importance of a graduate education for today's Department of Defense (DOD) Service members and civilian employees. The school superintendent, RADM Marsha Evans, also addressed the students and wished them well in their upcoming assignments.

Of the approximately 1,500 students who are enrolled at the school, 75 percent are in the U.S. Navy and Marine Corps, 15 percent are from other U.S. Services, and the remaining 10 percent are from allied countries. The presence of allied students provided an international perspective on challenges in the Defense community. Students are engaged in intensive studies leading to a master's degree in one of 48 different curricula split among 10 academic departments and four academic groups. The AAC students participated in the systems management curriculum which provides an M.S. in management. All students are required to complete a thesis as part of the graduate program.

The thesis research produced by the AAC graduates addressed a variety of Defense-related topics. Henningsen's thesis discussed the challenges faced when DOD managers implement the cost-as-an-independent-variable concept of cost control and compared it to the design-to-cost concept used in the past. Newborn analyzed the Army's configuration management system applicability to a commercial cataloguing system and suggests that the DOD revise its policies to adopt commercial practices. Stenger's thesis addressed military and civilian relationships and how they affect integrated product teams in the acquisition community. A brief overview of Gail Stenger's experience at the Naval Postgraduate School follows.

All three students will be taking new assignments in the Washington, DC, area.

Long-Term Training—Is It For You?

Gail Stenger's Reflections As An NPS Graduate

As a recent graduate of an Army Acquisition Corps long-term training program, I'd like to share my experience with you and encourage you to consider participation in long-term training to enhance your professional development.

My initial consideration of long-term training participation took place during an Army Acquisition Corps workshop. One of the sessions held during that seminar addressed the numerous long-term training opportunities which I had learned about previously, but had not considered until that conference. Professionally, it was time for me to consider earning my master's degree. After earning my bachelor's degree part time over a 10-year period, the program offered by the Army Acquisition Corps to earn an advanced degree presented a great opportunity.

Among the long-term training opportunities offered was the master's of science in management, with a concentration in systems acquisition management, at the Naval Postgraduate School. The program itself sounded challenging and stressed the integration of business principles, management theory, operations/systems analysis and engineering applications. The program is tailored to the management of Defense acquisition programs and the fundamentals of acquisition.

An interesting and unique aspect of the program is the student population. The majority of the students at the school are U.S. Naval officers, with a smaller percentage of Marine Corps, Army, Air Force and Coast Guard officers and DOD civilians. In addition, a large number of foreign defense officers and civilians attend the school. This international aspect adds an interesting mix to the student population by introducing unique viewpoints and opinions to the classroom discussions and casework environment. The instructors at the school also add diversity to the population due to their varied professional and educational backgrounds ranging from military officers to Berkeley Ph.D.s.

A critical part of the NPS program is the thesis preparation and publication. Almost anyone who has written a master's thesis can at-

test that the entire process is rigorous. From the first step of selecting a topic and research method, through numerous discussions and rewrites, to the final step of obtaining signatures for approval, it is an experience a student will not forget.

In addition to the aspects of the program noted above, the Army Acquisition Corps training opportunities present a privilege not offered to many government or commercial employees—full-time participation in a unique master's period. As mentioned, I earned my bachelor's degree while working full-time over a 10-year time period. While I'm thankful that I earned my undergraduate degree, and encourage others to do the same, acquiring any college degree on a part-time basis presents unique challenges to the student. If your job requires travel on a steady basis, those challenges are multiplied.

Now that I've completed the program with the assistance of a supportive spouse, I can only recommend that you consider a long-term training opportunity with the Army Acquisition Corps. I have been afforded a privilege to participate in an Army Acquisition Corps advanced degree program. The experience and insight provided during the program and the new career opportunities provided as a result will benefit both the Army and my professional development. I look forward to applying the skills gained in a developmental assignment at the higher headquarters level.

The next opportunity to apply for Army Acquisition Corps long-term training programs is in September. Training will be available at the Naval Postgraduate School, University of Texas at Austin, University of Texas at San Antonio, and the School of Choice Program. Additional information can be found in the *Army Acquisition Corps/Workforce Civilian Training Opportunities* for the academic year 1997-1998. In addition, information can be found on the Internet at http://dacm.sarda.army.mil/training/, or by calling Jim Welsh of the Acquisition Education and Training Office at (703)805-1046 or DSN 655-1046.

23 Graduate From MAM

Twenty-three students graduated from the Materiel Acquisition Management (MAM) Course, Class 97-003, at the U.S. Army Logistics Management College (ALMC), Fort Lee, VA. The graduates were:

AHO, Gary P.
AMACHER, Stephen P.
AMERSON, Anthony E. CPT
ARRINGTON, Vance R. CPT
ASCURA, Michael A. CPT
BAGGETT, Debra L.
BOVAIS, Jeffrey A. CPT
FISCHER, Lawrence J.
FLEMING, Jonathan C.
HAGER, Jeffrey E. CPT
JONES, Michel G. CPT
MOORE, Paul Jr. CPT
MURPHY, Terryne F. CPT
NA, Sung Hoo LTC
PERRY, Matthew J.
PESICEK, Todd P.
RASHID, Quenton T. CPT
REED, Stephen S. CPT
SANTOS, Cesar G. LTC
STEVENS, Jeffrey M.
TODD, Thomas H. III CPT
WILSON, Benita F.
WITTGES, Charles E. CPT

The graduates included two foreign officers—LTC Sung Hoo Na from South Korea, and LTC Cesar G. Santos from Phillipines.

Research and development, testing, contracting, requirements generation, logistics and production management are examples of the materiel acquisition work assignments being offered to these graduates.

The Distinguished Graduate award was presented to Debra L. Baggett, Joint Special Operations Command, Fort Bragg, NC.

The seven-week Materiel Acquisition Management 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 that they can effectively participate in the management of the acquisition process.

A Master's Degree And Training With Industry In One Year

The Army Acquisition Corps (AAC) and the University of Texas are offering a combination master's degree and Training With Industry (TWI) in one year at two locations—Austin, TX, and the Washington, DC area. This pilot program will allow military and civilian members of the AAC the opportunity to attend college and work in an industry that has direct linkage with their course work and identified Army interests.

Training With Industry

In the TWI Program, individuals will receive extended job management training, as outlined in a detailed plan or syllabus, and will work/train at the same level as an employee of that industry with similar background and experience. Industry training and academic studies will be linked via class reports and outside class assignments.

TWI assignments are available in a variety of high-technology industries. Examples of business focus are electronics, semiconductors, information technology, systems integration, technology assessment and telecommunications. TWI participants will work in the industry approximately 20 hours per week while concurrently participating in about 20 hours per week classroom and related activities.

Master's Of Science In Science And Technology Commercialization

The Master's of Science in Science and Technology Commercialization Degree Program (a special type of business degree), at the IC2 Institute at the University of Texas in Austin, is particularly well-suited for individuals with a technical background (although the latter is not required). In addition to understanding all traditionally addressed processes and functions, students learn about the accelerated transfer of research and technology from laboratories to use in all parts of the value chain of an enterprise. The program targets mid-level managers and team leaders in academia, industry, the military, and other government organizations.

Through the use of video teleconferencing, the program is conducted simultaneously in Austin, TX, and at the Defense Systems Management College at Fort Belvoir, VA. Faculty are present at both sites. Students learn to work on virtual teams. Extensive use is made of the Internet.

Classes run mid-January through mid-December. Normally, students attend a one-week workshop at the beginning of each semes-

ter (spring, summer, fall) and attend classes every other weekend. (NOTE: In 1998, the class schedule may change to every other Thursday afternoon, all day Friday and Saturday morning.)

The program focuses on such key competencies as:

- Leadership and management skills,
- Information technology proliferation and utilization;
- Interpersonal and group communication skills;
- Teaming skills;
- Oral and written presentation skills;
- Negotiation and persuasion skills;
- Creative and critical thinking skills;
- Technology assessment; and
- Risk management.

This program will provide the student, through the classroom and an industry working environment, the tools necessary to:

- Perform an assessment of a technology for its use in multiple environments;
- Perform market research, develop product and service test plans, and perform industry evaluations;
- Develop a knowledge of technology sources and apply a technology transfer model;
- Perform strategic and technology planning and incorporate into a business strategy/plan;
- Assess and manage risk;
- Understand and utilize best business practices; and
- Understand leadership requirements for creative and innovative environments and the importance of entreprenureship.

To participate in the 1998 program, individuals are encouraged to submit applications by Sept. 1, 1997. It is not necessary that the required tests (GRE or GMAT for example) be taken by that date. Additional information about the program can be obtained from Internet site www.utexas.edu/depts/ic2/msdegree or by calling Dr. Barbara M. Fossum at (800)687-8532, or Dr. Jerry Davis at (512)471-9060.

Defense Acquisition University Training

When and where are the next Defense Acquisition University (DAU) training courses conducted? Are there any vacancies in the courses? How do I apply? There are several methods currently available for obtaining answers to these questions. The most common one is to contact your civilian personnel operations center (CPOC) training coordinator for information on course schedules and availability, and application procedures. However, there are other information resources, which are discussed below.

Getting Information From The Web

For those individuals with access to the World Wide Web, the web site address is www.sarda.army.mil/rdaisa/atrrs/aaedau.htm). This web site provides timely information on a broad range of topics, including class schedules, course locations, availability of seats and course lengths. The unique aspect of this web site is that it also provides a by name list of approved attendees for each class. If your name appears on the class roster, you have been approved to attend the course. The site is updated daily.

Another Source of Information

For those individuals who can't find a training coordinator or do not have access to the World Wide Web, a Telephone Information Response System (TIRS) is available 24 hours a day, seven days a week by dialing 1-800-808-6467. By accessing the TIRS, you can have a copy of the current training schedule faxed to you. Additionally, you can obtain information on rental car authorization, travel advances, a school registrar telephone list and travel orders. This system is currently being expanded to provide additional information on training, training coordinator telephone listings, policies and application procedures. Expansion of this system is projected for completion sometime in July of this year.

Distance Learning: Future Delivery Of Courses

The DAU is currently reviewing selected courses for its Distance Learning initiative. The proposed modes of delivery include classroom or video-tele-learning, and technology based, to include the Internet or CD ROM. This initiative provides courses to a larger population by providing training at the worksite, reduces travel costs, and reduces the wait to attend a course. When the course converts to a technology-based mode of delivery, it will continue to be provided in a traditional classroom format for a short period of time and then will only be provided in a technology-based mode of delivery. Some courses are expected to be available in the technology-based format starting in FY 98.

The preceding article was written by Randall Williams, an employee development specialist and the Manager for Mandatory Training in the Army Acquisition Corps Education and Training Office. He can be reached at DSN 655-1050, commercial (703) 805-1050, or on the e-mail at Willir@aim.belvoir.army.mil.

Acquisition Civilian Record Brief 'Kick Off'

During an April 25, 1997, visit to the Research, Development and Acquisition Information System Activity (RDAISA) in Radford, VA, the Army's Deputy Director for Acquisition Career Management, Keith Charles, launched a program to send Acquisition Civilian Record Briefs (ACRB) to all civilian Army Acquisition Workforce (AAW) members. During the past year, the Acquisition Career Management Office, Office of the Assistant Secretary of the Army (RDA), established various new tools to maximize new competitive career enhancing programs for the AAW. The ACRB is currently being used by competitive selection boards, such as the Competitive Development Group (CDG) and Project/Product Manager (PM) boards.

The ACRB not only replaces the Defense Civilian Personnel Data System generated Certification Record Brief, but also provides a snap-shot view of a civilian acquisition career, just as the Officer Record Brief does for military officers.

The ACRB is a printout of an acquisition personnel record. It can only be generated by acquisition career management officials using the Acquisition Data Review System or the Army Acquisition Career Management Information System. Through the use of the ACRB, the accuracy of the assignment history, education, training, as well as other personnel data for the records of the AAW will steadily improve.

During the past year, a successful pilot program ("reach-out and touch"), spearheaded and managed by the Total Army Personnel Command (PERSCOM), contacted approximately 800 Acquisition Corps members. PERSCOM's Functional Acquisition Specialists are expanding the program to reach all 3,000-plus Acquisition Corps members before the end of summer 1997.

In May, all AAW personnel began receiving their ACRBs during their birth month. They are being asked to review, update and return their ACRBs with their corrections and acknowledgment signa-

AWSS POINTS OF CONTACT

- **Fort Monmouth AWSS**
  Kelly Irvin
  Commercial: (980)532-1406
  Fax: DSN 992-1032
  E-mail:
  irvin@doim6.monmouth.army.mil
- **APG AWSS**
  Polly Merlo
  Commercial: (410)278-1041
  Fax: (410)278-4611
  E-mail:
  pmerlo@tecl.apg.army.mil
- **MICOM AWSS**
  Sharon Clodfelter
  Commercial: (205)842-8677
  Fax: (205)876-1032
  E-mail:
  clodfelter-sc@fhssmtp.redstone.army.mil
- **SSDC AWSS**
  Margaret Dilworth
  Commercial: (205)955-5209
  Fax: DSN 645-3958
  E-mail:
  dilwortm@ssdch-usassdc.army.mil
- **NCR AWSS**
  Thomasine Coleman
  Commercial: (703)805-1094
  Fax: DSN 655-4163
  E-mail:
  colemant@aaesa.belvoir.army.mil
  Bruce Dahm
  Commercial: (703)805-2234
  Fax: DSN 655-4163
  E-mail:
  dahmb@aaesa.belvoir.army.mil
  AWSS Contractors
  Tom Evans
  Commercial: (703)805-1064
  E-mail:
  evanst@aaesa.belvoir.army.mil
- **Warren AWSS**
  Projected Summer '97
- **Rock Island AWSS**
  Projected Summer '97
- **White Sands AWSS**
  Projected Summer '97
- **Picatinny AWSS**
  Projected Summer '97

ture. If you have not received yours, or if you are unsure that RDAISA has your current mailing address, please send an updated address to ACRB@Radford-emh1.army.mil.

Explanations about the ACRB update are available on the WEB at **http://www.dacm.sarda.army.mil/workforce/acrb.** If you do not have access to the WEB, contact one of the Acquisition Workforce Support Specialists (AWSS) shown in the accompanying chart.

This "ACRB Kick Off" will reach more than 20,000 people, and is just another giant step in meeting the Army Acquisition Corps vision of creating "One Integrated Corps" for the 21st century.

The preceding article was provided by Gregory Zyto, an Army Acquisition Corps data specialist in the Acquisition Career Management Office.

PERSCOM Notes. . .

FY97 Experimental Test Pilot Board

One of the responsibilities of the Military Acquisition Management Branch (MAMB) is to manage the Army's Experimental Test Pilot (XP) Program. Once commissioned officers are selected for admission into the program, they are automatically awarded the functional area 51 (FA 51) of Research, Development and Acquisition (RD&A) and are accessed into the Army Acquisition Corps (AAC). Warrant officers are also selected for XP training. They continue to be managed by the Warrant Officer Division. Selected officers must then attend the U.S. Naval Test Pilot School (USNTPS) in Patuxent River, MD. Officers may also attend Advanced Civil Schooling to earn a master's degree in aeronautical engineering.

The FY97 Experimental Test Pilot Board met from March 11-13, 1997, and selected the best qualified commissioned and warrant officers. The board selected the following officers: MAJ Keith R. Darrow; MAJ Christopher F. Smith; CW4 Randy L. Bolding; CW3 John W. Woodyard; CW3 David W. Ward; CW2 William C. Fell; and CW2 Robert A. Pupalaikis.

Professional development of USNTPS graduates includes an initial utilization tour as an engineering test pilot. Further utilization will be in consonance with the officer's designated functional area specialty and the needs of the Army. Normal utilization in RD&A would be as engineering test pilots or in positions involving decisions affecting the type, design, and configuration of Army aircraft. Commissioned officers will also attend the Materiel Acquisition Management Course and compete for selection as product/program managers. Commissioned officers are no longer eligible for selection for battalion/brigade commands. Experimental test pilots' experience and skill represent a high dollar investment and since the number of active duty graduates is small, their utilization and professional development requires close monitoring.

The FY98 XP Board is scheduled for January 1998. Officers interested in applying should contact CPT Bob Marion at commercial (703)325-2800, DSN 221-2800, or email: marionr@hoffman-emh1.army.mil

1997 PERSCOM Acquisiton Candidate Accession Board

The 1997 PERSCOM Acquisition Candidate Accession Board (PACAB) was held the week of March 3-7, 1997, with the board reviewing records of 253 Year Group (YG) 90 officers for accession into the Army Acquisition Corps.

For the third year in a row, all records reviewed were from officers who volunteered for membership in the AAC.

The PACAB was instructed to select 80 percent of requirements for this year group, but was given the latitude to select up to 100 percent of requirements, if the files warranted accession.

The board selected 133 officers to be accessed into the AAC with an overall percentage of 86.36 percent selection of YG 90 requirements. With less than 100 percent selection, the AAC retains the flexibility to access officers from YG 90 who will continue to gain experience in their basic branches without being disadvantaged for future accession and assignments.

The board also reviewed the files of 33 officers from other than YG 90 who requested accession into the AAC. The board recommended accession of 15 officers from YG 89 to fill requirements from this YG and selected one officer from YG 91 to be accessed early.

The following list represents those officers who were accessed into the AAC, their basic branch, and the functional area they were awarded.

NAME	RANK	FA	BA BR
ADAMS, Larry	CPT	97	AR
BANKS, Thyris	CPT	97	MI
BARRERA, Marco	CPT	51	IN
BARRIE, Robert Jr.	CPT	51	AV
BARTOS, Charles	CPT	51	QM
BORJES, Karl	CPT	97	AR
BOYD, Raymond Jr,	CPT	51	EN
BRANDENBURG, John	CPT	51	SC
BRANHAM, Eva	CPT	97	MI
BREAGY, Stephen	CPT	97	AV
BROEK, Harold Jr	CPT	51	IN
BROUGHTON, Johnny	CPT	53	AG
BROWN, Aaron	CPT	51	AV
BROWN, Sharon	CPT	51	AD
BYRN, John	CPT	51	EN
CARD, Rose	CPT	51	QM
CATHCART, Eric	CPT	53	OD
CLARK, William	CPT	51	AR
COLEMAN, Willie	CPT	97	IN
COMPTON, Raymond	CPT	53	SC
CORMIER, Robert	CPT	53	AD
CRAFT, Jason	CPT	53	QM
CRICK, Michael	CPT	97	OD
CROCKETT, Jeffrey	CPT	51	SC
CUMMINS, Robert Jr	CPT	53	AG

CAREER DEVELOPMENT UPDATE

DANIELS, Mark	CPT	51	FA
DAVIS, Mershelle	CPT	51	OD
DAVIS, Rodney	CPT	97	AV
DELANEY, James	CPT	51	AV
DIONISIO, Robert	CPT	53	IN
DONOVAN, Sharlene	CPT	51	AV
DRONEN, Darrin	CPT	53	CM
DYKES, James IV	CPT	51	SC
EGGERT, John	CPT	51	AD
FALCO, Cynthia	CPT	97	MI
FARMER, Michael	CPT	53	AR
FIGUEROAMERCADO, Johnny	CPT	51	FA
FIORELLA, Salvatore	CPT	51	AR
FLOWERS, Thomas	CPT	53	MI
GAARE, Dennis	CPT	51	MI
GALINDO, Jason	CPT	51	AV
GARFIELD, Gwendolyn	CPT	51	AG
GIESE, Joseph	CPT	51	AR
GILLIGAN, Thomas	CPT	51	AR
GLOOR, Thomas	CPT	51	MI
GOULD, Robert	CPT	97	AV
GREEN, Gregory	CPT	97	MI
GRESHAM, Shawn	CPT	53	MI
GROSENHEIDER, Craig	CPT	51	MI
GROVER, Jeffrey	CPT	97	OD
HALL, Richard	CPT	51	FA
HAMILTON, Andrew	CPT	51	AV
HARGER, Daryl	CPT	97	TC
HENDERSON, Kevin	CPT	97	FA
HERRES, Roger	CPT	53	TC
HINTZ, James III	CPT	97	MI
HORST, Kelso Jr.	CPT	51	FA
HOSSACK, Timothy	CPT	51	FA
HOWARD, Paul	CPT	51	AV
HUNTER, Thomas	CPT	97	AG
JACKSON, Alfred	CPT	51	IN
JACKSON, Tonie	CPT	97	IN
JAMES, Dannie Sr.	CPT	51	TC
JOHNSON, Eddie	CPT	97	SC
JOHNSTON, Vincent	CPT	51	CM
KETCHUM, Robert	CPT	51	MI
KEIFER, Scott	CPT	51	IN
KLEESE, Bryan	CPT	53	SC
KOLLHOFF, Joy	CPT	97	QM
KRAUSE, Karl	CPT	97	FA
KROS, Todd	CPT	51	AV
LANCASTER, Odis Jr.	CPT	51	IN
LANE, Jeffrey	CPT	53	IN
LIM, Ho	CPT	53	MI
LIPPERT, Thomas	CPT	97	AV
LONARDO, Richard	CPT	51	OD
LOPEZ, Harold	CPT	51	EN
LOVER, James	CPT	51	FA
LUDDEN, Frederick	CPT	53	AR
MANNS, Terrence	CPT	97	IN
MAST, Jack Jr.	CPT	53	FA
MCNAIR, Ronald	CPT	51	TC
MCNAMARA, Paul	CPT	51	AD
MEEHAN, Scott	CPT	53	MI
MEYER, Stuart	CPT	97	IN
MILLER, Susan	CPT	53	FI
MINNERS, Bradford	CPT	53	AG
MORTLOCK, Robert	CPT	51	CM
MURPHY, Brian	CPT	53	AG
MURPHY II, Kennard	CPT	97	EN
NEAL, Mark	CPT	53	AV
NICHOLS, Walter Jr.	CPT	51	TC
NORRIS, Michael	CPT	53	MI
OBRIEN, Mark	CPT	97	AV
PARDEW, Paul	CPT	97	MI
PARKER, Keith	CPT	53	FA
PARODI, Michael	CPT	53	SC
PASSAPERA, Martinez	CPT	51	SC
PERRY, Robert	CPT	97	AR
PERRY, Sharlene	CPT	51	OD
PERRYMAN, Theodore	CPT	51	MP
PHILLIPS, Joel	CPT	51	MI
PHILLIPS, Mark	CPT	97	QM
PIATT, Eric	CPT	53	SC
PINTER, David	CPT	97	AV
POUND, Michael	CPT	51	AV
REDFIELD, Daniel Jr.	CPT	51	SF
REIM, John Jr.	CPT	51	QM
REIMAN, Joel	CPT	51	SF
ROBERTSON, Walter	CPT	51	OD
ROGERS, Stephen	CPT	51	MI
ROSS, James	CPT	97	FA
SANCHEZ, Anthony	CPT	53	MI
SANTIAGO, Derek	CPT	97	TC
SCHUETZ, Douglas	CPT	97	QM
SCOTT, Gregory	CPT	53	SC
SHORT, Daniel	CPT	51	AV
SMITH, Herbert	CPT	97	EN
STEIN, Charles	CPT	51	QM
STEIN, Cynthia	CPT	97	SC
STIKKERS, Richard	CPT	53	EN
STOCKER, Adrian	CPT	51	AD
STOVER, Howard	CPT	97	QM
STRAYER, Kenneth	CPT	51	AR
STREETER, Crystal	CPT	97	SC
STRICKLAND, Raymond	CPT	53	IN
STROYAN, Richard	CPT	53	AV
STUCKER, Chris	CPT	51	MI
TERRELL, Vaneada	CPT	97	SC
THOMSON, Mark	CPT	53	AV
TICE, Michael	CPT	51	AR
TUFTS, Scott	CPT	53	AR
TYSON, Rodney	CPT	51	QM
VANYO, Kevin	CPT	51	AR
VOGELHUT, Jonas	CPT	51	CM
WALDO, Matthew	CPT	53	SC
WALL, Steven	CPT	51	SC
WASHINGTON, David	CPT	53	AV
WATITI, Tom	CPT	51	SC
WATKINS, Thomas	CPT	97	AD
WHEELER, Brian	CPT	53	SC
WHEELER, Suzanne	CPT	53	AV
WILLIAMS, Andrea	CPT	53	QM
WILLIAMS, Richard	CPT	51	AV
WILSON, Eddie	CPT	51	MI
WOOD, Diane	CPT	97	FI
ZIMMERMAN, Ronald Jr.	CPT	97	EN
ZURMUEHLEN, Kevin	CPT	51	AV
ZUVANICH, Michael	CPT	53	OD

FY 98 LTC/COL PM, And Acquisition Command Board Results

The Military Acquisition Management Branch, U.S. Total Army Personnel Command, recently completed an analysis of the FY 98 PM/Acquisition Command Board results and overall Command opportunity for Acquisition Corps officers. The following paragraphs summarize these results and indicate possible trends.

FY 98 LTC PM/Acquisition Command Board Results

Overall LTC Results

Board members reviewed the files of 313 Acquisition Corps officers in year groups 1977 through 1980. From this population, the board selected 37 principals for Product Manager and Acquisition Command. Acquisition Corps results by functional area and year group are as follows:

FA	1980	1979	1978	1977
51	19	3	1	1
53	0	1	0	0
97	7	3	1	1

PM/Acquisition Command Board Procedures

The board recommended those officers best qualified to serve as lieutenant colonel LTC PM (23) and Acquisition Command (14). PERSCOM slated each of these officers to PM/Command positions after considering DA slating guidance, position criteria, experience, training, and personal preferences.

Who Got Selected?

Thirty-four of the 37 officers selected have master's degrees and one has a Ph.D. Only three of the selectees had not previously been selected for resident Command and Staff College. Of the 23 officers selected to become PMs, 17 have at least two years of experience in a program office or in the Office of the Assistant Secretary of the Army (Research, Development and Acquisition) (OASARDA). Ten of the 14 officers selected to be Acquisition Commanders have at least four years of contracting experience in either the Defense Logistics Agency (DLA), U.S. Army Materiel Command (AMC), or OASARDA.

Analysis

Based on the analysis applied to the above information, it is apparent that officers who complete at least two years in a program office are competitive for PM selection. Officers competing for Contracting Commands require at least three years of "hands on" contracting experience (preferably in DLA or AMC) to be competitive. The inflation of our current OER system requires a "top block above center of mass" performance in these key developmental positions.

General Observations

The file quality of officers selected for PM/Command continues to improve. Competition is tough for these key positions. Generally, officers are selected for Command the first or second time considered. For the FY 98 board, over 70 percent of those officers selected were selected on their first look. To be competitive for PM/Command, one must seek out and do well in those positions which will branch qualify an officer as a major. For Product Managers, previous program office experience is most important. However, there is no evidence that consecutive or repetitive program office tours better qualify an officer for PM selection. On the contrary, a successful program office tour, coupled with successful performance in other qualifying positions (e.g. test, combat development, DA/joint staff) is a common formula for PM selection. Contracting officers require extensive contracting training and experience in pre-award and post-award contracting. Success in other acquisition positions enhances overall file strength toward selection.

Command Opportunity

The Army Acquisition Corps continues to afford officers, in all three functional areas, a healthy opportunity to command. Army Acquisition Corps opportunity to command has compared favorably with the Army average of 10-14 percent for the past three years. Since each year group is considered four times for Command, total opportunity to command for a particular year group cannot be determined until that year group receives its fourth "look."

Summary

As future PM/Command boards convene, it is imperative that officers take the time to personally "scrub" their Officer Record Brief (ORB) and microfiche to ensure accurate information is conveyed to the board members. The Military Acquisition Management Branch will send pre-board scrub packets to officers in the zone of consideration 90 days prior to the convene date of the board. The pre-board scrub packet will consist of an ORB, a fiche, and a checklist. Use this packet to prepare your file for the board. Although not a part of the pre-board scrub packet, the photo is an important part of the board file. It is recommended that if a photo is more than three years old, then it is time for a new one. Prior to taking a new photo, check your awards, branch and U.S. insignia, etc. Attention to detail does make a difference.

Finally, as a captain/major, seek career broadening experiences to become competitive for early selection as a PM/Commander. With limited positions in the program offices, PERSCOM will continue to rotate captains and majors at 24-30 months to ensure a sufficient pool of experienced branch qualified officers for future PM and Command positions. Officers wanting to be competitive for Contracting Commands should seek warranted contracting officer positions in both pre-award and post-award environments.

FY98 LTC PM/Acquisition Command Selectees

Product Manager

Name	Branch	Career Field
Chase, Deborah	AV	51
Coppola, Alfred	FA	51
Crosby, William	AV	51
Davis, Darrell	MI	51
Dellarocco, Genaro	QM	51
Eisele, Kent	IN	51
Fritz, Gregory	FA	51
Fuller, Peter	AR	51
Groller, Robert	AR	51
Gutknecht, Donald	FA	51
Hogan, Thomas	FA	51
Hrdy, Russell	AR	51
Kreider, Stephen	FA	51
Ostrom, Peter	FA	51
Pallotta, Ralph	AV	51
Price, Nancy	SC	53
Riker, William	AR	51
Serino, Robert	CM	51
Smith, Michael	AD	51
Smith, Michael J.	OD	51
Souder, Michael	FA	51
Tensfeldt, Jeffrey	FA	51
Valent, Oscar	OD	51

Acquisition Command

Name	Branch	Career Field
Bianco, Stephen	FA	97
Bliss, Gary	AD	97
Breitenbach, Barry	IN	97
Coker, David	QM	51
Conley, Joe	QM	97
Diego-Allard, Victoria	OD	97
Maughn, William	TC	97
McQuain, Paul	AV	97
Patterson, William	QM	97
Polczynski, Kennith	AD	97
Samson, Bryan	QM	97
Stautz, Thomas	SF	97
Waller, Henry	AV	51
Willey, Jeffrey	OD	97

FY 98 COL PM/Acquisition Command Board Results

Overall COL Results

Board members reviewed the files of 42 Acquisition Corps colonels and promotable lieutenant colonels and 26 civilians in the grade of GS-15 or eligible for promotion to GS-15. The board selected 17 officers and two civilians. Results for military selectees by functional area and year group are as follows:

FA	1972	1973	1974	1975	1976
51	1		3	8	1
53					
97				4	

PM/Acquisition Command Board Procedures

The board membership consisted of six senior military and two senior civilian members. All were members of the Army Acquisition Corps. The board selected officers in two categories: Project Manager and Acquisition Command. This was the second DA centralized selection board to select the best qualified individual among senior civilian applicants and eligible colonels for selected positions in the Project Manager category. Three ACAT I programs were designated by the Acquisition General Officer Steering Committee to be filled by the best qualified candidate, either civilian or military. All other PM and AC Command positions were open to military only. Like last year, officers currently serving as, or with previous colonel PM or command experience, were not eligible for consideration.

The board selected two civilians and seven officers to be Project Managers and 10 officers to be Acquisition Commanders. The board slated selectees for the three ACAT I programs designated to be filled by the best qualified candidate. PERSCOM slated all other officers in accordance with slating guidance from the Chief of Staff, Army.

Who Got Selected?

Three officers have baccalaureate degrees and 14 have master's degrees. Sixteen have been selected for or have completed senior service college (14 of 16 resident). All of the 17 officers selected served as LTC Commanders or Product Managers.

Analysis

Of the 42 officers who competed, 38 have been LTC Commanders or Product Managers. In general, officers were selected at a higher rate as PMs or R&D Commanders if they served on the Army staff and had two tours in a program office, including LTC PM. Five of eight officers selected for Contracting Commands were FA 51. This trend is expected to continue. FA 97s selected as Contracting Commanders generally served three or more years in contracting positions with DLA and another Army MACOM.

Command Opportunity

This year's Command selection rate (43 percent) is somewhat higher than last year's rate (39 percent). This is primarily because the eligible pool of officers is somewhat smaller than in past years, which is a direct result of a lower selection rate for promotion to colonel in FY 96. The overall Army colonel Command selection rate (15 percent) is much lower than the Command selection rate for AC colonels. This year, 77 percent of the officers selected were being considered for the first time. Second time selectees made up 17 percent of the slate. As the numbers indicate, chances for selection are greatest during the first two years of eligibility.

Summary

As in all other branches and functional areas, selection for promotion to colonel and colonel Command in the Acquisition Corps is highly competitive. Because most officers selected for colonel have been successful as a lieutenant colonel PM or Commander, consistently high performance in a range of career broadening assignments is still the overriding factor in selection for colonel PM or Acquisition Command.

FY 98 COL PM/Acquisition Command Selectees

Project Manager

Name	Branch	Career Field
Cartwright, Charles	FA	97
Ellis, Bernard	FA	51
Izzo, Paul	AR	51
Monks, Stephen	SC	51
Patrick, Dennis	AV	51
Taylor, James	FA	51
Ward, Barry	FA	51
Kenyon, Richard	Civilian	
Perrapato, John	Civilian	

Acquisition Command

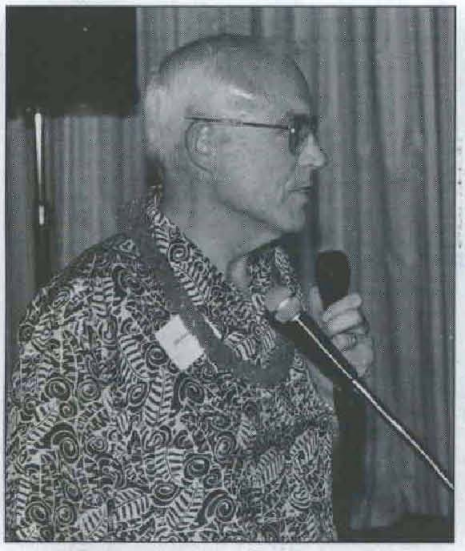
Name	Branch	Career Field
Dillard, John	IN	51
Ellis, Andrew	FA	51
Fast, William	OD	51
Flom, Ronald	QM	97
Frye, Jan	OD	97
Hoffman, John	OD	51
Langhorst, Richard	AV	51
Lewis, Milton	OD	97
Perrin, Michael	AD	51
Thomas, Laurence	AV	51

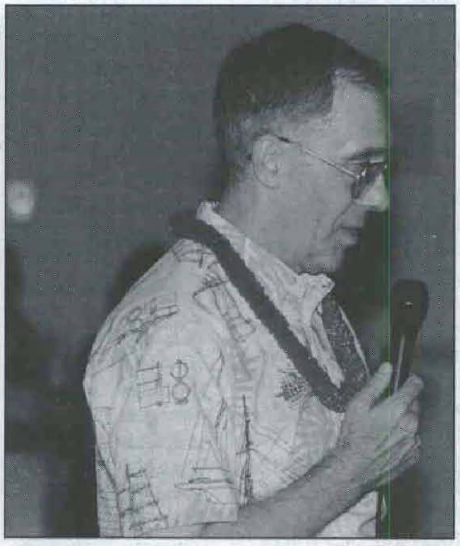
Caton Named Army Reserve Acquisition Career Management Advocate

MG Douglas A. Caton, Assistant Military Deputy to the Assistant Secretary of the Army for Research, Development and Acquisition, has been appointed the Acquisition Career Management Advocate (ACMA) for the U.S. Army Reserve (USAR). As the ACMA, Caton will establish a Customer Support Office at the Army Reserve Personnel Center to provide a direct communication and information link between the Director of the Acquisition Career Management and U.S. Army Reserve members of the Army Acquisition workforce. The ACMA will work to ensure a seamless integration of the USAR into the Army Acquisition Corps, in compliance with the requirements of the congressionally mandated Defense Acquisition Workforce Improvement Act (DAWIA).

ASA (RDA) Gilbert F. Decker Retires

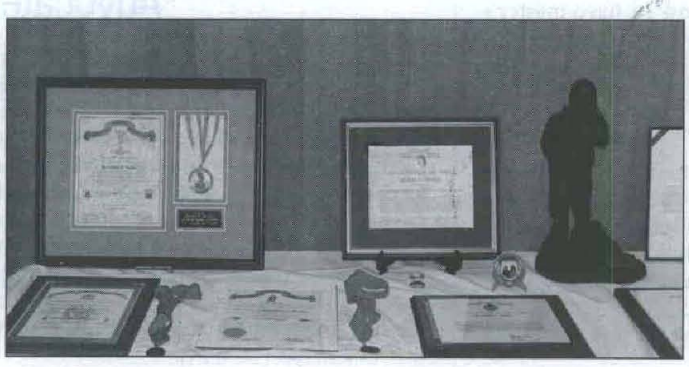
Shown left to right at ASA(RDA) Gilbert F. Decker's retirement reception are Decker, LTG Ronald V. Hite, Military Deputy to the ASA(RDA), and GEN Johnnie E. Wilson, Commanding General, U.S. Army Materiel Command.





LTG Otto J. Guenther, (left) Director of Information Systems for Command, Control, Communications and Computers, and MG William H. Campbell, PEO, Command, Control, and Communications Systems, were among the numerous guests at ASA(RDA) Gilbert F. Decker's retirement reception.

Numerous memorabilia from ASA(RDA) Gilbert F. Decker's distinguished career were on display at his retirement reception.



A reception in honor of retiring Assistant Secretary of the Army (Research, Development and Acquisition) (ASA(RDA)) Gilbert F. Decker was held May 2, 1997, at Fort Myer, VA. Hosted by the Military Deputy to the ASA(RDA) LTG Ronald V. Hite and Mrs. Millie Hite, the reception was attended by more than 200 individuals, including the Decker family, members of the Army and DOD acquisition communities, and congressional staff.

Remarks attesting to Decker's outstanding achievements during his tenure as the ASA(RDA) were provided by LTG Otto J. Guenther, Director of Information Systems for Command, Control, Communications and Computers; MG William H. Campbell, Program Executive Officer (PEO) for Command, Control, and Communications Systems; and LTG Hite. Mrs. Sandy Decker provided a humorous presentation, and gag gift t-shirts spoofing her husband as tough taskmaster.

Guenther commended Decker for his instrumental role in acquisition reform, adding that he was a successful team builder because of the great trust he put in his staff. "Decker is capable, smart, intuitive, honest, open and sincere. He is frank and up-front. He chose the right road on every issue no matter how hard the course," concluded Guenther.

Campbell, representing the PEO community, said that Decker came to the ASA position with a vision, and created fundamental change that made the job of supporting soldiers easier. He told Decker, "You have done a service to the nation that is a lasting legacy to live on through generations of PEOs and PMs to come."

Said Hite, "The accolades you have heard for Gil Decker are all true. He is a 10 plus on any scale. The true test of the success of an individual in this job is the respect that soldiers in the field have for that individual. You will never find another Army Acquisition Executive with more visibility and respect from the soldiers on the ground."

In closing comments, Decker noted that the breadth and dimensions of the ASA(RDA) position were exhilarating, challenging and mentally stimulating, but attributed his greatest pleasure to the numerous outstanding people he worked with during his tenure. Said he: "One need not be a rocket scientist to be a good manager or even know as much as those who work for you. What is important is to trust your staff. In so doing, you eliminate barriers and people perform magnificently."

Kern Takes Over As ASA(RDA) Military Deputy And Director, Army Acquisition Corps

LTG Paul J. Kern has assumed the position of Military Deputy to the Assistant Secretary of the Army (Research, Development and Acquisition) (ASA(RDA)) and Director, Army Acquisition Corps (AAC). He succeeds LTG Ronald V. Hite, who has retired, following more than 33 years of active military service.

With more than 30 years of military service, Kern has served in a broad range of assignments. As the former Commanding General, 4th Infantry Division (Mechanized), the Army's Experimental Force, Fort Hood, TX, Kern will be able to bring the AAC closer to the warfighter and strengthen the AAC's credibility with the user. As the Military Assistant to former Secretary of Defense William Perry, Kern worked closely with the Defense Acquisition Executive in acquisition reform, thus ensuring the Army remains committed to reforming acquisition policies and practices. Other acquisition assignments include serving as a special assistant to the Deputy Director, Defense Research and Engineering for Test and Evaluation, Office of the Secretary of Defense; as the Bradley Tank Team Chief in the Office of the Deputy Chief of Staff for RDA; and as Chief of Plans in the Bradley Project Management Office, Warren, MI. Kern has also served as the Senior Military Assistant to the Deputy Secretary of Defense, OSD; Assistant Division Commander, 24th Infantry Division (Mechanized), Fort Stewart, GA; and Director of Requirements (Support Systems), Office of the Deputy Chief of Staff for Operations and Plans, Washington, DC.

Kern is a member of the AAC. He holds a bachelor's degree from the U.S. Military Academy and M.S. degrees in mechanical engineering and civil engineering from the University of Michigan. In addition, Kern has completed the Army Officer Basic Course, the Infantry Officer Advanced Course, the U.S. Army Command and General Staff College, the Program Management Course at the Defense Systems Management College, and the Harvard University Senior Service College Fellowship.

Having served in Vietnam and in Operation Desert Shield/Desert Storm, Kern is a recipient of numerous awards including the Defense Distinguished Service Medal, the Silver Star, the Defense Superior Service Medal, the Legion of Merit with Oak Leaf Cluster, two Bronze Star Medals for valor, three Bronze Star Medals for meritorious service, and three Purple Hearts.

Kern will be a tremendous advocate for the AAC in the Army and OSD. His diverse background in acquisition and the operational Army will forge the partnership between the AAC and the user community.

Army R&D Organizations Recognized

The 1996 Army Research and Development Organization (RDO) Awards were presented to three Army organizations by Hon. Gilbert F. Decker, then Assistant Secretary of the Army (Research, Development and Acquisition) and Army Acquisition Executive. The annual **RDO of the Year Award** was established in 1975 to honor the Army Research and Development (R&D) laboratory conducting the best program during the preceding fiscal year. Annual **RDO Excellence Awards** honor R&D laboratories having particularly noteworthy programs. The selection criterion for both awards is the degree to which each laboratory realizes its full potential impact in enhancing the capability of Army operational forces. The selection is made by considering demonstrated achievement in the following areas: accomplishments and mission impact; vision; strategy and plans; resource input; and continuous improvement.

The U.S.Army Corps of Engineers Waterways Experiment Station (WES) received the **1996 RDO of the Year Award.**

• WES was recognized for its research to produce results with high potential for significant cost savings—not only to the Army but for commercial applications as well. For example, in FY 95 the Department of Defense (DOD) Groundwater Modeling System (GMS) was transitioned to 70 Tri-Service users within DOD, 13 Environmental Protection Agency users, and 32 Department of Energy (DOE) users. The system is being used actively on multiple DOD and DOE cleanup sites. A single use of the GMS by DOD at Schofield Barracks, HI, resulted in a reduction of $7.5 to $10 million in anticipated remediation costs while achieving regulatory compliance. Also in FY 95, the American Society of Civil Engineers (ASCE) presented WES with the first Government Agency Employer Recognition Award, honoring the government agency which best supports the ASCE in the 18-state southeastern region.

The U.S. Army Armament Research, Development and Engineering Center (ARDEC), and the U.S. Army Communications-Electronics, Research, Development and Engineering Center (CERDEC) received **1996 RDO Excellence Awards.**

• ARDEC was recognized for its accomplishments in inserting advanced technologies into development programs culminating in 24 type classified items and 14 items that were released to the field for the first time. These items will provide greater survivability to our soldiers; put mortar systems back into the battle with new advanced capabilities; deny enemy access to our lanes of passage with high performance mine systems; provide artillery with unique breakthrough hit and kill power against hard targets; and provide the men and women of our armed forces with greatly enhanced battlefield survivability.

• CERDEC was recognized for the successful completion of five advanced technology demonstrations: Common Ground Station, Survivable Adaptive Systems, Radar Deception and Jamming, Multisensor Aided Targeting-Air, and Close-In Manportable Mine Detector. These critical Science and Technology demonstrations are focused on accelerating the insertion of emerging technologies into operational systems. They provide the linkage among the materiel developer, program executive office and the user. CERDEC also expanded the operations of its Digital Integrated Laboratory to meet the challenges of digital technology insertion into Army warfighting experiments including Force XXI Joint Venture and Battle Lab Warfighting Experiments.

ASA(RDA) Gilbert F. Decker (left) (now retired) presents the 1996 Army Research and Development Organization of the Year Award to Dr. Robert Whalin, Director of the U.S. Army Corps of Engineers Waterways Experiment Station.

ASA (RDA) Gilbert F. Decker (left) (now retired) presents a 1996 Army RDO Excellence Award to Carmine Spinelli, Technical Director of the U.S. Army Armament RDE Center.

ASA(RDA) Gilbert F. Decker (left) (now retired) presents a 1996 Army RDO Excellence Award to Dr. Louis Marquet, Director of CECOM's Night Vision and Electronic Sensors Directorate, who accepted the award on behalf of CERDEC.

NEWS BRIEFS

Task Force XXI Advanced Warfighting Experiment

It was called Brigade '96 and began in 1994 as an outgrowth of a controversial National Training Center (NTC) rotation 94-07; gained momentum in 1995 with Advanced Warfighting Experiments (AWEs) such as Focused Dispatch and Warrior Focus; experienced reality in 1996 with the arrival of hardware and software at Fort Hood, TX; and culminated with the March 1977 National Training Center rotation 97-06 for the Experimental Force (EXFOR) of the 4th Infantry Division.

Early returns from Task Force XXI AWE made front page headlines. Analysis of the data collected during the experiment, as well as post-AWE modeling and simulation is continuing. However, there are many lessons learned from the AWE that apply to the research, development, and acquisition communities. This NTC rotation was the culmination of over a year's investment by the soldiers of the EXFOR, allowing the Army to experiment with a new division design and to gain insights into the interoperability and synergism of over 50 different pieces of hardware that involved all battlefield operating systems.

The NTC rotation was not about winning or losing the individual battles with the highly skilled OPFOR in the desert at Fort Irwin. It was much bigger than that; it was about Army XXI—how our soldiers will be organized, trained, and equipped in the next century. The Army Training and Doctrine Command was responsible for planning, hosting, and focusing the Army's effort that began at Fort Hood and concluded with the NTC rotation. All congressional, Department of Defense, and Service leaders who visited the exercise expressed their support of the Force XXI process as a model for benchmarking and validating change. Look for a subsequent article in *Army RD&A* magazine that will detail critical digitization results from the AWE and the implications of the Force XXI process on the RD&A community.

Aberdeen Test Center Becomes First In DOD To Use New Gigabit Ethernet

Imagine a heavily trafficked highway with people lined up on the ramp waiting to merge and join the flow. Typically, it means sitting there until there's a break in traffic. But what if you could just add a few lanes? That's exactly what Aberdeen Test Center (ATC) has done with its new Gigabit Ethernet, a way to handle communications at 1,000 megabits per second. The plan is to provide top service as ATC's customers drive in for testing.

It's like going from a four-lane highway to a 40-lane highway, according to John Ruhl, ATC's Information Management Chief. The Gigabit switches provide the bandwidth and speed ATC needs to enable its customers to participate in their test programs. "Gigabit Ethernet allows ATC to provide Army decision makers with information on demand. We'll soon be providing audio and video data to our customers at much higher speeds so they can actually watch testing from afar without interference over the network," says Ruhl.

Ruhl is designing a Gigabit Ethernet backbone to collect and distribute military equipment test data around the country, such as battle tank performance and weapons accuracy. The backbone will be compatible with existing Ethernet and fiber optic components which will speed-up the test results.

Ruhl notes that the Ethernet upgrade is part of the ATC vision for the 21st century. "Data and information are constantly needed throughout the Army and DOD for sound decisions in today's fast-paced environment. By creating a Versatile Information System Integrated On-line Nationwide (VISION) and linking the testing and training communities, we can provide a single data stream from concept to combat," says Ruhl.

ATC is the first organization in the United States to install the Gigabit Ethernet switches, delivered by Mark J. Bohs, southeast representative for the NBASE Communications Company of Chatsworth, CA. The units were the first shipped in the United States. Shipments of production Gigabit Ethernet modules began earlier this year.

Ruhl said ATC has the infrastructure and data requirements for these high-bandwidth products. By using the Gigabit modules at ATC, NBASE is able to give the future speeds required by ATC today. According to Bohs, the Gigabit Ethernet will be in high demand this year, with more than 250,000 installations projected in 1998. He added that ATC is an ideal organization to use Ethernet because of its applications and technology focus as the organization prepares for the 21st century.

According to Ruhl, the Army Test Incident Reporting System (ATIRS), which provides quick test data to customers, is the vehicle that's going to turn ATC's information management vision into a reality. "ATIRS was selected as a single-entry point for equipment data using the Gigabit Ethernet upgrade because of its existing nationwide network which links all test and evaluation centers and many of the operational test sites together. The system has over 550 users which includes project managers, equipment evaluators, technical and operational testers, and numerous contract personnel," according to Ruhl.

With 1,500 distributed data bases, ATIRS not only provides information for decision makers, but also has an easy-to-use portable computer interface. "The virtual library, using the ATIRS network and distributed data bases, provides information to any authorized user anytime anywhere," said Ruhl.

By adding the Ethernet upgrade to the system, Ruhl explained, "customers can enter the system by using standard programs such as Netscape or Internet Explorer and point-and-click technology to step through the system and acquire any information they need."

Enhancing existing systems with technology insertions like Gigabit Ethernet, and direct voice data entry will create a virtual library that provides equipment history, fast information exchanges, and the move to wireless connections with local area networks.

"We can lead the way in new developments because ATC is the perfect place to test technology. By creating an information system on line nationwide and linking the testing and training communities, we can provide a single data stream from concept to combat. This is strategic support the test and evaluation community can give today's warfighter," notes Ruhl. That warfighter is the final stop on ATC's testing highway!

The preceding article was written by Lena Goodman, Public Affairs Officer at the U.S. Army's Aberdeen Test Center.

NEW E-MAIL ADDRESS FOR *ARMY RD&A* MAGAZINE

Army RD&A magazine has a new e-mail address. It is:

bleicheh@aaesa.belvoir.army.mil

From The Acquisition Reform Office...

Acquisition Reform: An Army Top Priority

The Secretary of the Army announced March 10, 1997, that acquisition reform is now and will continue to be one of the Army's top priorities. Speaking at a press conference at the U.S. Army Tank-automotive and Armaments Command in Warren, MI, Secretary Togo D. West Jr. highlighted the importance of streamlining acquisition procedures to beef up modernization efforts.

"Acquisition reform emphasizes the elements of procurement that are smart, rather than just traditional," said West. "It is a priority to the American taxpayer, who wants to know we are investing his or her tax dollars wisely and are getting results. Acquisition reform will also give us all the best 'bang for the buck.' This makes it the **number one priority** for America's Army."

The press conference heralded the "Department of Defense Acquisition Reform Week." On March 17, Secretary of Defense William S. Cohen kicked off a week-long observance that focused on conferences, training, and other activities designed to sustain acquisition reform momentum.

Starting in fiscal years 1995 and 1996, the Army demonstrated approximately $10.4 billion in savings that will occur over the five-year Defense program periods and beyond. Near-term savings were used to accelerate programs, generating more out-year savings. About $2 billion in savings were used to pay operations and maintenance bills; the rest remained in modernization. These savings resulted from aggressive reforms that cut through red tape, shortened buying cycles, and leveraged new technology in innovative ways.

One recent acquisition success story was the Air Defense Bradley Stinger Fighting Vehicle-Enhanced, nicknamed "Linebacker." In a fraction of the time normally needed for weapon systems, Linebacker was fielded in 12 rather than 36 months, contract award time dropped from 18 to three months, and testing was cut in half, to one month. Those changes streamlined production to eight months, and the unit cost for 56 Linebackers dropped from a potential high of $2.4 million to about $290,000 per system.

AAE Comments On Acquisition Reform Week 2

The Army's Acquisition Reform (AR) Week 2 was very successful. Our acquisition community participated fully and with much enthusiasm—more than 25,000 civilian and military personnel in 49 different Army organizations worldwide. It is clear that the culture has changed. There had been resistance to reform, but this Acquisition Reform Week demonstrated that our people are empowered and that new and creative ideas are bubbling up from the bottom. They know that we, at Headquarters, depend on those who most understand the risks to manage them. Teamwork is the key.

"Working together we can make a difference." In all of our major programs, we know that teaming with industry is critical to success. During AR Week 2, the inclusion of industry representatives in the activities proved to be beneficial at each Army command. We had a very healthy exchange of information and ideas. A few are highlighted below:

- Small business firms perform some type of work in every single major procurement program we have. At the U.S. Army Tank-automotive and Armaments Command (TACOM) in Warren, MI, more than 50 small business firms participated in workshops and seminars geared toward enhancing their ability to contribute to acquisition reform and get the best product to the soldier at the best price.
- Twenty-six industry and government personnel from three of the Army's most experienced Integrated Process Teams (IPT) presented the pros and cons of joint IPTs to the acquisition workforce and industry representatives at the U.S. Army Simulation, Training and Instrumentation Command (STRICOM) in Orlando, FL.
- At the U.S. Army Soldier Systems Command (SSCOM) at Fort Belvoir, VA, the topic was empowerment. The group developed an action plan to resolve barriers to fully implement the empowerment concept within the command.
- At Fort Bragg, NC, the Directorate of Contracting (DOC) joined forces with the local Chamber of Commerce to organize a trade fair for credit card holders and local vendors and thereby enhance communications. Fort Bragg has approximately 1,600 credit card holders of which 1,000 or 62.5 percent attended the event throughout the day along with 80 local vendors.
- We all remember the Defense acquisition process that existed before these reforms were initiated—paperwork-intensive, overly managed, and costly. At Fort Stewart, GA, the DOC developed a game called "Acquisition Jeopardy" where the participants of Acquisition Reform Day 2 discussed what used to be versus what is now. Acquisition reform is fun at Fort Stewart!
- The Remote Electronic Contract Administration Program (RECAP), a fully automated contractor oversight system that will provide near real-time digital monitoring and recording of project progress and performance from anywhere in the world using a phone line and the Internet. Individuals will no longer need to be present to witness a task, record observations, or see a problem associated with a project.
- At Virginia Beach, VA, the U.S. Army Training and Doctrine Command (TRADOC) teamed with the Navy, Commander, Mid-Atlantic Region, and the Hampton Roads acquisition community for a seminar/workshop dedicated toward continued improvements in acquisition reform. More than 1,000 acquisition personnel attended.
- At Fort Bliss, TX, the DOC hosted a day of events for both customers and contractors. The Small Business Administration Procurement and El Paso Community College Contract Outreach Center provided staff members to assist with the event. The Greater El Paso Chamber of Commerce, El Paso Black Chamber, and El Paso Hispanic Chamber helped to

contact contractors to attend. One of the highlights of the day, as recorded on evaluation sheets, was that the customers and contractors had an opportunity to interface one-on-one.

Acquisition reform is a continuing priority for America's Army. It is absolutely critical to our modernization program and the future readiness of the force. We have made great progress as a team. Our success is real and visible. We are acquiring weapon systems and equipment, supplies, and services far more efficiently than in the past. These efficiencies within our own operation have enabled us to reinvest savings, in some cases substantial savings, in our modernization program.

While Acquisition Reform Week 2 demonstrated that the culture is changing, we must not relax our vigil. To remain efficient and ensure that we continue to improve our operation and adopt new ways to do business, requires continuous process improvement. I urge members of the Army acquisition community to take their good ideas and ways to improve their operations to their teams for implementation. I want you to let us know about your successes so we can trade the good ideas around. "Success is a journey, not a destination." We have to continue to work daily to get the goals tighter and better.

What's New With The New PMAP?

The Army's new Procurement Management Assistance Program (PMAP), designed to provide management consultant-type services to enhance and assist the procurement process, completed test assessments of the PMA concept at two volunteer test sites—U.S. Army Communications-Electronics Command and the U.S. Army Medical Research and Materiel Command. As a result of the tests, the PMA Team refined the PMA concept and included the lessons learned in procedures for future assistance visits.

One of the missions of the PMAP is to communicate throughout the Army the results of assessments, and to identify and communicate good news stories, best practices, lessons learned, methods of overcoming barriers to efficiency and change, acquisition reform initiatives and policy changes. This will be accomplished using the newly established PMAP Newsletter on the Deputy Assistant Secretary of the Army (Procurement) Homepage at **http://www.acqnet.sarda.army.mil.**

Dual Use Applications Program

The Army is actively working to reduce operational and support (O&S) costs. One of the ways it is doing this is through the Commercial Operations and Support Savings Initiative (COSSI) of the Dual Use Applications Program (DUAP). COSSI's mission is to develop and test a method for reducing O&S costs by inserting commercial products and processes into fielded military systems. The insertion of commercial products and processes is expected to reduce O&S costs of parts and maintenance, reducing the need for specialized equipment, increasing reliability, and increasing the efficiency of subsystems.

Proposals have been solicited for this effort through the use of a competitive Broad Agency Announcement by the Defense Advanced Research Projects Agency, and are currently under evaluation. Selected proposers will develop, manufacture, and deliver prototype "kits" for installation into a fielded system. Proposers may offer maintenance service agreements for their "kits" to ensure their performance and reliability. In Stage I of each selected project, DUAP and the chosen proposer will share the costs of developing and testing the "kit." In Stage II, provided Stage I has been successful, the military customer may purchase reasonable production quantities of the kit and pay for their insertion into the fielded system.

To reduce the traditional administrative burden and oversight of a procurement contract, an innovative type of agreement—one not generally subject to the normal federal procurement laws and regulations—known as an "other transaction" will be used for Stage I. This type of agreement allows a great deal more flexibility and has far fewer regulatory requirements than a typical federal acquisition regulation contract. In particular, this instrument will not generally require government cost accounting standards nor government audits. Furthermore, intellectual property provisions may be negotiated that differ from those usually found in procurement contracts.

Proposals selected for Phase I were announced by the DUAP Office in May 1997, with awards of the "other transactions" for Stage I to be made no later than Sept. 30, 1997. The Army point of contact, Stephen Lake, may be contacted at DSN 227-9982.

For additional information on this article, contact LTC L. Hooks on (703)681-9479 or e-mail: hooksl@sarda.army.mil.

Army Operations Research Symposium

The 36th annual U.S. Army Operations Research Symposium (AORS XXXVI) will be held Nov. 13-14, 1997, at Fort Lee, VA, with registration Nov. 12. Three hundred government, academic, and industrial leaders are expected to participate. The U.S. Army Concepts Analysis Agency will sponsor AORS XXXVI. Co-hosts are the U.S. Army Combined Arms Support Command, and the U.S. Army Logistics Management College, both located at Fort Lee, VA. Attendance is by invitation only.

The theme of this year's symposium is "Building an Analytical Bridge to the 21st Century." Concurrent special sessions will address force development; modernization and requirements analyses; information systems for command, control, communications and computers and information warfare; logistics systems analyses; personnel systems analyses; Army and joint operational analyses; advances in modeling and simulation; and test and evaluation support to Army warfighting experiments and Force XXI.

For additional information, write Director, U.S. Army Concepts Analysis Agency, ATTN: CSCA-EN, 8120 Woodmont Avenue, Bethesda, MD 20814-2797, call Bob Barrett at (301)295-1655, DSN 295-1655, or e-mail aors36@caa.army.mil.

ARMY RD&A WRITER'S GUIDELINES

About Army RD&A

Army RD&A is a bimonthly professional development magazine published by the Office of the Assistant Secretary of the Army (Research, Development and Acquisition). The address for the Editorial Office is: DEPARTMENT OF THE ARMY, ARMY RDA, 9900 BELVOIR RD SUITE 101, FT BELVOIR VA 22060-5567. Phone numbers are: Commercial (703)805-1035/1036/1038 or DSN 655-1035/1036/1038. Datafax: (703)805-4218 or DSN 655-4218. E-mail addresses for the editorial staff are as follows:

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Purpose

To instruct members of the RD&A community relative to RD&A processes, procedures, techniques and management philosophy and to disseminate other information pertinent to the professional development of the RD&A community.

Subject Matter

Subjects of articles may include, but are not restricted to, policy guidance, program accomplishments, state-of-the-art technology/systems developments, career development information, and management philosophy/techniques. Acronyms should be kept to a minimum and, when used, be defined on first reference. Articles with footnotes are not accepted.

Length of Articles

Articles should be approximately 1,500 t o 1,600 words in length. This equates to approximately 8 double-spaced typed pages, using a 20-line page.

Photos and Illustrations

Include any photographs or illustrations which complement the article. Black and white is preferred, but color is acceptable. Graphics may be submitted in paper format, or on a 3 1/2-inch disk in powerpoint, but must be black and white only, with no shading, screens or tints. We cannot promise to use all photos or illustrations, and they are normally not returned unless requested.

Biographical Sketch

Include a short biographical sketch of the author/s. This should include the author's educational background and current position.

Clearance

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

Offices and individuals submitting articles that report Army cost savings must be prepared to quickly provide detailed documentation upon request that (1) verifies the cost savings; and (2) shows where the savings were reinvested. Organizations should be prepared to defend these monies in the event higher headquarters have a higher priority use for these savings. All Army RD&A articles are cleared through SARD-ZAC. SARD-ZAC will clear all articles reporting cost savings through SARD-RI. Questions regarding this guideline can be directed to SARD-ZAC, Acquisition Career Management Office, (703)695-6533, DSN 255-6533.

Submission Dates

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

Authors should include their address and office phone number (DSN and commercial) with all submissions, **as well as a typed, self-adhesive label containing their correct mailing address**. In addition to providing a printed copy, authors should submit articles on a 3 1/2-inch disk in MS Word, or ASCII format. Articles may also be sent via e-mail to: bleicheh@aaesa.belvoir.army.mil

Dr. Kaminski's Farewell Message to the Acquisition Workforce

People are our most important asset. Our defense acquisition workforce is blessed with some of the very best and brightest people in the world. During the past two and one-half years, I have observed on many occasions that our workforce is highly dedicated, motivated, and becoming more empowered with each passing day.

Our acquisition workforce is the envy of my counterparts around the world. A couple of months ago, my Russian counterpart asked me how many members of our workforce actually had the authority to sign contracts on behalf of the United States Government. In Russia, decisions are highly controlled–very few people have this authority. My counterpart was floored by my response: a couple of *thousand* contracting officers can sign contracts. At that moment, it became apparent to my Russian colleague that the strength of our system was our *people*.

Quite often, I hear the prevailing view expressed in Washington, D.C., that the defense acquisition workforce is too large. Very little thought is given to the fact that the workforce must first become *better* before it can become *smaller*. I have worked with very small teams that were extremely effective in managing highly classified programs. A key factor was the quality of the people–we were able to select the very best for our team. Our workforce is qualitatively better today than it was four years ago, but we still have a long way to go to create a culture of continuous education and training.

One of the most significant accomplishments made over the past two and one-half years has been the wholesale reengineering of the way we support the warfighter, using teams working together in parallel rather than our past sequential, serial approach. Integrated Product Teams–composed of warfighters, testers, trainers, doctrine writers, acquirers, and their industry contractors–have dramatically improved the way we do business and have significantly shortened our acquisition cycle times. This process reengineering initiative began with OSD-led Advanced Concept Technology Demonstrations (ACTD), continued with the fielding of a Bosnia Command and Control Augmentation (BC^2A) system, and has expanded with the Army's Force XXI experiment, the Navy's "Smart Ship" project, and the stand-up of the Air Force's Battle Labs.

I take the most pride in seeing our people willing to think "out-of-the-box," pushing hard to be better. It means our incentives and rewards are beginning to work. Our program managers are not afraid to take prudent risks to do what is best. There is a much greater sense that we are all on the same team and are all working toward a common goal.

It has been a pleasure to work with you–the finest acquisition professionals in the world. I wish you all the best in your future endeavors.

– **Paul G. Kaminski**
Under Secretary of Defense
(Acquisition & Technology)

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PERIODICALS

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