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ARMY

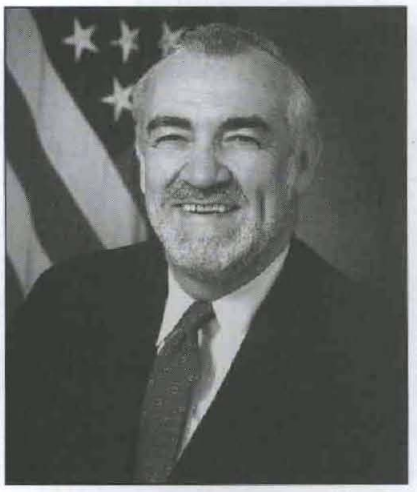
RD&A

MARCH - APRIL 1995

ARMY CORPS OF ENGINEERS

- FORCE XXI SUPPORT
- CONSTRUCTION ENGINEERING
- CIVIL WORKS
- TOPOGRAPHY R&D
- COLD REGIONS RESEARCH

FROM THE ARMY ACQUISITION EXECUTIVE . . .



In *Acquisition Reform: A Mandate for Change,* Secretary of Defense Perry concluded "...DOD has been able to develop and acquire the best weapons and support systems in the world. DOD and contractor personnel accomplished this feat not because of the [acquisition] system, but in spite of it. But they did so at a price—both in terms of the sheer expense to the nation and eroded public confidence in the DOD acquisition system. It is a price the nation can no longer afford to pay."

As we continue to drawdown the force structure and the overall Defense budget continues to decline, acquisition reform is imperative. It is a top down commitment, which must be embraced by the entire acquisition work force for maximum effectiveness. We must reduce acquisition costs by adopting successful business practices from the commercial marketplace. The potential savings are significant. For example, the Carnegie Commission on Science, Technology and Government, using an indirect measure of the cost of the DOD regulatory system, calculated that the management and control costs associated with the acquisition process were about 40 percent of the DOD acquisition budget, as compared to 5 to 15 percent for commercial firms. I am committed to narrowing the difference.

I came to this job with acquisition reform as my main goal, and I am very pleased by the Army and DOD's continued progress. DOD's Process Action Team (PAT), chartered to reengineer the oversight and review process, has completed a report with more than 30 recommendations for a more effective and efficient process, while maintaining an appropriate level of oversight. The recommendations have been reviewed by senior OSD and Service leadership. They are strong and controversial. They have created much debate and "rice bowl" protection; but, we should keep in mind that bold change almost always creates great resistance and support for the status quo. Notwithstanding, they will go to Dr. Paul Kaminski, the undersecretary of Defense (acquisition and technology), for review. While not all of the recommendations are likely to be implemented, it is virtually quaranteed that this team's effort will cause a vast simplification of the burdensome oversight that existed in the past.

This streamlined oversight will enable attaining the following four "stretch" goals identified by the PAT: (1) reduce the percentage of programs with acquisition program baseline breaches to no more than 5 percent; (2) reduce cycle time by 50 percent; (3) reduce the number of people in the acquisition oversight and review process by 50 percent; and (4) reduce the average cost of a milestone review by 50 percent.

The team sought to drastically reduce the cost of review and oversight without sacrificing quality or increasing risk. It recommended adopting a three-milestone process, a single formal review prior to milestone decisions to reduce both decision times and their variances, and a dramatic decrease in the number of documents and activities required for a milestone decision.

In addition, the PAT recommended adoption of the Integrated Product Team approach for oversight and review, which the commercial world has used successfully for years. Product development decisions from day one must be based on their impact across functional areas. It's just plain common sense. It is clear to me that despite reluctance on the part of some parties, both at DOD and in the Services, this recommendation will be adopted with vigor.

In support of the overall management oversight reform effort, I directed that a lean, fast-paced PAT be formed to streamline the Army Systems Acquisition Review Council (ASARC) process which has become burdensome, time-consuming and expensive. I was particularly concerned about the amount of documentation and the number of briefings required to obtain an ASARC decision.

In just three days, recommendations were made to streamline both the ASARC oversight and decision process and the documentation required to support it. These recommendations are currently being tested on the JSTARS Common Ground Station acquisition, and include an ASARC Coordination Team (ACT) to replace all ad hoc working groups, committee meetings and the pre-ASARC. The ACT is the Integrated Product Team. It includes the program's staff action officers. The PM and PEO will meet throughout the program to raise and resolve issues early. Three basic rules will be followed: (1) issues remaining from working group deliberations will be discussed openly; (2) issues will be discussed from the system perspective rather than from a single functional viewpoint to give the Milestone Decision Authority (MDA) an integrated view of the program risks; and (3) issues will be either resolved or raised to the MDA through the ASARC process. A scheduled review will not be delayed.

Further, ASARC attendance will be flexible according to the issues that will be raised to the senior Army leadership. There will be just one document for review by the ASARC/AAE, a modified Integrated Program Summary (IPS), which will be an executive summary of the program and the issues to be addressed, not a detailed, voluminous document.

We must build a sound program from the beginning so that the soldier will have what he needs when he needs it. We don't need bureaucratic excuses, delays and indecision. We need innovation, teamwork and program stability. Above all, we need to expedite the process. The current cycle time for DOD systems is eight to 12 years as compared to the commercial world where the cycle time for complex products is four to five years and decreasing.

Acquisition reform is a reality. Our key to success is identifying the need to change, establishing PATs and developing proposals for change, and enunciating the guiding principles for a streamlined, effective and efficient acquisition system. We are making good progress.

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07960

Research Development Acquisition ARMY RD&A

Professional Publication of the RD&A Community

FEATURES

DEPARTMENTS

COVER

Army Corps of Engineers research involves a broad range of missions, including support to Force XXI efforts, civil works, topography R&D, cold regions research, and construction engineering.

Corps of Engineers Labs...

A UNIQUE NATIONAL ASSET IN RESEARCH CAPABILITIES

By Dr. Robert B. Oswald

Introduction

The U.S. Army Corps of Engineers research facilities and staff offer the military and the nation engineering resources unmatched in any other private sector or government organization. Each of our four research and development (R&D) laboratories opened with a specific mission and for a specific reason: the Army's R&D needs could not be addressed by an existing private sector capability. The same is true today.

In civil engineering R&D, the construction industry has traditionally invested very little into technology development. This complex industry is fragmented and conservative, with many competing interests. Without a sustained R&D initiative, the facilities and expertise to address civil engineering R&D in the private sector have not evolved.

In environmental R&D, private companies have had little motivation to fund R&D to solve military-specific problems such as training land management. A vast industry sprang up to do work such as environmental cleanup, but the technologies for doing it have largely come from research in the Department of Defense (DOD) and other federal agencies.

In terrestrial sciences R&D, Army leadership has recognized that topography underlies all of the Army's modernization plans. The digital battlefield will not become a reality for Force XXI unless there is a digital terrain data base on which to position the forces in opposition. The Army's vision for this R&D area is to provide the ability to rapidly generate and deliver timely topographic products with integrated weather data to commanders engaged in force projection operations anywhere in the world.

The need for Army research in cold regions lies in the fact that the environment changes significantly when temperatures fall below freezing, no matter where in the world it occurs. As the cold becomes severe, even common activities can become difficult or impractical. At some point, survival becomes the sole focus, and many mechanical devices simply stop functioning. During the Korean War, American troops suffered 34,500 casualties due to the cold. Operating in cold regions requires appropriate equipment, training, and doctrine, often very different from those used in more temperate climates. These special requirements cover a broad range of military activities and can incur major cost or capability penalties.

Like civil engineering and environmental research, topography and cold regions R&D have no champion in the private or other government sectors. Yet they are critical to national security.

Today, no single organization can afford to conduct the level of R&D required to achieve our nation-rebuilding and environmental sustainment goals. However, by partnering and capitalizing on the Corps R&D resources, these goals can reach fruition. The expertise in these labs which emerged to support military and civil works missions has already been producing technologies for many years that find equal use in the private and public sectors.

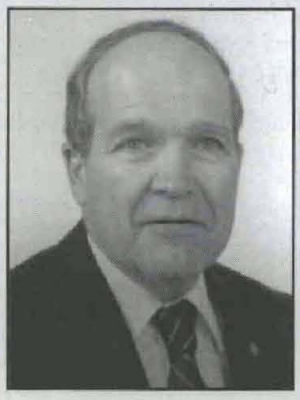
Perhaps the most compelling evidence of the Corps labs' importance to the nation comes from the private sector itself. A study released last summer from the director of the Defense Research and Engineering Commission reported the findings of government and non-government panels looking at 12 technology areas.

In the civil engineering area, the non-government panel observed that the private sector has very limited R&D infrastructure to support the DOD civil engineering program and further, that the private sector architecture, engineering and construction (AE&C) industry needs support from the DOD R&D community to help maintain economic competitiveness. The Corps labs were specifically cited as Service engineering facilities that "should be expanded and used as a springboard for building a broad-based Government-Industry-Academic applied research effort in this technology area."

Reliance Directs R&D Missions

In 1991, DOD looked closely at the programs within its laboratories and set out a framework to ensure no duplication of effort. This framework, called Reliance, gave each Service the lead in specific science and technology areas. Lead roles were based on the

CORPS OF ENGINEERS LABORATORY LEADERSHIP



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The Corps environmental quality research and development provides the Army with technologies to meet its environmental goals at reduced costs and with minimal impact on readiness.

strength of the Service's existing program and mission functions, as well as the resources and expertise available within the laboratory infrastructure. Other Services then rely on the lead for science and technology needs within a given area.

The Corps of Engineers military R&D program was structured to fit into three Reliance technology areas: civil engineering (CE), environmental quality (EQ), and battlespace environment (BE). In the CE technical area, the Corps laboratories have program leads in conventional facilities, airfields and pavements, survivability and protective structures, and sustainment engineering (base support). In the EQ technical area, the Corps laboratories have program leads in cleanup, compliance, and conservation. And in the BE technical area, the Corps laboratories have leads in cold regions and topography.

Corps Military R&D

The Corps of Engineers military R&D program involves three areas: military engineering, base support, and environmental quality. The research in these areas seeks to develop technologies that support the soldier on the battlefield, improve the affordability and quality of installations, and improve the environment where soldiers train and live.

Military engineering research focuses on the battlefield environment and technology in support of Force XXI objectives. It does not involve weapons research, which is the domain of the Army Materiel Command, but instead provides creative technologies that help soldiers better understand, adapt to, and control the battle environment in which they are engaged. The military engineering program encompasses topography, cold regions sciences, battlefield environment effects, sustainment engineering, and mobility/countermobility.

The base support R&D program provides technologies that ensure the Army in garrison has facilities that sustain the ability to mobilize and the quality of life, and that are affordable for the nation. The base support area focuses on military construction, energy conservation, facility operation and maintenance, and hardened structures.

The Corps environmental quality R&D provides the Army with technologies to meet its environmental goals at reduced costs and with minimal impact on readiness. The program addresses installation challenges in cleaning up hazardous materials, preventing pollution, complying with numerous environmental regulations, and conserving natural and cultural resources.

Corps Civil Works R&D

From its roots at West Point—the first engineering school in the U.S.—the Corps of Engineers has been deeply involved in nation-building. The civil works research capability at the Corps laboratories focuses on improving construction, operation, and maintenance of the nation's infrastructure. Today the Corps civil works assets total $150 billion.

The civil works R&D program focuses on advanced materials, flood control and navigation, coastal engineering, water resources planning, environmental quality (specific to civil works projects), surveying and remote sensing, dredging, and wetlands management.

Funding and Customers

The Corps research program in FY 94 totaled $642 million. This figure includes direct funding from the Corps headquarters and leveraged funds from reimbursable customers in the Services and other federal agencies. The reimbursable work allows the Corps labs to refine and further develop technologies produced in the direct funded program. Reimbursable customer funding comprises 60 percent of the Corps research program.

The Corps has long been a leader in technology transfer, with many of the R&D products developed for the Army having direct application in the public and private sectors. Another article in this issue by Dr. Lewis Link provides details. (See page 10 of this issue.)

The Corps Laboratories

The Corps of Engineers has four laboratories, each with a specific R&D mission and unique resources to conduct research. They include the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) in Hanover, NJ; the U.S. Army Construction Engineering Research Laboratories (CERL) in Champaign, IL; the U.S. Army Engineer Waterways Experiment Station (WES) in Vicksburg, MS; and the Topographic Engineering Center (TEC) in Alexandria, VA.

Some 2,700 scientists, engineers, and support professionals work at the four Corps laboratories. Researchers work closely with their customers in developing technologies. The labs also take advantage of expertise in academia and industry through research partnerships. (For example, see the article by Dr. William Roper on page 14 of this issue.)

CRREL

Research at CRREL provides the expertise and technology that allow the Services and the nation to operate under the special challenges of cold environments. CRREL is the only DOD research facility that focuses on pure science in the environment as it changes state during freezing. It is also the only DOD lab that does applied research aimed at sustaining an effective war fighting force in cold regions.

CRREL has a complex of low-temperature laboratories and experimental research facilities not found anywhere else in the world. The main laboratory consists of 24 low-temperature research labs with a temperature range down to -30 F. The 73,000 square foot Ice Engineering Facility houses three special purpose research areas: a large, low-temperature towing tank; a 100-foot-long refrigerated flume for modeling rivers; and a large, hydraulic model room for studying ice impacts on civil works facilities, mainly locks and dams. The 29,000 square foot Frost Effects Research Facility supports full-scale research on the impact of freeze-thaw cycles on pavements, foundations, and utility systems. CRREL's Geophysical Research Facility was opened in 1993 specifically to support the Navy's research on sensors under icy sea conditions.

CRREL's permanent workforce is 358 employees which includes 169 researchers. Its FY 94 technical program totaled $51.9 million.

CERL

The mission of CERL is to develop infrastructure and environmental technologies to improve the Army's ability to cost-effectively construct, operate, and maintain its facilities and training lands at installations. Quality facilities and training lands are critical to sustaining the Army's power projection capability, enhancing the quality of life for soldiers, and achieving training and environmental goals.

CERL is unique within DOD for both its mission and its affiliation with the University of Illinois at Urbana-Champaign (UIUC). CERL's multi-disciplinary team multiplies the expertise onboard by hiring students and faculty at UIUC. This partnership resulted from open competition among several major colleges and universities with top engineering schools.

As an allied agency of UIUC, CERL has access not only to a diverse research staff, but also to all the experimental facilities at the university. Examples are the National Center for Supercomputing Applications, the Materials Engineering Laboratory, and the Toxic and Hazardous Materials Laboratory.

Onsite, CERL houses the nation's most powerful earthquake test facility, which is currently being upgraded to allow triaxial motion. This will permit more realistic scale model studies on survivability of military facilities and equipment under blast and seismic events. CERL's other facilities include a million-pound structural load frame, an ion plater, and a DOD-unique heating, ventilating, and air-conditioning test facility.

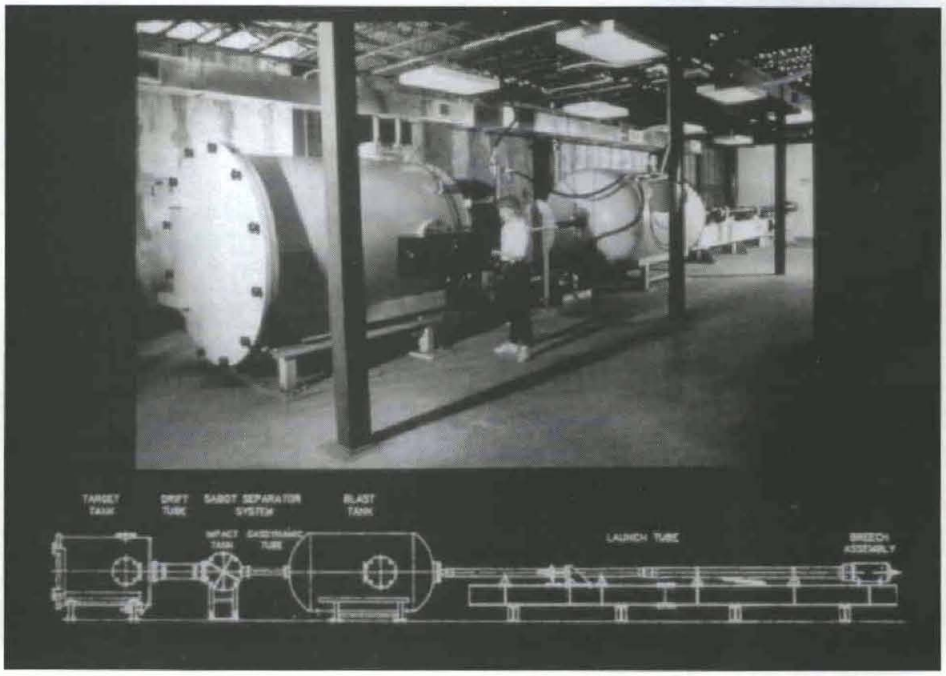
CERL's program in FY 94 totaled $92 million. In that year, some 400 university researchers supplemented the federal staff of 400 to conduct research in a wide variety of disciplines.

WES

WES conducts the largest portion of the Corps civil works R&D. It is the largest and most diverse civil engineering and environmental quality R&D laboratory complex in the world. WES, designated a National Historic Civil Engineering Landmark, is a 675-acre complex with over $630 million in capital assets and $130 million in information technology resources.

WES's six centrally-managed laboratories contain several unique test facilities. These include the Supercomputing Facility; Projectile Penetration Test Facility; Engineering Geology Research Facility; Geochemistry, Microbiological, and Radioisotope Laboratories; Contamination Fate and Effects R&D Facility; Ship/Tow Simulator; the world's largest

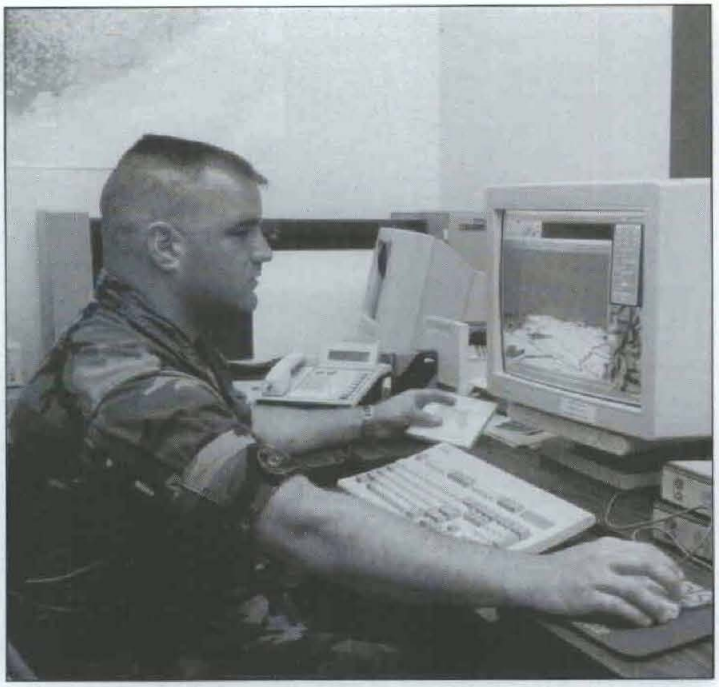
The WES Hazardous Waste Research Center is developing cost-effective treatment technologies and is the only EPA-permitted facility in DOD.



The unique Projectile Penetration Test Facility at WES is used in a hardened structure research and can simulate a variety of projectile threats.

An artist's rendition of the Digital Topographic Support System/Quick Response Multi-color Printer system, due to be fielded to division, corps and echelon above corps Engineer Terrain Teams starting in 1998.

A soldier operates TEC's Digital Topographic Support System—Multi-Spectral Imagery Processor (DTSS-MSIP).



centrifuge (under construction); and others.

WES executes an annual R&D program of more than $364 million. The permanent workforce of 1,457 includes 728 engineers and scientists.

TEC

TEC is the Army's center of expertise for digital mapping, terrain intelligence, terrain visualization, and remote sensing technologies. TEC's R&D supports military programs and the nation's civil and environmental initiatives. TEC's Operations Directorate produces terrain databases and conducts terrain and water resource analyses.

TEC's unique facilities and systems include the Image Extraction/Processing Test Bed; Battlefield Visualization Test Bed; War Breaker Spatial Information Test Bed; Joint Precision Strike Demonstration Facility; Image Exploitation System; and other assets specific to TEC's topographic mission.

The research program budget at TEC is about $134 million annually, and the staff numbers 434. Its Army and DOD customers include the Joint Precision Strike Projects Office, Advanced Research Projects Agency, U.S. Army Materiel Command, U.S. Army Space Program Office, and others.

For More Information...

To learn more about the Corps of Engineers R&D program, contact Dr. Donald Leverenz at the Corps Headquarters, (202)272-1415. Points of contact for the labs are: CRREL—Dr. Lewis Link, director (603)646-4450; CERL—Dr. Michael O'Connor, technical director (217)373-7202; WES—Dr. Robert Whalin, director (601)634-2664; and TEC—Dr. Walter Boge, director (703)355-2600.

DR. ROBERT B. OSWALD is director of R&D for the U.S. Army Corps of Engineers. He holds a B.S.E. in engineering mathematics, a B.S.E. in mechanical engineering, an M.S.E. in mechanical engineering, and a Ph.D. in nuclear engineering, all from the Univeristy of Michigan.

CORPS SUPPORT TO FORCE XXI

By Walter E. Boge and Leonard I. Huskey

Introduction

Force XXI implements the concepts of power projection and information warfare to mobilize, deploy, employ and sustain highly trained combat forces anywhere in the world. Doctrinal changes currently are being implemented around digitization of the battlefield, horizontal integration of information, and the use of new computer and communication technology.

The U.S. Army Corps of Engineers' (USACE) research and development community is actively engaged in helping the Army achieve its Force XXI goals in several key areas of combat engineering—topography, mobility/counter-mobility, sustainment and survivability. This article describes several of these developmental efforts and indicates their impact on Force XXI capabilities.

Topography

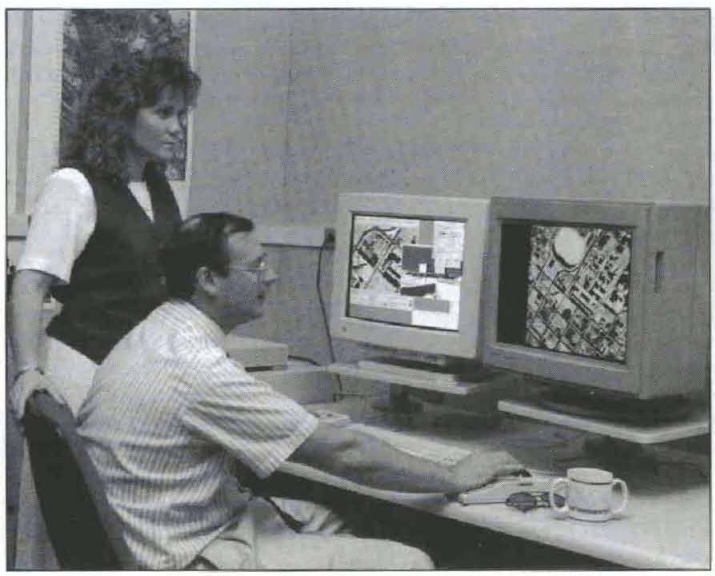
Effective digitization of the battlefield hinges on commanders' ability to see and exploit the terrain upon which they must fight. Digitized terrain is the chess board upon which Force XXI will move, shoot and communicate. In order to plan combat operations, establish command and control, or maneuver forces; the commander must know the "lay-of-the-land," and where friendly units are located in relation to opposing forces. Force XXI units at all echelons must have the capability to display current and accurate digitized maps (or map substitutes) integrated with intelligence and planning overlays. Certain units will need to visualize the terrain in three-dimensional perspective to walk/fly-through the battlefield and conduct terrain analyses for mission planning and intelligence preparation of the battlefield. Terrain and weather data will also be exploited in computer-based mission rehearsal activities and combat models and simulators.

Rapid Mapping. The problem is, that for the projected future, terrain data at the operational scales necessary to support Force XXI requirements (1:50,000 and larger) will not be available for most of the earth's surface. In response to this operational deficiency, the Topographic Engineering Center (TEC) has been investigating technologies to rapidly produce maps and map substitutes, and to provide better methods to visualize battlefield terrain.

One rapid mapping development effort has recently completed the technical feasibility phase and is currently being fielded to the 30th Engineer Battalion (Topographic), Fort Bragg, NC, as a prototype. This rapid mapping capability is the Terrain-Intelligence Integration Prototype (TIIP). The TIIP was designed to accept and process digital or hard-copy stereo imagery from all sources, and automatically generate customized Digital Terrain Elevation Data (DTED) and orthophotographs. For quick-reaction, image-map substitutes, a grid can be overlaid on the orthophoto; or the ortho-image can be draped onto a three-dimensional terrain mesh (made from the DTED) for a 3-D perspective. These products are digital, and can be transmitted to tactical users electronically or reproduced in hard-copy by other TIIP hardware components.

The Corps and the Advanced Research Projects Agency (ARPA) are cooperatively developing a second rapid mapping technology. It involves the use of Interferometric Synthetic Aperture Radar (IFSAR) processors to automatically compute elevation information over large areas. IFSAR sensors have been developed and are currently being flown over test areas to evaluate the utility and practicality of this concept. Preliminary results indicate that dense arrays of highly accurate (better than 5 meters) elevation data can be generated rapidly. The unique feature of IFSAR is a day-night, all-weather mapping capability, as well as the strong potential to automatically extract feature data (e.g., vegetation) from the imagery.

Terrain Visualization. Digital terrain data have the potential for being exploited in many different Force XXI applications. For



TEC scientists work at a Terrain-Intelligence Integration Prototype (TIIP) stereo-image processor.

This image, produced by TEC from Defense Mapping Agency and SPOT imagery, shows advancements in rapid battlefield visualization.

example, for early entry or planning, maps or current imagery can be draped over elevation data and "terrain walks" or flythroughs can be generated to determine potential landing areas, choke points, likely minefield locations, etc. Other potential applications include: using realistic terrain representations for training simulators; exercising combat models with real, three-dimensional terrain rather than flat earth hexagons; and assessing air-defense vulnerability. The applications are endless, but critical to success. TEC engineers have been investigating and developing different algorithms and numerical techniques for generating and displaying three-dimensional representations of the terrain. In addition, they are assessing the more than 200 different commercially available software applications for displaying terrain data.

Ongoing activities are concerned with helping the Army's Training and Doctrine Command (TRADOC) define its requirements for terrain and battlefield visualization capabilities, and providing technical support to developers of training, modeling and simulation systems. In addition, TEC's Operations Directorate is building digital terrain data bases to support Army exercises and real-world Joint Task Force activities.

Mobility/Counter-Mobility

Achieving effective mobility for friendly forces and inhibiting the enemy's maneuver capabilities will be critical to FORCE XXI success.

Mobility Modeling. Research efforts at the Waterways Experiment Station (WES) and the Cold Regions Research and Engineering Laboratory (CRREL) are providing global, all-weather, near-real-time assessments of ground mobility through more accurate predictions and representation. Accurate representations of mobility in command and control systems, combat models and simulations will help maximize the maneuver commander's ability to concentrate firepower on the battlefield, provide realistic mobility representations for evaluating force design concepts, allow evaluations of vehicle designs prior to prototype construction, and provide realistic training for soldiers in vehicle simulators.

Current research is advancing mobility modeling technologies by addressing several key issues: modeling methodologies that treat vehicle speed as a function of random variables for terrain and vehicle factors; automated methods to derive mobility terrain variables that are unavailable from standard data; and modeling the complex interaction of vehicles moving in thawing soils, and through shallow and deep snow.

Obstacle Planning. WES is developing the Obstacle Planner Software (OPS) to assist in planning, developing and tracking effective obstacle plans. This software will include the synergistic relationships between emplaced obstacles, naturally occurring obstacles and covering fires. The present OPS, which will be demonstrated in Prairie Warrior '95, can assist in the emplacement and resourcing of obstacle zones, belts, groups and individual

obstacles, based on mobility corridors developed from the battlefield's terrain and environmental conditions. Future software developments will evaluate the integration of obstacles with direct-and indirect-fire plans, and predict the effect on the threat force in terms of speed, direction of movement and attrition. These developments also will produce an obstacle plan, based on the commander's intent and scheme of maneuver, engineer resources and type of threat force.

Sustainment

Corps of Engineers labs are developing civil engineering technologies that will enable the Force XXI engineer to meet the new challenges for rapid deployment and sustainment of our forces, particularly in new construction practices and materials, and the development of military engineering decision aids.

Lines of Communication/Materials and Methods. The capability of the combat engineer to rapidly repair or construct an in-theater transportation infrastructure that will withstand uniquely military traffic directly impacts the ability of the Army to project and sustain Force XXI. The Corps R&D community is developing new construction materials and methods for roads, airfields and railroads that will provide engineers with the ability to rapidly repair or construct the in-theater lines of communications required for force projection and sustainment. Focus is on the use of locally available and possibly lower-quality materials for in-theater construction to minimize hauling or shipping distances and reduce stress on the logistics system.

Force XXI will rely heavily on port facilities to transport forces from the United States to locations anywhere in the world. Since many port facilities will be inadequate, it is critical to develop ways to establish Logistics Over the Shore (LOTS) operations to project and sustain our forces onto the land. However, present LOTS capabilities cannot meet the Department of Defense requirement for LOTS operations in wave heights up to 5 feet. USACE is developing the technologies required for the engineer to emplace wave energy attenuation devices rapidly. That will reduce adverse sea-states and allow LOTS operations to continue during coastal conditions that would ordinarily preclude them. Physical model tests have been completed on a rapidly installed floating breakwater system. The results of these 1/8-scale tests show that this new system can reduce wave heights by 50 percent or more.

Lines of Communication/Planning and Assessment. Automated methods for planning, evaluating and scheduling general engineering tasks do not currently exist. Typically, the engineer plan developed is based on out-of-date or historical data, making it far less than optimal and certainly unacceptable for Force XXI. The Corps is developing the technologies and analytical software to assess the capability of existing lines of communication (roads, bridges/tunnels, rail, airfields and LOTS) facilities in all climatic conditions. This will permit the planning and scheduling of a variety of convoys, determining construction requirements, planning LOTS operations, determining engineering effort required to maintain logistical throughput, and developing effective engineer resource allocation and scheduling plans. This technology is being demonstrated as part of the Total Distribution Advance Technology Demonstration.

A floating breakwater system, consisting of geotextile and pipe, was model tested at WES in the directional spectral wave generator basin in the 1:75 scale.

Survivability

With the worldwide proliferation of advanced conventional and terrorist weapons, survivability will be a major issue for the Force XXI Army.

Field Fortifications. The Corps of Engineers is developing lightweight, easily transportable and quickly assembled protective field fortifications for fighting positions, aviation assets and command centers to defeat blast and fragmentation effects of existing and developing conventional weapons. The various concepts being developed feature the use of either advanced materials and construction procedures, or materials commonly found throughout the world. The data from this research will be used to develop a simplified analysis procedure that will provide a survivability assessment for structures, fighting positions and personnel. The analysis also will ensure that protective positions provide the maximum in survivability using the manpower, resources and time constraints associated with the Force XXI battlefield.

Hardened Facilities. To protect critical fixed facilities acquired during force projection operations, technologies to assess vulnerability are coupled with hardening techniques to increase survivability. These technologies will allow Force XXI soldiers to retrofit existing facilities and to survive advanced weapon threats.

Fixed Facility Camouflage, Concealment and Deception (CCD). To increase the survivability of fixed facilities and long-duration assets, WES is developing CCD materials and applications techniques that disrupt the threat's aerial munitions detection/delivery cycle. Emphasis is on techniques to reduce multispectral signatures through use of terrain and structural shaping, as well as the more traditional use of paints, coatings and low-cost, lightweight screen materials.

Summary

To accomplish missions quickly with minimum casualties, our forces in the 21st century must deploy rapidly with a superior knowledge of the potential battlefield, to transit unfamiliar lands with greater mobility and confidence, and operate with minimum detectability and maximum survivability. The Corps of Engineers' laboratories place great importance on providing these capabilities for Force XXI. We are working with the Battle Labs, participating in Louisiana Maneuvers exercises and fielding rapid prototype capabilities. Through these efforts, the Corps labs are continuing to make a valuable contribution to the success of Force XXI.

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LEONARD I. HUSKEY is a physical scientist in the Office of Technical Programs and Plans at the U.S. Army Engineer Waterways Experiment Station. He graduated from the U.S. Military Academy with a bachelor's degree in basic sciences.

CORPS OF ENGINEERS TECHNOLOGY TRANSFER

By Dr. Lewis E. Link Jr.

Introduction

The Corps of Engineers R&D programs are highly focused. From basic research addressing key knowledge gaps, through exploratory development which applies new knowledge to specific capability requirements, each effort has a goal that is rooted in a mission or user specified need. The best R&D is of little use, however, if it is not effectively transitioned into operational use. Technology transfer is, therefore, a very critical aspect of all research. However, technology transition needs normally far exceed the direct funding available. This has presented a continuous challenge to the laboratory community which has responded with a diverse and multifaceted approach to getting the job done.

The Corps research programs involve infrastructure, environmental quality and military environment/engineering thrusts that address a broad range of war fighting, readiness, affordability and compliance issues. Because of the special experimental R&D facilities at the Corps labs and the excellent technical and support staffs, the research programs executed go significantly beyond that funded by the direct civil and military R&D funds provided through the chain of command. Funds provided by individual customers to address specific technical problems account for 60 percent of total laboratory funds. This is a tremendous leveraging factor, allowing the labs to sustain a much larger and more comprehensive level of effort than would be possible under the direct mission programs. Another significant lever is the complementary civil and military missions of the Corps.

Technology Transition Mechanisms

The large customer programs of the Corps labs are a distinct advantage for technology transition/transfer. By working directly with customers, the labs stay tuned to the most significant technical issues and have the opportunity to demonstrate and transfer technology directly. Since some of these customers are federal agencies other than DOD, there is the added benefit of transfer of technology throughout the government and to the constituents these agencies serve.

Partnerships and cooperative programs, often with other federal agencies, states or industry, are also a key mechanism within the Corps to both accomplish research and effect the transition/transfer of technology. Since many of the services needed by the DOD are provided by private sector contractors, this can accelerate the availability of cheaper or more effective services. Coupled with the formal technology demonstration and transition programs, these activities outline the primary mechanisms that the Corps lab community uses to put the results of their research to use. Each will be described in more detail below.

The Corps research programs involve infrastructure, environmental quality and military environment/ engineering thrusts that address a broad range of war fighting, readiness, affordability and compliance issues.

Demonstration/Transition Programs

Under the Army RDTE technology demonstration (6.3) program, the Corps has been involved in integrating digital data and terrain modeling capabilities to provide assistance to field commanders. The most recent thrust was focused on the ability to create tactical decision aids (TDA's) that provide the commander quantitative and distributed information on the effect of terrain and weather conditions on Army operations. This effort, the Air Land Battlefield Environment (ALBE) Technology Demonstration Program, began in 1986 and was completed in 1993. During this period, a number of demonstrations were accomplished within the U.S. and worldwide during field training exercises. The ALBE software is currently being used as the interim terrain analysis package for Army terrain analysts pending fielding of the Digital Topographic Support System. Some of the ALBE software will also soon be available as part of the Terrain Evaluation Module of the Army Tactical Command and Control System.

The current thrust of the demonstration program is the Countermobility and Survivability Technology Demonstration. It will consolidate and transfer several maturing applied research products for obstacle planning and survivability to the Tactical Engineer Command and Control System. This system will provide automated command and control to engineer staffs and commanders, enhancing the maneuver commander's ability to

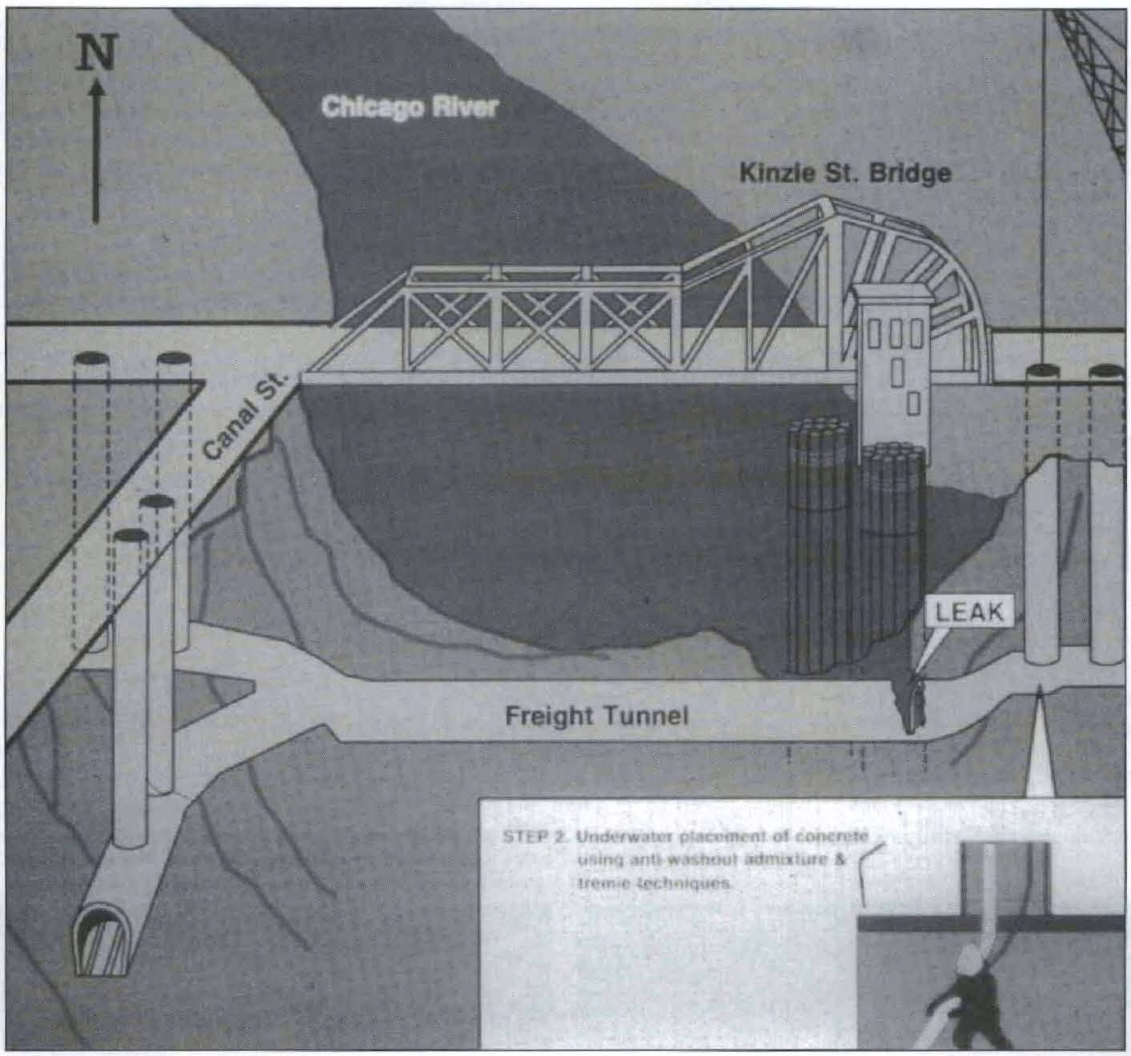


Figure 1.
Schematic of Chicago Service Tunnel plugging with underwater concrete mixture.

wargame, plan and execute mobility, countermobility and survivability missions.

Infrastructure Demonstration Programs

The Facilities Engineering Application Program (FEAP). FEAP demonstrates innovative technologies in real world situations on Army installations. Since 1984, more than 60 technologies have been demonstrated at over 70 installations. Technologies are conducted in seven areas: energy, buildings, environmental quality, natural resources management, pavements and railroads, and corrosion to save money, conserve energy, or improve operational effectiveness, environmental quality, war fighting capability, or safety.

Widespread use of FEAP technologies will result in more cost-effective installation management and improved quality of life. An innovative cracking and sealing technique for pavement repair at Aberdeen Proving Ground, MD, documented a $1.2 million savings from a single application of this technology. Ground coupled heat pump technology demonstrated in limited numbers of family housing units at Fort Polk, LA, is now being installed in 4005 housing units throughout that installation.

The Repair, Evaluation, Maintenance and Rehabilitation (REMR) Program. REMR is a civil works program initiated to develop and demonstrate affordable technologies to maintain and extend the service life of water resources projects. Phase I of the program was recently completed and Phase II will continue through 1997. Technology developed has been transferred throughout the federal agencies, state agencies and the private sector, resulting in improved safety and reliability, reduced manpower requirements and improved operational capabilities. Along with demonstrations of technologies at Corps civil works facilities, the REMR Program uses a bulletin, on-line data bases, technical reports, technical journal articles and training courses for awareness and transition of technologies.

Two noteworthy examples of REMR technologies are precast lock walls and underwater concrete placement. The precast concrete forming system was developed for refacing navigation lock walls. It is faster and less costly than conventional methods and results in a concrete surface of superior durability. It was adopted by the state of New York for rehabilitation of the locks on the Erie and Oswego Canals. The underwater concrete mixtures and placement techniques have been used at numerous water resources projects to reduce costs up to $500,000 per site by eliminating the need to dewater for repairs.

Another example of the use of this technique was to plug the service tunnel under Chicago in April 1992 when the Chicago River flooded the tunnel.

Wetlands Research Program. Congressional mandates require consideration of environmental impacts and analyses of consequences of activities that affect wetland functions and values. The Corps Wetlands Research Program (WRP), in coordination with other government agencies, academia, and other wetland professionals, provides environmentally sound, cost-effective techniques to assess, regulate, restore, and manage the nation's wetlands. Evolving technology is transferred to the private sector through the *Wetlands Delineation Manual* which is used by all federal, state, local, and territorial governments in regulating wetlands. The Army developed an exportable wetland delineation training package that was provided to over 1,200 private contractors, universities, and federal and state agencies to meet their training needs. Last year, an estimated 10,000 private sector professionals and students were taught wetlands delineation using the manual.

Reimbursable/Cooperative Research Programs

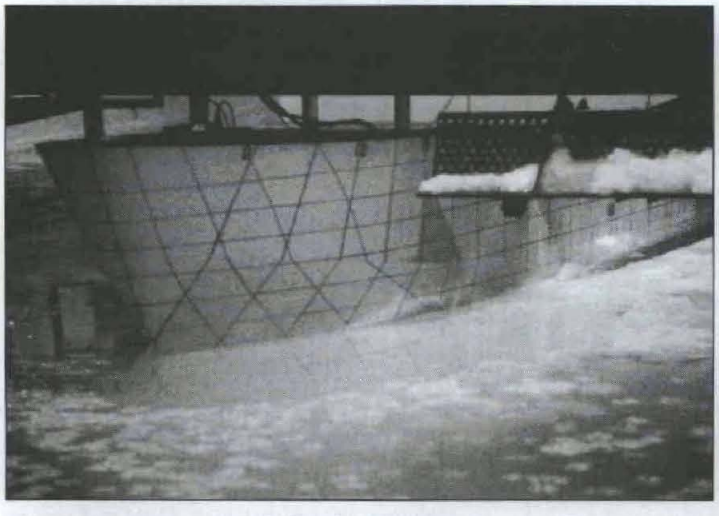
The large civil and military reimbursable programs provide a direct connection for the labs to users/customers and their immediate problems. Typically, the reimbursable work extends or complements the work funded under the direct R&D programs. For DOD customers this provides a direct opportunity to demonstrate or evaluate emerging technologies with high potential for operational use. Examples include characterization of the effects of the changing environmental conditions on new weapons systems such as the Wide Area Mine and SADARM. In each case, models that predict the character (with respect to the sensing mechanisms used by the weapons systems) of terrain surface features developed in the direct R&D programs were applied to evaluate potential impacts of the environment on system performance.

Some reimbursable efforts are part of cooperative programs where resources from the Corps and other agencies are combined to address major technical issues that are priorities for both the DOD and the other agencies. An example of this type of effort is the Airfields and Pavements Research Program conducted by the Corps with the Federal Aviation Administration and the Federal Highway Administration. The program is even broader in that many state departments of transportation (through the National Cooperative Highway Research Program) participate in the effort.

The technology transfer from this cooperative effort has been extensive. Every U.S. military and civilian airport and many in foreign lands, use the Corps soil classification and design criteria for the design and construction of airport pavements. Twenty-six states use Corps-developed asphalt mix and thickness designs for highway pavements. One hundred forty-nine U.S. cities and counties and 131 private consulting firms use the Corps-developed pavement management system. In addition, since 1989 new technologies have been demonstrated at 38 jointly-funded projects with the U.S. construction industry.

Partnering With the Private Sector

The Corps labs work under a variety of government-wide, DOD and service specific authorities. The Stevenson-Wydler Technology Innovation Act of 1980 addresses dissemination of technology information generated in the federal sector and established Offices of Research and Technology Application at major federal laboratories. A second major initiative, the Federal Technology Transfer Act of 1986, which has been significantly amended, empowered lab directors to enter into cooperative R&D agreements (CRDA)



The design of the ice breaker Nathaniel B. Palmer was tested for North American Ship Building Inc. in CRREL's ice engineering facility (shown left). The vessel is now supporting National Science Foundation research in Antarctica (shown right).

CRREL developed methods for near real-time determination of TNT contamination in soils have been commercialized by EnSys Inc. as a field test kit.

and negotiate licensing agreements with private sector partners.

The Corps labs have some unique partnering capabilities through the civil works mission and authorities. In contrast to the government and DOD initiatives, the Corps labs can be involved in cooperative research that is an industry initiative. This is implemented through a special CRDA as a part of the Construction Productivity Advancement Research (CPAR) Program or through a Technology Assistance Agreement (TAA).

Examples of Partnering

CPAR. The CPAR Program allows the Corps labs to conduct cost-shared cooperative research on construction relevant technologies that are an industry initiative, but of interest to DOD. Up to 50 percent of the development effort can be funded through the Corps CPAR authority. Under CPAR, partnering proposals for specific technologies are competed and a number selected for funding each year. The work is accomplished via a CRDA that defines the roles and responsibilities of each partner and specifies the rights of the government and the private partner to the technology following development. A long list of CPAR projects has been initiated since the inception of the program in 1989. They include the development of antifreeze admixtures for low temperature concrete, landfill clay liner design criteria, robotically assisted masonry construction, recycling of plastic waste as construction materials and prestressed clay brick walls.

TAA. The TAA allows the Corps labs to provide technical assistance on a reimbursable basis to any U.S. firm which is competing for or has been awarded a contract for a project outside the U.S. The technical assistance provided under a TAA can involve use of unique experimental facilities or technical expertise of Corps scientists and engineers. An example of an active Technical Assistance Agreement is CRREL support to Alden Research Laboratories which assisted them in winning a contract against international competition on power plant intake designs for the Niagara River.

Reimbursable R&D Support. The labs can also provide reimbursable assistance, through a CRDA, to U.S. corporations if the support required is not available commercially. This usually occurs when the Corps has a special expertise or R&D facility not generally available in the private sector. Examples include the use of CRREL's ice towing tank to support North American Ship Building, Inc. in the testing of ice breaker vessel designs. The unique physical modeling facilities at WES have been used to support the design of the power plant structure for Vidalia, LA, for the Old River Control Structure.

Publications. Lest we forget the classical technology transfer mechanism, technical publications, the Corps labs produce literally hundreds each year ranging from accounts of fundamental research in peer review journals to updates to engineer manuals and field manuals. Each lab publishes a series of technical reports and a wide variety of fact sheets and newsletters. Many technical presentations are made at professional conferences and meetings that are published in the proceedings and most of the technical staff in the labs participate in professional society activities that are an invaluable source of information and avenue for transitioning information to the public sector. These documents are available through a variety of sources to include the Defense Technical Information Center, the National Technical Information Service, and the information technology groups at the individual laboratories.

Conclusion

The Corps R&D programs serve a broad customer base and often offer technological products that are equally useful for the DOD, other government agencies and the private sector. The need to facilitate technology transition/transfer for these programs has evolved an equally broad variety of methods. Some are formal programs funded by direct DOD accounts, but many involve cooperative programs and partnerships that create an opportunity for the research community and the customer to work together in the demonstration or transition of the new technology. Customer involvement is a tremendous asset and has become a key component of the formal demonstrations and transition efforts as well. The large reimbursable customer programs in the labs provide an invaluable connection between the research world and the real world, providing focus for the research and a direct multifaceted pathway for technology transition to the user.

The ability of the Corps to partner with the private sector through CRDA's, at times with cost sharing, has created many new opportunities to both leverage the expertise of the private sector and expedite transfer of technologies outside of DOD for broader application. Based on the Corps experience, there is no single approach to technology transition/transfer that is the best. Rather, getting new technologies into the real world requires a variety of methods that are often used in conjunction with each other.

For more information contact the following individuals: CERL: Jeff Walaszek, telephone (217)373-7216, fax (217)373-7222; CRREL: Nancy Liston, telephone (603)646-4221, fax (603)646-4712; TEC: Darlene Seyler, telephone (703)355-2647, fax (703)355-3176; or WES: Billy Bridges, telephone (601)634-2504, fax (601) 634-2361.

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CONSTRUCTION PRODUCTIVITY ADVANCEMENT RESEARCH PROGRAM

By Dr. William E. Roper

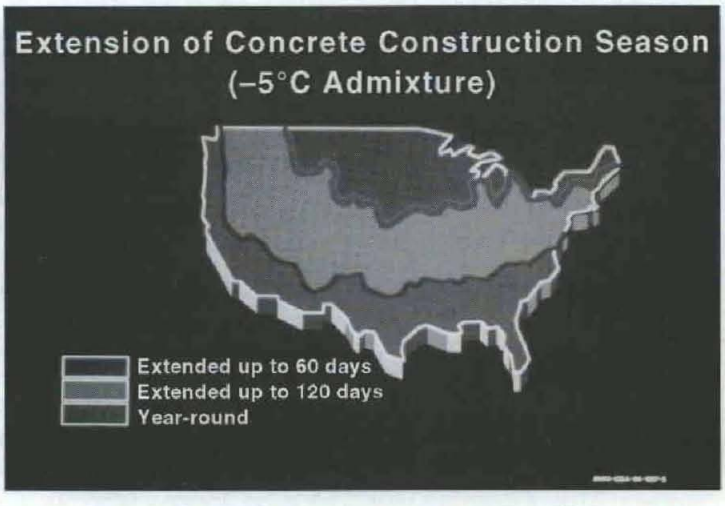
Introduction

Due to our mission, the Corps of Engineers has a keen interest in improving the construction industry's capabilities. We have taken several major actions in this area through partnerships with other government agencies, private industry, professional associations, and academia.

It is widely recognized that the construction industry plays a major role in the social and economic well-being of our nation. The U.S. construction industry, with $800 billion in annual sales representing 13 percent of the gross domestic product and employing 10 million people, has experienced a decline—or at least no growth—in productivity over the past 25 years. The industry is facing existing and growing international competition in a contracting market for construction services, with an increasing share of the domestic market going to foreign firms. At the same time, the nation is at a critical stage in infrastructure rehabilitation and investment which will depend heavily on the capability of our construction industry.

The federal government is the largest single buyer of construction services. Technology advancements that improve construction productivity will reduce construction program costs. Projects not now economically feasible might become so due to lower construction costs. Savings would accrue directly to the government's construction program, as well as benefit the U.S. construction industry and the U.S. economy in general.

Map of low temperature concrete admixture impact on winter construction.



Creation of the CPAR Program

Since both the government and the construction industry could benefit from improved construction productivity, it is logical that we should work together toward this goal. The U.S. construction industry is very fragmented and, as a whole, has limited research and development (R&D) capabilities.

Recognizing this, Robert Page, who was then assistant secretary of the Army for civil works, in early 1988 directed the Corps to conceive and develop a cost-shared R&D program with the U.S. construction industry. This concept resulted in the Construction Productivity Advancement Research (CPAR) Program, established by Congress in mid-1988 to assist the U.S. construction industry, enhance productivity and competitiveness, and increase industry's R&D investment. The idea was to build on the foundation of the existing Corps construction R&D capabilities and laboratories through the expansion and leveraging effect that cost-shared partnerships provide. The project ideas, however, are those of the private sector partner and not limited to the ongoing R&D program at the Corps labs.

The CPAR objective is to facilitate research, development and application of advanced technologies through cooperative R&D, field demonstrations, licensing agreements

and other forms of commercialization and technology transfer. The four areas of research interest are: design improvement; improved construction site productivity; advanced materials; and technology transfer innovation.

Program Status

To date, 73 projects have been funded (16 completed) under the CPAR Program at a combined Corps-industry investment of over $70 million. Some 125 industry organizations have participated, including construction and architecture-engineer firms, equipment and materials manufacturers and suppliers, nonprofit organizations, trade associations, state and local government agencies, and academic institutions. CPAR products are now being used by the construction industry.

As we move into the future with the CPAR Program, the past six years' experience will provide lessons learned that will shape our direction:

- It is important to continue emphasis on the three essential components of CPAR projects: cost-and risk-shared R&D; technology demonstration involving all partners; and product commercialization by the industry partner.
- In recent years, more and more proposals involve multiple participation arrangements, often involving academics and commercialization experts in addition to the industry partner. While we will continue to encourage such arrangements, it is our experience that having the construction industry as the lead partner produces more effective CPAR projects.
- To date, our CPAR project selection process has favored advanced concept, lower risk types of technologies. We need to pursue more high risk, high potential payback projects in the future.

The following are examples of current CPAR projects.

Concrete Prestressed With Composite Cables

One CPAR project demonstrates a revolutionary concrete prestressing technology that uses composite reinforcing cables. The project involves a 40-by 20-foot section of a test pier built on the Pacific coast at Port Hueneme, CA. The structure is expected to have a longer service life than if it had been made with steel prestressing cables because the high strength composites do not corrode.

The U.S. military and civilian communities estimate that maintenance of waterfront structures costs nearly $2 billion a year. This cost is largely due to corroding steel.

In 1991, the South Dakota School of Mines and Technology (SDSM&T) built the nation's first bridge using fiberglass and carbon fiber reinforced composite cables for prestressing concrete. SDSM&T had developed the technology to do this type of construction, which is very similar to prestressing with steel cables. That bridge supports some 800,000 tons of truck traffic each year with no signs of deterioration.

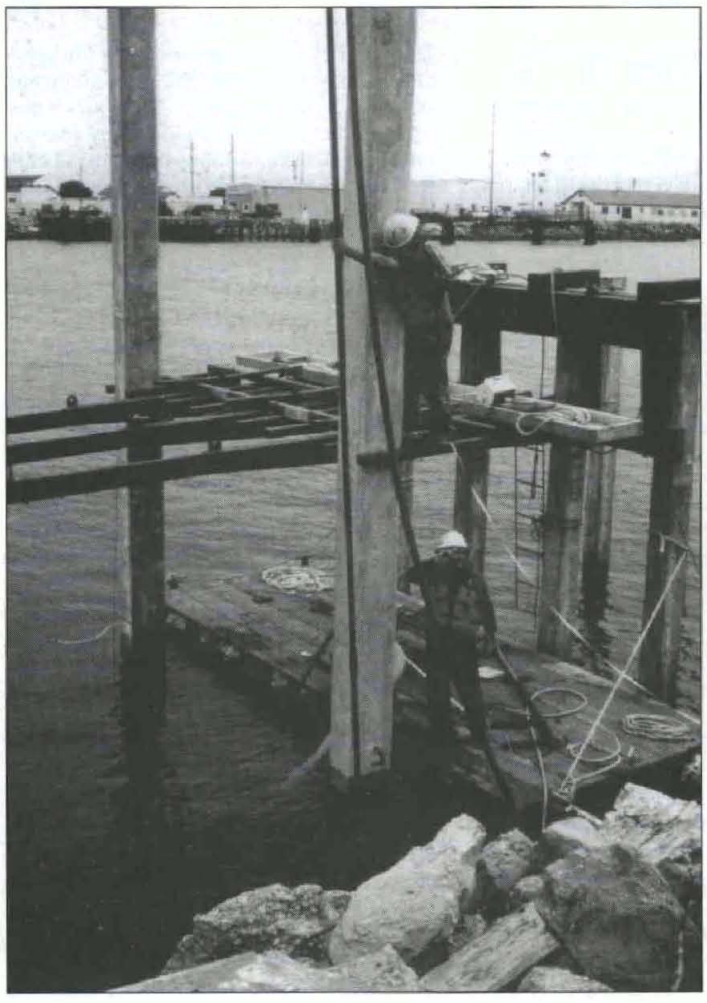
The CPAR project aimed to demonstrate the potential benefits of this technology in a highly corrosive marine environment. The partners in the project are SDSM&T and the Corps of Engineers Construction Engineering Research Laboratories (CERL). Other participants are the U.S. Naval Facilities Engineering Service Center (NFESC) at Port Hueneme; Owens-Corning Fiberglass, Granville, OH; Amoco Performance Products, Alpharetta, GA; and NEPTCO, Pawtucket, RI.

Test Pier

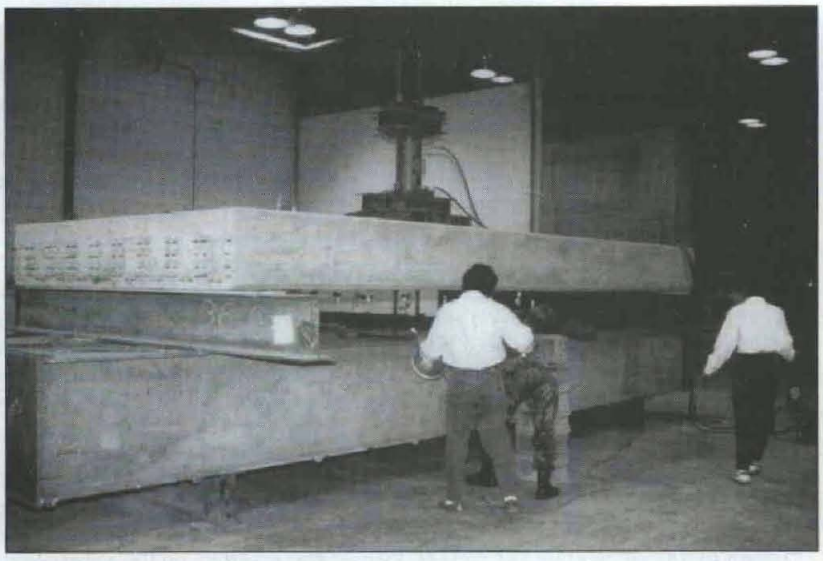
Cables for the pier section are made of fiber reinforced polymer composites. SDSM&T has done extensive work to assess the performance properties of carbon and fiberglass cables for prestressing tendons. For the pier, Owens-Corning provided the fiberglass and Amoco Performance Products donated the carbon fibers. NEPTCO made the fiber-reinforced, pultruded rods and SDSM&D made the cables by twisting together several of the individual rods.

To make the piles, the graphite cables were placed in a mold and pulled by jack to 20,000 pounds in each cable. The piles were fabricated at a concrete casting plant in South Dakota that normally makes steel cable prestressed concrete. Deck fabrication was similar. The pile caps were made on-site after the piles were installed. Glass fiber reinforced composite cables were used for the pile caps.

The pier section was built during October 1994. Driving the piles into the ocean bed had no effect on the prestressed concrete, as indicated by sensors placed on the material



A pile being positioned and "jetted" (using pumped water) into the ocean bed.



Laboratory test loading of the deck section made using carbon fiber reinforced composite cables.

before driving. The piles had been tested at SDSM&T before being transported to California and were found to meet all applicable codes for the design, including those established for seismic survivability. After construction, NFESC subjected the deck to falling weight deflectometer testing, which verified the pier's safe load carrying capacity.

What's Next?

CERL will continue to monitor the pier section's performance over the next year. Lessons learned from the CPAR project will be used in developing guidance for future use of the composite cables in prestressing applications.

Meanwhile, NEPTCO is actively marketing the composite prestressing cables. Most casting plants that already make steel cable prestressed concrete could easily adapt their process to use the composite cables. For additional information, contact Richard Lampo, CERL, P.O. Box 9005, Champaign, IL, 61826-9005, telephone (217) 373-6765, E-mail r-lampo@cecer.army.mil.

Retrievable Microtunneling System

Microtunneling is a remote-controlled, guided pipe jacking process for earth. It can be used in constructing utility or access tunnels under densely developed areas or military facilities without disrupting surface activities. Microtunnels could also provide secure transport corridors between high security areas or support high security storage.

The U.S. Army Engineer Waterways Experiment Station (WES) and McLaughlin Microtunneling, Greenville, SC, signed a CPAR agreement in 1994 to demonstrate and evaluate an innovative, retrievable microtunneling system that uses temporary steel pipes during the jacking process, followed by an overreaming process and subsequent installation of product pipe. This evaluation involved a specially constructed test facility about 330 feet long. It had five different types of soil conditions through which the machine had to navigate.

The test was designed to evaluate: retraction of the Microtunneling Boring Machine (MTBM) under adverse ground conditions (flooded running sand) while maintaining the stability of the excavation face and avoiding surface settlements; completion of the 330-foot drive through the five soil profiles using the temporary steel pipe system; and removal of the MTBM, attachment of the upsizing reamer system, and redriving from the reception shaft to the drive shaft. The 33.5-inch outside diameter concrete product pipes were installed behind the reamer as the temporary steel pipes were removed from the launch shift.

The test showed that the system can successfully install a wide range of pipe diameters (24-to 42-inch) using the same MTBM. This feature sets the system apart from conventional MTBMs that are capable of installing only one or a narrow range of pipe diameters. In addition, important questions were answered about the proper selection and use of slurry mixtures and lubricants, the prediction and control of jacking forces and ground disturbance (i.e., settlement and heave), and the satisfactory performance of the system under widely varying ground conditions.

This system can provide the high degree of reliability for tunneling underdeveloped areas. It is also attractive because it does not require personnel to enter the tunnel. For additional information, contact David Bennett, WES, 3909 Halls Ferry Road, Vicksburg, MS 39180, 601-634-3974.

Pushing the Winter Concreting Envelope

Protecting freshly poured concrete from freezing costs the U.S. construction industry about $800 million per year in heating and extra labor for items such as shelters and insulation. With the construction industry increasingly moving toward a year-round schedule, considerable savings could be realized by finding more cost-effective methods to protect concrete against cold weather.

The U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) has teamed with W.R. Grace and Master Builders to develop and test special chemical compounds that, when added to a concrete mix, can protect concrete placed at low air temperatures without requiring additional heat or insulation for protection. These compounds, called "antifreeze admixtures," work in two ways: to depress the freezing point of mix water and to accelerate the hydration of Portland cement at low temperatures.

Both industry partners had prototype products that protect concrete down to 23 degrees Fahrenheit. The CPAR project intended to demonstrate that the admixtures: promote strength gain at low temperatures at the same rate as concrete cured at 40 degrees Fahrenheit; are readily available as new formulations of products currently approved for use in concrete construction; do not promote corrosion of steel embedments or otherwise harm the concrete; and cost less than conventional winter concreting methods.

Demonstration

In March 1994, both partners' products were tested under winter field conditions at the Corps of Engineers Soo Locks in Sault Sainte. Marie, MI. With air temperatures ranging from 32 degrees Fahrenheit down to 5 degrees Fahrenheit and concrete temperatures as low as 23 degrees Fahrenheit, the admixture protected the concrete throughout the curing process without requiring any additional protection techniques.

This technology enabled the Corps to replace badly deteriorated concrete pads adjacent to the locks during the facility's normal winter shutdown. Being able to do concrete work in the winter is a great benefit, because it means much less disruption to ship traffic than during the busy spring and summer months at the locks.

Based on this CPAR project, the cost of using antifreeze admixtures is projected to be less than half the cost of using conventional heated shelters to cure concrete in the winter. Besides saving money, antifreeze admixtures can extend the time of year during which normal work can continue. These chemicals can effectively add 2-1/2 months to the construction season in cold regions of the U.S. For additional information, contact Charles Korhonen, CRREL, 72 Lyme Road, Hanover, NH 03755-1290, 603-646-4438.

Global Positioning System Use in Construction

Automation currently is being applied to many aspects of the design and construction processes. Most engineering designs are already done using computer-aided design and drafting (CADD) systems. The Topographic Engineering Center (TEC) and Caterpillar, Inc., are extending CADD to the construction site in earth-moving applications.

In April 1993, TEC and Caterpillar signed a 3-year CPAR Program CRDA to develop a Global Positioning System (GPS)-based construction vehicle positioning and navigation system that will be adapted to various construction equipment platforms. The envisioned system will display terrain information for guidance to the equipment operator and will produce as-built drawings of the construction site for the engineer to verify the design surface. TEC is providing real-time GPS-based positioning technology capable of delivering three-dimensional positions of decimeter accuracy or less over a range of 20 kilometers. Caterpillar is contributing development of and expertise in an on-the-machine dynamic construction site data base.

TEC scientist on a Caterpillar dozer uses GPS positioning information to automate construction activities.

Under this CPAR project, the GPS and CADD technologies have been combined and tested at Caterpillar's facilities. The TEC hardware and positioning software were successfully combined with Caterpillar's Dynamic Site Data Base on a track-type tractor (dozer). The machine prepared a section of a highway construction site without grade stakes or a survey crew. The dynamic construction site data were broadcast to a reference station/base to provide a current topographic model of the site. Multiple repeatability tests also were performed, verifying that the positioning system consistently measures in the sub-decimeter range over long periods of time. The combination of high accuracy GPS, CADD tools and the on-machine site data base has demonstrated the viability of automating the construction, navigation, and positioning system to a production-level system. For additional information, contact Jeffrey Walker, TEC, 7701 Telegraph Road, Alexandria, VA 22310-3864; 703-355-2766.

For more information on the CPAR Program, contact any Corps R&D lab or HQUSACE, CERD-C, 20 Massachusetts Ave. NW, Washington, DC 20314-1000; (202) 272-0257. Guidance available includes how to make proposals, who to contact, a sample agreement, and other useful material. Proposals for the FY96 CPAR Program will be requested in May 1995.

Demonstration of antifreeze admixture for concrete at Corps of Engineers Soo Locks in Saulte Sainte Marie, MI, during March 1994 with temperatures as low as -20 degrees C.

DR. WILLIAM E. ROPER is the assistant director of research and development (civil works), U.S. Army Corps of Engineers, Washington, DC. He holds a Ph.D. in environmental engineering from Michigan State University, and an M.S. in agricultural engineering and a B.S. in mechanical engineering from the University of Wisconsin.

More Than A Demo...

SYNTHETIC THEATER OF WAR—EUROPE

By Robert Sottilare

A test engineer rubs his eyes and drains the last precious drops of coffee. Things are just starting to come into focus at 0430, but the activity level is high in preparation for the Synthetic Theater of War—Europe (STOW-E). The workday at the Combat Maneuver Training Center (CMTC), Hohenfels, Germany, is always long, but STOW-E means there are software and test engineers at 16 sites (see Figure 1) in Europe and the United States preparing to support today's training exercise. There is much to be done.

Distributed Interactive Simulation (DIS) interfaces, network bridges and routers are being tested in preparation for the coming battle. Teams at the Warlord Brigade/Battalion Battle Simulation (BBS) Center down the road, the Simulator Network (SIMNET) in Grafenwoehr, Germany, and other sites are all preparing to support the clash of live, virtual and constructive simulation forces.

The date is Nov. 4, 1994, day one for the STOW-E demonstration. The live battalion in the "box" at CMTC will be supported by a battalion in SIMNET, a virtual tank simulation, and a battalion in BBS, a constructive simulation. Live forces along with additional BBS forces make up the opposing forces or OPFOR. Air support is furnished by helicopter simulators at the Aviation Testbed at Fort Rucker, AL.

Line of departure for today's mission is 0700 Central European Daylight Time, and time is short. A project engineer for the U.S. Army Simulation, Training and Instrumentation Command (STRICOM), begins monitoring DIS network traffic, while a software engineer brings the Brigade Operations Display and After Action Review System (BODAS) online.

BODAS will monitor and record the daily battle by accepting DIS entity and fire mission data from STOW-E simulations, and integrating this data with data from the CMTC-Instrumentation System (IS), which tracks live

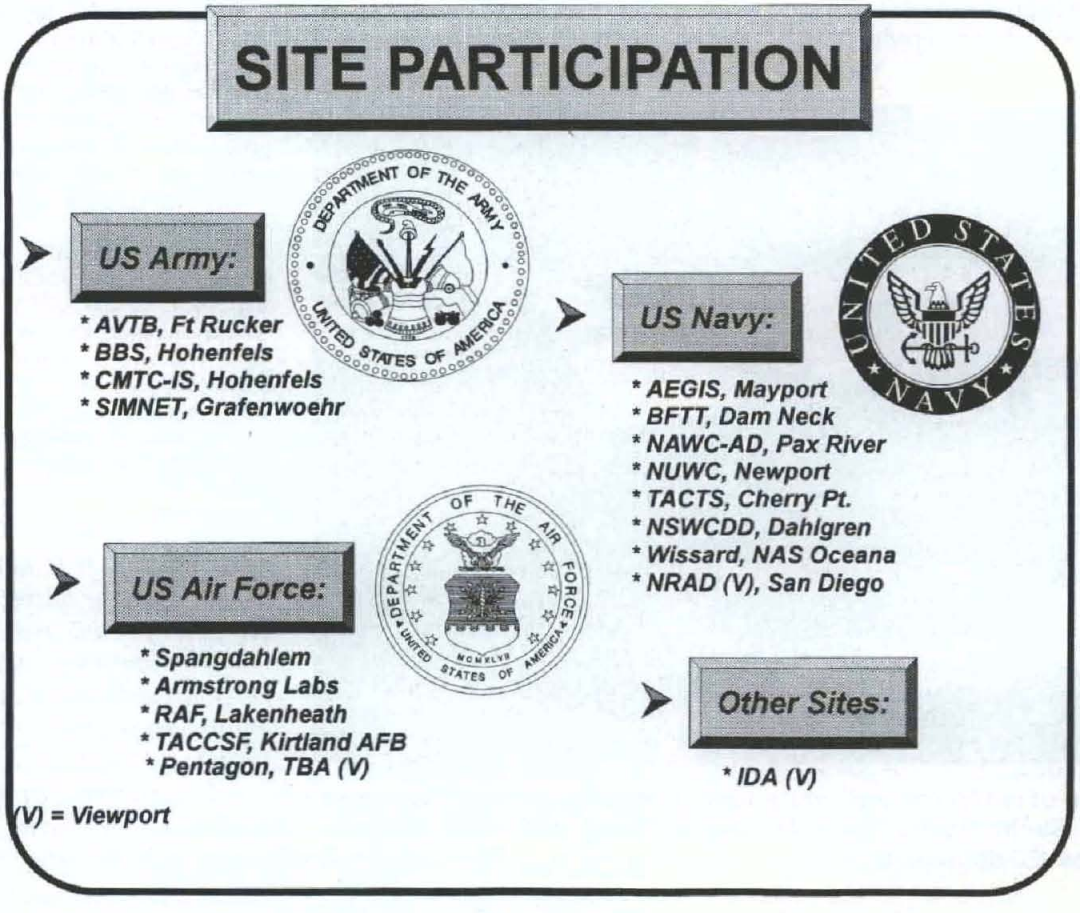
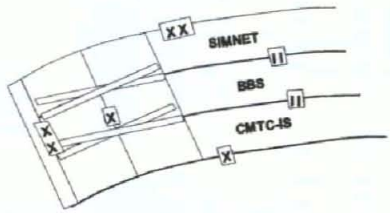


Figure 1.

CINC USAREUR TRAINING REQUIREMENT

REQUIREMENT

Create a Brigade Training Environment to Raise Entry Level Proficiency of All Tactical Echelons ICW CMTC Rotations



BATTLEFIELD OPERATING SYSTEMS (BOS)	SIMNET	BBS	CMTC-IS
• Intelligence	• Fair	• Good	• Good
• Maneuver	• Good	• Fair	• Good
• Fire Support	• Good	• Fair	• Good
• Mobility/Countermobility	• Fair	• Fair	• Good
• Air Defense	• Fair	• Fair	• Good
• Combat Service Support	• Fair	• Good	• Good
• Battle Command	• Good	• Good	• Good

Figure 2.

players and their fire missions. BODAS stores this data for replay later as feedback to the troops being trained during STOW-E. BODAS workstations are located at CMTC-IS, SIMNET, BBS and at the STOW-E Exercise and Analysis Facility (SEAF) in Grafenwoehr for real-time tracking of the battle.

Activities at the SEAF are at a fevered pitch as last minute preparations are made for the hundreds of visitors that will stream through the SEAF during STOW-E. Technical teams representing STRICOM, the Advanced Research Projects Agency, U.S. Army Europe, the U.S. Navy and the U.S. Air Force monitor simulations as the culmination of 14 months of work begins.

The battlespace, once limited to the CMTC maneuver box, is now extended through the use of simulation. SIMNET and BBS, which in the stand-alone mode only provided fair training proficiency in some of the battlefield operating systems, now provide extended capabilities within a synthetic theater of war (see Figure 2). STOW-E provides training for "proper utilization of assets" and the opportunity to "fight across a brigade front" according to COL Paul Lenze, commander of the Operations Group at CMTC.

Back at CMTC-IS, the Brigade Training Analysis and Feedback (TAF) analyst strains to listen to the tactical radio networks as he task organizes brigade units to support the after action review. The Brigade TAF analyst monitors the battle using BODAS as live forces are engaged by indirect fire from BBS.

The brigade attacks with three battalions abreast and in three domains (see Figure 3). At SIMNET, manned tank simulators engage constructive OPFOR generated by BBS. The helicopter simulators at the Aviation Testbed engage ground targets from SIMNET and BBS, and CMTC players generate indirect fire missions onto SIMNET positions.

Transparent to the soldier in the field, STOW technology is at work supporting training objectives. DIS protocol data units (PDUs) stream back and forth between the simulations, carrying the status of battlefield players and their interactions. Has the M1 tank on the hill, which is being simulated by SIMNET, been damaged by indirect fire from CMTC OPFOR artillery? Is it a mobility kill? Is the tank on fire? Reams of data are sent and received each second.

A BBS unit represented by a platoon symbol deaggregated into four T72 tanks as the unit symbol enters the sphere-of-influence (SOI) of a SIMNET tank. The SIMNET tank kills one of the T72s before it is fired on and destroyed. The remaining T72s move off and aggregate into a platoon unit symbol as they leave the SOI.

In SIMNET, the stealth operator adjusts his position on the battlefield as his three

The battlespace, once limited to the Combat Maneuver Training Center maneuver box, is now extended through the use of simulation.

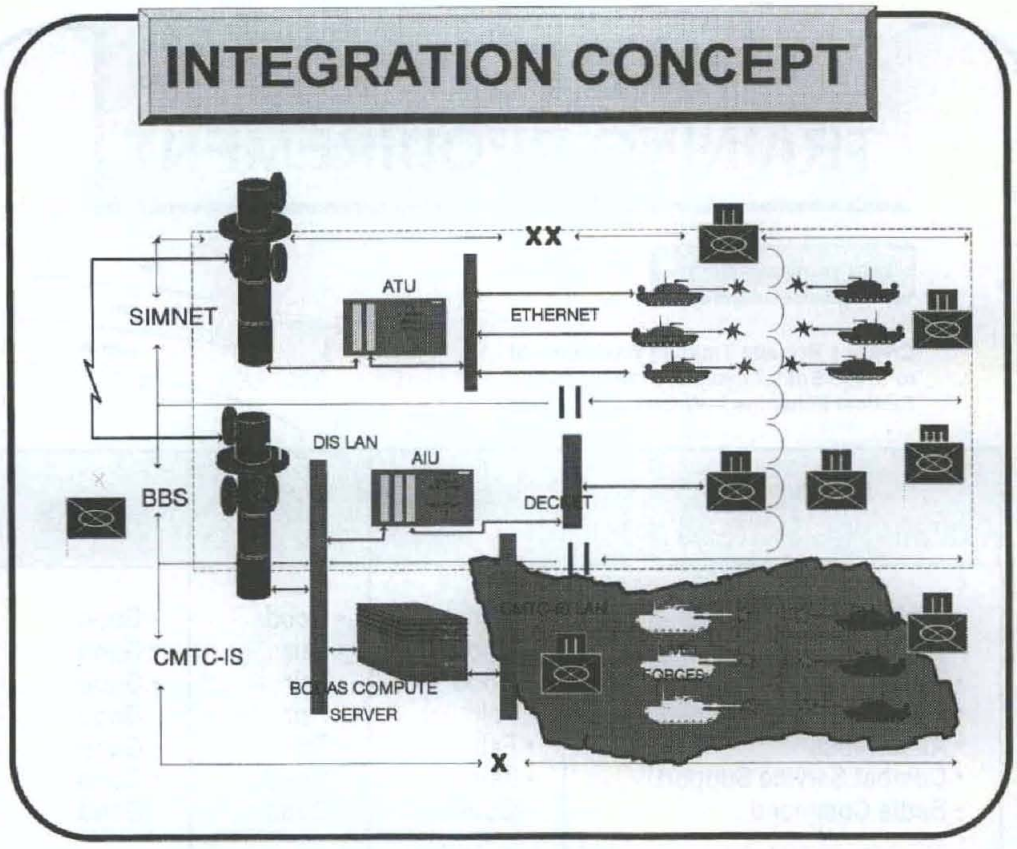


Figure 3.

dimensional window follows the hills and valleys of the synthetic terrain. He watches as two live CMTC M1 Tanks engage. Their images and actions are mimicked in the synthetic environment. He witnesses the destruction of one of the tanks. Back at CMTC, the destroyed tank displays only a flashing yellow light to indicate its "killed" status.

Also in the box at CMTC is a BMP traveling one of the muddy, hilly roads that crisscross CMTC. The BMP's status light begins to flash indicating the vehicle has entered and been killed by an electronic minefield. This event is registered at CMTC-IS and relayed to BODAS. Next, BODAS generates an entity state PDU for the vehicle and transmits it to the other STOW-E simulations. Back at SIMNET, the stealth operator watches as the image representing the real BMP bursts into flames.

As the battle ends, COL Dean Cash, the 1AD Brigade commander, solicits feedback from the troops. Feedback is in the form of smiles as officers were "able to do the things [they] were trained to do."

Over the next three days, the cycle continues—Early morning preparations, daily mission and monitoring of the battle, After Action Review (ARR) preparations and finally the AAR itself. The AARs are centered around tactical feedback to the troops executing the battle in the live, virtual and constructive domains. In parallel, the technical teams are documenting where this still fragile technology needs work.

The DIS compliance testing effort conducted by STRICOM has isolated and resolved many problems prior to the major STOW-E tests, but as software continues to change, up to the 11th hour of STOW-E start, interoperability issues crop up. Some of the design criteria, set 11 months earlier, are exceeded as entity counts and activity levels grow during the exercise, creating huge amounts of data. Hardware fails and software is driven into unanticipated options. This is research and development-learning by stressing the system.

STOW-E has been developed for two purposes: to support and expand brigade training capabilities, and as a proof-of-concept demonstration of Advanced Distributed Simulation technologies. The brigade participating in STOW-E receives their training, analysis and feedback through a training environment in which the level of stress and realism is not achievable through traditional means. While STOW-E does not meet 100 percent of the expectations, it does enhance brigade training. Concepts such as scaleability, compression, grid filtering, and semi-automated forces are tested in an operational environment. The Defense Simulation Internet, the wide area network used to carry STOW-E data, performs superbly recording 99 percent availability.

The STOW-E demonstration is over, but the engineers' work is far from done. Now comes the less glamorous task of transforming this demonstration of new and potent technology into a hardened, robust training infrastructure in Europe and in the United States. The U.S. Army will reap very near-term benefits from its participation in STOW-E. Technology developed for and used during STOW-E will be the cornerstone for U.S. Army brigade training in the future. "STOW-E has been an extraordinary effort to provide ordinary training and we need to make it an ordinary effort to provide extraordinary training" according to BG Charles Bauman, commander, U.S. Army Europe, 7th Army Training Command. STOW-E has been more than a demonstration. It has been an experience and a legacy.

ROBERT SOTTILARE is a project director for the project manager for Distributed Interactive Simulation (DIS) within the U.S. Army Simulation, Training and Instrumentation Command (STRICOM) in Orlando, FL. During the past year, he served as the STRICOM STOW-E project director. He holds a B.S. degree in electrical engineering from the University of Central Florida and is chair of the DIS Field Instrumentation Working Group.

Acquisition Reform...

THE PRODUCTION AND DEMILITARIZATION PHASES

By Gregory S. Haynes

Introduction

In the current movement to reinvent government, acquisition reform tops many lists for generating large savings and increasing productivity. To date, most defense acquisition reformers have concentrated on the front end of the acquisition process, the R&D and Engineering Manufacturing Development phases. The majority of the spending for a weapon's program occurs in the production and sustainment phases. It is generally true that the most effective sequence for reengineering any process is to start at the end of the process and work towards the beginning. This discussion presents a new strategy, one that offers benefits for all parties involved, the government as developer, the military as user, and the producing contractor.

This discussion focuses on one class of weapon system, the short range manportable missile systems such as the future Multi-Purpose Individual Munition/Short-Range Anti-Armor Weapon (MPIM/SRAW), and the current Light Assault Weapon/Anti-Tank 4 (LAW/AT-4). This procurement strategy is not limited to these types of missile systems. It can also be applied to ammunition, MREs (meals ready to eat), or other items that are non-commodities items procured in large quantities.

Background

The current method for procuring close combat rockets and missiles is to buy a large quantity over a short period of time, 100,000 units per year for three years. This gives the U.S. Army a stockpile of 300,000 for future conflicts, training, and quality assurance testing. The government purchases these systems at a discount, since the production volumes are high. This mass production strategy has its roots all the way back to Henry Ford and the Model-T and has served both the American manufacturers and the U.S. armed Services well in the past. The mass production strategy during the Cold War made good sense both economically and from a war fighting readiness standpoint due to the size of the threat. However, today we need to be more creative in our strategies and management practices, in order to maintain our readiness for any potential conflict or mission.

In addition, demilitarizing ordnance with today's rigorous environmental regulations is getting more expensive every year. The U.S. Army currently has approximately 750,000 close combat rockets and missiles in inventory that will require demilitarization in the near future. The cost to demilitarize these missiles will likely be more than to manufacture them, initially.

Missiles Made To Order Concept

The Missiles Made to Order (MMTO) concept has its roots in just-in-time manufacturing, time-based competition, and process reengineering. The MMTO strategy suggests

The government benefits from the Missiles Made to Order strategy in that it can now purchase far fewer missiles over the life of the program in a peacetime environment, thus reducing the amount of total funding required to produce and sustain the weapon system over its life-cycle.

SAMPLE OF MISSILES MADE TO ORDER STRATEGY

	00	01	02	03	04*	05	06	07	08	09**
PRODUCTION QUANTITIES	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
NEW INVENT. 1	2,500	5,000	7,500	10,000	10,000	10,000	10,000	10,000	10,000	10,000
PREVIOUS INVENT. 2	0	0	0	0	2,500	5,000	7,500	10,000	10,000	10,000
PREVIOUS INVENT. 3	0	0	0	0	0	0	0	0	2,500	5,000
TRAINING RD FROM PROD	7,500	5,000	2,500	0	0	0	0	0	0	0
TRAINING RD FROM INVEN 1	0	2,500	5,000	7,500	7,500	5,000	2,500	0	0	0
TRAINING RD FROM INVEN 2	0	0	0	0	0	2,500	5,000	7,500	7,500	5,000
TRAINING RD FROM INVEN 3	0	0	0	0	0	0	0	0	0	2,500

*NEW OR PRODUCT IMPROVED WARHEAD!
**ENDING INVENTORY WILL BE GREATER THAN ZERO, IF NO NEW SYSTEM BEFORE END OF PROCUREMENT CYCLE.
AT THE END OF 10 YEARS PRODUCTION THE OLDEST ROUND IS ONLY 3-YEARS OLD!

that missiles be manufactured as they are needed for training, testing, or fighting. As the DOD moves to adopt commercial standards, the future in building military hardware will rest with commercial manufacturers. Manufacturers that use flexible and lean manufacturing systems to provide small quantities of high quality goods at reasonable cost will reap the rewards from the Defense Department.

A simple example illustrates the concept. The Army requires 10,000 units (annually) of a close combat missile for training, testing, and storage by the rapid deployment forces. These missiles are maintained at the same level as ammunition is for contingencies. This suggests there would be no inventory at the various Army depots. The required number of missiles to be manufactured would drop from the current norm of 100,000 to 10,000. In addition, missiles would be rotated at the holding sites to ensure that missiles more than a year old are used first, just as items are used in the food processing industry.

In times of potential conflict, surge capacity from the manufacturer would be required as a part of the contract and production facility, but this manufacturing strategy is not new. In fact, most automobile manufacturers have adopted these processes and have proven them successful. The government needs to emulate private industry by binding the production contractor to a long-term contract. In turn, the production contractor would require fewer, but more dependable suppliers. The MMTO strategy will eliminate inventory at the depots, thus reducing the demilitarization phases of the life-cycle and associated depot costs.

Advantages

The government benefits from the MMTO strategy in that it can now purchase far fewer missiles over the life of the program in a peacetime environment, thus reducing the amount of total funding required to produce and sustain the weapon system over its life-cycle. The carrying cost will be reduced because storage space, annual safety inspections, and personnel required to handle, transport, and inventory missiles will be largely eliminated. The shelf-life requirement for the missile can now be reduced from 10 years to no more than three years since no missile will remain in storage more than two years without being consumed either for training or deployment (see accompanying figure). The reduction of the shelf-life requirements can add up to large savings for a missile program in design, production, and maintainability. In addition, the new MPIM/SRAW and similar weapons have been and will continue to be high on terrorist organizations' wish lists. Thus, a smaller number of total units manufactured and stored will reduce the probability of theft and will facilitate accountability.

The cost of demilitarizing ordnance increases every year. The MMTO approach avoids the entire demilitarization phase, since there will be no excess inventory to be destroyed.

The military benefits from the MMTO strategy because users get to add weapons to their arsenal that they could not otherwise afford.

The soldiers will always be training and fighting with the latest weapons. The past wisdom concerning these inexpensive close combat rockets and missiles was to retrofit existing missiles with a new technology (new warhead or new rocket motor). The MMTO strategy allows for any new technology to be integrated into the production line resulting in the soldiers' receiving upgraded missiles within months, not years. Our soldiers will always have the latest technology in their hands for both training and fighting, allowing them to maintain an edge over potential adversaries.

The missile's shelf stay will never exceed three years, thus reliability will be increased with no increase in design cost. The fighting units that use these weapons would now be responsible for their storage and care much as they are with basic ammo loads. Soldiers' lives virtually depend on the care they give their equipment. Adding the manportable weapon system to the unit's responsibility will improve the readiness for the system.

Defense contractors will also benefit from the MMTO manufacturing strategy. Contractors know that if they want to produce weapons, they must find ways to reduce cost to the customer. The contractor gets a known workload because the government issues a long-term production contract. The contractor gets paid for having surge capacity in reserve. This will increase his profit margin per missile but will keep overall program cost lower than current procurement practices, assuming a low number of surge requirements. In the MMTO strategy, the contractor would be assured of a continuous flow of business for as long as the weapon and its upgrades were required. Foreign Military Sales can contribute to increasing overall profit and cost reductions by accelerating the contractor along the learning curve. In addition, the contractor would have greater incentive to perform continuous product improvement research with his own money.

Risk

The risk to the government in adopting the MMTO strategy is that it is very difficult to implement any new system of procurement, particularly one that requires all the parties involved to work more closely than they have in the past. The life-cycle cost using the MMTO methodology will be lower unless there are many large scale conflicts requiring surges in production capacity. The more surges required, the higher the cost of the program over its life-cycle. Even so, this strategy offers potential savings over the current system of paying for storage and demilitarization.

The military has the most risk with the MMTO strategy. Currently, military commanders know the weapons they need are stored at the various depots. However, these same leaders need the flexibility many different types of weapons offer, but cannot because large quantities of new weapons are far too expensive given the current budget. The MMTO strategy gives commanders a way to buy more types of weapons with the same funding levels. The MMTO strategy is optimal for the small scale, short duration conflicts such as Grenada, Panama, Somalia, and Haiti. However, should a large-scale, global conflict arise, and surge could not handle the increasing demand quick enough, the MMTO strategy could be considered potentially risky.

The risk to the production contractor is minimal. The production contractor will have a long-term contract and be the sole supplier of any upgrades to the system. The contractors will have to adapt to a new manufacturing strategy. Many defense contractors are already reengineering to provide improvements as the defense budget decreases. Contractors continue to look for areas to increase productivity and decrease government cost while maintaining acceptable profit levels.

Impediments

There are several impediments to achieving the MMTO strategy. The first is that the government must issue a long-term contract to the production contractor. Budgets change from year to year; a long-term contract would be required for the contractor and government to enjoy any benefits from the MMTO strategy. The manufacturer must have a known production quantity and stable funding to design and optimize his production processes. Only through optimization can the government receive any cost savings and the contractor make a fair profit. The MMTO strategy accomplishes this with a fixed demand curve, unless conflicts appear on the horizon when demand exceeds the standard rate.

The Missiles Made to Order Strategy allows for any new technology to be integrated into the production line resulting in the soldiers' receiving upgraded missiles within months, not years.

The second impediment is the changes needed to the logistics system. The logistics system cannot currently handle tracking individual missiles, only lots of missiles. However, by the time any new strategy is approved, the logistics system can be made to track individual missiles. However, other potential logistical impacts and savings have yet to be explored and need further investigation.

Finally, the major impediment to the MMTO strategy is in the way most of us view the cost of a program. When someone asks what a missile systems costs, the answer is usually "so many $1000's per round." A better question to ask is, "How much does the program cost over its life-cycle?" After all, that is the real program cost. The cost per round simply depends on the quantity being produced, who is producing the round, and other such variables.

Conclusions

The strategy presented here can be applied to other military procurements, not just missile systems. This article should be used as a starting point to investigate potential savings without sacrificing readiness. The MMTO strategy will save money in the long run, reduce out-of-date missile inventories, and give the soldier the most up-to-date missile system with which to fight and win!

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WORKSHOP ATTENDEES REVIEW ACQUISITION CORPS IMPLEMENTATION

LTG William H. Forster, director, Army Acquisition Corps, OASARDA, sponsored the conference.

Approximately 80 civilian and military Army Acquisition Corps (AAC) members attended an Acquisition Career Management Workshop in San Antonio, TX, Dec. 14-16, 1994. The purpose was to provide a forum to report on and assess ongoing efforts related to implementation of the AAC. The workshop was sponsored by LTG William H. Forster, director, Army Acquisition Corps, Office of the Assistant Secretary of the Army for Research, Development and Acquisition (OASARDA). Representatives from numerous AAC implementing organizations spoke on a broad range of topics.

The first formal speaker, LTC(P) John Holly, assistant to the director of acquisition education, training and career development, Office of the Deputy Undersecretary of Defense for Acquisition Reform, reported on Department of Defense implementation of the Defense Acquisition Workforce Improvement Act (DAWIA). He noted that this law was written with an emphasis on *improvement*, which is being brought about in part by mandated career paths and statutory support for education and training programs to professionalize the workforce.

Dr. Bennie H. Pinckley, deputy director for acquisition career management, OASARDA, discussed Army implementation of DAWIA. Pinckley believes that the Army already had a world-class acquisition workforce before this implementation began, but that the competence of the workforce is being improved through an emphasis on the education and training policies outlined in the law. He said that an information system is needed to disseminate news on various topics such as training and education.

OASARDA Director of AAC Policy COL Richard A. Grube outlined military implementation and requested feedback from the attendees regarding acquisition policy, processes and products. These products include competency, completed educational courses, and accessions. Relative to the certification process, Grube said, "The military has a distinct advantage in that we have a well-disciplined management information system called TOPMIS (Total Officer Personnel Management Information System), which allows for a computer-assisted certification process.

A briefing on civilian implementation given by Dr. James H. Edgar Jr., deputy director, AAC policy, OASARDA, followed. Edgar illustrated the importance of attendees' feedback on policy, processes and procedures, stating, "Performance measurement is very important, because when managing you need to know how well you're doing. Feedback can help guide needed adjustments to existing plans." Edgar also discussed other issues such as training and certification. He believes that one problem for AAC civilians is that the guidance for training requirements is sketchy. Edgar noted also that the clear designation and publication of acquisition positions—both critical and non-critical—is a very positive element relative to the civilian portion of the Acquisition Corps.

COL William F. Hanna, director, Reserve affairs, OASARDA, gave an overview on AAC Reserve Component implementation. He stated that a major concern for the Reserves is that experience requirements for AAC officers, achievable by active duty members, are unrealistic for Reserve officers, who train only two weeks annually.

A briefing on acquisition, education and training was provided by LaVerne Jones, chief of the Acquisition, Education and Training Office, OASARDA. She discussed Army-specific programs such as centrally-funded and long-term training, and DAWIA-mandated programs such as the Defense Acquisition Scholarship, Intern, and Mentor Programs, and the Tuition Assistance Program. The Army-specific programs are announced yearly and are competitive. Defense acquisition scholars pursue graduate degrees in areas such as business administration, science, engineering, management, and technology. Following their graduation they are hired as GS-9 interns and are paired with mentors who have acquisition experience.

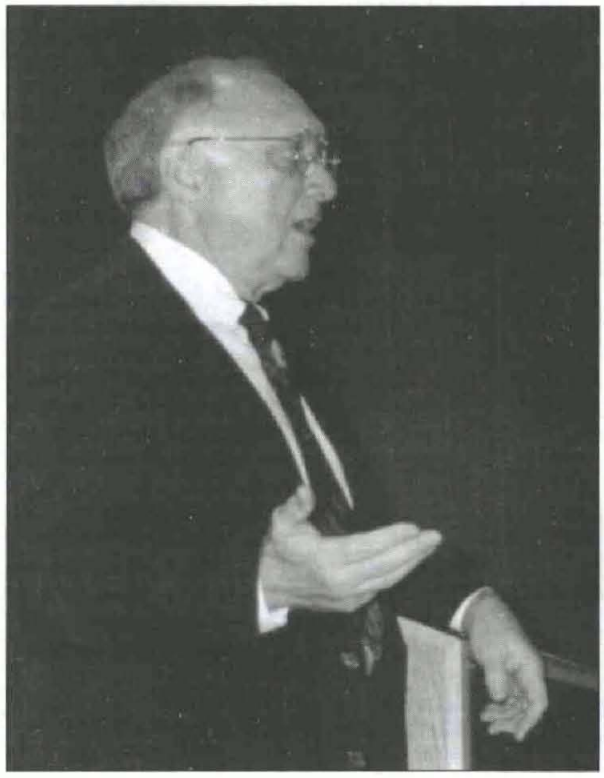
LTC(P) Richard O. Bailer, chief of the Military Acquisition Management Branch, U.S. Total Army Personnel Command (PERSCOM), stressed the importance of civilian, as well as military, attendees understanding how the military portion of the AAC is managed. This is because many civilians have military supervisors or employees. Bailer also emphasized that AAC officers remain in their basic branch of service even though they become more acquisition-oriented as they work toward certification. A

presentation on the Civilian Acquisition Management Branch (CAMB), PERSCOM, was given by Dr. Janet Brown, chief of the branch. The vision of CAMB is to have a fully-integrated, joint military and civilian team. Brown said that to achieve this, career program managers, who represent the various career programs within acquisition (such as contracting, logistics, and comptroller), should work closely with civilian AAC members and with personnel management specialists in CAMB on issues such as training, mentorship and leader development.

LTC Jody Maxwell, AAC personnel policy integrator for the deputy chief of staff for personnel, discussed implementation of the DAWIA requirement to select "best-qualified" program managers based upon consideration of both civilian and military Acquisition Corps members. In determining who is best qualified, many factors are considered, such as performance records and achievements, and acquisition experience and training consistent with DAWIA requirements.

LaVerne Jones returned to the podium to discuss mandatory training administered by the Defense Acquisition University (DAU). She said that DAU's role in mandatory training involves managing quotas and resources, and integrating annual training requirements. Mandatory training options include on-site, resident, and correspondence courses, comprehensive knowledge tests, and college courses equivalent to mandatory courses. Jones noted that on the DAU mandatory training horizon are new pilot courses and a process action team.

The conference concluded with a motivational session provided by Dr. John A. Daly, a professor in the College of Communication and Business at the University of Texas.



Dr. Bennie H. Pinckley, deputy director for acquisition career management, OASARDA, discussed Army implementation of the Defense Acquisition Workforce Improvement Act.

LTG Forster welcomed the attendees, and provided brief remarks. Said he: "This is an important event for the Acquisition Corps. I will be retiring this spring, so it is particularly appropriate now to assess where we are, how far we've come, what we've done right, what we've done wrong, and where we've fallen short. That is the genuine purpose of meeting here at this time."

The attendees then gathered into civilian and military work groups to discuss how certain issues impact their portion of the AAC. The civilians discussed accessions, certification, central referral, and the critical acquisition position listing, while the military AAC members addressed accessions, the military acquisition position listing, and personnel concepts.

The following morning, work group team leaders COL Robert Brown, deputy director for contract operations at the Command, Control, Communications, Computers and Intelligence Acquisition Center, Communications and Electronics Command, and John K. Shannon, acting project manager, aviation life support equipment, reported on the groups' discussions. COL Brown emphasized the importance of recruiting and developing the best individuals, and ensuring that junior officers are mentored. According to Shannon, training is the most significant civilian issue. He suggested the formation of a process action team on civilian training, which could provide recommendations and the rationale behind them. This, he said, would help career managers and DAU components in structuring and defining future courses.

Following the work group reports, Dr. Bennie H. Pinckley commended the attendees for their participation, noting that they were definitely on target with their comments relative to focusing on and recording the issues. He also appealed for their continued input, and stated his intention to follow up and make the Acquisition Corps even better.

LTG Forster then addressed several issues related to the career development of Army acquisition professionals. "You have to assure your people that career management and professional development is their job—they have to actively seek out opportunities," he explained. Forster also noted that more cross-training opportunities should be made available to civilians. "As the Army gets smaller, we will need a more versatile workforce, a more versatile Acquisition Corps. Employees may find themselves migrating from series to series or job to job, so being qualified in more than one area can make employment more secure," he added.

The conference concluded with a motivational session provided by Dr. John A. Daly, a professor in the College of Communication and Business at the University of Texas. Daly offered several suggestions on how to succeed in the AAC and in general. These included development of people skills; knowing your business and your customers well; and defining your purpose in terms of a service, rather than a product.

Daly added that managers should break processes down into achievable accomplishments and should grade outcomes rather than processes. The distinctive attribute of great leaders, he said, is an incredible sense of optimism.

THE PALADIN ENTERPRISE SOLUTION

An Integration of Contractor New Production and Government Overhaul Activity at Letterkenny Army Depot to Modernize the M109 Howitzer

By LTC Charles A. Cartwright, Tom Carr and The Paladin Enterprise

Editorial Note: During the Paladin Full-Scale Production (FSP) program's source selection process (Nov. '92), FMC and HARSCO announced their intention to form a limited partnership of their Defense-related business units. In the early part of 1993, FMC became the managing partner (60 percent ownership) of United Defense, Limited Partnership. HARSCO's 40 percent was primarily composed of the BMY Combat Systems Division. The events discussed in this article span the period of transition, including the name change of the production contractor from FMC to United Defense. To avoid confusing the reader, we have continued to refer to FMC during the entire chronology; however, the proper name for Paladin's FSP contractor is currently United Defense, LP, Paladin Production Division (PPD), Chambersburg, PA.

Competitive Strategy

The Paladin Program is a consolidated package of product improvements to the M109A2/A3 self-propelled Howitzer. Downward budget adjustments and cost and schedule concerns mandated implementation of a competitive strategy for subsequent production activity. Several factors caused Paladin production to be perceived as unattractive to potential competitive bidders. The incumbent development contractor enjoyed an obvious, significant advantage in terms of program experience and technical understanding of the system. Additionally, evolutionary downsizing of the program from an initial production quantity of 1,700 to 824 units decreased the potential return on investment. The production strategy that emerged was dubbed "Producibility Evaluation Task" (PET). (See *Army RD&A Bulletin*, Jan-Feb 1994, "Paladin and PET.")

A market survey, in the form of an industry day, was held to familiarize industry with the Paladin Program and provide information on the PET effort. With PET, potential contractors could be paid to learn first-hand about the Paladin system, study the technical data package, and prepare a manufacturing plan and proposal for FSP. The program executive officer for Field Artillery Systems, procurement officials, and legal advisors supported the government's position for potential competitors to consider an innovative, streamlined approach to their FSP proposals. Letterkenny Army Depot (LEAD) officials encouraged innovative approaches by describing their organic production capability related to the self-propelled Howitzer.

The PET effort resulted in competitive FSP

proposals from three sources: the incumbent, BMY Combat Systems; FMC, Ground Systems Division; and General Dynamics, Land Systems Division. During PET, all sources discussed the use of government facilities with LEAD. These discussions, obviously competition sensitive, were carefully managed and scrupulously documented by LEAD officials. LEAD's intent was to be completely responsive and cooperative, while remaining passive to any suggestion of strategy or partnering concepts. Similar protective measures were implemented at the PMO. Some contractor requests to LEAD were declined due to the illegality of binding fixed price agreements and selling productive services directly to the contractors.

Best value source selection procedures and criteria were implemented through the FSP solicitation instructions and subsequent evaluation of the proposals. The FMC Ground Systems Division proposal was judged best value, and FMC was awarded the $334 million, multi-year, FSP contract. FMC's approach included creation of the Paladin Production Division (PPD), a collocated production facility at LEAD. PPD utilized the existing LEAD capability for chassis overhaul and conversion, armament testing, completed vehicle break-in, and performance testing. This strategy evolved from FMC's analysis of the business risks associated with the Paladin Production Program. They accurately perceived the value of a lower cost business environment and the benefits of avoiding duplication of the existing production infrastructure at LEAD. FMC planned to procure the new turret and then perform all system integration activity at LEAD facilities on a "rent-free" basis. Additionally, FMC planned to renovate and upgrade Building 56 (at their expense) and procure facilities' support services from LEAD (utilities, snow removal, rail service, etc.)

Benefits attributed to the Paladin Enterprise Strategy:

1. Delivery by LEAD of the first chassis to FMC-PPD two months early.
2. Delivery by FMC-PPD of the first completed Paladin System to the Government two months early.
3. Successfully completed all component first article testing prior to delivery of the first system to the Government.
4. $46 M in savings attributable to the competitive multi-year acquisition strategy.
5. $15 M in cost avoidance attributable to process streamlining.
6. Risk reduction attributable to the integration of computer systems, shared information, and team management.
7. Consolidation of vehicle assembly and integration at one geographic location.
8. Higher product quality ensured by system-level performance tests.
9. The preservation of the production infrastructure strengths of both public and private sectors.
10. The promotion of shared learning and adoption of commercial best practices.
11. The resulting model of a successful Government-Industry cooperation and business partnership.

The Enterprise Solution

Soon after contract award, FMC hosted a three-day team building session for senior-level representatives from the primary organizations involved in Paladin FSP. A consensus vision evolved from that session: "Team Paladin will be a model of government/industry cooperation for an efficient industrial base, utilizing best practices from all sectors...". Mutual trust, open communication, and commitment to the ownership and continual improvement of the process were adopted as basic operating principles. Their charter stated, "This team management concept is based on recognition that program problems cross organizational boundaries, within and between government and industry, and that proactive cooperation is the key to program success... 'Arms length' connotes, not only the obligation of government and industry officials to look out for their respective interests, but also sufficient closeness to shake hands and work together to jointly solve problems."

Subsequent working sessions of the group coalesced into a true partnership environment as they mutually began to appreciate the scope of risk presented by the proposed new way of doing business. There was no precedent to follow and cultures had to change. Regulations and standards appeared to be insurmountable obstacles to the efficient inter-organization exchange of workload, materials, and information. Team Paladin concluded that achievement of their vision would require radical action. Dale Adams, PEO Field Artillery Systems, requested that PM Paladin and FMC executives "identify non-value added tasks, requirements, and procedures, etc." He suggested, "These things need to be removed to reduce cost," and further added: "Focus on dumb things to eliminate." The creation of an integrated partnership and operational system to manage and produce the required flow of information, materials and 660 Paladin systems was given the highest priority. Team Paladin conceived the "Enterprise Solution."

Steps to Achieving the Paladin Production Partnership:

1. Acquaint industry with Government's desire for innovative approaches.
2. Structure solicitations and source selection to achieve best value.
3. Actively disseminate information regarding Government production capability.
4. Implement management team building to achieve partnered leadership.
5. Use an integrated product team to achieve a new operational paradigm.
6. Document and train the entire enterprise on the new way of doing business.
7. Strive for continuous improvement.
8. Manage and evaluate performance on a single enterprise basis.

Implementation of the FMC proposal required significant change to the typical way government does business with a production contractor. Integration of the FMC-LEAD production operation complicated traditional oversight activity. Implementation of the proposed manufacturing strategy required streamlining and defining the organizational interactions required to produce an efficient flow of information and material.

The complexity of multi-organizational interaction was compounded by government regulations for property accountability, quarterly funding authorization for overhaul work at LEAD, and repair parts shortages that were incompatible with an integrated production partnership. The organizational interdependencies demanded efficiency and communication linkage typical of an integrated *enterprise*.

Team Paladin executives established the Paladin On-Site Integration Team (POINT) to address structuring the organizational interfaces to achieve FSP. This integrated product team was composed of operational managers from each organization of the partnership. Each manager had both intimate technical knowledge of his respective organization's contribution to the production enterprise and decision-making responsibility to commit to streamlined procedures. POINT

Paladin's innovative business practices have demonstrated the transition of modern theory into profitable practice.

was given top-level management commitment and resources to achieve top-down reform. The team was challenged to develop and accept a new paradigm for Paladin production that described the "should-be" way of doing business for the enterprise.

POINT used the Integrated Definition (IDEF) modeling technique to develop and document a structure for the "should-be" way of doing business. Each major activity of the production process was analyzed to describe its controls, resources, input and output. The IDEF modeling analysis produced a series of process maps that documented the Paladin FSP manufacturing strategy comprehensively.

The Paladin "should-be" process required the government to consider FMC as a set of work stations within LEAD's maintenance activity. (Building 56 is located within the confines of LEAD.) Under this scenario, it is neither necessary, nor cost effective, to process material transfers within the LEAD maintenance activity through utilization of the MILSTRIP/DLA process. Therefore, material transfers are processed using a new unified LEAD/FMC process. The new process provides a "real-time" validation of material movement through electronic tracking, and provides timely materials to—and from—FMC-LEAD to fill their respective production line requirements. Control of materials using FMC's Manufacturing Resource Planning (MRP) II system interlinked with LEAD's Programmed Depot Maintenance Scheduling System and the Standard Depot System is far more rigorous than the government property accounting procedures. Parts inventory, tracking, and control are supplemented by routine Defense Contract Management Area Operations (DCMAO) on-site audits. The intent of the new process is to allow LEAD/FMC "real-time" accountability procedures in lieu of more cumbersome, less accurate government procedures designed for depot maintenance activity—not volume production.

The POINT representatives reached numerous operational agreements that resolved much of the uncharted path to Paladin manufacturing strategy implementation. POINT commissioned the preparation of a "Paladin Enterprise Property Management Plan" to document the material flow, procedures, and agreements reached during the "should-be" process development. This document describes the policies and procedures necessary to account for parts and materials during the production process, and to control Contractor Furnished Material to LEAD and Government Furnished Material to FMC. It describes the production process flow and defines roles and responsibilities for all organizations involved. Management information flow and control interfaces are coordinated and efficient. The plan serves as the substitute for existing government accountability regulations that are not designed to support the efficient operation of an integrated production enterprise (such as the collocation of FMC and LEAD).

Organizational interdependencies are inherent to the enterprise partnership. PM Paladin has summarized the agreements that support the enterprise operation in a Memorandum of Understanding (MOU) that supplements the FMC contract and provides formal cohesion among the five Paladin partners: FMC, PM Paladin, LEAD, DCMAO, and Defense Logistics Agency (DLA) at LEAD. Management Plan and the Enterprise MOU provide the implementation mechanism for the "Paladin Enterprise Solution."

The Paladin Enterprise experience has highlighted some obstacles to the achievement of full partnership:

1. The culture change is difficult to achieve:
   - The traditional view of separate Government and commercial industrial bases, in competition with each other, is hard to change.
   - The traditional focus on winning business without consideration of overall long-term efficiency is well ingrained.
   - The pressure to preserve status-quo involving policy, regulation, procedure, bureaucracy, public jobs, and entitlements is strong.
   - The traditional perception that creating new infrastructure and abandoning old is the ideal strategy precludes optimum utilization of shared complementary industrial strengths.
2. The Arsenal Act and Federal Acquisition Regulations prevent/discourage formal teaming of industry and Government production organizations.
3. There is a need to protect competition sensitive information.
4. There are incompatibilities between current Government and Industry automated information systems and data networks.
5. There are difficulties in establishing common objectives and leadership for a true partnership.
6. There are difficulties in establishing and institutionalizing an integrated corporate vision.
7. It is illegal for the depot to quote binding fixed prices.
8. There is geographic dispersion of the "team".
9. There is the inability of the Government Supply System to adequately support timely delivery of common usage parts.
10. The Standard Depot System is insufficiently flexible to be tailored to the information processing and operational planning needs of a discrete production enterprise such as Paladin.

The temptation and convenience of "doing business as usual" had to be overcome. The organizational, cultural, and regulatory constraints were serious impediments. The team approach and the modeling process used to develop this enterprise were catalysts for identifying constraints, reaching agreement to solve the problems, and developing an implementation plan. Both contractor and government have committed significant resources to create the physical and managerial infrastructure that constitutes the Paladin Production Enterprise.

Initially, significant benefit was derived from the integrated product team approach and the modeling process used to establish the enterprise operational structure/strategy/procedures. This initial operational understanding was perpetuated by communicating to the entire production organization through extensive training based on the Paladin Enterprise Property Management Plan. Additionally, the Paladin Enterprise has implemented a joint LEAD/FMC Quarterly Management Review (QMR) where all presentations and progress reporting are done together with a consolidated audience. A comprehensive program risk and customer satisfaction survey is given to each QMR attendee to assess how the Enterprise (and each partner) is performing. This feedback is very important.

Development of the new paradigm for a contractor-government partnership caused introspection on how, and why, we do business the way we do. Paladin's vision was to create a "should be" process that streamlined production flow and the interaction of government agencies with each other *and* the contractor. The Paladin Enterprise Solution was born.

Benefits

Paladin has demonstrated the result is worth the effort. Major benefits resulting from the "Enterprise Solution" are:

• *Streamlined and defined organizational roles and responsibilities.* Collocation and teaming have reduced finger pointing and delays dealing with program issues. Daily contact between partners has alleviated unfounded suspicion and general mistrust between the public and private sectors. Non-value-added participation and transactions were eliminated. Organizational interfaces are now transparent with inter-linked electronic communication and data availability. The risk from inappropriate or late deliveries or non-performance has been reduced greatly.

• *The development and implementation of alternatives to conflicting government regulations.* The best practices of commercial industry have been established using MRP II techniques for tracking and control of materials, in-process activity, and finished product. Cumbersome, less accurate government accountability and transfer transactions have been replaced. The linkage of planning, scheduling, and tracking information systems between FMC and LEAD, with data access available to DCMAO, PM Paladin, and the U.S. Army Armament, Munitions and Chemical Command (AMCCOM)—now the U.S. Army Industrial Operations Command (Prov), provides real-time inventory control and project management.

• *Streamlined parts and material flow to the production lines.* The just-in-time flow of materials and parts—made possible by the MRP II capability—allows for an assembly-line facility configuration to replace LEAD's station/bay build configuration used during limited production. The assembly line provides efficiency and a rate capability to match FSP requirements.

• *Process flow improvements that reduce cost, enhance quality, and reduce schedule risk.* The collocation has encouraged the acceptance of best commercial business practices at LEAD. The production process flow is no longer dictated nor impeded by formal property accountability regulations that require a multitude of material transfer transactions. New materials, reclaimed parts, and product flow freely between FMC and LEAD. Division of work has been adjusted, resulting in more timely and reliable testing, less mileage incurred during break-in and final test, optimum utilization of production facilities (painting, test track, etc.) less "sit-time" from production inactivity, and reduced delivery schedule risk. Redundant government-contractor activities have been eliminated.

• *Improved repair parts availability.* The OMA-funded portion of the program, M109A2/A3 chassis and component overhaul, was at considerable risk because common repair parts were unavailable from the supply system. Availability of these parts is affected by funding, timely procurement action, and vendor performance. The impact of these constraints has been reduced significantly by securing authorization to fund parts procurement for overhaul activity annually at LEAD. The annual funding replaces a quarterly authorization cycle mandated previously at the depot. Annual funding permits LEAD to provide DLA with fully-funded one-year parts requisitions. This has reduced the risk of parts shortages substantially by providing DLA the lead-time to contract for—and preposition—production repair parts to satisfy LEAD's requisitions.

• *Cost reduction opportunities introduced to LEAD.* Placement of the Paladin workload at LEAD is critical to resourcing and preserving the depot work force and critical maintenance skills. Some of LEAD's underutilized capacity (i.e. Building 56) received $3.4 million in improvements at no cost to the government. The direct delivery of government-furnished parts to FMC lowers schedule risk and avoids LEAD costs associated with packaging, preservation, transportation, etc. FMC is paying a prorated share of the overall installation base operating cost. FMC is sharing corporate knowledge gained from extensive experience with other successful high-rate production programs (e.g., the Bradley Fighting Vehicle) with LEAD. FMC production and management techniques (such as MRP II, assembly line set-ups, and "just-in-time" inventory management) used for Paladin are applicable to other programs at LEAD. Paladin's innovative business practices have demonstrated the transition of modern theory into profitable practice. The modern manufacturing experience is a valuable by-product of this partnership that enhances LEAD's competitiveness for future programs.

THE PALADIN PRODUCTION ENTERPRISE IS A WIN-WIN STRATEGY FOR BOTH THE CONTRACTOR AND THE GOVERNMENT.

The Paladin Enterprise represents the team effort of many organizations. For more information, contact LTC Cartwright at (201)724-2572; Jerry Nitterhouse, chief, Production Engineering Division, Letterkenny Army Depot, at (717)267-9077; or Peter Scott, general manager, United Defense, L.P., Paladin Production Division, at (717)261-5903.

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OWNING THE WEATHER

The Environmental Side of the Information War

By Dr. Mary Ann Seagraves
and Richard J. Szymber

Introduction

"Owning the weather" (OTW) is a vision for battlefield weather support to assist the Army in achieving its objectives more effectively. The OTW thrust consists of:

- Using knowledge of battlefield environmental conditions and their effects on friendly and enemy systems, operations, and tactics to gain a decisive advantage over opponents; and
- Exploiting and improving weather-related technological advantages of our battlefield systems over hostile systems, making weather a force multiplier.

The OTW approach is a major factor in "winning the information war." It encompasses providing battlefield weather information never before available to commanders and assessing weather effects, allowing us to ascertain advantages over the enemy. We can then use our combat systems and sensors to our advantage by knowing when and how weather conditions are affecting battlefield combat power at all times during an operation.

As the Army moves into the 21st century with an ever-diminishing base of resources, we must find ways to achieve our missions more efficiently and effectively. One opportunity to acquire a force multiplier is to exploit the emerging computer and electronic technologies that will enable us to win the information war. Winning the information war includes owning the night, owning the spectrum, and digitizing the battlefield. But to succeed at night operations and to provide the right data at the right time and place, knowledge of the environment is essential.

Weather and War

The pages of history poignantly document weather's effects on wars, war fighters, and weapons. A great many battle outcomes have depended on weather, among them Waterloo, Trenton, Operation Overlord, and the Battle of the Bulge. Some warriors who shaped the course of history used the weather to gain an advantage, while others were mercilessly victimized by weather conditions. For example, in 217 B.C. Hannibal gained an advantage by positioning himself between the Roman armies and their capital after marching 40,000 troops over the snow-packed mountain passes and then through treacherous marshes—believed to be impassable during the spring floods. More recently, the war in the Persian Gulf stirred us with images of vehicles stranded because of winter rains, and of the burning Kuwaiti oil fields that generated dense smoke and obscured vision.

Owning The Weather

The modern era of rapidly changing threats creates an impetus to field new technology and weapon systems quickly. Development of "all-weather" weapon systems and sensors is very costly and involves considerable technical risk. We can, however, provide a near all-weather capability to the commander with minimal investment in weather exploitation technology. Proper use of this technology will supply an effective capability within the next decade. OTW will enable commanders to exploit knowledge of the weather and its effects, turning the weather from foe to friend.

The atmosphere affects nearly all Army systems, especially the newer, high-tech smart imagers, seekers, and munitions. For example, haze and fog can severely degrade target recognition and acquisition devices, and dense fog could render them useless. Precipitation is a concern not only for trafficability, but it also degrades optical and infrared devices, and can even incapacitate radar systems. Chemical agents and obscurants move and disperse according to wind direction and speed, turbulence, and temperature. Accurate, timely knowledge of the weather and its impact on friendly and enemy materiel and operations provides an advantage and a combat multiplier.

A Combat Multiplier

Our ability to own the weather, used in conjunction with the Army Tactical Command and Control System, will provide commanders with a combat multiplier that allows them to exploit superior knowledge of the environment and its effects. Some examples of OTW technology are:

- Tactical Decision Aids (TDAs) permit commanders to rapidly develop war game courses of action; determine probable effects on friendly and enemy systems, tactics and doctrine; and incorporate weather effects into tactical planning and operations.
- Accurate and timely meteorological information throughout the battlefield is critical in meeting the requirements of accurate predicted fire support. The ability to acquire and apply accurate meteorological data is a major advantage for short- and long-range fire, Army aviation, and air defense artillery.
- The assessment of the effects of the weather on terrain and on the ability of friendly and enemy weapons systems to negotiate that terrain, aids in deciding on effective offensive or defensive courses of action. Mobility and counter-mobility information puts friendly and enemy capabilities into perspective and allows commanders to concentrate their forces at the most advantageous places and times.

Weather For Winning

The heart of the OTW capability is embodied in the "Weather For Winning"

process, a strategy for exploiting the battlefield environment.

First, weather conditions must be observed before they can be forecast and converted into weather intelligence. OTW begins with timely, accurate meteorological observations. Observations over target areas require great detail and high resolution and accuracy. These data are difficult to collect, but have the highest potential payoff as a combat multiplier.

Theater observations are also of vital importance, but generally require less detail and resolution. All the required observations cannot be supplied by any single sensing system. Rather, a suite of complementary and synergistic sensing systems—space-based, airborne, and ground-based—is necessary to provide observations at the required accuracies, resolutions, and coverage. Some of the required data can be extracted from measurements intended for purposes other than weather. For example, wind information may be obtained from some types of radar data. Data from every available sensing system must then be validated and assimilated to build a complete horizontal and vertical picture of the atmosphere.

The second step in the process involves the processing and distribution of mission-specific observations, forecasts, and weather intelligence information. The Integrated Meteorological System (IMETS) provides this capability. IMETS is a mobile, tactical, automated weather data system designed to provide timely weather and environmental effects forecasts, observations, and decision aid information to appropriate command elements. IMETS uses existing Army common hardware/software, standard integrated command post shelters, tactical vehicles and communications, and specialized software and weather products to provide a complete battlefield weather system.

The third step in the process is the generation of the weather effects information for planning tactical operations and for making decisions in combat. This type of information is critical throughout the military decision-making process, from intelligence preparation of the battlefield (IPB) to mission execution.

IPB, TDAs, and war-gaming are all means by which commanders quickly and accurately can determine the weather effects on impending operations and to change or modify actions accordingly. TDAs not only provide information about weather impacts on friendly systems, but also show the commander if and when weather conditions give him an advantage over the enemy. OTW capabilities provide commanders confidence that their plans have fully incorporated the impacts weather might have on their operations and mission.

Tomorrow's Battlefield

The fall of the Soviet Union and domestic pressures to reanalyze commitments of resources require new, innovative approaches in the development of doctrine, leaders, organizations, training, and materiel. Army Battle Labs serve as the bridge between development of operational concepts and doctrine based on the old theater threat of the Cold War era and the analysis of requirements and capabilities for a global "Force Projection Army" faced with new and unpredictable future threats.

The Battle Labs, the link between battle dynamics and modernization requirements, provide an excellent proving ground for possible alternatives with the insertion of various technologies into the hands of soldiers. These technology insertions take place where warfare is taught and where the capability exists to test solutions to potential threats. Use of weather scenarios and weather effects information dramatically increases the level of realism in the Battle Lab environment. Exercising these capabilities is key to including weather in operations planning and in building confidence in battlefield weather data gathering and processing.

The Army is beginning to rely on computer-generated, synthetic environments to meet training, testing, combat simulation, and operational planning needs. For such environments to be truly realistic, they must portray accurate and timely weather influences.

The Army Research Laboratory is working with the Army Corps of Engineers to introduce realistic environmental elements such as haze, fog, precipitation, and battlefield obscurants into such scenes for the Battle Labs. Computer models for the diffusion and mixing of smoke within a forest canopy can portray simultaneously atmospheric effects for sensors ranging from visible direct-view optics to infrared thermal viewers.

Louisiana Maneuvers

Equally important as the Battle Labs in the development of new solutions to potential threats is the Louisiana Maneuvers (LAM) initiative. Because the Battle Labs will be linked to LAM, it is essential that weather applications used in the Battle Labs be carried over to LAM. Use of accurate weather information in LAM will allow realistic experimentation and analysis of requirements for force projection operations, combat operations, and operations other than war. This use of weather information will also enhance the efforts of leaders at all levels working in the LAM environment to find new ways to achieve advantages over the enemy.

The LAM process stresses experimentation by simulation, but with real soldiers and units. Actual weather data gives simulations and war games a realism that the use of climatology or assumed atmospheric conditions cannot achieve. Thus, simulations can realistically depict the battlefield for both training and evaluation of candidate weapon and targeting systems. For example, consider a case of reduced atmospheric visibility and its effect on the outcome of a tank battle. In Figure 1, the visibility is 4 km, and both sides can

Our ability to own the weather, used in conjunction with the Army Tactical Command and Control System, will provide commanders with a combat multiplier that allows them to exploit superior knowledge of the environment and its effects.

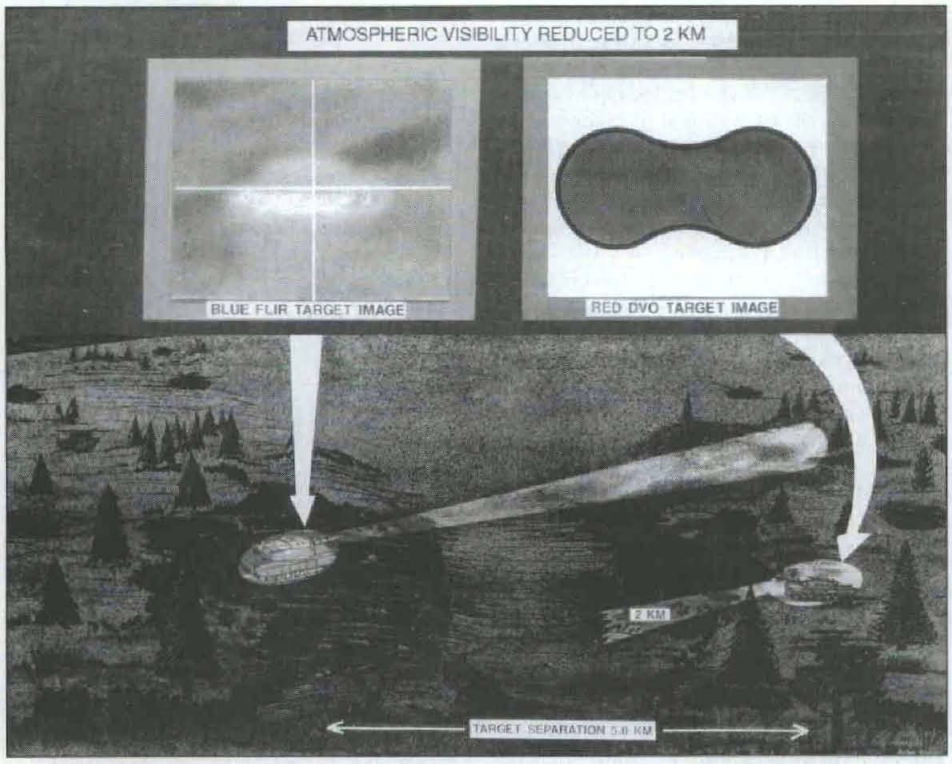

Figure 1.

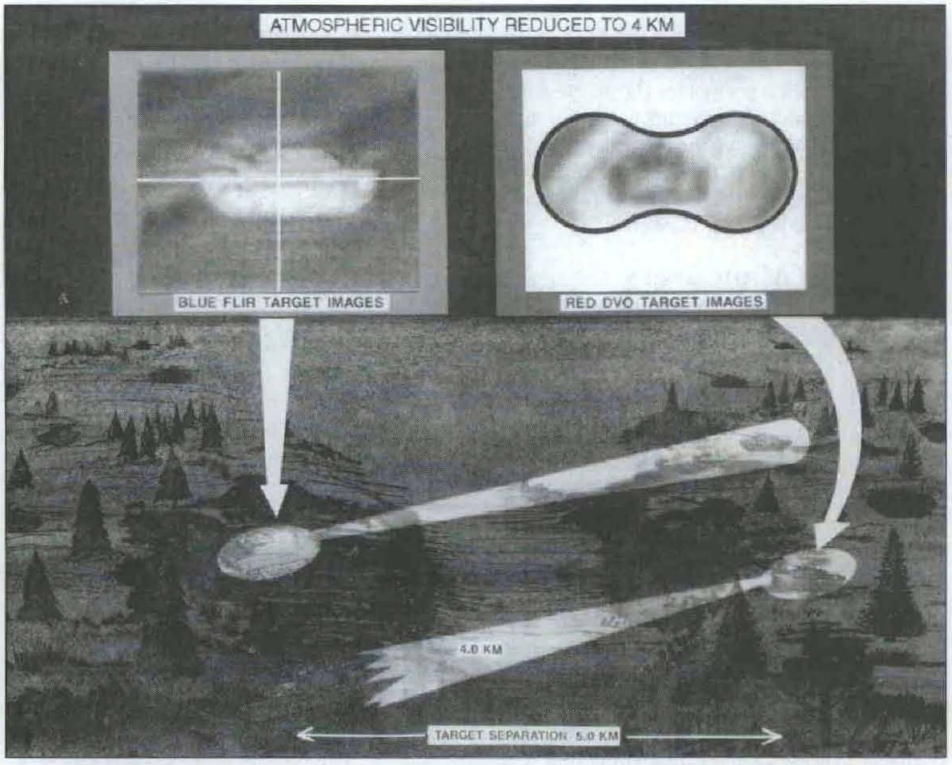

Figure 2.

see the target about equally well. When visibility drops to 2 km, shown in Figure 2, the enemy can no longer see us with his optical (i.e., visible) aquisition system, but we can see him with our infrared sensor and now we have a clear advantage. Use of this type of realistic simulation helps to train commanders to enhance their warfighting capability by exploiting the weather.

Conclusion

Owning the weather provides an effective, near all-weather capability enabling the Army more efficiently to seek and destroy its enemies on the battlefields of tomorrow with a significant contribution to winning the information war. The Army needs advanced meteorological observing, analysis, assimilation, processing, modeling, weather effects interpretation, and dissemination techniques and systems to support commanders into the next century, and thereby allow them to own the weather. The complete owning the weather capability can be a reality by the end of the next decade.

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TESTING AT U.S. ARMY YUMA PROVING GROUND'S MINE, COUNTERMINE, AND DEMOLITIONS COMPLEX

By Ron Jasper
and Mary Ball

The 1988 Base Realignment and Closure Commission's decision to close U.S. Army Jefferson Proving Ground and transfer the ammunition production acceptance test mission to U.S. Army Yuma Proving Ground may have been a blessing in disguise. Faced with this situation, senior Army planners found themselves in a unique position. It was as if someone had asked, "If we could start all over again, improve the facility and use new technology, how would we design it differently?"

Relative to mine, countermine and demolitions (MCD) testing, answering this hypothetical question has produced the safest, most adaptable and one of the most up-to-date MCD test facilities in the world today. Located under the clear skies of southwest Arizona's hot Sonoran Desert, U.S. Army Yuma Proving Ground's Walter DeGrande MCD Test Complex incorporates digital data processing, allows real-time data gathering and offers the ability to electronically transmit test data directly to the customer. Test developers are now able to test their products in "tactical real life" and a multitude of "what if" scenarios—all at one location.

In addition to general testing, specific procedures and robotic equipment have been developed which provide the capability of detailed failure analysis of tactical high explosive mine duds without exposing personnel to safety hazards. Failure analysis of actual test munitions provides the customer with specific data on mine malfunctions without the added expense of attempting to simulate the failure mode.

Present test operations include mine system deployment and functioning while measuring deployment velocity, mine pattern dispersion, and individual mine functioning times. Testing at Yuma's MCD complex includes lot acceptance and engineering evaluation testing of the Volcano Mine System, canister and individual anti-tank mines, surveillance testing of various mine systems such as the Modular Pack Mine System (MOPMS) and Pursuit Deterrent Munitions (PDM), and render safe/disposal demolition procedural tests. A static firing explosively-formed penetrator range is being designed to enhance the complex's capability. The open field test facility began operation in April, 1994, with lot acceptance testing of the M87 Volcano Canister Mine System.

MCD Test Complex

This new facility at Yuma Proving Ground couples state-of-the-art technology, equipment and capabilities with a highly experienced staff of munitions experts. Munitions and demolition test customers benefit from a real-time data acquisition system, digital data processors and failure analysis as Yuma Proving Ground personnel perform requested tests. Test technicians adapt and customize the facility to each customer's specific needs, unhindered by noise abatement programs and "lost time" due to thermal inversions and inclement weather frequently encountered at other test locations.

The open test fields, closed test cells, and control center of the MCD complex provide testing capabilities unique to the test and evaluation community. Ron Jasper, test director at YPG's MCD complex, states the facilities complement each other. "You can do things in closed chambers that you can't do on an open field—and vice versa," said Jasper. "Also, because the data is collected at a single location, it's easier to consolidate into a single test sequence." The open field facility handles "real world" tests while the closed chambers simulate a variety of controlled "worst case" scenarios.

Test engineers designed an armored robotic vehicle to safely remove mines at the Mine, Countermine and Demolitions Test Complex's two open field test areas.

Open Field Facility

The open field test facility consists of two test fields separated by adequate distance to allow independent operations to occur on each field at the same time. Each field is made up of six fully instrumented test cells, each cell of which measures 60 meters by 100 meters in size (approximately the area of a football field).

Dedicated instrumentation includes 24 high resolution video data collection cameras with 15X telephoto lenses which are mounted around the test fields to monitor test operations. Remotely controlled from the safety of the control center, the video system features videotape recorders, digital frame grabbers and time code insertion units for each camera. An acoustical microphone array provides independent monitoring of all test operations, including mine function and location.

A four bay ammunition temperature conditioning and staging area with overhead and side fragmentation protection is centrally located between the two test fields. Temperature conditioning chambers are remotely monitored and operated from the control center.

An on-site weather station provides climatic data. Weather data is monitored on an around-the-clock basis and is time coded and digitally stored in the control building.

For Family of Scatterable Mine (FASCAM) testing, each test munition is remotely armed by specified mine air launchers and

is deployed onto the open test field. In addition to velocity acquisition and acoustical and video monitoring, the open test field design also provides for magnetic target simulation, physical disturbance and target penetration evaluation capabilities. Provisions have been made for the facility to accommodate future digital (fiber-optic and radio frequency) control and monitoring capabilities.

Closed Chamber Facility

This portion of the MCD Test Complex provides a carefully controlled test environment to support tactical munitions testing in a limited area without exposing personnel or equipment to unacceptable risk.

Each of the facility's 30 individual steel testing chambers is fully instrumented to provide digital timing of munition arming and functioning characteristics by acoustic monitoring, magnetic target simulation, remote physical disturbance, armor penetration and target penetration, and warhead evaluation. Each steel chamber is located inside a concrete bunker to contain mine fragments and allow overpressure venting.

A four bay ammunition temperature conditioning and staging area with overhead and side fragmentation protection is centrally located near the test chambers. The temperature conditioning units have remote operational controls and 24-hour digital monitoring located within the central control building.

After each test munition is manually armed, it is deployed into the test cell by launching it with an air gun, and colliding it against a simulated impact medium. This represents a tactical "worst case" deployment scenario. The cell is then sealed closed. This method of testing permits the conduct of high volume test operations in a relatively small test area with minimum exposure of personnel and equipment to fragmentation hazards. Additionally, test engineers can easily control the munition under test to negate outside influences on the munition that may corrupt test results.

Control Building

The control center is centrally located between the open field and closed chamber test facilities. Test data is collected and recorded at individual work stations and digitally networked throughout the control center to provide real time data reporting. The central location of the center provides substantial cost savings to the customer by allowing test instrumentation and operations personnel to simultaneously control both test facilities.

Instrumentation at the control center includes remote control centers for data and security video systems, temperature conditioning chambers, on-site climate monitoring, acoustical scoring, radio frequency measurement equipment, and wave form generators.

The test director's workstation provides information and equipment to calculate cost estimates, produce test records and reports, and analyze data. Video safety monitoring and technical representative work areas are also incorporated.

A mine detonates at the U.S. Army Yuma Proving Ground's Mine, Countermine and Demolitions Test Complex last year.

The communications network for the building consists of copper cables (ranging from three-pair to 200-pair) and fiber-optic cables (both 24 and 36 fiber), with over 100 miles of cable networking the entire complex.

A video array workstation provides for mine field monitoring, video recording, video scoring of function times and deployment positioning, and digital enhancement.

An electronics workstation allows remote control of data processors, an acoustical scoring array of function events and positions, radio frequency strength monitoring and magnetic signal/target simulation generation.

Controls for each temperature conditioning unit (TCU) provide remote operations and monitoring of TCUs, capability for adjustment of TCU temperatures, emergency shutdowns, and both audio alarm and video TCU monitoring. Real time temperature chart generation and digital temperature data storage is also provided.

The control building's meteorological monitoring station provides remote monitoring of the MCD complex's meteorological tower. Monitored data includes minute, hourly, and daily meteorological measurements, real time temperature generation, and digital meteorological data storage.

State-of-the-Art Operations

Although Yuma Proving Ground's Mines, Countermine and Demolitions Test Complex was initially built to support the development of the Family of Scatterable Mines (FASCAM), the facility was designed to support a wide variety of munitions testing into the 21st century. The "state-of-the-art" MCD complex incorporates hard wire and fiber optic digital command and control systems in what has become one of the most modern, comprehensive and adaptable MCD test complexes in the world. Spare hard wire and fiber optic cable has been run throughout the facility to provide adaptability for future testing requirements. These unique capabilities provide customers with a one-stop center that truly meets present and future testing challenges.

U.S. Army Yuma Proving Ground personnel have established rigid policies to perform each test procedure. Using standing operating procedures developed at Jefferson Proving Ground, Yuma test directors have carefully developed checklists to guide all testing phases, on a step-by-step basis. These two-person checklists are similar to those used by airline pilots.

Yuma Proving Ground has also carefully designed and implemented a thorough operator training program. All operators are trained and certified in this program before working on tests at the MCD complex. This provides operators with mission experience and exposure to safety concerns and reduces human error during testing.

All facilities and equipment for the test complex were designed with personnel safety in mind. Workers are protected from direct exposure to exploding test munitions by custom-designed armored vehicles, shelters, or distance.

At the end of each test phase, mine fields are cleared of all high explosive materials. Maintaining the fields in this manner prevents the development of a "no-man's land" for future generations to cope with and increased long-term cleanup costs. Through the diligent removal of unexploded munitions from the facility after each test, eventual cleanup costs have been minimized.

Yuma Proving Ground's MCD planners have succeeded in designing a flexible, modern test facility that incorporates rigid safety procedures with a responsible environmental outlook. The complex is another example of the constant search by Yuma Proving Ground's motivated, experienced, and highly skilled team of engineers and technicians for new methods, equipment, and designs to improve test operations and reduce customer costs.

RON JASPER is a 10-year Army civil service veteran who relocated to U.S. Army Yuma Proving Ground, AZ, as part of the BRAC mission-transfer from Jefferson Proving Ground, IN. A former construction engineer, he is considered an expert on the test and evaluation of the Family of Scatterable Mines (FASCAM).

MARY BALL is an Army community services specialist at U.S. Army Yuma Proving Ground, AZ. She became a Department of Army civilian in 1984 and has worked in a variety of positions.

CONTINGENCY CONTRACTING IN CENTRAL AMERICA

By MAJ Preston Butler Jr.

Introduction

This article is based on my last assignment as a contracting officer in Central and South America. My primary assignment was to support engineer task forces that deployed from the continental United States to provide nation building assistance to countries throughout the Southern Command theater. The comments in this article are exclusively my opinion and are intended to assist engineer units with their deployment planning.

In laymen terminology, contingency contracting is the process of providing goods and services to troops down range using host nation vendors to the maximum extent practicable. This, of course, is a simplified definition and is not to be taken as all-inclusive. However, it provides a good foundation for the rest of the article.

Contingency contracting is not new, but it is receiving a great deal of attention since the fall of the Berlin Wall and the end of the Cold War. Instead of focusing on European defensive and offensive military strategy, we are now concentrating our efforts on contingency operations. In light of this, contingency contracting has come to the forefront of operations planning for deployments outside the continental United States (OCONUS).

Six Tips For Customers

I am convinced that too many military personnel do not understand contracting procedures and their role in the process. Customers (the end users) have a need to know procurement. Why? Because the process does not start until the customer initiates a request which can be formal or informal. Contrary to popular belief, the customer is the key to successful contingency contracting, not the contracting activity. The importance of the customer's participation is discussed below. There are six major issues to consider for every deployment and, if performed, will significantly improve the procurement process and logistics planning.

• *Know Your Requirements.* Know supply and service requirements thoroughly. Ambiguity and ball park figures are lethal in the contracting world. For instance, if you say "I need five 4x4 vehicles with AM/FM radios, air conditioning, heat, tinted windows, and eight-passenger capacity, it sounds very descriptive. However, there are several bits of information missing. What type of fuel (i.e. diesel or unleaded), what type of transmission (i.e. automatic/standard), acceptable year models (i.e. 1991 or better)? All of this may sound somewhat picky and trivial, but it is essential. Some countries may not have diesel fuel or may charge so much that it is too expensive to purchase. Additionally, planning must be tailored for each country because they are all different. When a critical specification is omitted, many contractors take the liberty of filling the gap with whatever they think is best. So, do your homework and gather as much information as possible. Attention to detail is paramount.

• *Plan Early.* Start planning early. One year prior to start of exercise is normally sufficient. Most units know well in advance when they will deploy on an annual rotation exercise. Task force commanders are normally selected 18 to 24 months in advance. I recommend each task force designate at least two representatives who are familiar with the supply and service requirements. You should prepare a tentative estimate of supply and services (such as bill of materiel and transportation needs), and then contact the contracting office for support. By providing the procurement officer a copy of the estimate, he or she can recommend changes and ensure you are preparing it in sufficient detail. The key is to start early enough to allow for changes. If you do not start before the Initial Planning Conference or first formal meeting, you are already behind.

• *Contact the Local Contracting Office.* I strongly recommend you link up with the contracting office that will be supporting you. Find out what they require in terms of lead time and paperwork. Lead times may vary by command, but four months for a formal contract (>$100,000) is a good "rule of thumb." Someone coined a phrase that said, "knowledge is power." This can not be overstated when dealing with contracting issues.

• *Assist the Contracting Officer.* No one knows your needs better than you. It is critical that the customer be part of the market

When we are on foreign soil, we must remember we are ambassadors in uniform. We must put our best foot forward especially during recurring exercises.

survey team to verify the specifications on the requirement document (normally a DA Form 3953, Purchase Request and Commitment). The two biggest challenges customers tend to have are: late submission of requirements and inadequate descriptions on the DA Form 3953.

Both challenges can be managed by starting the procurement process early. However, descriptions still pose a unique challenge when dealing with foreign vendors. Our terminology may have a different meaning in places like Bolivia and Honduras. One technique I found very useful was to include drawings or pictures of the requested supplies especially if the items were unique.

During a market survey in Santa Cruz, Bolivia, the description and specifications the customer provided was for a hot water tank that was significantly larger in South America than in the U.S., with the same specifications. There was nothing wrong with the specifications as long as I was procuring the item in the United States. Here was a case where another country had the same specifications, but a different item.

Fortunately, the task force sent a representative along who was able to physically identify the exact water tank needed to complete a project. Had he not been there, we would have purchased the wrong item. So the lessons learned are: prepare your specifications based on the country you will operate in, and budget for a couple of OCONUS temporary duty trips to conduct market surveys and site visits.

• *Invite Contracting Representatives to Key Meetings.* Invite a contracting representative to all planning conferences, especially the initial planning conference, and any critical in-process reviews (IPRs) or site surveys. Failure to do so will only decrease the likelihood of having all contractual arrangements in place when required. Inviting contracting representatives early in the planning phase helps the contracting activity with scheduling because they are always working on multiple exercises simultaneously. So, if you wait until the last minute to send them an invitation, they may not be able to accommodate you due to prior commitments.

• *Follow the Rules.* The procurement process is stacked with an overwhelming amount of cumbersome rules which the contracting community has recognized. Steps are being taken to improve the process as evidenced by the recent signing of the Federal Acquisition Streamlining Act. As a customer, you are not expected to know all the rules. Nevertheless, if you apply the five preceding steps, you will become very familiar with the process and the rules you need to know.

Too many people want to take shortcuts! Shortcuts get you in trouble and should not be confused with streamlining. They are not synonymous. There are several laws, regulations, and policies that govern procurement that can not be taken lightly. Contacting your contracting office may help you learn the rules, but you have to be disciplined enough to follow them.

With every deployment, something is overlooked until you are on the ground. If it is a critical oversight, the ground commander quite often gives an order that sounds like this—"make it happen." By the tone of his voice, you understand that he wants it done immediately. Unfortunately, many contracting issues can not be fixed overnight without bending the rules and placing someone in a compromising position. In my limited experience, I've noticed most task force commanders do not want to accept the fact that a contracting issue can not be resolved quickly. The possibility of a situation occurring like this is one of the reasons contracting officers normally do not report directly to the ground commander. If rules are violated and it is discovered during an investigation, the commander might get reprimanded or relieved, but the contracting officer could lose his warrant (procurement authority) and be incarcerated.

While on an exercise in the country of Belize, Central America, one of the ground commanders kept demanding I purchase some items that could not be bought with exercise funds. I told him repeatedly that the items could not be purchased with the color of money I had at my disposal. As stated earlier, knowing the rules of engagement is one thing, following the rules is another thing. Many soldiers are under the impression that when you are down range, you are allowed to manipulate the rules. This is not only false, but it can be a career-ending assumption. Well, I don't want to leave you hanging, so here's the rest of the story.

Since "no" is an unacceptable response from a staff officer to a commander (unless the directive is illegal), I had to do something. Fortunately, I was able to find a vendor who was willing to loan use of the supplies. To my knowledge, there was no regulation, law, or policy that prohibited us from borrowing supplies. So we used the items and returned them to the supplier at the end of the exercise.

Although this situation turned out okay, it could have gotten ugly. The best advice is to let the contracting officials do their job and for the sake of the mission, work with them. After all, contingency contracting officers are graded on how well they support an exercise. The grade the exercise receives is normally a reflection of the quality of support.

Conclusion

When we are on foreign soil, we must remember we are Ambassadors in uniform. We must put our best foot forward especially during recurring exercises. Some governments are not very forgiving. Additionally, when our actions harm or upset a contractor, he may be reluctant to do business with us during future exercises. If he is the only game in town, we will have a very large obstacle to overcome. He might increase prices and justify it as a cost of doing business with the U.S. government.

Remember, the keys to successful contingency contracting are the customer, early planning, and early involvement by contracting personnel. If you need help, contact your nearest contracting activity.

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HIGH ACCURACY INTRINSIC VOLTAGE STANDARDS

By Brian R. Moore

Introduction

The modern Army utilizes state-of-the-art test equipment to ensure that its personnel and systems of all types receive the proper support to maintain readiness and safety. Army test equipment is used for a wide variety of measurements in physical, electrical, optical and radiac-related applications. The U.S. Army Test, Measurement, and Diagnostic Equipment Activity (USATA), located at Redstone Arsenal, AL, is tasked with the support of 650,000 pieces of test equipment located throughout the world. A large percentage of that equipment is electronic in nature, requiring calibration support of such parameters as voltage, resistance, current, power and complex impedance.

Voltage is an important measurement parameter in the modern Army with an increased reliance on electronic sensing, guidance and communication. Accuracy requirements of a few parts per million are common among modern test instruments and even better measurement standards and techniques are required to ensure those accuracies. Josephson array voltage standards are an emerging technology that promises to change the way the Army supports voltage parameters in test, measurement, and diagnostic equipment (TMDE).

The Josephson array voltage standard is an intrinsic standard, meaning the derived values are based on physical constants and can be produced at any location with equal accuracy without the age-old dependence on traveling artifact standards to provide traceability to higher level standards at the USATA's U.S. Army Primary Standards Laboratory Directorate (USAPSLD) or the National Institute of Standards and Technology (NIST). Josephson array voltage standards are typically used to measure stable, solid-state voltage references. However, they can also be used for special testing of voltage linearity on resistive dividers and digital voltmeters. Laboratories using these Josephson array standards have achieved accuracies on the order of a few parts per billion, a capability that satisfies virtually every known DC voltage measurement requirement.

History

The Josephson effect has been known for about three decades. The phenomenon has been used to define and maintain the accuracy of this country's legal volt at the NIST in Gaithersburg, MD, for more than two decades. The first attempts at comparisons between Josephson devices and other voltage standards were very tedious and often inaccurate because of the millivolt output levels of the early Josephson devices and the requirement to resolve minute differences with the human eye on the graduated scale of a light beam galvanometer.

As technology emerged, arrays of Josephson junctions in series were constructed to raise the output voltage to a level that was more convenient, first one volt and then later to more than 10 volts. These arrays were constructed using microwave monolithic integrated circuit (MMIC) technology to place more than 20,000 junctions in series on a chip half the size of a postage stamp. Until 1993, only the NIST laboratories in Boulder, CO, had the capability to produce these circuits.

The manufacturing yield of working arrays has typically been very low. The arrays have been very fragile and could even be destroyed by prolonged exposure to air due to the moisture in the atmosphere. Over the last 20 years, improvements in computers and high-resolution digital voltmeters have virtually eliminated the tedium of the Josephson array measurements. Even though significant advances have occurred, the number of operating Josephson array systems has been limited to less than a dozen in the United States. Reasons include the lack of availability of Josephson arrays and the complexity of the associated equipment. The arrays require cryogenic cooling, provided by expensive liquid helium at four degrees Kelvin. Also, a source of stable microwave energy at an accurately known frequency (typically, 70-80 GHz) is required.

Highly trained personnel are required to operate and diagnose problems with today's existing systems. Figure 1 shows the Josephson array system at the USAPSLD with the computer, voltmeter, frequency counter, helium dewar and other ancillary equipment.

A Combined Effort

The USATA has been an active participant in Josephson array research for many years and recently took the initiative to advance the technology to the next level. Widespread deployment of Josephson array devices will require a reliable source of robust, affordable arrays, simplified supporting equipment, and software that will detect and correct problems that might defeat a novice operator.

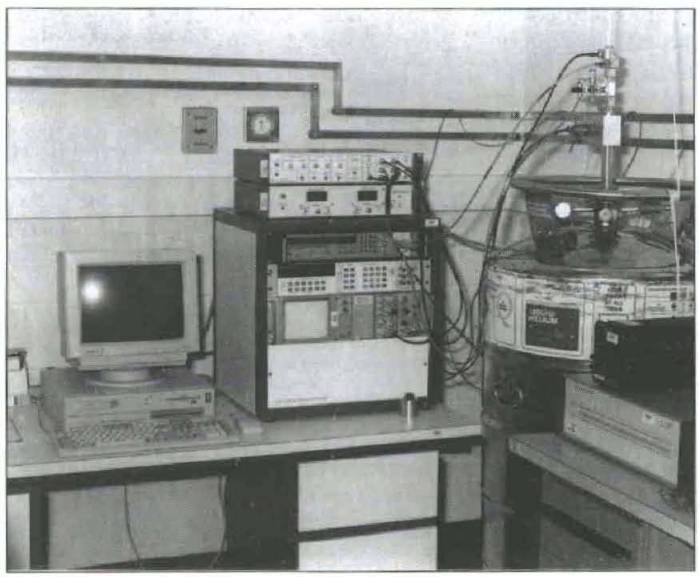

Figure 1. The Josephson array system.

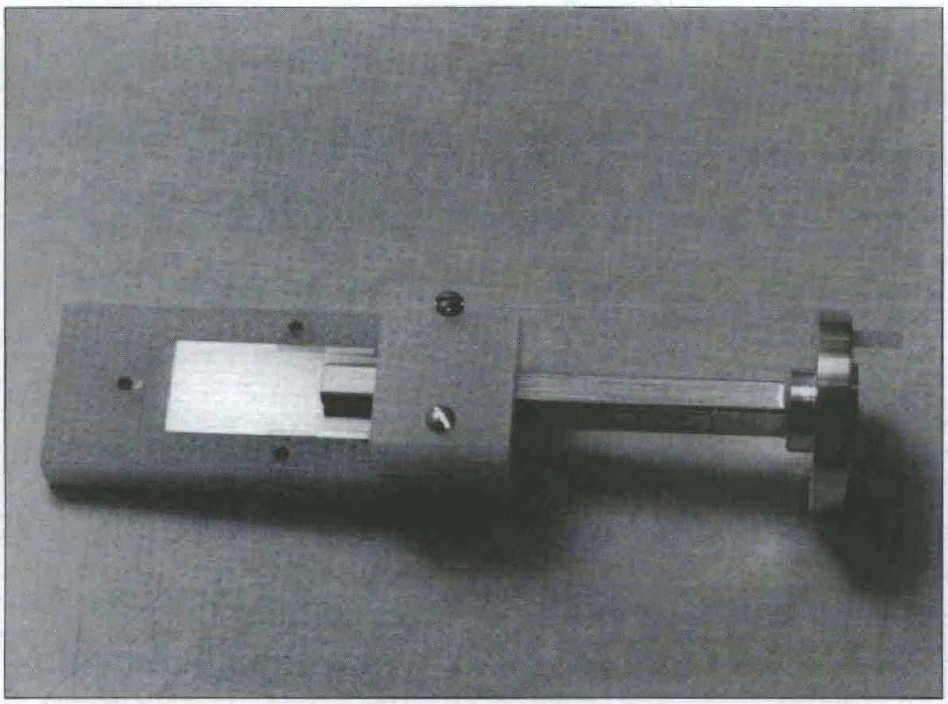

Figure 2.
The mounted Josephson array.

A program funded by the USATA and executed in a cooperative effort by the USATA, the NIST, the Army Research Laboratory (ARL) and a private company, HYPRES Inc., has made progress toward that goal. HYPRES improved the NIST design in their fabrication facility at Elmsford, NY, to produce all-niobium Josephson arrays, eliminating the lead content of earlier lead-niobium arrays which limited their life and caused them to be very fragile. The first of these new arrays have been tested at the USAPSLD and the NIST. A recent lot of 33 arrays tested at the USAPSLD produced eight working arrays. Figure 2 shows a mounted Josephson array ready for final connections and immersion in the liquid helium dewar.

The process that produced the good arrays is well-documented and future yields are expected to be even better. This is a significant development in Josephson array technology. A commercial company has demonstrated for the first time that arrays can be produced in quantities that would be required to make Josephson standards a reality at lower level support centers. Secondly, these arrays are more rugged than all earlier designs and will be better suited to operation in harsh environments.

The ARL has been tasked with building a prototype mechanically refrigerated system which eliminates the requirement for liquid helium and will reduce the cost of maintaining the Josephson array systems at Army TMDE Support Centers. Also, single frequency microwave sources are being investigated to further reduce the initial costs of these systems and simplify operation.

The NIST at Boulder, CO, pioneered early Josephson array technology and has developed software which monitors almost every aspect of the measurement process, providing analysis and diagnostics which greatly simplify the measurement process. A part of the USATA-funded future NIST research is directed toward a digitally programmable Josephson array chip for use in low frequency waveform synthesis. That effort could possibly result in the development of an intrinsic AC voltage standard.

Future Plans

The USATA's long-range goal is to place intrinsic measurement capabilities at the lowest possible support level in the Army. The benefit is two-fold. First, a tremendous savings is experienced by the elimination of all the support equipment and personnel now required to ensure traceability to national measurement standards. In addition, readiness is improved because more accurate standards are on hand at a lower level which can be accessed more quickly.

The goal for future generations of test equipment is to have embedded standards and diagnostics. These smart instruments could ensure their own accuracy without the requirement for conventional calibration. When a malfunction occurs, the instruments would also tell the Army technician what is wrong and how to fix it.

Another promising example of intrinsic electrical standards is the quantum Hall effect resistance standard. These standards produce extremely accurate resistances in the presence of cryogenic temperatures and intense magnetic fields.

Future research in quantum Hall effect resistance technology and Josephson array technology will be directed at testing materials which might be capable of producing these phenomenon at ambient temperatures. The use of these high temperature superconductors could virtually eliminate the requirement for the complex equipment associated with cryogenic cooling.

Summary

The Army has been a partner in a significant advancement of technology through participation in the research and development of Josephson array voltage standards. This initiative is expected to save both money and manpower by simplifying the support of important measurement parameters in Army test equipment worldwide, and it serves as an example of how technology can work to maintain a high level of readiness at a time when the USATA and the Army are reshaping to meet the challenges of the future.

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MILITARY SPECIFICATIONS AND STANDARDS: BLUEPRINT FOR CHANGE. . . SOME CAUTIONS

By Truman W. Howard III and Gary B. Davis

Background

On June 29, 1994, the Honorable William J. Perry, secretary of Defense, signed a memorandum directing implementation of the recommendations in the *Report of the Process Action Team on Military Specifications and Standards, Blueprint for Change,"* April 1994. The primary objectives outlined in this report are to:

- Ensure that system and data requirements do not unnecessarily preclude commercial practices;
- Express requirements as form, fit, and function;
- Eliminate unnecessary specifications and standards;
- Use non-government standards and commercial item descriptions;
- Encourage industry to propose alternative solutions;
- Ensure correct applications.

These objectives will be accomplished in part by using performance specifications, restricting the use of military specifications and standards, removing excessive references and tiering of specifications, and partnering with industry to replace military standards with commercial standards. The recommendations are logical and are endorsed by the complete Army chain of command.

The U.S. Army Missile Command (MICOM) understands the principles of acquisition streamlining, and fully concurs with the philosophy underlying the Process Action Team (PAT) recommendations. In fact, MICOM conducted 17 combined industry, professional society, and government workshops Nov. 29-30, 1994, to draft a realistic implementation plan that meets the intent of these new initiatives. More than 600 MICOM prime contractor and supplier specifications and standards experts participated. Followup meetings are being scheduled throughout CY 95 to develop detailed contractual approaches to ensure that critical missile system reliability requirements and long-term (10-years required, 20 years desired) storage life requirements for our missiles and rockets will continue to be met.

Reliability Requirements

The heart of MICOM missile systems is the sophisticated electronics that provide the capability to rapidly acquire, track, and intercept targets. To meet advancing threats, missile system electronics have become much more dense, sophisticated, and complex. New components may be more sensitive to the effects of temperature, mechanical stress, and chemical corrosion. The missile system hardware must be highly reliable, not only at delivery, but also after transportation and handling and 10 to 20 years of storage in harsh environments world-wide.

To achieve high reliability for missile systems, MICOM has stressed the requirement for high reliability soldering and parts, process controls, additional rescreening of selected microcircuits, and environmental stress screening (ESS) of printed circuit boards and higher level assemblies. Data gathered over a period of years verifies that the use of high reliability soldering and parts in production increases yields and reduces the system total life cycle cost due to increased reliability.

The cost effective manufacturing process outlined in the accompanying figure is based on cost estimates from MICOM prime contractors. The message is clear that using high reliability parts, along with processes that find defects at the lowest level of manufacturing, is cost effective.

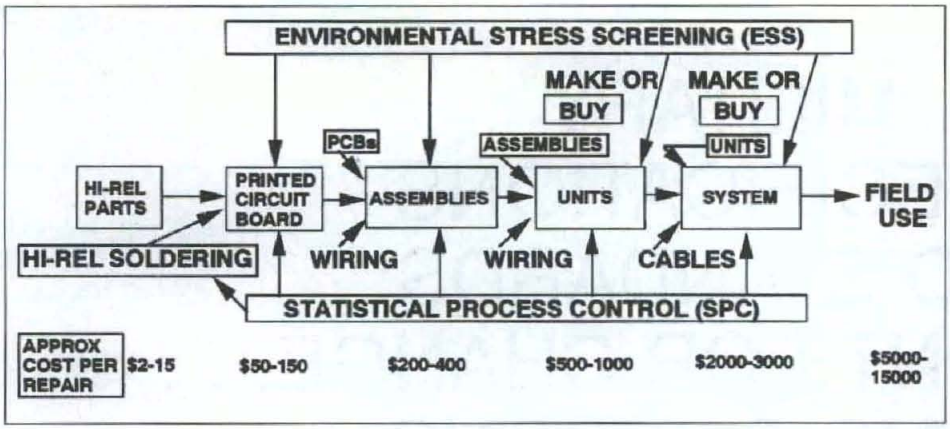
Prior to the Army implementation of Dr. Perry's memorandum, MICOM used tailored military specifications and standards to ensure that the above mentioned high reliability, high quality practices would be used to design and build missile system hardware. Now we must carefully transition to the new way of doing business. Government and industry personnel have concerns about the transition process that need to be considered.

Government-Industry Experience

The Army Materiel Command has conducted roadshows to present the new acquisition initiatives. These roadshows, while providing good ideas, did not ease the concerns of those that must implement the initiatives. For example, MICOM has had to contractually "force" certain processes on contractors, who later credited the government with improving their overall quality and reliability, while reducing scrap and rework and increasing profit margins. The commercial industry, because of the intense pressure of competition, has historically been more willing to invest up front to gain efficiencies. Since competition is very limited in missile system procurements, the Defense industry has been reluctant to invest its capital dollars to improve processes.

Without the incentive of a contractual requirement and funding to conduct certain process improvements, most contractors have been willing to go with the status quo. This was true for the implementation of ESS and statistical process control (SPC). A few years ago, because of the capital investment costs, many government contractors were hesitant to fully implement ESS and SPC. In all probability, they would have limited applications in their plants today if the government had not required them contractually. Now, most of our prime contractors are strong supporters of ESS and SPC.

With these initiatives and other cost effective manufacturing techniques, such as high reliability soldering and selective electronics parts rescreening, five MICOM prime contractors (Boeing Company, Loral Voight Systems, Corporation, Martin Marietta Electronics and Missiles, Rockwell International Corporation, and Raytheon Company) have become higher quality producers of MICOM materiel. They have become recognized for their superior efforts by admittance into the government initiated Contractor Performance



Cost Effective-Manufacturing.

Certification Program (CP)2.

The new acquisition reform policy emphasizes immediate cost reductions by using commercial specifications and electronic devices, with little apparent concern for operations and support (O&S) costs. Lower quality and reliability will show in the weapon system inventory unless high reliability processes are emphasized during development and production. Some at the secretary of Defense level seem to more clearly understand this point as shown in the recent memorandum on the use of Ada by the acting under secretary of Defense (acquisition and technology): ". . .other programming languages can be considered if proposed by a contractor as part of his best practices since waivers to the use of Ada can be granted, where cost-effective, in accordance with procedures established in the policy referenced above. However, such proposals require strong justification to prove that the overall life-cycle cost will be less than the use of Ada will provide.

The PAT's recommendations addressing the use of military specifications and standards in solicitations must have been misinterpreted based on the direction that has been passed down verbally to MICOM and missile project managers. The guidance being issued verbally is that all military specifications and standards should be removed from Army solicitations. The PAT report, however, recognizes the need for specifications and standards and that unique military specifications and standards exist. Mr. Griffin, PAT chairman, in the July-August 1994 *Army RD&A Bulletin,* stated: "all major buyers, even commercial ones use specifications and standards to procure quality products. Standards are a critical component of international competitiveness; they contribute to higher quality at lower prices, increased product safety, and reliable and common production techniques.

The PAT indicates that "common sense" should be applied and that only essential military specifications and standards should be used. Industry also recognizes that some military unique specifications and standards have no commercial counterparts. The MICOM workshop participants stated that months to years of effort will be required by industry and professional societies to convert them. Given the proposed implementation schedule, the government will be forced to procure hardware without the benefits of specifications and standards during this transition period. Industry experts have expressed their concern. Mr. Lesser, the editor of *Defense Electronics* magazine, says: "Are there adequate . . .standards that can meet existing DOD rad-hard requirements, temperature range requirements and shock and vibration requirements?. . .when it comes to totally removing mil-spec requirements, I question the soundness of the directive and the logic behind it."

Similarly, a Martin Marietta manufacturing team in August 1994 required the use of only solderable military specification wire. After completing their study, team members said: "I will be able to do my job in one pass rather than 4 to 10 attempts. . .The Ocala team is totally satisfied with the solderability of the new wire bought to the improved specs. . . cost performance to improve 6 points."

During a recent visit by government executives to the Saturn automobile plant in middle Tennessee, it was clear that the Saturn plant relies heavily on tough specifications and standards and supplier oversight to procure and build quality hardware. Their use of stringent specifications and standards, along with good supplier control, has allowed them to produce vehicles that are consumer satisfaction index rated only below the top-of-the-line, and much more costly, Lexus and Infiniti.

Implementation of the PAT recommendations needs to be accomplished through a well thought-out plan with a reasonable timeframe. The current implementation schedule leaves little time to make the required changes to the current processes without incurring high risk.

Missiles and rockets have unique mission critical reliability requirements and must be capable of storage in harsh environments for 10 to 20 years and then must work every time! Before we throw out every specification and standard, the new practices must be proven to be cost effective over the life cycle. The Army can ill-afford tomorrow to have reduced the reliability of our missile stockpiles, lowering readiness and putting our soldiers at risk, to save a few million dollars by using less reliable, cheaper parts and processes.

Summary

While most of the Department of Defense (DOD) PAT recommendations are worthwhile and overdue, the way they are being interpreted and implemented within the Army may seriously impact missile reliability and shelf life, and future system O&S costs. The PAT, the commercial world, and DOD recognize that tough specifications and standards are necessary to procure top quality hardware. Our dependence on unique military specifications and standards, however, does need to be dramatically reduced to allow maximum use of the commercial industrial base for military hardware production.

Implementation plans and schedules need to address the concerns presented in this article. The MICOM workshops on Nov. 29-30, 1994, along with the followup meetings, have made a good start on that process. The final plan needs to allow adequate time for a low-risk transition to the new way of doing business. Our future soldiers deserve missile system hardware they can bet their lives on!

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THE PARTNERING TEAM

Implementation of an Acquisition Improvement Practice

By MAJ Wayland P. Barber III

Introduction

The U. S. Army Materiel Command (AMC) has met the challenges of budgetary constraints and costs associated with Defense acquisition regulation and oversight with an aggressive program of acquisition improvement practices. In the Roadshow series, senior AMC acquisition officials have conducted seminars to illustrate the formulation and use of improved acquisition strategies. Roadshow III explained the concept of "partnering" and how to use it to support AMC's acquisition improvement philosophy.

Partnering finds its origin in the Administrative Disputes Resolution Act of 1990 as a team concept for program management. The concept was promulgated in a memorandum for the acquisition community signed by both the Army acquisition executive and commanding general, AMC, in October 1992. The fundamental premise behind partnering is the acknowledgement that we have effectively failed if our contractors fail.

In AMC, partnering is defined as a commitment among two or more organizations to improve communications and avoid disputes. It is accomplished through an informal process and is a means of providing our soldiers with quality products, on time and at a reasonable price. Partnering is neither a panacea nor a one-way street and is not contrary to government business practices. It requires total commitment from all involved parties.

The partnering process has been successfully applied to meet critical production deadlines for the 120mm M121 Mortar System Program. The concept of a partnering team was developed and employed to facilitate the partnering process. A partnering team is a group of technical and administrative specialists. Their purpose is to closely interface with contractors, open lines of communication, resolve conflicts, identify problems early, and prevent contract disputes. A partnering team must be flexible, dynamic, and tailored to meet the specific contracting situation. A successful partnering arrangement can produce both near- and long-term benefits for cost, schedule and quality of a product.

Background

The 120mm M121 Mortar System is a non-developmental item (NDI) acquired from the Israeli firm, Soltam, Ltd. The system acquisition is managed by the product manager, mortar systems located at Picatinny Arsenal, NJ. The U.S. Army Armament Research, Development and Engineering Center (ARDEC), Fire Support Armament Center's, Mortar Systems Office is the development program office for the system. An engineering services contract to support the initial technical data package (TDP) was necessary, as a result of the numerous language, drawing convention, and production difficulties encountered during the initial production of the M121.

Benet Laboratories, a subordinate organization to the Close Combat Armaments Center within the ARDEC, was contracted to support this NDI system through the production and development phase of the mortar. The contract for the production of the 120mm M121 Mortar Weapon System was awarded to the Watervliet Arsenal, Watervliet, NY. Since Benet Laboratories and the arsenal production facility are collocated, the engineering support element was able to work directly with the production line personnel using a systems engineering approach.

The Initial Production Test (IPT) quantity of six, and the first two years' buy quantities, totaling 287 systems, were developed and produced at Watervliet Arsenal. A preponderance of the learning curve, associated with the first two years' procurement, was borne by the arsenal. The arsenal worked directly with Benet to resolve technical issues and enable the production line to effectively make the mortar system.

For subsequent buys, the Office of the Product Manager, Mortar Systems approved Watervliet Arsenal's decision to switch from in-house production to sub-contracting many of the major components for the mortar system. The switch was made as a cost savings measure to meet the budgetary constraints of the program. To facilitate this switch, the arsenal and Benet developed and employed the partnering team concept.

A partnering team, specifically tailored to support the production and delivery schedule of weapons and ancillary items for the 120mm M121 Mortar System Program, was chartered to foster a cohesive working relationship between critical contractors and the Watervliet Arsenal production facility. Partnering was employed to effectively manage quality and delivery schedules of the contracted items for mortar production.

The 120mm Mortar Partnering Team

The partnering team capitalized on the talents its members gained during initial production of the mortar system. The team was comprised of the following members, one of whom was from the Defense Contract Management Area Operation (DCMAO):

Team Leader: A military representative, from Benet, was the team leader, having responsibility for coordinating team efforts and acting as the spokesperson.

Contracting Officer Representative (COR): The COR, from Watervliet Arsenal, was responsible for all contractual requirements. All actions were reviewed by the contracting officer or the contracting officer's technical representative (COTR) to ensure conformance within the contract.

Planner: A planner, from Watervliet Arsenal, was responsible for directly interfacing with production engineers within the contractor's plants. Planners assisted the contractors in set-up and assembly line procedures.

Quality Representative: The quality engineer, from Product Assurance, instructed the contractor on all quality requirements pertaining to incoming inspection and first-article acceptance.

Engineering: Engineers and designers from Benet Laboratories coordinated efforts with engineering elements at the contractor's facilities. The engineers resolved technical issues in the TDP, and were highly responsive to the contractor's questions.

The partnering team provided the technical expertise required for successful partnering between Watervliet Arsenal and their contractors.

Partnering Team Evolution

When the acquisition strategy was changed, the majority of the program was shifted from

Watervliet Arsenal to contractor-owned, contractor-operated facilities. To minimize program risk, contracted items were assessed to determine which ones were the most critical.

Pre-award surveys were conducted to determine the viability of all potential contractors to meet quality and delivery schedules. The pre-awards initiated communication between the arsenal and potential contractors. Questions were answered, clarifications to the TDP were provided, and many issues were resolved prior to the award of the contract. The pre-award surveys set the stage for successful partnering with potential contractors.

Immediately after the contracts were awarded, the partnering team conducted their first visit with contractors producing the critical contracted assemblies for the mortar. These initial visits stressed the critical role each contractor played in the mortar delivery schedule. Contractors were generally receptive to the partnering team concept, though initially skeptical toward the atypical openness of a government contracting organization. Subsequent visits by the team effectively eliminated their apprehension.

Team Strategy

The primary objective of the partnering team was to work with selected contractors to open lines of communication and expeditiously resolve issues to ensure the success of the program. Subsequently, the partnering team developed procedures (a check list) which were employed during liaison visits with a contractor. The current check list follows:

- **Communication:** A continuous dialogue between the contractor and a contracting officer's representative or the contracting officer's technical representative (COTR) was paramount to having a successful partnering arrangement. It was imperative for contractors to have a clear avenue to identify problems that could hinder cost, schedule and performance. When the contractors had questions, it was the government's responsibility to expeditiously resolve them. Open and free communication was the essential element for a successful partnering arrangement.
- **Technical Data Package Evaluation:** The initial effort of the team was to completely review every drawing in the TDP pertaining to the contracted item. A planner or engineer from Watervliet Arsenal or Benet Labs and production personnel from the contractor's plant conducted this technical review. The process served three purposes. First, the team could guarantee the contractor was producing to the proper TDP in accordance with the contract. Second, questions were answered by the planner or engineer with regards to procedures previously used on the Watervliet's production line. Third, the team ensured the clarity of the drawings.
- **Cost and Schedule Review:** The partnering team constantly emphasized the importance of quality, cost and delivery in terms of how each of the contractors fit into the overall delivery of the weapon system.
- **Use of Contract Options:** Options were considered for all contracts, allowing the government to procure additional quantities from the same contractor when desired. The situation allowed the contracting activity to continue working with a partnered contractor and contractor performance on the basic quantity determined if options were exercised.
- **Learning Curve Transfer:** Any learning curve and lessons learned, borne by the contracting activity, were transferred to the contractors. A planner or engineer with first-hand experience and expertise provided beneficial information, previously gained from the arsenal's production line, to the contractors. This information was related to assembly line procedures, problem identification and resolution, and specific production control approaches. This learning curve transfer equated to increased quality and delivery schedules for contracted items.
- **Provide an Example Part:** The team used available production parts, as examples, during many team visits. Contractors were very receptive to seeing what the finished product would look like.
- **Provide Tooling and Gages:** Excess tools and gages were leased to contractors when requested. These production items assisted the contractor by providing them with the same proven tooling used on the arsenal's initial production line. Delivery schedule acceleration was possible when government furnished equipment (GFE) was provided.
- **Expedite Essential Waivers and Deviations:** A streamlined process to expeditiously review any questions or changes requested by the contractors was essential for meeting quality and delivery schedules.
- **Allow Concurrent Production:** Contractors, identified on the critical path of the system, were authorized to procure long lead items prior to the government's production approval (first article). This compressed the delivery schedule. To minimize risk, the contracting officer reviewed the contractor's source of supply to ensure they could produce conforming material.
- **First Article Evaluation:** First article evaluations, traditionally conducted at Watervliet Arsenal, were performed at contractor plants. This concept resulted in rapid first-article evaluations. The quality inspector had the opportunity while in the contractor's plant to make on-the-spot corrections for minor non-conforming material. This saved time, rework, and transportation costs for many long-lead items.

Results

The Watervliet Arsenal and Benet Laboratory team successfully implemented the partnering team concept in support of the 120mm M121 Mortar System production operation. The smooth transition from make to buy, orchestrated by the partnering team, equated to a cost decrease of approximately $12,000,000 (FY92 production) and the unit cost decrease was approximately $27,000 (FY92 production). Deliveries of the M121 Mortar System were a month ahead of schedule. Contract options were exercised to sustain production with many of the same contractors for future production requirements. Problems were identified and resolved before they equated to production line delays.

First-article evaluations were conducted at various contractors plants. Clear-cut lines of communication were established. Mutual respect and trust were established among many of the contractors. Selected contractors were allowed to proceed with concurrent production prior to first article approval. The partnering goal—to open lines of communication, resolve issues, attain quality parts on schedule and within budget—was attained for the M121 program.

Conclusion

The partnering team approach establishes an environment of mutual trust between the government and critical contractors and ultimately works as an acquisition improvement practice. Partnering with contractors is labor-intensive and requires initial costs related to resources, special talents, and a concerted effort to overcome existing paradigms. When properly implemented, partnering provides long-term benefits. To have a successful partnering arrangement, it is essential to start the approach prior to contract award and maintain the relationship through contract completion. A tailored check list, as outlined in this article, is adaptable for different DOD programs. Partnering can be accomplished under the provisions of the FAR/DFAR and current statutes. The partnering team is an innovative means of administrating contracts which has the potential to contribute to the success and cost savings for new acquisition programs within the Department of Defense.

MAJ WAYLAND P. BARBER III, CPL, is assigned to Benet Laboratories in Watervliet Arsenal, NY. He was detailed as a production manager for the M121 120mm Mortar Program for 12 months. An Army Acquisition Corps officer, Barber holds a B.S. degree in mechanical engineering from Northeastern University, and an M.S. degree in both systems acquisition and logistics from the Naval Postgraduate School.

XM56 TYPE CLASSIFIED

A New Era of Large Area Obscuration Begins

By CPT Peter A. Taran

Introduction

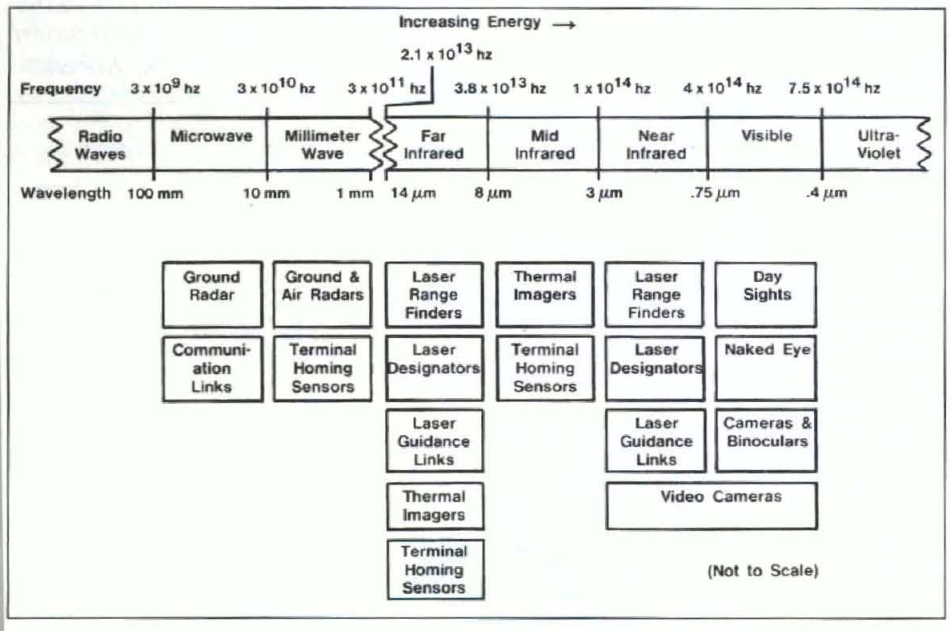
On Sept. 27, 1994, BG George Friel, commanding general of the U.S. Army Chemical and Biological Defense Command and milestone decision authority, approved the XM56 for type classification standard A and entry into the production and deployment phase. The M56 is the Army's first multispectral large area smoke system providing both visual and infrared obscuration on the battlefield. The M56 is the first new design in large area smoke since the M3 series of smoke generators which were originally developed in the 1940s. An armored variant of the system, the XM58, which is mounted on the M113A3 chassis is currently in preproduction qualification test with type classification expected in fourth quarter FY95.

Discussion

On the modern battlefield anything that can be seen can be killed. Until recently, this was confined to the visual spectrum and viewing devices such as the eye, cameras, day sights and other devices relying on light to operate. Referring to Table 1, it is evident that new and emerging technologies make it possible to acquire, designate, and seek targets in other portions of the spectrum.

The infrared spectrum which is divided into near, mid, and far provides a tremendous advantage in gathering information not possible with the naked eye. Laser designators and rangefinders, thermal sights, and many weapon guidance systems operate in this region.

Table 1.
Wave Bands of Military Interest.



The millimeter wave portion of the spectrum is the operating region for ground based radar and advanced guidance systems for some smart weapons.

The M56 is the first smoke generator that can deny all these regions to the enemy's information gathering devices. Presently, the M56 can provide visual and infrared obscuration with a preplanned product improvement scheduled to add the Millimeter Wave (MMW) portion of the spectrum.

Description

The M56 is a large area smoke generator which was developed to meet the Army's urgent requirement for a highly mobile, enhanced obscuration capability. Mounted on the M1097 High Mobility Multipurpose Wheeled Vehicle (HMMWV), the M56 consists of four basic modules: the power module, the visual module, the infrared module and the control module.

The power module consists of a Tiernay Turbines TT40-4 turbine engine mounted in a protective enclosure which also houses the engine control electronics, fuel pumps, and other associated hardware. The turbine is started by slaving power from the HMMWV batteries, but once started, a 10 KW DC generator which is integral to the engine provides the electrical requirements for the system. The temperature of the turbine exhaust is accurately maintained at 1,050 F which is the optimum temperature for fog oil vaporization and dissemination. The turbine engine is supplied with fuel from a separate 19-gallon fuel tank which is enough fuel to conduct a one-hour mission inclusive of start-up and shutdown. The turbine can utilize JP8 and all grades of diesel. This is an important improvement in that the prime mover and the smoke generator operate off of the same type of fuel. A hose is provided to draw fuel from an external source for stationary missions.

The visual module consists of two 43-gallon high-density polyethylene fog oil storage tanks, a variable output fog oil pump, and hoses to allow the system to operate off of an external fog oil supply such as a tank and

M56 Large Area Smoke System.

pump unit. The fog oil pump output can be varied from zero to 1.3 gallons per minute. Operated at maximum output, there is an ample supply of on board fog oil to conduct a 60-minute mission without resupply. The fog oil is pumped from the storage tanks to the exhaust cone of the turbine where it immediately vaporizes and recondenses in the form of visual smoke.

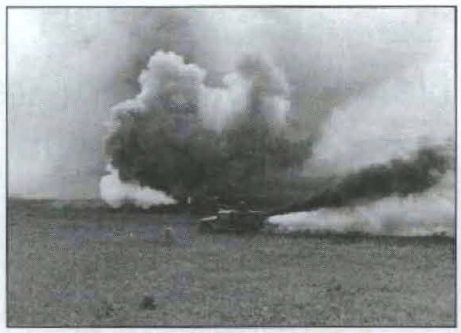
The infrared module consists of a hopper assembly for storing the graphite pellets; a grinder assembly for reducing the pellets to the proper size particles; and an ejector assembly for disseminating the graphite onto the battlefield. The infrared obscurant is graphite which is supplied to the field in 30-pound reusable containers. The pellets are poured into the hopper which holds 300 pounds, enough graphite for a 30-minute mission. The graphite is conveyed out of the bottom of the hopper into a high speed grinder where it is ground into micron sized particles. From here the ground graphite is drawn out of the grinder by a vacuum produced by the turbine, through the ejector and into the atmosphere.

The control module consists of a panel located on the interior of the HMMWV and includes not only operating functions but also warning and troubleshooting indicators. Numerous cables relay information from each of the other modules to the control panel for display to the user. The infrared and visual modules can be operated by the driver or the passenger, either independently or simultaneously as the threat dictates.

In addition, the system has a watertight storage box which has ample space for the M249 squad automatic weapon and spare barrel, one ammunition can of linked 5.56 mm, an AT4 antitank weapon, on board spares for the system, tools, and manuals.

Programmatics

The requirements document was originally signed in November 1986 by the user, the U.S. Army Chemical School. A Milestone I/II in-process review was conducted in the first quarter FY87 with a decision to enter engineering and manufacturing development (EMD). Subsequently, an EMD contract was awarded to Chamberlain MRC in the fourth quarter FY87 to design, develop, and test a working prototype. Seven working prototypes were delivered from the contractor in August 91 and were evaluated during production proveout testing (PPT) and early user test and evaluation (EUTE) which occurred simultaneously from fourth quarter FY91 to fourth quarter FY92. Failures resulting from PPT and EUTE were analyzed and the systems redesigned to correct deficiencies. Eight preproduction qualification test (PPQT) systems were delivered in June 1993 which incorporated the necessary design changes. PPQT began in June 1993 and was completed in



Tactical mobile mission conducted during independent operational test and evaluation at Fort McClellan in June 1994.

second quarter FY94. Testing occurred at Dugway Proving Ground, White Sands Missile Range, Cold Regions Test Center, Tropical Test Center, Combat Systems Test Activity and Yuma Proving Ground resulting in over 1,000 hours of reliability testing.

The independent operational test and evaluation (IOTE) was scheduled to occur at Fort Carson in January 1994. Due to lack of funding to the Operational Evaluation Command, the test was postponed and modified to a length, duration, and cost that the product manager's office could afford. The IOTE was successfully completed at the U.S. Army Chemical School in June 94. Failures found in both PPQT and IOTE were analyzed and the technical data package modified to reflect necessary engineering changes.

The Milestone III in-process review was conducted on Sept. 27, 1994, with the decision to proceed to production and deployment. A five-year firm fixed price multiyear production contract will be awarded for FY95 through FY99 for procurement of systems and will be solicited competitively. Contract award is anticipated for early 1995.

Deployment to Force Package One will consist of 267 systems and begin with fielding to the 82d Airborne Division in May 1997 and conclude in October 2001.

Two preplanned product improvements are funded for the system to maximize the value and flexibility to the battlefield commander. The first will consist of a third fog oil tank that would replace the infrared module and increase the visual smoke mission to 90 minutes. This would be desirable in locations where no infrared threat exists. This effort is funded for FY96.

The second improvement is to develop a millimeter wave (MMW) module which could be substituted for the infrared module. The MMW module is ready for EMD and is funded beginning in FY99.

The modular design of the M56 will allow the maneuver commander to tailor the system to meet the threat. Some systems could be outfitted with visual and IR smoke while others could be outfitted with visual and millimeter wave smoke, effectively blocking the entire electronagnetic spectrum that is of military interest. Another scenario could be to block the visible and millimeter wavelengths while leaving the infrared spectrum open, an area in which the United States armed forces currently enjoy a technical advantage.

Conclusion

The M56 is ready for production and deployment and when fielded will provide the maneuver commander maximum flexibility in countering threat sensors and weapons. For the first time in history, large area multispectral smoke is an option that can be used on the modern battlefield to provide the decisive edge commanders need to win wherever the Army is called on to fight. LTC George Birdsong is the current product manager for smoke and obscurants. His point of contact is the system manager, Randy Loiland, DSN 584-2806.

CPT PETER A. TARAN was the deputy system manager for the M56 when he wrote this article. He is currently at the Chemical Officer Advanced Course and holds a B.S. degree in chemistry from Dickinson College. As a member of the Chemical Corps, he has served as both decontamination and smoke platoon leader in the 2d Division, Korea.

TRAINING WITH INDUSTRY AT GENERAL MOTORS

By CPT Wallace Tubell

Introduction

Training With Industry (TWI) at General Motors (GM)? GM makes commercial automobiles, not Defense products, right? Correct, but GM also conducts research and development (R&D) in such areas as materials, manufacturing processes, advanced modeling and simulation, vehicle electronics, advanced batteries and alternative propulsion systems. These sound like the very areas to which the Army also applies extensive R&D resources. For years, there was little or no knowledge of these efforts, nor was there a mechanism for exploring the potential of joint R&D.

Much of GM's research is similar in nature to Army research and is of value to the Army. Likewise, the government has conducted research with value to industry without industry involvement. Today, we have the opportunity to work with companies like GM and seek out leveraging opportunities for dual-use technology. GM is a firm believer in leveraging technology and realizes the federal government is a prime source for leveraging opportunities. Combine this with Army and DOD current initiatives to streamline the acquisition process and incorporate more and more commercial specifications in military procurements, and you quickly realize that GM offers a tremendous TWI opportunity to Army officers.

Background

In the early fall of 1993, LTG William H. Forster, director, Army Acquisition Corps and military deputy to the assistant secretary of the Army for research, development and acquisition, visited the Tank-Automotive Research, Development and Engineering Center (TARDEC). During this visit, LTG Forster received a detailed briefing on the efforts of TARDEC's newly created National Automotive Center (NAC) to develop closer ties between the Army and the big three automobile manufacturing companies—General Motors, Ford and Chrysler. LTG Forster was impressed by TARDEC's emphasis on dual-use technology and collaborative R&D with the commercial auto industry via the NAC. Dr. Ken Oscar, former TARDEC director and now principal deputy for acquisition at Headquarters, U.S. Army Materiel Command, suggested to LTG Forster that he consider establishing a TWI Program with the auto industry for Army Acquisition Corps (AAC) officers. LTG Forster agreed, and GM volunteered to be the first host for the new TWI program. In September 1994, I was fortunate enough to be the first officer assigned to this new TWI position.

While TARDEC was creating the NAC in 1992, GM was conceiving its Research Technology Partnerships Directorate (RTP). Numerous articles about the NAC have previously been published in the *Army RD&A Bulletin*, so my focus for the remainder of this article will be on GM's RTP Directorate.

RTP Directorate

The RTP Directorate was officially activated on Oct. 1, 1993, and is one of four directorates within the General Motors Research and Development Center. The directorate, with Dr. Christopher C. "Kit" Green as director, consists of several departments. The primary departments that the TWI officer will be working with and their mission statements are:

- **Government Partnerships.** The mission of this department is to create highly leveraged R&D partnerships involving GM and government funded organizations to enable the corporation to reduce the risks, cost, or time involved in achieving GM's R&D portfolio and other business plan objectives. The intent is also to assure that new and emerging government-funded science and technology opportunities are identified and evaluated in a timely manner with respect to their potential competitive impact on the corporation.

The future of R&D in the United States will be founded upon collaboration among and between the federal government, private industry and academia.

• **Industrial Partnerships.** This department's mission is to obtain highly leveraged R&D expertise from the industrial sector; to support the R&D portfolio and enhance commercialization and rapid deployment of new technologies; and to develop the process and guidelines to license non-core and non-competitive GM technologies.

• **Academic Partnerships.** This department has a mission to obtain highly leveraged research expertise from the academic sector.

The goals of the RTP Directorate are to:

• Provide a new business focus for ongoing activities, if resourced too thinly, or to expand beyond GM's traditional borders;

• Develop government, industry and academic partnerships that are more cost-effective; that couple GM with high science and technology not developed or capitalized at GM due to resource limitations; and that are clearly associated with outside centers of business excellence.

• Filter all opportunities through a business case model, using the GM R&D portfolio as a pre-audit, and accepted measures of effectiveness to post-audit.

Since the establishment of the RTP Directorate, GM has collaborated with multiple departments of the federal government using mechanisms such as Cooperative Research and Development Agreements (CRADAs), cost sharing R&D contracts, and other cooperative agreements. Examples of current or proposed programs include hybrid-electric vehicles, vehicle conspicuity (reverse camouflage), collision avoidance and intelligent highway systems.

The Future of R&D

The future of R&D in the United States will be founded upon collaboration among and between the federal government, private industry and academia. TARDEC and GM have traditionally led their respective automotive communities for years, and are now again leading the way in today's new acquisition environment. Army project managers, scientists and engineers will have to work harder in the future to support R&D efforts to maintain our Army's technological superiority. Likewise, managers within GM who are seeking approval for new R&D efforts must frequently look to outside agencies like the Army for funding, special facilities, specially trained personnel, etc. The solution to these concerns lies in leveraging technology through collaborative R&D.

Collaborative R&D can provide government researchers access to industry's and academia's facilities, personnel, technical knowledge and vice-versa. This is a two-way street; the flow of information and resources is back and forth between the partners based on the terms of the contract, CRADA, or other cooperative agreement. Frequently, these partnerships are 50-50, but others range to an 80-20 relationship. This is a relatively untapped resource which has the potential to meet our future R&D needs as well as the needs of both industry and academia.

Aspects of the Assignment

The RTP Directorate is located at the General Motors Technical Center in Warren, MI, just one mile north of the U.S. Army Tank-automotive and Armaments Command (TACOM). Selfridge Air National Guard Base, located 23 miles to the northeast, provides military housing, troop medical clinic and dental clinic, commissary and base exchange services, an officer's club and nearly all the morale, welfare and recreation activities available at any military installation. Thus, the TWI officer at General Motors will be offered the best of both worlds—the chance to work in industry while still maintaining a close relationship to the Army community. Some officers performing TWI at General Motors may receive a follow-on assignment to TACOM or one of the two PEO's collocated with TACOM.

General Motors has taken a hands-on approach to the TWI Program with an attitude of learning by doing. The TWI officer can expect to be treated as an integral member of the RTP Directorate and will be heavily involved in the Government Partnerships Division of the directorate. In this capacity, the TWI officer will be exposed to the industry perspective on dual-use technology and collaborative R&D, and may participate in or observe the development of proposals, Cooperative R&D Agreements and contracts.

For approved programs, the TWI officer will be part of the creation and staffing of Project/Program Management and Systems Engineering Offices. TWI officers at GM will also have the chance to work with many federal agencies. General Motors collaborates with the Departments of Commerce, Defense, Energy, Health and Human Resources, Transportation, and NASA and many smaller federal agencies.

During the tour of duty, the TWI officer will also learn how GM collaborates with academia, other industries, and international partners, and how GM manages R&D efforts valued at several hundred million dollars annually within the GM R&D Center alone. Finally, TWI officers will also use their Army-provided $1,500 travel allowance to spend up to one week in GM's Washington, DC, office to participate in and observe business in our nation's capital.

Conclusion

The concept of dual-use technology and collaborative R&D is still relatively new. This concept is not unique within the world of industry to GM. GM is, however, certainly leading the way in the commercial auto industry, and was quick to volunteer for the TWI Program. TWI at General Motors is a chance for Army officers to get hands-on experience in the techniques the Army will use to manage R&D in the future. Officers leaving this assignment will bring industry's perspective on working with the federal government back to the Army. This experience will undoubtedly help when writing solicitations, or seeking new and innovative ways to manage R&D programs. This is a super opportunity for any Acquisition Corps officer to learn today, the future of R&D management and R&D acquisitions.

CPT WALLACE TUBELL, a member of the Army Acquisition Corps, is a TWI participant assigned to the General Motors R&D Center, Warren, MI. He is a graduate of CAS3 and the MAM Course and has a B.S. degree in mechanical engineering from Florida Institute of Technology, and a master's of engineering management degree from St. Martin's College.

Guest Editorials

FORCE XXI RDA ISSUES

Dr. Robert B. Oswald
Director of Research and Development
U.S. Army Corps of Engineers

Force XXI is the Army of the future—lethal, light, and mobile. It will be a very flexible force capable of meeting U.S. military objectives in the 21st century. Force XXI is based on the concept of an information-based force capable of out-performing the enemy because of its real time distributed knowledge of the situation (friend and foe) and its ability to act inside of the enemy's reaction time.

Information will be a critical component of the Force XXI Army. Information will enable command groups, units, and individual soldiers to act as independent members of a combat team applying their expertise and executing their role within the commander's battlefield strategy to achieve the objectives.

Certainly one of the key resources in the Force XXI battle scenario is the map. The digitized battlefield map becomes the basis for battle planning and execution. The digitized battlefield will include critical information on current enemy positions and strengths; updates on weather, mobility and target acquisition; and friendly force assets.

The key role of the Corps of Engineers labs is to provide the technology to process the information and make digitized maps that can be rapidly and accurately updated to reflect changing conditions. This information then becomes the basis for battlefield tactics and the use of the combat assets of the future.

The research and development challenge is to not develop military-unique software and hardware, but to take advantage of technology already commercially available. The commercial marketplace is already providing information technologies and capabilities that are advancing at staggering rates.

Commercial information technology provides the engine which we must adapt to the Army's needs and methods of operation for Force XXI. The process for adapting commercial technology will rely heavily on field demonstration and evaluation to explore and validate its applicability as well as identify future needs.

The real user's input will be critical to the assessment of the technology and its further evolution. This demonstration, assessment, and development process must be dynamic. The technology development will always be evolving due to the continuing commercial advancement of the technology and as we gain greater insight from field exercises and simulations. We must be ready to adopt those technologies that improve our performance on the battlefield.

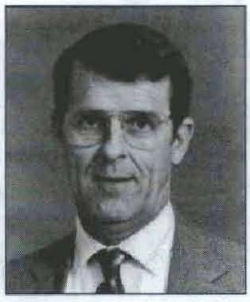
One major concern we need to address, with this approach to acquisition, is to ensure that we do not build an information system with an achilles heel. Field exercises or simulations will only be a limited test of the viability of the information systems needed for the Force XXI Army. The enemy will have the capability to learn and understand the commercial systems we adopt and potentially exploit them. Thus, we need to design complimentary experiments that will fully stress the systems as they will be stressed and exploited by our adversaries. These experiments should evaluate how we protect against the common threat of jamming but also evaluate the more sophisticated threat of information corruption, as well as ensuring that the enemy cannot gain access to this information for their purpose.

Another issue that must be addressed as we evolve into the information based force is: "Will our communication systems be adequate to handle the large volume of data that will be needed to rapidly update information on our digitized battlefield?"

The combat effectiveness of the U.S. Army's technology edge was aptly demonstrated in Desert Storm. Our task now is to ensure that the soldier maintains that combat advantage as we move into the 21st century. The Corps of Engineers research community is committed to the development of the digitized battlefield critical to the success of Force XXI.

What Suggestions Do You Have to Improve the Certification Process?

Robert Morig
Director, Army Acquisition Executive Support Agency
Fort Belvoir, VA



My agency was selected to be the test case for the acquisition certification process in September 1994. Even with limited documentation available, we were able to walk about 40 of our personnel through the process with little difficulty. Now that the certification "train the trainer" workshop has been completed, and the documentation has been refined based upon that experience, it is my view that this process is fairly straight-forward.

I have yet to see the product of all this work appear in the form of a completed ACPERS Record Brief from the civilian personnel office. When we all have our data in the system and the system can produce a correct record brief on our employees, then the process can be fully evaluated. As of now, the employee, the supervisor, and the certifying official have done their part.

My guess is that this process will create a "bow wave" of training requirements that will stress the Defense Acquisition University and result in some frustrated employees. But I do believe that once the "bow wave" is worked off, the training demand will stabilize and this issue will go away.

I think it is always good for the employee and the supervisor to evaluate the qualifications for each acquisition position and to ensure the employee has the opportunity to attain the necessary experience, education, and training, not only for their current position, but also to prepare them to compete for promotion opportunities. The certification process does this.

I believe it is very important for us not to lose perspective of our real objective—that of enhancing the professional competence of the Army acquisition workforce. This process forces the supervisor to examine position requirements, employee competencies, and to determine corrective actions required to enhance those competencies. Supervisors need to continuously re-examine the changes in qualifications required so as to ensure our employees are afforded the opportunity to stay qualified for future positions.

The people who worked so hard to establish the procedures for certification deserve credit for an "about right" process. It meets the objective of getting our employees certified, and for those that don't meet the requirements, it forces us to take action to get them qualified. I say, "Job well done."

Randy D. Colvin
Chief, Technical Management Division
Corps Surface-to-Air Missile (CORPS SAM)
Project Management Office
Redstone Arsenal, AL

In a continued environment of downsizing and increased competitiveness among the federal workforce for critical positions, the move toward certification was inevitable. The process of certification has emerged from the need to come to grips with the future acquisition environment and the ever-increasing scrutiny the federal workforce must endure in the acquisition of new systems in the future. The acquisition workforce has recently undergone accession / entry into the Army Acquisition Corps. Since the process of obtaining Acquisition Corps membership required a similar process of defining background, training, and documenting experience, it would seem that the two processes could have been more closely associated to take advantage of the synergies and similarities of the two processes. Since both processes are governed by the Defense Acquisition Workforce Improvement Act of 1990, the timing would have supported a more synergistic process.

The biggest complaint I found in addressing the certification process is the complexity and sometimes conflicting instruction that accompanied the Certification Review Board.

The documentation was voluminous and complex and required significant understanding of several of the existing and evolving civilian personnel office automated systems, specialty codes and definitions, acquisition-related mandatory training breakouts and current computer system limitations. The combination of unfamiliar terms, awkward forms that required significant manual red lining, and somewhat unclear and confusing instructions made execution a frustrating activity.

The next most recognizable and complicating factor was that of timing. In an attempt to wait for system modifications to ease the manual burden of the certification process, the Army inadvertently shortened the reaction time for submitting the certification package. Additional complicating factors also surfaced, including late delivery of the computer-generated forms and background data, a rather inflexible capability to address other experience (military and industry) to the process, the need to do alternative fulfillment for training and experience, and the non-flexibility in the system to accept more than one certification package. These were all complicating factors and added to the difficulty and confusion in the execution of the certification process. Most evolutionary system / process changes do not occur without a measure of pain, this one included. I'm convinced, though, that the end justifies the means. However, the process could have been much more fruitful and rewarding if the circumstances had not been time-critical, if the information system had not been constrained, and if the Acquisition Corps submittals had been better coordinated.

Amy H. Bradley
U.S. Army Space and Strategic Defense Command
Huntsville, AL

The purpose of the Army acquisition certification process was to assure that acquisition personnel were qualified in terms of education, experience, and training to perform the duties of their current assigned acquisition position in accordance with the standards set forth in DoD 5000.52M (November 1991).

If an individual is unable to meet certification standards for his or her acquisition career field and level, then the individual will have 18 months, which began in January 1995, to meet certification standards under the new DoD 5000.52M. Once an individual is certified, he / she is not required to go back and attend mandatory training for a lower career level or meet future mandated training at the current level even though requirements changed in January 1995. If an individual's supervisor feels that this training should be obtained, then the individual could be considered for the classes as they become available.

Overall, our certification process went very well. The Certification Review Board Guides were very helpful once our agency prepared a reference sheet advising personnel of the page numbers for the various codes. The major improvement that could be made to the process is to combine the data from the guide and the handbook into one document.

LTC Mark W. Jones
FA51 Proponency Officer
Office of the Assistant Secretary of the Army (RD&A)
The Pentagon

I would focus on the three "R's" relative to certification..."AR," "PR," and "LR." With respect to "AR" (Army regulation), although DAWIA and DOD 5000-52M provide adequate top-level guidance, many of the problems in implementing certification for the Army, stem from the fact that no HQDA regulation exists which defines organizational responsibilities, relationships and procedures for managing the Army Acquisition Corps (AAC) / Acquisition Workforce (AWF). The impact on military acquisition officers of not having an AR has been minimal, due to the existing centralized personnel system which provides adequate certification oversight and data. On the civilian side, the lack of an "AR" has resulted in a dysfunctional combination of decentralized CPOs on one hand and the need for centralized management and reporting on the other. Until an AR or supplement to an existing AR is approved, efforts to fully address, automate and / or centrally manage certification will be temporal at best. As to "PR" (public relations), a concerted campaign is needed to educate everyone as to the benefits of certification and eradicate the negative perception that certification is just one more "top-down" requirement for which there is little return on investment and / or enforcement. The fact is that the education, training and experience requirements for certification IAW DOD 5000-52M, directly translate into DOD's annual funding of more than $5 million in Army requirements for mandatory career field and assignment specific courses and training.

With respect to enforcement, it's a fair statement that certification has been a "non-player." This is no longer true. The requirement that an individual meets the certification requirements for a specific position (with emphasis on Level III), will become a reality in the assignments process during FY 95. Approval to grant Level III certification waivers will continue to reside at the three-star level with the DACM.

Finally, as for "LR" (long range), a closed-loop process needs to be implemented that provides continuous feedback from the field to the proponency / career field representatives as to what's working, what's broken, and what needs to be considered in the future of acquisition certification. VTC's, roadshows and an AAC e-mail bulletin board are just a few examples. Feedback is especially critical to the AAC Proponency Division, as we coordinate future DOD 5000-52-M certification requirements with OSD and the other Services. Hopefully this will result in tomorrow's acquisition leaders with the requisite education training and experiences which will enable them to lead, rather than follow the Army's digitization and horizontal integration efforts of Force XXI.

From The AAC Career Manager...

FY95 Civilian Product Manager Selection Board Results

The Army Acquisition Corps is proud to announce the results of the Product Manager (PM) Board that was held in October 1994 to select civilian PMs for the Multiple Launch Rocket System (MLRS) Improved Fire Control System and the Standard Theater Army Command and Control System (STACCS). Congratulations to the following individuals on their selection as PMs:

Robert G. Wilks Jr. has been selected to serve as PM, MLRS Improved Fire Control System. Wilks is currently assigned to the Office of the Program Executive Officer (PEO), Tactical Missiles. He has more than six years of acquisition experience, is a graduate of the Program Management Course, and holds a B.S. in management from James Madison University.

Peter O. Johnson has been selected to serve as PM, STACCS. Johnson is currently assigned to the Office of the PEO, Command and Control Systems. He has more than 10 years acquisition experience, is a graduate of the Program Management Course, and holds a B.S. in electrical engineering from Monmouth College and an M.S. in electrical engineering from Farleigh Dickinson College.

At the time of this publication, no assignment dates have been identified for these PMs, however, tenure for these positions will be three years from assignment date.

The selection board process was very successful and we plan to expand this process to include project manager (PM) positions.

The civilian PM selection boards will parallel the military PM selection boards. As such, the boards will be held simultaneously. Also, PM positions will continue to be reviewed annually by the General Officer Steering Committee to validate the requirement for continued need for centralized management. This review will begin the FY97 cycle which will occur during the fall of 1995.

In accordance with the Defense Acquisition Workforce Improvement Act, the assignment period for PMs will be:

a. Acquisition Category (ACAT) I programs: Limited to the completion of the major milestone that occurs closest in time to the date on which the person has served in the position for four years.

b. ACAT II, III and IV programs: Limited to three years.

Reassignments of civilian PMs is not a punitive action. It is an opportunity for civilians to provide their expertise in jobs of equal or greater responsibility.

PERSCOM Notes...

FY95 Centralized Selection Board Schedule

The following is a list of tentatively scheduled centralized selection boards for the remainder of FY95. Exact dates will be released in the zone message prior to each board. The schedule was current as of Sept. 30, 1994.)

3rd Quarter, FY95

MAJ, Army	Apr. 11 - May 6, 1995
Senior Service College, Army	Apr. 25 - May 19, 1995
Command and General Staff College, Army	June 6 - 30, 1995

4th Quarter, FY95

COL, Army	Aug. 15 - Sept. 9, 1995

AAC Accession Board Results

The Military Acquisition Management Branch is pleased to announce the result of the 1995 Acquisition Corps Accession Board. The following is a list of officers who were selected for accession into the Army Acquisition Workforce and Corps.

FY 95 PERSCOM Acquisition Candidate Accession Board Results

Rank	Name	Branch	FA
CPT	ALVARENGA, Charlotte D.	SC	51
CPT	AMBROSE, Matthew H.	AD	51
CPT	ANDERSON, Mark A.	AV	97
CPT	ARN, Mark R.	EN	51
CPT	ARUZZA, John A.	FA	51
CPT	BAGLEY, Michael J.	AV	51
CPT	BAKER, Terrence J.	QM	51
CPT	BALLEW, Mark E.	AV	51
CPT	BANKS, Douglas T. III	OD	51
CPT	BECK, Anthony F.	SC	53
MAJ	BLACHER, Maurice P.	AR	97
CPT	BLODGETT, Mark A.	IN	51
CPT	BOCHONOK, Jeffrey T.	EN	53
CPT	BOOZELL, James H.	AV	97
CPT	BORUFF, William M.	TC	97
CPT	BOSSE, Scott P.	AV	53
CPT	BOSWORTH, Brian E.	AD	51
CPT	BOVAIS, Jeffrey A.	IN	51
CPT	BOWIE, Jimmy D.	AV	51
CPT	BRECHER, Joseph A.	SF	51
MAJ	BROUSE, Steven M.	AD	97
MAJ	CATIGNANI, Richard A.	EN	97
CPT	CHANDLER, Jeffery T.	FA	53
CPT	CHAPEL, Preston L.	FA	53
CPT	CHAPMAN, David P.	AV	51
CPT	CHINOWSKY, Lary E.	CM	51
CPT	CHUNG, Hong Ki	SC	51
CPT	COLBOURNE, Alfonso	SC	53
CPT	COLE, William E.	FA	51
CPT	COLVIN, Darryl J.	OD	51
CPT	COPELAND, Kenneth D.	OD	97
MAJ	CORDOVA, Andrew J.	EN	97
CPT	CRUM, David B.	TC	51
CPT	CULVER, Robert W.	SF	97
CPT	CUMMINGS, Brian P.	IN	51
CPT	CUNNINGHAM, Daniel J.	FA	51
CPT	DANNER, Benton A.	AR	51
CPT	DAVIS, Christopher P.	AV	51
CPT	DAVIS, James V.	MI	51
CPT	DEATON, Phillip G.	OD	97
CPT	DELUCA, Ralph C.	AR	51
CPT	ELLISON, Dennis B.	MI	51
CPT	EVARO, Victore J.	QM	51
CPT	EVENSEN, Kenneth C.	AG	53
CPT	FAIRBANKS, Michael A.	QM	51
CPT	FAUST, Rodney D.	CM	51
CPT	FOLDEN, Raymond G.	FA	97
CPT	FORD, William M.	QM	97
CPT	FOSTER, Stephanie L.	TC	51
CPT	FREY, Charlotte S.	QM	51

CAREER DEVELOPMENT UPDATE

AAC ELECTRONIC MAIL POINTS OF CONTACT

CHIEF, AACMO	CLAWSONO@HOFFMAN-EMH1.ARMY.MIL
BOARD OFFICER	DELANAYM"
ADV CIVIL SCHOOLING	HAMILTOR"
SEPARATIONS	ELLERBYC"
CHIEF, CAMB	BROWNJ2"
CHIEF, MAMB	BAILERR"
AAC COLONELS ASSIGNMENTS	LEES"
FA51 LTC ASSIGNMENTS	GAULTC"
FA51 MAJ ASSIGNMENTS	DOWLINGE"
FA51 CPT ASSIGNMENTS	RHODESW"
MIL PERS SPEC (MAM, PM)	YAGERR"
FA53 LTC/MAJ ASSIGNMENTS	REYENGAR"
FA53 CPT ASSIGNMENTS	LIPSCOJØ"
FA97 LTC/MAJ ASSIGNMENTS	STONEJ"
FA97 CPT ASSIGNMENTS	WOMACKJ"
AAC COMPUTER ENGINEER	MUNOZD"
AAC STRENGTH MANAGER	HAMILTOR"

CPT	FRIEDLAND, Jeannette J.	QM	97
CPT	FROM, Jeffrey D.	OD	51
CPT	FRULLA, Kurt A.	SF	97
CPT	FULLER, William S.	FA	97
CPT	GABBERT, Jeffrey A.	QM	97
CPT	GARCIA, Joseph G.	AD	53
CPT	GENET, Bradley L.	MI	53
CPT	GOLDFISH, Timothy P.	FA	51
CPT	GONZALEZ, Gregory B.	MI	51
CPT	GORE, Barry J.	FA	51
CPT	GREGG, Michael G.	EN	97
CPT	GRIFFIN, Gene E. Jr.	EN	51
CPT	GUILFORD, Daniel J.	EN	51
CPT	GUTHRIDGE, George A. III	IN	51
CPT	HALE, David A.	AG	53
CPT	HALLINAN, James G.	EN	51
CPT	HAMILTON, Leon G.	AD	51
CPT	HAYNES, Lincoln C.	AD	51
CPT	HENDERSON, Michael A.	FA	51
CPT	HENDREN, Jeffrey L.	MI	51
CPT	HERRMANN, Colleen J.	MP	51
CPT	HIGGINS, Michael C.	MI	53
CPT	HILL, Desiree M.	SC	51
CPT	HILL, Paul M.	AR	97
CPT	HIRSCHMAN, Keith A.	FA	51
CPT	HITZ, Stephen E.	FA	51
CPT	HODGE, John E.	IN	51
CPT	HOGAN, Melvin S.	IN	97
CPT	HOTALING, Sean	AD	53
CPT	HUBNER, Michael W.	FA	53
CPT	HULCHER, Bruce S. Jr.	OD	53
CPT	INMAN, Gail G.	QM	53
CPT	JENE, Bernard L.	OD	51
CPT	JIMENEZ, Ramon	AD	51
CPT	JOHNSON, David L.	FA	51
CPT	JOHNSON, Ptosha R.	SC	51
CPT	KILBY, Gregory R.	FA	51
CPT	KING, John S.	AR	51
CPT	KINLEY, Gloria L.	EN	97
CPT	KIRSCHBAUM, Christine A.	SC	53
CPT	KIRSOPP, Frank L.	IN	51
CPT	KOTOUCH, Gary J.	FA	51
CPT	KRUCZEK, Richard C. Jr.	MI	51
CPT	LAASE, Gary L.	FA	51
CPT	LARRABEE, Patricia M.	MI	51
CPT	LAZAR, John M.	AR	51
CPT	LEMONDES, John Jr.	QM	51
CPT	LEPINE, Paul R.	FA	51
CPT	LICHTENBERGER, Robert N. Jr.	FA	51
CPT	LINNEMEYER, Lawrence C.	AD	53
CPT	LIPSCOMB, Racheau D.	CM	51
CPT	LITTLE, John W.	SF	97
CPT	LOFTON, Daryl W.	OD	51
CPT	LOUGHNANE, Stephen D.	QM	51
CPT	MAGO, Angelo E.	OD	51
CPT	MANCULICH, Michael G.	TC	51
CPT	MASON, William R.	IN	51
CPT	MCKEITHEN, Timothy M.	QM	97
MAJ	MCNERNEY, Catherine A.	AV	53
CPT	MCVEY, Wade L.	AR	97
CPT	MILLER, George B.	SC	51
CPT	MILLER, Patrick V.	FA	51
CPT	MOBLEY, Donald R.	AV	51
CPT	MOLES, Tony L.	CM	51
CPT	MOORE, Aaron D.	SF	53
CPT	MOORE, Paul Jr.	MI	53
CPT	MUSCHEK, Richard C.	AV	51
CPT	NASERS, Gary D.	CM	51
CPT	NEILSON, Lisa R.	QM	51
CPT	NIGHTINGALE, Malcom E.	IN	51
CPT	OLSON, John R.	IN	51
CPT	OLSON, Keith R.	MI	51
CPT	PACE, Phillip F.	FA	51
CPT	PAYNE, Kenneth E.	MI	51
CPT	PINCOSKI, Mark J.	AD	51
CPT	POPE, Joseph K.	OD	51
CPT	POTTS, Anthony W.	AV	53
CPT	POWERS, Timothy W.	QM	51
CPT	PULFORD, Scott A.	AR	51
CPT	PUTHOFF, Frederick A.	SC	53
CPT	RAFTERY, Brian W.	AR	51
CPT	RANKIN, James A.	SC	97
CPT	REED, Stephen S.	IN	97
MAJ	REISWEBER, Deborah A.	MP	51
MAJ	REISWEBER, Mark A.	AV	97
CPT	RETTIE, Craig L.	OD	51
CPT	RIGGINS, David W.	FA	51
CPT	RILEY, Donald D.	AR	51
CPT	RIORDAN, Matthew T.	EN	97
CPT	ROBERTSON, Daniel S.	AR	51
CPT	ROBINSON, Stanley B.	AR	51
CPT	RODESCHIN, Darrin H.	EN	97
CPT	ROHALL, David J.	OD	51
CPT	ROWE, James R. J.	AR	53
CPT	RUIZ, Alvin	SC	51
CPT	RUSIN, Daniel S.	OD	53
MAJ	SAFLIN, Stephen T.	AV	97
CPT	SANDERS, William A.	QM	97
CPT	SAVAGE, Roger	QM	51
CPT	SCALSKY, David W.	FA	51
CPT	SCHAEFER, Craig P.	IN	53
CPT	SCHOOLCRAFT, David E.	AV	97
CPT	SCHUTTER, Jeffrey D.	FA	51
CPT	SCHWARTZ, Thomas L.	SC	53
CPT	SHADE, David M.	MI	51
CPT	SHANNON, Joseph C.	AR	51
CPT	SHERE, Kelly J. A.	CM	97
CPT	SHOOP, Brian P.	AV	51
CPT	SIMMONS, Bennie L.	AD	53
CPT	SIMON, Carl J.	AV	51
CPT	SINGER, Calvert T.	MI	53
CPT	SMITH, William A.	IN	51
CPT	SMYTHE, Daniel R.	AV	53
CPT	SPENARD, Arthur E.	FA	97
CPT	SPENGLER, William R.	IN	51
CPT	STORMS, Russell L.	AV	53

CPT	STRANGE, Timothy J.	EN	97
CPT	TAYLOR, Joseph M.	AR	51
CPT	THIES, Dennis	OD	51
CPT	THOMAS, Eric	SC	53
CPT	THORPE, James S.	OD	51
CPT	TOOMEY, Daniel A.	EN	51
CPT	TORRENT, Fernando L.	SC	53
CPT	TREGRE, Jacqueline R.	SC	53
CPT	TURNER, Keven	AD	53
CPT	URQUHART, Darlene M.	OD	97
CPT	VASQUEZ, Terry R.	AD	51
CPT	VISCONTI, Albert J.	MI	51
CPT	VITALE, Joseph L.	AG	53
CPT	VOIGT, Jeffrey R.	IN	97
CPT	WAGNER, Raymond L.	AV	51
CPT	WELLBORN, Robert M.	FA	53
CPT	WESTERGREN, Brad L.	IN	97
CPT	WHEELER, Darrell A.	AR	53
CPT	WHITE, Thomas J.	OD	51
CPT	WHITEHURST, Vincent E.	SC	51
CPT	WHITWORTH, Mary K.	QM	51
CPT	WILKINSON, Chris A. B.	MI	53
CPT	WILLIAMS, Nancy S.	QM	97
CPT	WILSON, Veronica A.	AG	53
CPT	WINBUSH, James O.	OD	51
CPT	WOMACK, John S.	AR	97
CPT	ZARBO, Michael E.	MI	51

Video Television Conference

On Dec. 13, 1994, the FA51 major and lieutenant colonel Acquisition Corps assignment officers (MAJs Dowling and Gault) conducted a video television conference (VTC) with 15 officers from PEO-ASM (Warren, MI). MAJs Dowling and Gault provided an Acquisition Corps overview, information about the operation and procedures of the Military Acquisition Management Branch and the assignment process and conducted individual interviews. The VTC facility at Headquarters, U.S. Army Materiel Command was used and the session was videotaped.

The assignment officers accomplished in two hours what would normally take one to two days of TDY. The cost in travel and time spent away from the desk was minimized. The VTC does not eliminate the need to travel to locations that have larger populations of Acquisition Corps officers such as, Huntsville, Detroit, Fort Monmouth, Fort Hood. However, it does allow assignment officers to reach personnel located in lower density locations including Japan, Germany and Kwajalein.

If your organization would like to receive an Acquisition Corps update via the VTC, please contact your assignment officer.

MAMB Recorded Information Available

The Military Acquisition Management Branch has a new recorded information line. Touch tone phone users can access information about promotion lists, how and when to apply for the Army Acquisition Corps, how to apply for Advanced Civil Schooling (ACS), including a listing of what schools are available, how to apply for Training With Industry (TWI), and how to obtain a copy of your regular and restricted microfiche. In addition, officers can be automatically transferred to their assignment officer, the schools/TWI officer, or AAC certification officer through this system. The number is DSN 221-3411 or commercial (703)325-3411.

This system was designed to answer the most commonly asked questions about these topics. If you have questions concerning any of the above topics, please try the recorded information line first. Then, if you still have questions, call your assignment officer.

One important note: If you want to speak with your assignment officer after listening to one of the messages, or if you just want to listen to another message, press the star key (*) at the conclusion of the message to be returned to the main menu. This will allow you to make another selection, to include being transferred to your assignment officer.

Microfiche

The Military Acquisition Management Branch has indicated that PERSCOM recently began converting all OMPF microfiche to optical digital image files in the state-of-the-art Personnel Electronic Records Managements System (PERMS). If you recently received a copy of your OMPF fiche, you may have noticed that recent documents forwarded for filing did not appear on the fiche. This is because the master microfiche are not available for update during the conversion process. Conversion for active duty officers should be completed by March 1995. In the interim, promotion, command, and school selection boards are provided a copy of the existing microfiche plus any authorized hard copy performance documents received for filing which have not been added to the microfiche. Once PERMS is operational, a PERMS-generated OMPF microfiche will be forwarded to you to validate the accuracy. Since this product is the principal document in the selection board file, it is critical that the record is accurate and up to date.

To ensure that all active duty Army acquisition officers receive the above mentioned PERMS-generated microfiche, you should forward a completed DA Form 3955, Change of Address Card, with your work phone number to include commercial and DSN and home phone number, to your branch assignments officer. You must keep your mailing address and telephone numbers current at PERSCOM to ensure you receive the new microfiche and other important PERSCOM communications.

On The Horizon...

Single Functional Area

Based on LTG Forster's approval with the AAC Proponency Division's briefing in December 1994, the formal staffing to combine FA's 51, 53, and 97 into one functional area has begun. This change, if approved, will result in assignments, positions, certifications, etc. designated with a 51/A, C, R, S, T, V, X, or Z which is IAW with the acquisition career fields in DOD 5000.52-M and DODI 5000.58. The AR 611-101 NOFC combining of functional areas, which includes changing authorization documents, typically requires 18 months.

FY 96 Military Acquisition Position List (MAPL)

The FY 96 MAPL reviewed by the Council of Colonels during January 10-14, 1994, and subsequently approved by the DACM has been distributed to the field. The MAPL is the DACM's document for recognizing those positions requiring an acquisition officer, providing they are authorized on a TDA or MTOE. Additional copies of this document can be obtained via E-mail by contacting the appropriate proponency officer.

Correction

The "On the Horizon" article on page 57 of the January-February 1995 issue of *Army RD&A* contained several errors relative to the AAC Proponency Office E-mail addresses and phone/FAX numbers. The correct information is as follows:

FA 51 (LTC Mark W. Jones): JONESM@BELVOIR-AIM1.ARMY.MIL
FA 53 (LTC Earl Rasmussen): RASMUSSE@BELVOIR-AIM1.ARMY.MIL
FA 97 (MAJ Vicki Diego-Allard): DIEGOALV@BELVOIR-AIM1.ARMY.MIL

The phone numbers are: DSN 655-4059 or commercial (703) 805-4059. FAX numbers are: DSN 655-4163 or commercial (703) 805-4163. Provide your proponency officer with your address to receive up-to-date information on certification, Military Acquisition Position List (MAPL), Training With Industry, and other related topics.

From the Proponent FA 97... (Contracting and Industrial Management)

Numerous inquiries have been received regarding certification. The following is provided as a response:

Functional area certification is critical for career development. Certification requirements are outlined in DOD 5000.52M, *Acquisition Career Development Program,* dated January 1995. This manual applies to military members and civilian personnel who are in, or desire to be in the Army Acquisition Corps (AAC). All AAC personnel should be familiar with this manual.

AAC FA 97's who desire to compete for procurement command should be Level III certified in the contracts and industrial management career field, or capable of achieving Level III certifications within 18 months of assumption of command. Level III certification equates to the completion of seven mandatory courses and 48 months of contracting experience. Getting the requisite contracting "time" is the crux of certification at Level III. Specific Level III certification criteria are shown on the accompanying figure.

You will find your individual level of certification in the bottom right column of the officer record brief. Level of certification achieved will be annotated under "Title X/AAC Status," followed by the calculation date.

Level III certification is a key factor in command consideration as well as assignment to critical acquisition positions. Level III certification achievement should be a factor in your career development and assignment plans.

Any questions related to FA 97 career management policy matters can be directed to MAJ Vicki Diego-Allard on DSN 655-4059 or commercial (703) 805-4059.

Career Path
Contracting (including Construction)

Level/ Typical Grade	Typical Assignments	Experience[1]	Education	Training[3]
Level III GS/GM-13 and above O-4 and above	Procurement analyst Branch head Division director Director of contracts Supervisory contracting officer	**Mandatory:** Four cumulative years contracting experience **Desired:** An additional four years of contracting experience	**Mandatory:** (1) Baccalaureate degree; or (2) at least 24 semester credit hours from among the following disciplines: accounting, business finance, law, contracts, purchasing, economics, industrial management, marketing, quantitative methods, organization and management; or (3) pass equivalency exam(s); or (4) have at least 10 years acquisition experience as of 01 Oct 91[2] **Desired:** Master's degree in business administration or procurement	**Mandatory:** One advanced (Level III) DAU course in executive contracting **Mandatory:** One advanced (Level III) DAU course in primary contract orientation (pre-award, post-award, or cost and price analysis) **Mandatory (Assignment Specific):**[4] One advanced (Level III) DAU course in systems acquisition contracting **Desired:** Two weeks management and leadership training

[1] A General/Flag officer or SES must have at least 10 years experience in acquisition positions. At least 4 years of this experience must have been performed while assigned to a critical acquisition position.

[2] See Appendix K for specific requirements for acquisition corps and critical acquisition position criteria. Credit by examination is directed by 10 U.S.C. 1724 and covered in DoD Instruction 5000.58.

[3] Refer to the current edition of the *Defense Acquisition University Catalog* for a list of mandatory and desired courses and approved equivalenices that can be used to meet the training standards for this career field.

[4] This course is mandatory for contracting personnel assigned to major programs (but not required for certification). Refer to the current edition of the *Defense Acquisition University Catalog* for Level III Contracting.

Career Path Note: Critical acquisition positions may only be filled by members of an Acquisition Corps.

CAREER DEVELOPMENT UPDATE

NOTICE FOR ARMY ACQUISITION CORPS CIVILIANS

If you are a member of the Army Acquisition Corps (AAC) and now receive *Army RD&A* at your home address, you *must* notify the Total Army Personnel Command if you change your address. Address changes may be mailed to Joe Kunze at Commander, U.S. Total Army Personnel Command, ATTN: TAPC-OPB-B (Mr. Joe Kunze), 200 Stovall Street, Alexandria, VA 22332-0411. Address changes may also be faxed to Joe Kunze at DSN 221-8111 or commercial (703)325-8111. Please send your E-Mail address to (TAPCOPBB@Hoffman-emh1.army.mil).

37 Graduate From MAM

On Dec. 9, 1994, 37 students graduated from the Materiel Acquisition Management (MAM) Course at the U.S. Army Logistics Management College, Fort Lee, VA. Research and development, testing, contracting, requirements generation, logistics and production management are examples of the materiel acquisition work assignments being offered to these graduates.

LTG William H. Forster, director, Army Acquisition Corps, addresses MAM graduation late last year.

LTG William Forster, director, Army Acquisition Corps, gave the graduation address and presented diplomas. The Distinguished Graduate award was presented to CPT Martin Mansir, Theater High Altitude Area Air Defense Project Office, Huntsville, AL.

The eight-week MAM Course provides a broad knowledge of the materiel acquisition function. It covers national policies and objectives that shape the acquisition process and the implementation of these policies and objectives by the U.S. Army. Areas studied 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.

PERSONNEL

Glisson Heads Soldier Systems Command

BG Henry Thomas Glisson has assumed command of the Army Materiel Command's new Soldier Systems Command, which was provisionally activated in November 1994. He served formerly as commander of the Defense Personnel Support Center, Defense Logistics Agency.

Backed by more than 28 years of active service, Glisson has also served as executive officer and special assistant to the deputy chief of staff for logistics and deputy director, Directorate for Plans and Operations, Office of the Deputy Chief of Staff for Logistics, Department of the Army, Washington, DC; and commander, Division Support Command, 4th Infantry Division, Fort Carson, CO.

Glisson holds a master's degree in education from Pepperdine University in California and a bachelor's degree in psychology from North Georgia College. He received his commission as a second lieutenant in the U.S. Army Quartermaster Corps in September 1966 through the Reserve Officer Training Corps. In 1967, he was selected as a Regular Army Officer. His military education includes the Quartermaster Officer Basic and Advanced Courses, the Command and General Staff College, and the Army War College.

Glisson's military decorations include the Defense Superior Service Medal, the Legion of Merit with four oak leaf clusters (OLC), the Bronze Star Medal with "V" Device and one OLC, the Purple Heart, the Meritorious Service Medal with four OLC, the Army Commendation Medal, the Air Medal, the Combat Infantryman Badge, the Parachutist Badge, the Parachute Rigger Badge, and the Army Staff Identification Badge.

RD&A NEWS BRIEFS

TARDEC Signs MOA With CASCOM

The U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC), Warren, MI, has entered into a partnership agreement with the U.S. Army Combined Arms Support Command (CASCOM), Fort Lee, VA, to focus on combat service support (CSS) issues facing both organizations.

The memorandum of agreement (MOA), signed last year by TARDEC Director Wayne K. Wheelock and CASCOM's Technical Director Clayton R. Lee, is the first of its kind between CASCOM and an RD&E center. The MOA defines agreements and clarifies methods of doing business between CASCOM and TARDEC.

TARDEC is the nation's laboratory for advanced automotive technology. Its mission is to conduct research, development and engineering work to achieve global technological superiority in military ground vehicles. It is also charged with stimulating the transition to a growing, integrated national industrial capability which provides the most advanced, affordable military systems and the most competitive commercial products. More than 1,200 TARDEC associates design and develop vehicles for all U.S. Armed Forces, many federal agencies, and more than 60 foreign countries.

According to Marcia Erickson and CPT Chris Oliver, TARDEC's liaison officers to CASCOM and the Combat Service Support Battle Lab at Fort Lee, VA, CASCOM initiated the agreement, which was developed in an interactive process that lasted only three months.

The agreement states that TARDEC and CASCOM's Modernization and Technology Directorate will jointly provide matrix support on specific projects with CSS logistic implications to both communities. "That means that we get the right people in touch with one another," Oliver explained.

CASCOM, through its Modernization and Technology Directorate's Technology Modernization Division, will centrally coordinate all pertinent programs and issues between CASCOM and TARDEC; provide technology objectives and priorities based on operational capability requirements and lessons learned from fielded systems; and represent CSS interests in evaluating government/industry dual-use technology proposals under the purview of the Technology Reinvestment Program.

Additionally, it will represent the proponent in development and prioritization of user needs for logistics advanced technology demonstrations, science and technology objectives, and technology management decision execution packages; and periodically conduct science and technology reviews of user needs and technology work efforts.

TARDEC's Emerging Systems Division will maintain a dedicated CSS Liaison Team to coordinate all germane programs and issues between CASCOM and TARDEC, as well as coordinate TARDEC CSS issues with other TRADOC Battle Labs when appropriate. The CSS liaison team will work with CASCOM to understand mobility and technology needs as they relate to the CSS Operational Capability Requirements and establish and maintain an information exchange with CASCOM on potential technology opportunities to enhance CSS mobility.

"This agreement represents a very positive step toward establishing a closer working relationship with CASCOM," said LTC William Whitesel, chief of TARDEC's Emerging Systems Division. "It facilitates communication between the two organizations, and established common areas of support and mutually beneficial methods of doing business. This is the latest in a series of steps we are trying at TARDEC to ensure the CSS piece of the equation gets the full consideration it deserves early in the R&D process," Whitesel added.

The preceding article was written by Rae A. Higgins and Angela Penick. Higgins is a publicist assigned to the U.S. Army Tank-Automotive Research, Development and Engineering Center's Customer Relations Office. Penick is a marketing co-op with TARDEC. She is currently in her fourth year at Wayne State University, Detroit, MI, where she is pursuing a bachelor's degree in marketing.

Army Automatic Identification Technology Program

The Army's Automatic Identification Technology (AIT) Program is in high gear. The Army product manager for AIT, in cooperation with the DOD community, has awarded an eagerly awaited AIT contract. This multifaceted contract for joint Service and other government agency use was awarded to Intermec Corporation of Everett, WA. Though the contract was subjected to protest, a decision to overrule in favor of the government was made last year. That ruling cleared the way for exciting, innovative and much needed technologies to enter the DOD and government arena.

Though the contract combines the requirements of three separate contracts and is a successor to the existing logistics applications of Automated Marking and Reading Symbols Program, the latest in microcircuit technology in logistics applications (MITLA) equipment have also been included. With a potential contract worth approximately $250 million, Intermec Corporation is now tasked with providing the next generation of vital AIT equipment and services to potential users.

With the Army leading the way, requirements were identified and pursued, challenges were met and overcome, and goals were set and achieved. Sound management, concentrated effort, meticulous attention to detail, and joint Service cooperation paid off handsomely in the attainment of what is expected to be a very technically advanced, beneficial and rewarding contract. This contract allows for a commercial off-the-shelf, multi-service and government agencies buy of source data collection and peripheral equipment including LOGMARS and MITLA hardware, software, and services already developed and successfully used in private industry.

This wide array of equipment includes portable and fixed data collection terminals; bar code scanners, wands, slot scanners, and wedges; voice recognition devices; magnetic stripe encoders and readers; printers (laser, thermal/thermal transfer); communications devices (modems, wire and radio frequency networks); and storage devices (memory, laser, integrated circuit cards together with their associated readers/writers). This assortment of equipment will provide a common baseline of bar code and microcircuit devices for both tactical and non-tactical applications throughout DOD, Coast Guard and other federal agencies. A wide variety of software will be provided to include equipment operating systems, bar code label and form generation, bar code application generation and compiler languages. The Services' portion of the contract will provide for maintenance, training, technical engineering services, installation, and translation of small applications for use with existing bar code systems and development of applications.

This valuable and ambitious effort is led by LTC Aaron R. Andrews, product manager, automatic identification technology, Tactical Army Management Information Systems (TACMIS), U.S. Army. Overseeing the program are COL Charles Mudd, program manager, TACMIS and Charles L. Austin, program executive officer, Standard Army Management Information Systems.

TARDEC Eyes Composites For Expanded Combat Vehicle Role

Army researchers and United Defense Limited Partnership (formerly FMC and BMY corporations) have teamed up to develop a composite research vehicle to demonstrate the weight-saving potential of fiberglass-reinforced plastic composites in combat vehicle structures.

The aim of the program is to demonstrate a 33-percent weight savings in the structure and armor of a combat vehicle over a comparable metal vehicle. Such a reduction would cut the gross vehicle weight by about 10 percent.

The feasibility of composites in a primary combat vehicle structure has not been demonstrated to date. But the current emphasis on downsizing the military has led to a requirement for a smaller Army capable of more rapid worldwide deployment, creating a need for lighter-weight, lethal, and survivable vehicles.

Responding to this need, the U.S. Army Tank-Automotive Research, Development and Engineering Center (TARDEC) initiated a two-phase program in 1992 to determine if lightweight organic composites could be used in lieu of conventional metals to cut vehicle weight.

Phase I, which has already been completed, consisted of a preliminary design concept study conducted by General Dynamics Land Systems and FMC. The study included an investigation of various design and composite material possibilities, a trade-off analysis to identify their strengths and weaknesses, and initial assessments of associated issues such as manufacturing, cost, and durability.

Phase II began in December 1993, when TARDEC awarded United Defense a $53.7 million, 57-month contract for in-depth development of design alternatives, materials testing and the construction and testing of the research vehicle.

Known as the Composite Armored Vehicle Advanced Technology Demonstrator (CAV ATD), it will have a maximum projected weight of 22 tons. That is about 10 tons less than the M2/M3 Bradley Fighting Vehicle, and falls within the C-130 cargo plane roll-on/roll-off weight requirement.

The CAV ATD will consist of three main parts: an upper hull, a lower hull and a two-man crew capsule. The upper hull will be a sandwich structure consisting of alumina (aluminum oxide) armor ballistic tiles between layers of fiberglass-reinforced epoxy.

CAV will demonstrate a lightweight, survivable and deployable composite structure.

The lower hull and crew capsule will be homogeneous structures. The lower hull will use a combination of fiberglass and a thermoplastic called polyphenylene sulfide, while the crew capsule will be made of fiberglass and epoxy. For added protection, the crew capsule will also feature bolt-on modular armor.

The vehicle will have no turret or fire-control system but will carry a force generator on a base plate atop the upper hull. The purpose of the force generator will be to demonstrate that the structural composite materials can withstand gun-firing loads and shock during test-firing.

The CAV ATD will use a 6V92TA Detroit Diesel engine and the M2/M3 Bradley vehicle transmission. It will also incorporate the T-150 track used on the Armored Gun System and a Cadillac Gage-built hydropneumatic suspension system.

"The key thing that needs to be emphasized," said TARDEC's Jeffrey P. Carie, CAV contractor's technical representative, "is that this vehicle is non-mission-specific. That's why we don't have a turret, fire control, elaborate communication system or other onboard equipment to speak of.

"The only controls that we have are automotive controls," he added. "We did this to keep the costs of the program down and keep the program emphasis solely on composite materials."

Under terms of the CAV ATD contract, United Defense will prepare a Composite Structures Design Guide that will document the entire design process for the vehicle. "We hope this will serve as a guide for future vehicle developers who may want to use this technology in a future developmental program," Carie said.

According to Carie, the CAV ATD is expected to be completed in October 1996, at which time it will undergo two months of gun-firing tests at Camp Roberts, CA. From there, it will go to Aberdeen Proving Ground, MD, for a year of survivability and endurance tests that will include 6,000 miles of operation on surfaces ranging from paved highway to cross-country.

Carie pointed out that, although the major emphasis of the CAV ATD program is to determine the structural viability of composite materials in combat roles, the program will also include several projects aimed at addressing other important issues. He said one of these will involve building a ballistic test hull for use in gunfire tests that will allow engineers to validate the ballistic requirements and study the effects of ballistic shock on composite materials.

"We've got a pretty good handle on how metal vehicles respond to ballistic shock," said Carie, "but we've got a data void with composites. In theory, composites may prove better because of lower stiffness values, but component attachment methods are a question."

Carie added that following completion of the ballistic evaluation, the test hull will be used to demonstrate composite material repair procedures being developed in the program for use in the field and in depots.

Noting other program efforts, he said United Defense will be conducting an analysis of the CAV ATD design approach to determine the feasibility of using it in a vehicle weighing as much as 50 tons and as little as eight tons. He also said United Defense will be providing TARDEC with detailed concept drawings showing the structural modifications that would be needed to produce squad carrier and mortar carrier versions for possible use in future research.

The preceding article was written by George Taylor, who formerly served as a technical publications writer and editor at the U.S. Army Tank-Automotive Research, Development and Engineering Center.

RD&A NEWS BRIEFS

Natick Awards GEN II Soldier System Contract

The U.S. Army Natick Research, Development and Engineering Center, Natick, MA, has awarded a $44 million system contract for the development of the Generation II (GEN II) Soldier System to the Motorola Government and Systems Technology Group, Scottsdale, AZ. This award represents a key milestone in soldier system research and development.

For the first time, the Army will use a single system contract for the development of a soldier system in a manner similar to the development of other major systems and weapons platforms. Motorola, as the GEN II primary contractor for the 56-month, five-phased contract, has teamed with Honeywell, Hughes, Arthur D. Little, Battelle and Gentex.

The GEN II advanced technology demonstration is the core and integrating effort of the 21st Century Land Warrior (21CLW) Top Level Demo. The 21CLW will be the individual combatant's link into the digitized force of the future, resulting in enhanced survivability, situational awareness and lethality at both the individual and unit level, and will significantly enhance force effectiveness due primarily to the digital link.

GEN II will develop and demonstrate integrated headgear, individual soldier computer and radio, weapons interface, and protective and microclimate cooling subsystems. GEN II subsystems will integrate and/or interface with new infantry weapons and target acquisition and hand-off systems, combat identification and personnel status monitoring. The GEN II computer and radio will use the Army's emerging command, control, communications, computers, and intelligence technical architecture for compatibility with the digital command and control network.

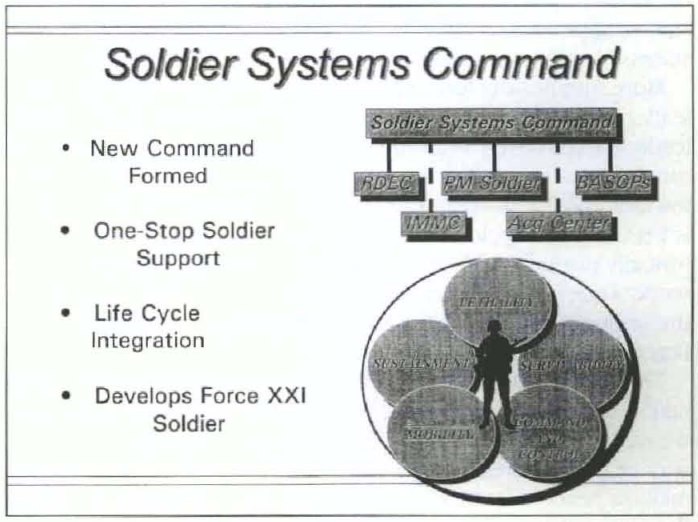
Army Activates Soldier Systems Command

With an eye toward the future, the Army recently activated the U.S. Army Soldier Systems Command at the U.S. Army Natick Research, Development and Engineering (RDE) Center in Natick, MA. The new command, under the leadership of BG Henry T. Glisson, former commander of the Defense Personnel Support Center, will provide research, development, engineering, and acquisition support for everything the soldier wears, carries, or consumes.

The U.S. Army Soldier Systems Command will support the Army chief of staff's vision for the 21st century fighting force by modernizing the soldier as a total system by ensuring all aspects of the system are integrated to achieve a balance among the soldier's warfighting capabilities, to include lethality, mobility, sustainability, survivability, and command and control.

The U.S. Army Soldier Systems Command has been established provisionally until final approval and incorporates personnel from the Natick RDE Center; the Project Manager Office, Soldier at Fort Belvoir, VA; and the Philadelphia Clothing and Textile Branch of the U.S. Army Aviation and Troop Command (ATCOM). Additionally, some acquisition and materiel management support will be provided on a matrix basis from ATCOM in St. Louis. These geographically-separated organizations will now have their functions managed by a single command—giving one stop support for soldier systems. It is a cost-effective, long-term solution to take full advantage of rapid technological advancements.

Upon assumption of the new command, Glisson remarked, "We're ready to grow and we're going to grow. I can't think of any more important business than the business of taking care of soldiers."



CONFERENCES

Upcoming Conferences

• The 49th meeting of the Society for Machinery Failure Prevention Technology will be held April 18-20, 1995 in Virginia Beach, VA. The theme is "life extension of aging machinery and structures." Organized and managed by the Vibration Institute, the meeting will feature topics such as diagnostics, failure analysis, life extension, sensors technology, time frequency analysis, and detection, monitoring and response. For additional information, contact Marc Pepi, exhibits chairman, U.S. Army Research Laboratory, AMSRL-MA-CB-292, 405 Arsenal Street, Watertown, MA 02172-0001; Phone (617) 923-5334; or Sallie C. Pusey, registration chairman, 4193 Sudley Road, Haymarket, VA 22069-2420; phone (703) 754-2234.

• The 1995 Institute of Electrical and Electronics Engineers Inc. (IEEE) International Frequency Control Symposium will be held May 31-June 2, in San Francisco, CA. Sponsored by IEEE, the symposium will address recent progress in research, development and applications related to frequency control and precision timekeeping. For additional information, contact Michael R. Mirarchi, Synergistic Management Inc., 3100 Route 138, Wall Township, NJ 07719; phone (908) 280-2024.

War and Anti-War: Survival at the Dawn Of the 21st Century

By Alvin and Heidi Toffler
Little Brown and Company
Boston, 1993

Reviewed by LTC R. Mark Brown, procurement program analyst, Directorate of Program Analysis and Evaluation, Office of the Chief of Staff, Army

The Tofflers' most recent work is must reading for every member of the Acquisition Corps and for every Army officer. The latest work by the prolific futurists, whose other works include: *Future Shock, The Third Wave,* and *Powershift,* is focused on a vision of what military technology and the resultant tactics, operational art, and strategy will be like during the third wave. The book concludes with an in-depth analysis of the implications for the nation's political leadership and diplomatic community with some suggestions on "how to" wage peace, because as Clausewitz states, "...war is an extension of politics by other means..."

More significantly for Acquisition Corps members and all Army leaders is that this work is one of two thrusts the senior Army leadership has used as an intellectual underpinning for the continuous creation and recreation of the future Army as we drive towards Force XXI—the Army of the 21st Century. The other thrust is breaking the cycle of readiness and un-readiness that has historically plagued the U.S. Army as described in Heller and Stofft's work, *America's First Battles: 1776-1965.* The Toffler's book aids the understanding of the road we are already traveling towards Force XXI.

The authors' thesis is that mankind makes war the way mankind makes wealth and that we are entering the third wave in the way we make wealth. The impact is that since we are entering a new way of making wealth, and war, we must create a new way of making peace. Mankind's failure to do so will lead us to suffer the same catastrophic outcomes that resulted from our previous failures to create peacemaking strategies that coped with our past war making capabilities.

The technological first wave of mankind was agrarian. Likewise, mankind made war in an agrarian fashion with forged hand tools and implements such as horses, spears and swords. The second technological wave of mankind was the industrial revolution. During this period mankind has made war in an industrial fashion, complete with mechanized warfare and mass destruction. The ultimate weapon of this wave is nuclear weapons. Industrial age war is epitomized by the mass destruction and casualties of the American Civil War, and the two World Wars. We are now entering the third wave, the information age, which will bring changes in warfare no less pivotal than those seen between the agrarian age and the industrial age. The authors point out that there is not a discreet dividing line between the ages, but that we are likely to witness a blurring of the ages, with each succeeding conflict becoming more and more information-based.

The Gulf War was the first war of the information age, but was a hybrid war, still displaying characteristics of the industrial age. There were the simultaneous characteristics of both ages with "smart bombs" flying down ventilation shafts of buildings while B-52s were carpet bombing Iraqi troops. Future wars will be less industrial age and more information age-based. Characteristics of the future wars will include non-lethal weaponry, robots with intelligence, real-time situational awareness, de-massification, systems integration, non-governmental and transnational organizations, among others. Through it all, warfare will be more precise, decision cycles will be further compressed, and high-technology will be powerful, plentiful, cheap and widely proliferated. The old paradigm of one state interaction with another from a position of strength or weakness may not apply.

The highly recommended book is an excellent read and is quite fascinating. The authors use well-known historical examples, current events, and predictions weaving them into a book that is hard to put down. The authors are impressed with the U.S. Army as a learning organization, demonstrated by the ability to transform itself from the post-Viet Nam force into the force that won Desert Storm. They express optimism that the Army will continue to learn and transform, while expressing pessimism that the political leadership may not. The Tofflers provide "food for thought" as we continue our journey towards Force XXI. For acquisition professionals, the book highlights challenges associated with harnessing the benefits of powerful, plentiful, cheap, and widely-available technologies to modernize the Force XXI Army, with an acquisition cycle that turns much slower than the development and production cycle that is spinning out those technologies. This phenomenon causes the need for the acquisition reform and TDA re-engineering axes of the Army Force XXI Campaign Plan. It will demand our attention for years to come.

Six Reports Offer New Technologies

The following six recently published reports describe ongoing studies in the Repair, Evaluation, Maintenance, and Rehabilitation (REMR) Research Program. The REMR Program was initiated in 1984 to develop more efficient and cost-effective methods for repairing water resources projects. These projects include the numerous hydraulic structures on inland waterways which the Corps of Engineers has been responsible for maintaining for many years. These reports are now available and may be obtained by writing to: Director, U.S. Army Waterways Experiment Station, ATTN: CEWES-SC-A/Technology Transfer Specialist, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199, or by calling Ms. Lee Byrne at (601)634-2587.

Overlays on Horizontal Concrete Surfaces: Case Histories
Technical Report REMR-CS-42 (1994)
By R. L. Campbell Sr.
U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS

BOOKS

This study documents the current practices for overlaying horizontal concrete surfaces as a first phase in the development of performance criteria for concrete overlays. The case histories presented are typically for overlays completed within the last 10 years and located at Corps of Engineers civil works projects. Overlays documented in the report include bonded conventional, low-slump, fly-ash, silica-fume, polymer-modified, and fiber-reinforced concretes. Unbonded overlays are also described.

Structural Evaluation of Riveted Spillway Gates Technical Report REMR-CS-43 (1994)
By J.E. Bower, M.R. Kaczinski, M. Zouzhang, Y. Zhou, J.D. Wood, and B.T. Yen
U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS

Guidelines are presented for structural inspection and evaluation of riveted spillway gates. An overview of the structural systems of most common types of spillway gates is provided along with an identification of critical areas that may be subject to degradation from corrosion and/or fatigue damage for each type of gate. Observations from site inspections at four locks and dams are included.

Field Testing and Structural Analysis of Vertical Lift Lock Gates Technical Report REMR-CS-44 (1994)
By B.C. Commander, J.S. Schultz, G.G. Goble, and C.P. Chasten
U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS

The objective of this study was to measure the behavior of vertical lift lock gates experimentally and to develop modeling and analysis procedures for the evaluation of existing gates and design of new gates. Lift gates at Mississippi River Lock 27 and Locks and Dam 26 were investigated. The gates were instrumented and tested under various loading conditions, and analytical models were developed to simulate structural response of each.

Detection of Structural Damage on Miter Gates Technical Report REMR-CS-45 (1994)
By B.C. Commander, J.S. Schulz, G.G. Goble, and C.P. Chasten
U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS

The primary goal of this study was to develop structural evaluation tools that can be used to assess the current condition of aging steel lock gates. An integrated experimental and analytical system is evaluated to determine if such a system could be used in identifying existing structural damage on the basis of comparing measured and calculated strain data without having information from prior detailed structural inspections. The integrated system proved to be valuable in both damage detection and assessment.

REMR Management Systems—Navigation Structures; Condition Rating Procedures for Tainter and Butterfly Valves Technical Report REMR-OM-14 (1994)
By L. Greimann, J. Stecker, and J. Veenstra
U.S. Army Construction Engineering Research Laboratories, Champaign, IL

This report presents the development of condition rating procedures for tainter and butterfly filling and emptying valves for navigation lock structures. Several site visits and field investigations were conducted. Experts from the U.S. Army Corps of Engineers were asked to rate the valves, and the results were compared to a preliminary version of the rating system. Modifications were made to reflect the experts' opinions more accurately.

REMR Management Systems—Navigation Structures, User's Manual for Inspection and Rating Software, Version 2.0 Technical Report REMR-OM-15 (1994)
By L. Greimann, J. Stecker, K. Rens, and M. Nop
U.S. Army Construction Engineering Research Laboratories, Champaign, IL

A primary goal of the REMR Research Program is to provide procedures for performing condition surveys, consistent and quantitative condition assessments, and database management that can help managers perform efficient maintenance and repair planning. Collectively, these procedures are called the REMR management systems. This user's manual describes how to use the software associated with the REMR management systems for miter lock gates, emptying and filling valves, sector gates, and steel sheet pile.

Book Reviews

If you have read a book which you feel may be of special interest to the RD&A community, please contact us. The editorial staff welcomes your literary recommendations. Book reviews should be no longer than two double-spaced typed pages. In addition, please note the complete title of the book, the author's name, and your name, address and commercial and DSN phone numbers. Submit book reviews to:

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LETTERS

Dear Sir:

Please allow me to propose a suggestion that may enhance your already excellent journal. I would like to see a "Letters to the Editor" section. The very nature of *Army RDA* compels us to be on the edge of innovativeness. This requires not just the postulation of future direction by your very competent authors and the passive acquiescence by your readers, but also an opportunity by others to confirm or test these articles' validity with either experiences or alternative hypothesis. Without such dialogue and resolution, well-intended thoughts, particularly when presented by senior leaders, tend to prematurely become dogma. AUSA's *Army* magazine uses a "letters" section most effectively to this purpose and may be the most consistently read section of that fine journal.

Sincerely,
Richard T. Bulova

Army RD&A Response:

Army RD&A has, since its inception in 1960, always encouraged feedback from its readers. In fact, a section devoted exclusively to "Letters" was formally established more than six years ago. Despite this—and other repeated appeals for reader feedback—the editorial office continues to be an infrequent recipient of letters. Like yourself, the editorial staff is open-minded and remains committed to alternative hypotheses.

Harvey L. Bleicher
Editor-in-Chief

Commercial or Military Specifications? Trade-offs That Make a Difference

The Debate

The debate is on regarding the use of commercial components in military systems. On the one hand, it is argued that commercial components will reduce cost and increase availability. Critics point out that military needs are unique, commercial products are not produced to meet military requirements, and the use of multiple, uncontrolled, commercial products will create logistics nightmares. Indeed, both sides of the argument have strong points. In the end the final decision to use commercial or military specifications can not be a broad dictum either way, rather, it must depend on a review of the specifics of the product and the system that it is a part of.

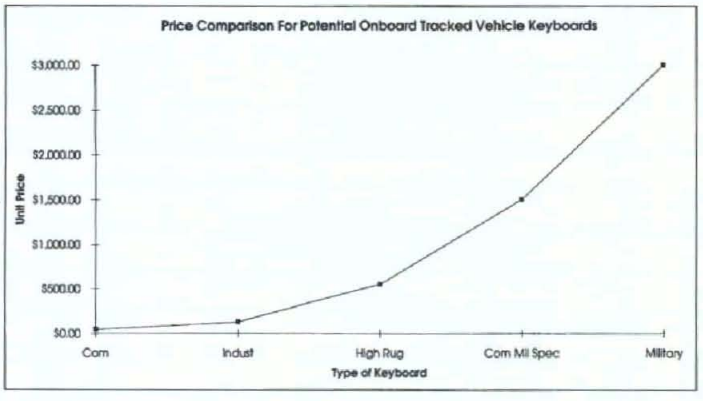

Figure 1.

Cost Savings

How much money can be saved by using commercial parts? Most discussions simply grant that a large but unquantified sum could be saved. However, to have an effective discussion, real costs should be considered. Recently, a study was performed which considered various types of computer keyboards for use on tracked military vehicles. The results, illustrated in Figure 1, show that the cost of a full military specification keyboard is 68 times the price of a normal keyboard used with a desktop PC. In between are various categories of keyboards with corresponding price differences: an industrial keyboard used on a shop floor, a highly ruggidized commercial keyboard for use in very harsh environments, and a commercialized version of a military design where commercial parts are substituted for their military specification equivalents.

Choices

What is the right choice? That depends on the requirements. For instance, will the keyboard on your desk withstand being sprayed down with a jet stream of high pressure water? Can it be occasionally stepped on with a combat boot and still function? This is the environment for a component on board a tracked vehicle. Likewise vehicle designers should ask themselves what can be done to design a system so that commercial components might survive. Perhaps for keyboards, covers could be designed to put on during washing, or the keyboard could be placed in a location where it would not be used as a step. Chances are that with some consideration of both specifications and integration, keyboards in between a pure commercial and pure military specification could be utilized.

Responsibility

Who is responsible for carrying out this analysis? First and foremost senior leadership of an organization must set a policy which requires and supports a trade-off analysis of commercial versus military specifications. With support, the actual buyer, purchasing agent or acquisition officer should be responsible for insuring the trade-off is performed, because ultimately it is his or her job to obtain the best total value.

More Information is Needed

As the debate continues about the feasibility of using commercial components on military systems, more specific examples of the actual price differences between choices must be put forward. By considering these examples, senior leadership and procurement professionals will be better able to develop a true sense of the potential benefits and concerns of utilizing commercial or military parts or systems. With this improved understanding it will become increasingly possible to satisfy what should not be conflicting goals of obtaining components and systems that meet soldiers' needs, at a reasonable price.

William J. Kohnen
Purchasing Agent
United Defense L.P.
Santa Clara, CA

ARMY
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WRITER'S GUIDELINES

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LENGTH OF ARTICLES: Articles should be approximately 1,500 to 1,800 words in length. This equates to 8-9 double-spaced typed pages, using a 20-line page.

PHOTOS: Include any photographs or illustrations which complement the article. Black and white or color are acceptable. 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.

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