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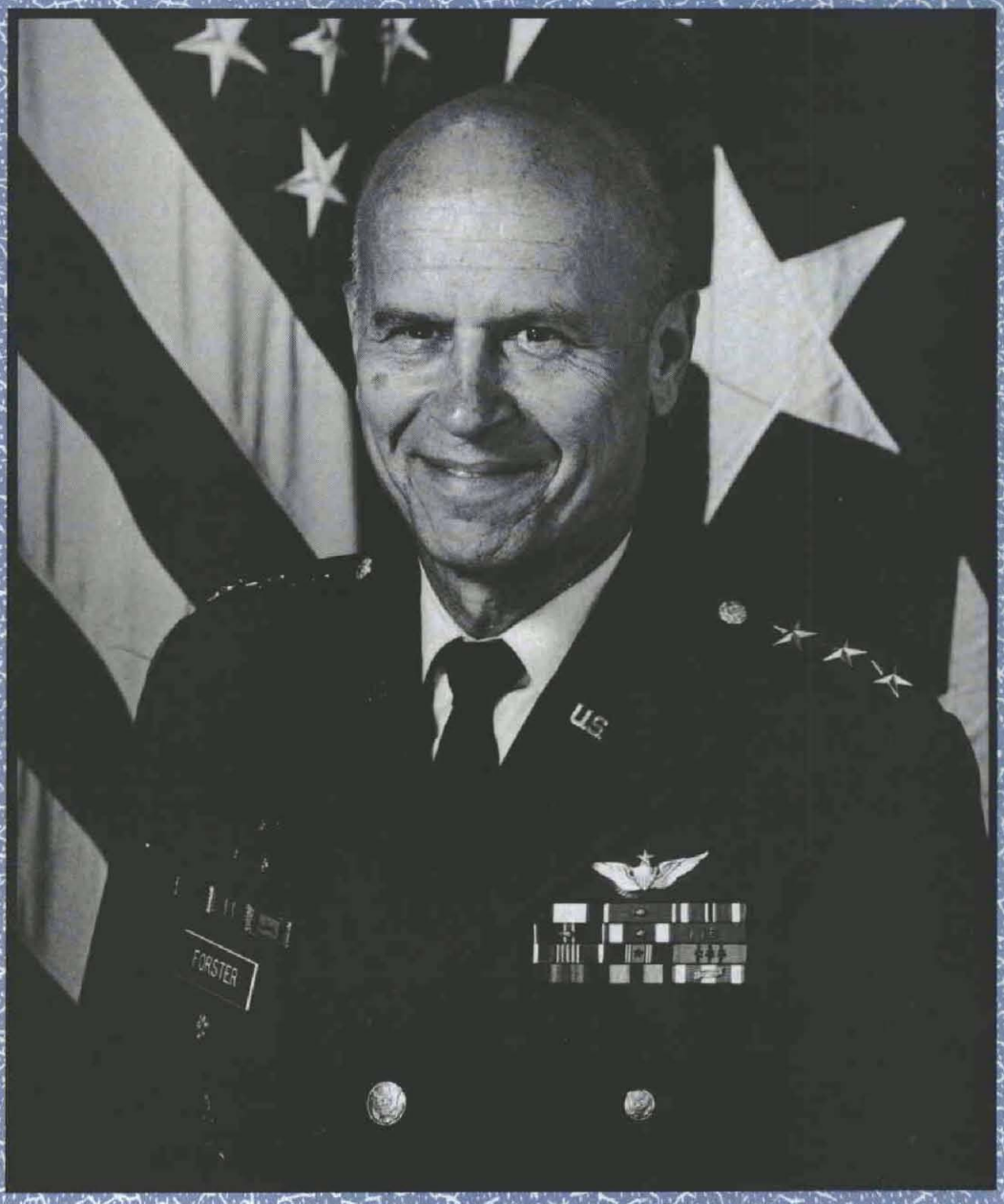
ARMY RD&A BULLETIN

SEPTEMBER - OCTOBER 1993

SPEAKING WITH THE DIRECTOR OF THE ARMY ACQUISITION CORPS

an exclusive interview



LTG WILLIAM H. FORSTER

special acquisition corps issue

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Research Development Acquisition ARMY RD&A BULLETIN

Professional Bulletin of the RD&A Community

FEATURES

Acquisition Special

DEPARTMENTS

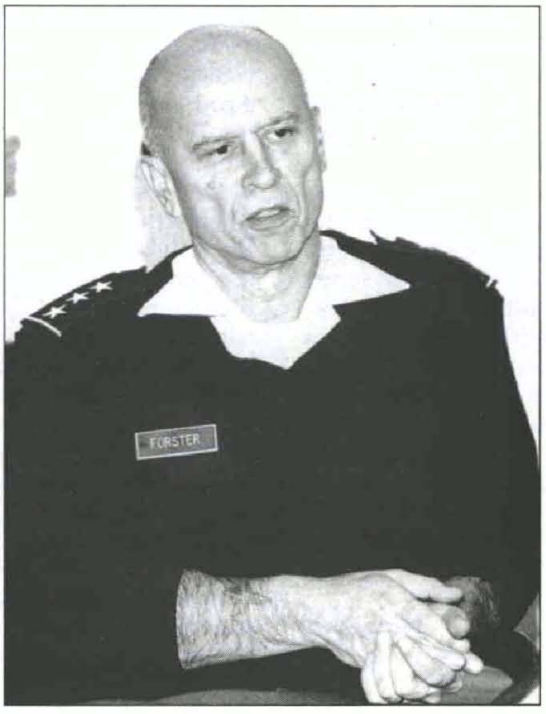
COVER

This special issue on the Army Acquisition Corps (AAC) features an exclusive interview with AAC Director LTG William H. Forster. Other articles include a report on a recent Army Acquisition Conference and TRADOC's role in developing future AAC officers.

INTERVIEW WITH LTG WILLIAM H. FORSTER DIRECTOR OF THE ARMY ACQUISITION CORPS AND MILITARY DEPUTY TO THE ASSISTANT SECRETARY OF THE ARMY (RDA)

Q. How would you describe your management philosophy?

A. I was once accused of managing by tool kit—implying that I didn't have a management philosophy but just dug into a tool kit and picked out the philosophy that seemed to apply at the time. I thought that was a little unkind because I really do try to manage by objective and maintain this as my overall philosophy. However, I do realize that in some cases, management by objective doesn't always work. It then becomes necessary to look at other types of management philosophies and try to work within the context of the problem and the circumstances in which you find yourself. However, I much prefer to set goals and objectives and have the middle managers, the PMs and the PEOs work on their own with minimal supervision to achieve those goals and objectives.



Q. What is your role as the Army's director of the Acquisition Corps?

A. There are several different aspects to this. One is to be the advocate for the members of Acquisition Corps—to be their point of contact in Washington, representing their interests in the personnel management arena—both civilian and military personnel—and to be their representative in dealing with the Office of the Secretary of Defense on acquisition personnel issues. I also see my role as the overall coordinator and spokesman for the Acquisition Corps. Another aspect of my role is to manage our involvement in the Acquisition Workforce Improvement Program to insure that there are adequate educational and advancement opportunities available, and that we put qualified people in the right jobs.

We must also make sure that we don't expect people to do more than they were trained for and that training, educational, and experience opportunities are available to everyone early on in their career so they are qualified and competitive in the acquisition functions. This applies to both military and civilian personnel.

So, with regard to my role, I am certainly a proponent for the Acquisition Corps and for every member in it. As such, I speak out for them and I need to try to help them become as qualified as possible for the critical acquisition jobs of the future.

Q. You just mentioned training and education. How important is this in the career development of Acquisition Corps members?

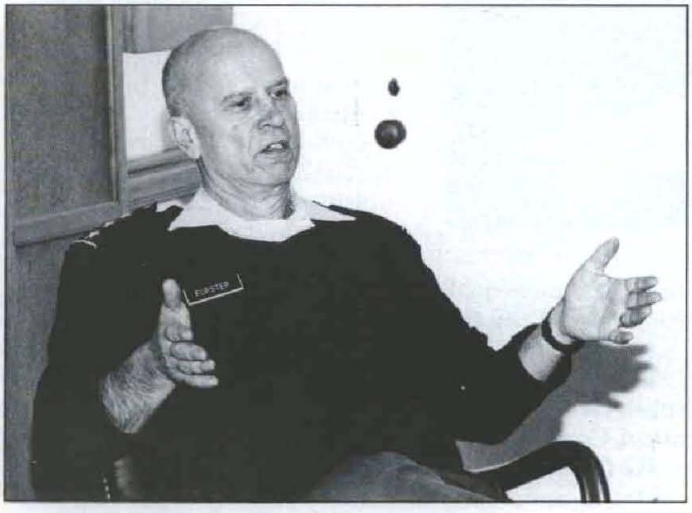
A. It's absolutely critical because you don't walk into a critical acquisition position and learn on the job on a billion dollar a year cost-plus contract. We can't afford to do

that. That's like teaching yourself to fly. The other reason training and education is so critical is that it is required by law. You simply cannot get to the premier assignments unless you have achieved the requisite level of education, training and experience. This is not something we throw out there to an individual and say "it's your problem." We have to make funds available and provide the time for them to train. Education issues, particularly for civilian employees, are tough because of the long-term training requirements and the time away from their families. These are things that those of us in uniform take for granted, but are very tough for people who elected to leave the service and become DA civilian employees. This is not an easy thing to deal with for many of them. However, we have to be very honest and explain what the requirements are for the advanced jobs, for the promotions, and for the interesting jobs and make the opportunities available and encourage people to take advantage of them. When we do this, the people who put the time and effort in to develop their skills will get the good jobs.

Q. How will the DOD drawdown impact the Army's ability to attract quality applicants for the Army Acquisition Corps?

A. It's difficult to give a definitive answer to that at this particular time because we are just now starting the Acquisition Corps during a drawdown period. So, we really don't have a baseline to compare it to. The drawdown will not reduce the quality of people we attract into the Acquisition Corps at all. In looking at the results of recent promotion boards and other selection boards, people will realize that Acquisition Corps personnel are doing very, very well— better than on the average. People will view this as an opportunity for the future. Subsequently, I believe we will attract even higher quality people—both military and civilian.

The question is how do we replace a person who had expended the effort to become qualified, who went to graduate school and got an advanced degree, and who was working in a program office? We have to go out and look for someone who is as qualified as that person for that particular job, or look for someone who has the potential to become that good. So the educational opportunities—along with the challenging assignments and the fact that modernization isn't going to go away—make this a very attractive career field.



Q. Could you cite some of the important factors a newly accessed member of the Acquisition Corps should keep in mind when planning for their career development?

A. I think the most important thing is individual commitment to the acquisition career field. Acquisition is hard work. I thought that being a project manager of a system in development was as tough a job as I would ever want until I became a program manager of a system involved in fielding. I found out that was just as hard. Then, I became a PEO and that was an even tougher job. So, this is no place for lightweights—either for people looking for 40 hours a week or for people looking to just skim by. A person's name goes on the dotted line just about every day when they are in the acquisition field. They have to be committed to excellence if they want to be successful. They also have to realize that things change and what was learned at DSMC in 1982 is not good enough to use by itself for managing programs in 1993.

People must be committed to continually improving themselves by taking correspondence and other courses and by expanding their educational levels. They have to do this to remain current. It is really key to enter the Acquisition Corps and face first assignments with these two things in mind. It requires talent and commitment and a continuous effort to stay abreast of new approaches to manage acquisition programs.

Q. Are you saying that an individual really needs to be flexible to be a member of the Acquisition Corps?

A. Yes, and a person has to realize that every program is different. For example, they might think that going from a product to a project manager is a piece of cake, but it is not. This is because the product manager job may have required an extensive technical background and entailed real world, down and dirty engineering problems. However, when a person becomes a project manager they may discover that the only thing that could destroy them in the near term is the way they manage the achievement of milestones. As a project manager, they may never get into the technical detail or what is considered the fun stuff. Therefore, an individual must be flexible and adjust to each phase of the program and to the critical issues of the program.

Q. How would you assess progress to date in implementing the Army Acquisition Corps?

A. It's been pretty good, largely because we had some really good people working on it long before I got here. For example, COL Al Greenhouse [former AAC Deputy Director for Acquisition Career Management] did an exceptional job and I learned something from him every time we met.

The Acquisition Corps educational program is in place, we have some reasonably good publicity out there, we have made great strides in getting our views and positions across within the personnel management community and, in general, we are taking care of our people. I think that a lot of work remains to be done though, particularly from the standpoint of managing and helping the civilian portion of the Acquisition Corps. Because of the obvious interest in and small size of the uniformed Acquisition Corps, we tackled that first and have done a credible job. The fact that the civilian side of the Acquisition Corps is 10 times larger led us to postpone biting into that elephant, but now it's time to be

very serious and bring management of it to center stage. We're not there yet, but we are going to get there.

Q. What do you see as the primary incentive for someone contemplating a career in the Army acquisition field?

A. The prime incentive is job satisfaction. Nowhere else can a person get the type of responsibility, authority, and enjoyment of making something happen as can be done in the Acquisition Corps. In an acquisition career field, a person can take a program from vugraphs and promises all the way to the field. This can be viewed from the standpoint of working on something from the time it's somebody's bright idea until you see a soldier drive off in it or fight with it. There is no other way to get that type of job satisfaction. For example, I am delighted to have been the PM for the OH-58D Kiowa Warrior, for the Apache Helicopter, and for some space systems and to have seen them all perform so well in combat in Just Cause, in Prime Chance, and in Desert Storm.

Q. Some people contend that Reservists should be included in the Army Acquisition Corps. What are your thoughts on this?

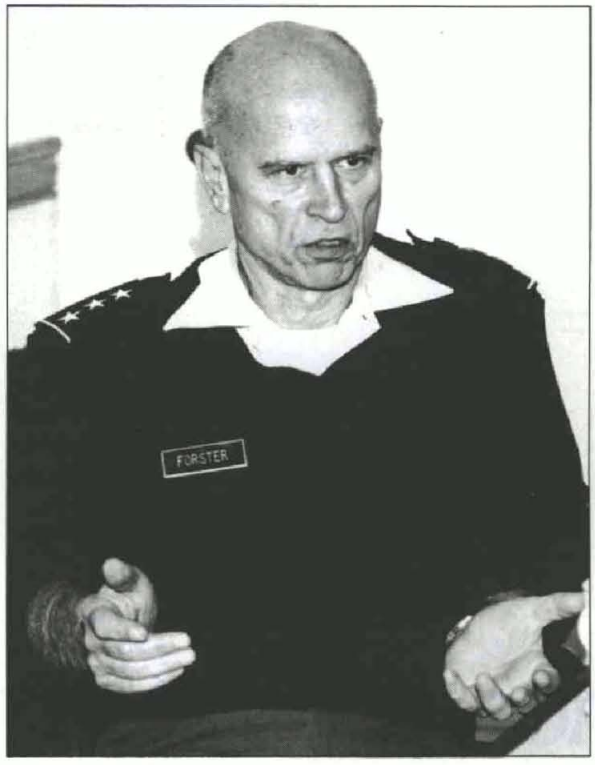
A. I agree wholeheartedly. We have Reservists and National Guardsmen performing Acquisition Corps duties in their civilian life and they should be considered for the corps and brought into it. In fact, with my mobilization designee deputy, MG Bob Menist, we are currently working with the Army Reserve Command and the National Guard Bureau to identify potential Reservists and Guardsmen who should be accessed into the Acquisition Corps. We have people in both components that are performing procurement duties for Guard and Reserve units that clearly merit being in the Acquisition Corps. We have Reservists and Guardsmen who are major program managers in their civilian jobs, that are certainly as well qualified as our program managers, project managers and Acquisition Corps personnel on active duty. We certainly have to recognize this and make provisions for them during mobilization and emergency periods. They are an asset we can't afford to waste.

Q. How does the Army's Acquisition Corps differ from those of the other services?

A. As near as I can tell, we are a little more mature in developing an Acquisition Corps as a true corps—with corps meaning a body of people. So, it is difficult to say there will be much difference at all in two or three years from now. However, at this moment, we tend to have fewer officers committed to the Acquisition Corps and more civilians as a relative percentage. I think this is a reflection of the fact that Department of the Army professional civilian employees have always been fundamental to the success of our research, development, and acquisition programs. As such, we will always have a substantially higher percentage of civilians in our Acquisition Corps than the other services.

Q. In your view, what is the biggest challenge facing the Army acquisition community?

A. I think the biggest challenge we face in the acquisition community is doing well those things that are high priority for the Army and insuring that they remain fully funded. All the services are clearly facing a drawdown in size and



a reduction in overall funding. Modernization funding will be reduced at the same time other elements of funding will be reduced. So, there will be a small number of programs left that will not always be funded to the degree we would like to handle all contingencies.

So the challenge is really going to be to do the best we can within these circumstances and to understand what is important to the Army and to focus our efforts on making that happen. In doing this, we have to realize that we will have fewer people and fewer funds than we are used to.

As I just noted, we can't continue to modernize at the pace we have in the past. In the near-term, we need to focus on project upgrades and ways to get more warfighting capability out of our dollars. This will entail the integration of new technology and new systems onboard existing vehicles where the vehicle platform is good enough. In this sense, things like the A2 upgrades to the M1A1, the Bradley upgrade program and the Longbow upgrade to the Apache are of great importance to us. This will be of even greater benefit if we can bring these types of upgrades together in a horizontal integration so that when we upgrade tanks we also upgrade the Bradleys and the Apaches that fight with these ground systems. In this manner, we get the capability that our Chief talks about relative to fighting on the "digital battlefield." This is where a target picked up by a Longbow fire control radar on an Apache is displayed to the Apache pilot and also shown, in its relative position, to the tank commander and to the Bradley squad leader in their vehicles. This is made possible because of compatible modems that allow the transmission and receipt of data among all three elements. Everyone will be sharing a common view of the battlefield when this is brought into the Advanced Field Artillery Tactical Data System and into the Command and Control System. This will improve our warfighting capability much more than if we looked only at the sum of the three upgraded programs. So, this is where our focus will be in the near to mid-term.

WHY DO WE NEED AN ARMY ACQUISITION CORPS?

By MAJ R. Mark Brown

The Army Acquisition Corps (AAC) was organized from existing Army personnel assets and acquisition organizations. The AAC resulted from successive pieces of more precise legislation concerning the way the American people, through Congress, wanted the Department of Defense (DOD) to conduct the acquisition process and acquisition management. The most recent, and most strict, legislation was the 1990 Defense Acquisition Workforce Improvement Act (DAWIA), now incorporated into Title 10 United States Code, Armed Forces.

As is often the case with any large-scale organizational change, there has been resistance from within the Army acquisition community and from the Army at large. The Army leadership's commitment to complying with the letter and the spirit of the law has been very strong, enabling the AAC to make remarkable progress towards full compliance with the law in a very short time. The purpose of this article is to answer the following question for a wider audience: "Why do we need an Army Acquisition Corps?"

A superficial analysis should be sufficient to answer the question, but there are better answers. The superficial answer is, because the law says we will have an AAC! Title 10, Chapter 87, Subchapter III, Section 1731 (a) states, "The Secretary of Defense shall insure that an Acquisition Corps is established for each of the military departments..." The law continues chapter and verse to outline specific requirements regarding organizations, policies, and training for military officers and civilians in these corps. National Security Decision Directive (NSDD) 219 implementing the Defense Management Review (DMR) also directed the services to create acquisition corps.

The legislative and executive branch directives alone should be sufficient reason to justify the organization of the AAC. Still, I hear continuous criticism of the AAC concept and the need for the existence of an AAC. This criticism comes from both inside and outside of the acquisition community. I categorize this criticism as understandable, well intentioned, and believable but usually uninformed, emotional and lacking a strategic viewpoint.

The Army Acquisition Corps is right for the Army today and supports overall Army objectives and goals.

To find better answers to the question, "Why do we need an Army Acquisition Corps?," start by reading the headlines of any newspaper. The defense budget is enormous. Even after the inevitable reductions from the new administration it will still be enormous. An enormous budget will draw commensurate interest, oversight, commentary and criticism from all quarters because of competing interests.

Consider the damage done to the reputation of the Navy and the Air Force, as well as their operational readiness, that resulted from the dismissal of the military and civilian executives of the Navy's A-12 and the Air Force's C-17 Programs. The Army is not immune from these scenarios, though we have not been in the spotlight recently.

Quite apart from the reputation and readiness damage caused by such events, there are other good reasons for an AAC. As the defense budget is drastically reduced, each budget dollar becomes relatively more important to the readiness of the force. That shrinking dollar must be more productive to produce similar results.

The Army must have experts managing the exchange of funds between the Army and the defense industrial base to satisfy all operational requirements. The processes have become too complex and ripe with the potential for spectacular error for part timers to do this consistently well.

The Army needs people to accomplish this mission that have internalized the fact that the core mission of the Army is to fight and win wars and understand what that means to the soldiers and units in the field. Just as important is the Army's need for technical experts with a depth of knowledge that can only come from years of experience in a career field. The only way to achieve this end is through a blend of military and civilian acquisition experts.

The Army is becoming ever more technical regardless of the career skill,

military or civilian, operational or otherwise. This is driving the whole Army to increasing specialization in the joint arena, command, acquisition, personnel, operations, fire support, training, communications and so on. An example of this is the way the Army trains. Training systems like U-COFT, SIMNET, the Louisiana Maneuvers and operational systems like the Inter-Vehicular Information Systems (IVIS) and the Advanced Field Artillery Tactical Data System (AFATDS) show that even "non-technical" skills like training and operations are becoming more complex.

The days of the generalists are slipping away, even if we lament their passing or say it isn't so. If this is good or bad isn't the issue, it's happening. The best interests of the Army are served by recognizing these long-term trends and proactively planning for them rather than trying to hold on to the past.

The AAC is right for the Army today and supports overall Army objectives and goals. Our chief of staff has provided the Army with a vision. In that vision, the chief outlines six imperatives. Those imperatives are quality soldiers, competent leaders, training, modern equipment, force mix and doctrine. In varying degrees, the AAC cuts to the heart of each of these imperatives.

Modern equipment is the domain of the AAC, be it developing and obtaining new systems for the future or supporting and upgrading existing systems today. The acquisition mission is not a throw away mission and requires competent leaders and the proper training no less than any function the Army has. The AAC requires the correct force mix by branch, functional area, career program, civilian and military within the AAC. Likewise, the AAC must support the Army's overall force mix by drawing a sufficient personnel investment to meet Army acquisition requirements. But this personnel investment must be one the Army can afford in its overall force mix requirement. The AAC must develop and support doctrine. Only people who are trained in the doctrine and understand it can do that.

The Army's stated strategy is one of shifting from a "forward deployed" Army to a CONUS based "forward presence and power projection" Army. Examples of this strategy in action are already numerous today. Urgent Fury, Just Cause, Desert Storm, Provide Comfort, and Restore Hope are some of the operational names that conjure up the notion of CONUS based "power projection." The AAC is a force multiplier in this new age of power projection. The Army is still, and probably always will be, in a "come as you are" mode of operations in the world of "power projection."

Much of the logistical support for operations where a support base is not well established (Somalia) will be contracted. Contracting is the domain of the AAC. The chief's vision states the Army must be trained, versatile, deployable, expansible and capable of decisive victory. The AAC is one means to achieving versatility, deployability, and expansibility. The AAC must develop and procure equipment that has deployability and versatility characteristics. The AAC is also a means to expand the Army to rapidly obtain current capability shortfalls when the Army gets the "green light" to take on urgent new missions.

The fact that defense program 6 (Research and Development) funding is being sharply reduced is often cited as mitigating the need for an AAC. First, the size and composition of the AAC is not directly dependent on the size of the R&D program. There are 11 major defense programs. The AAC is involved in spending Strategic Forces funds (Program 1) and Special Operations funds (Program 11 funds), among others. The AAC spends all 11 to varying degrees through the procurement process. If the Army does not develop and buy new equipment, the old equipment will have to be sustained, overhauled, modified, and/or improved, which will be funded by Program 2 (General Purpose Forces). This will be done by the members of the AAC in conjunction with the Army's combat service support branches.

The Army's hardware, new or old, will have more and more imbedded and integrated software. Development and acquisition of this software, which is driving the cost and schedule of systems to a much greater degree, will be done by the systems automation component of the AAC. A well known example of this is the rapid software modification for the Patriot Missile during the Gulf War to add the capability for an anti-aircraft missile system to also become an anti-ballistic missile system.

Further, the Army can not afford to completely eliminate research, development, test and engineering. Technology advances too rapidly and is proliferating all over the world. There will be a time when the Army's equipment is worn out and obsolete. The only question is, "When?" The Army can't simply wake up one day in the future, turn on a switch, and modernize. As with any force, the most important component is people. To modernize the Army in the future, the acquisition work force must be developed and nurtured over the long term. That work force requires extensive training and, more importantly, experience. That work force is led by the AAC.

In summary, there are many good reasons why the Army needs an Army Acquisition Corps beyond the reason that Congress told us to do it. The AAC reflects the trend that all skills, not just acquisition skills, are becoming more technical and complex. Our country's national military strategy is changing and the AAC can and should be a vital player in supporting the new strategy. Technology has never stopped advancing and never will. The AAC will be required to harness, manage and procure that technology to satisfy Army operational requirements. The members of the AAC manage the exchange of all funds between the Army and the industrial base to satisfy the Army's operational requirements.

The days of the generalists who can do anything are slipping away, even if those days were ever a reality. The shrinking defense budget demands more acquisition leadership and management expertise, not less, to gain similar results from what is left. It is in the best interests of the Army to recognize and proactively manage these trends the right way, because we understand what is happening to us, rather than to resist them and do it because we are being forced to.

MAJ MARK BROWN is assigned as chief of Army Acquisition Corps policy on the Army Staff in DCSPER. He is an armor/procurement officer with a B.S. from the U.S. Military Academy and an M.S. in systems engineering from Virginia Tech. He is a graduate of the Defense Systems Management College and the Command and General Staff College.

PROFESSIONALIZATION OF THE ACQUISITION WORK FORCE

By Marilyn Harris

The Defense Acquisition Work Force Improvement Act (DAWIA)—mandating a professional acquisition work force and corps within each of the military services and defense agencies—is part of the FY 1991 National Defense Authorization Act, H.R. 4739, Public Law 101-510, Title XII.

Representative Nicholas Mavroules (D-MA) chaired the House Subcommittee on Investigations, Committee on Armed Services. His year- long study culminated in a 776-page report, "The Quality and Professionalism of the Acquisition Work Force," printed on May 8, 1990. That report focused on the following four major questions:

- Are the services appointing program managers, deputy program managers, and contracting officers with the experience, education and training required by law and regulation, and are program managers being retained in their positions for the mandatory four years or until they complete a major milestone?
- Is there a career program structure to develop qualified and professional acquisition personnel—both military and civilian?
- Is there an appropriate mix of military and civilian personnel within the work force?
- What impediments must be overcome to develop a quality, professional work force?

In the winter of 1991, prior to passage of DAWIA, Congressman Mavroules wrote an article for the *National Contract Management Journal* titled "Creating a Professional Acquisition Work Force." That article highlighted the philosophy behind the DAWIA and discussed its aim "to create a very professional acquisition work force and its leadership corps to each service." This article is in response to implementation of the DAWIA in view of Congressman Mavroules' intent to establish a professional acquisition work force.

I must admit that when I first heard about the DAWIA (pronounced dah-wee-ah), I experienced a rush of cynicism. After all, I've heard about defense acquisition reform for years.

Typically, each time a scandal erupts over some procurement issue, a commission is established to study the problem and, following about a year of research, a 500-plus page report is released. The result is a consistent outcry for acquisition reform.

The next step is that Congress enacts a new set of laws while the Pentagon writes a new set of regulations. Mavroules notes that there seems to be a scandal about once each generation. Is it any wonder that some say that we are overregulated? The late 1980s and 1990 saw the $100 hammer and $999 pliers interspersed with outrageous cost overruns. He notes that cost overruns are not new—the Navy's contract for its first warship, the USS Constitution, had a 175 percent cost overrun.

I agree that since World War II, no fewer than six commissions have studied military acquisition problems: the Hoover Commissions of 1949 and 1955, the Fitzhugh Commission in 1970, the Commission on Government Procurement in 1972, the Grace Commission in 1983, and the Packard Commission in 1986 all recognized the need for a competent, trained and educated work force.

The focus in the past was primarily on the process and structure of the defense acquisition system—so Congress amended laws and indicated the policies and procedures to be used to buy equipment. This approach only treated the symptoms in order to satisfy a constituency who was reading, in the hometown news, about the $6,000 coffee maker.

Additionally, in the past, the government hired auditors and wrote regulations and, as was cited in the Congressman's article, while there may have been no more $6,000 coffee pots, there might be a $5,000 teapot. Again, if only the symptoms are treated, the disease is masked for awhile but shows up later in some other symptomatic form.

Representative Nicholas Mavroules' Subcommittee on Investigations took a new approach—it focused on people. Their one-year study revealed significant gaps in the career development of acquisition personnel:

- Half the people in contracting lack a college education.
- The fragmented, scattered, and diffused training system requires 12 courses on contracting but none for systems engineering or logistics, although these are key drivers of equipment costs.
- A large part of the contracting work force remains untrained even after the establishment of "mandatory" courses 30 years ago.
- Five times more people than will ever fill program manager slots are

graduated from the course designated to train management officials. (Yet, all services have failed to fill a majority of program manager positions with graduates of this course, even though it is required by law.)

- No service had complied with long-standing policies to appoint civilians to positions not requiring a military officer.
- The turnover in program managers is too rapid. In 1984, a law was enacted requiring that program managers of major programs remain on the job for four years or until a major milestone is completed. In all of the services since 1984, only six of 94 program managers have served either a four-year tour of duty or until a major milestone.

Clearly, all commissions since 1949 have recognized the problems and recommended solutions. The shortfall has been in implementing their recommendations.

So now you understand the basis for my somewhat jaded view of more legislation as a result of still another study. I am a "worker bee." I currently live down in the trenches although I spent several years as an analyst on a MACOM staff.

Having worked at an installation as well as a headquarters level and now deeply entrenched as a manager in the form of a supervisory contract specialist, I have recent memories of eager employees unsuccessfully seeking training—mandatory courses. This was devastating to their morale.

In the 1980s, I heard "no more slots" or "no more money." Relative to education, when I entered this field, I quickly learned not to refer to college or to degrees—statements on these subjects didn't earn any points with first line supervisors. However, I wondered how we spent so much of the taxpayers' money and were not even considered "professionals." I was told early on that contracting was a clerical function because all that was required was for one to check the regulations and follow a "boiler plate."

I always thought that contract specialists were expected to be a lot like lawyers and contracting officers, like judges. So, where was the education factor and why was it so hard to get the funds and the slots to train personnel? Yet, let someone sign a contract for a $6,000 coffee pot and the entire acquisition force is critiqued on the 6 and 10 o'clock news. I bowed my head and stopped telling people what my "job" (not profession) was. At the height of a scandal, we knew there would be a new message—the forerunner of an amendment to the Federal Acquisition Regulation (FAR) or at the least, a new policy.

This is an opportunity to be part of a "professional" career field and broaden one's perspective through college courses.

There has been much debate over the DAWIA. Some people resent the fact that there is legislative determination to "professionalize" the work force by requiring college degrees, college credits and experience and training in order to qualify for certain positions and grades. Some critics also say that the government is equating a college education with being "smart." Representative Marvoules states that education and training simply makes a smart person smarter.

I don't mean to imply that the DAWIA is a perfect solution—it does have its shortcomings. For example, the study failed to consider that most of the acquisition work force in the European and Korean theaters is local national (about 60 percent in USAREUR). These individuals were not initially covered.

For the first time, I sense that someone "up there" cares about individuals—not just when we make mistakes—but someone who wants us to feel good about what we're doing and be proud of our profession. As a professional, I am motivated to give 110 percent. As a manager, I now have the tools to motivate my staff.

Caring is contagious. I have always cared about the professionalism of my staff and now I have the opportunity to send employees to training and to encourage education. DAWIA has taken most of the subjectivity out of who gets trained, and the government has put its money on the line and provided funds for training and for college courses. We are encouraged to apply for long term training programs.

What an opportunity! This is an opportunity to be part of a "professional" career field and broaden one's perspective through college courses. I'm excited about *this* acquisition reform. I know that some of my colleagues are skeptical—there will always be resistance to change. However, I believe it will work.

As discussed earlier, long term training is also a change. Two years ago, only two employees in the acquisition career field attended long term training. This year, there are 20. That's improvement that can be seen and counted.

I see the Defense Acquisition Improvement Act working not just for me and for the total Army, but for all the services. In the conclusion to his article, Congressman Mavroules states that what he has proposed is "... really based on common sense and sound management principles. Improving DOD's acquisition process is one of our country's most pressing national security problems. By addressing the people issue, we take a big step in that direction."

The U.S. military strategy focuses on strategic deterrence, forward presence, power projection and reconstitution with a smaller force. The acquisition process is not only an important link in the sustainment of our forces but also in maintaining the advantage of technological superiority. As we look more closely at prepositioning and forward presence, we must not fail to recognize the "worker bees" who provide support. I believe the Congressman was right, DAWIA is the right step.

MARILYN HARRIS is chief, Contracts Branch, Regional Contracting Office, U.S. Army Contracting Command, Fuerth, Germany. She is a graduate of the University of Missouri-Rolla and has pursued graduate studies at the University of Missouri-Columbia, Austin Peay State University and Boston University.

CONFEREES DISCUSS KEY ACQUISITION ISSUES

Approximately 300 members of the Army acquisition community attended the Army Acquisition Conference, June 14-16 in Research Triangle Park, NC. The purpose was to inform program executive officers, program managers and other key Army acquisition personnel about current and future acquisition policies and programs, and to provide a dialogue among all participants to improve the efficiency and effectiveness of the Army's acquisition process.

Sponsored by the Army Acquisition Executive, the conference featured major presentations and discussions on topics such as the future of Army acquisition; the Army Acquisition Corps; decreasing defense resources; digital technology; and acquisition reform.

George E. Dausman, Army acquisition executive, welcomed the attendees. He said, "Our new administration is deeply committed to the reform of the defense acquisition system. There is no question that improving America's defense acquisition system is necessary in order to buy more military strength for the dollar, reduce overhead, and help integrate defense into comprehensive efforts to strengthen the U.S. economy."

Deputy Secretary of Defense Dr. William J. Perry gave the keynote address on reform of the defense acquisition system and the following geopolitical changes that will drive it: the end of the cold war, budget reductions, and new threats such as ethnic and regional conflict. Perry stated, "It is our responsibility to see that our forces, when they are called into battle, will always have, over any potential adversary, what I would call an unfair competitive advantage."

Dr. Anita K. Jones, director of defense research and engineering, discussed the execution of science and technology programs as related to acquisition changes, citing factors such as cost effectiveness, change in adversary, and the value of information. She also addressed the forces of change on R&D performers, discussing downsizing, research universities, and DOD labs. "We need to be able to react in the R&D community and in the acquisition community in the same way we talk about reacting on the battlefield. We want the decision cycle to be shorter than the enemy's so that we can react more rapidly," said Jones.

A presentation on the defense industrial base was given by David J. Berteau, principal deputy assistant secretary of defense for production and logistics. He said that in the past, defense conversion meant that we stopped making weapons and started making something else. Berteau suggested that we look at defense conversion as a process—a process by which we take all assets being used by defense today, whether public or private, whether uniquely defense or dual use—and expand their application to a broader economic base. This, he believes, is a more workable definition which gives us a basis for analysis and for making tradeoffs and decisions.

An industry perspective was provided by dinner speaker A. Thomas Young, president and chief operating officer of Martin Marietta, who focused on weapon systems, the acquisition process, and the industrial base. According to Young, the U.S. defense industry has been producing the best weapon systems using the best processes. He said that one recent improvement to government/industry interaction is that there is a better sense of when to use arms-length dealings and when to form a partnership. Young also discussed the defense industry's reaction to declining resources with actions such as sell-off, conversion, diversification, and consolidation.

Military Deputy to the Assistant Secretary of the Army (ASA) (RDA) LTG

Photo by Don Parker.

George E. Dausman, Army acquisition executive, opened the conference.

William H. Forster opened the second day of the conference with remarks on the Army Acquisition Corps (AAC). Forster, who also serves as the director of the AAC, described the composition of the AAC and the Army acquisition work force; AAC training requirements and options; acquisition reform; policies and procedures; and the role of the Program Executive Officer (PEO) and the Project Manager (PM). He told PMs in the audience, "You must be in charge of your program. We expect you to be in charge of it—we expect nothing less than that. You will have a lot of external influences. You have to deal with them intelligently but you don't have to let them affect how you manage internally. Your job is always to seek and establish stability for your program."

LTG Peter A. Kind, director of information systems for command, control, communications, and computers (DISC 4) talked about software growth in weapons and its impact on warfighting capabilities; software codes and software costs. He emphasized the need to test and catch "bugs" early. He said, "If you find indicators of trouble early, you

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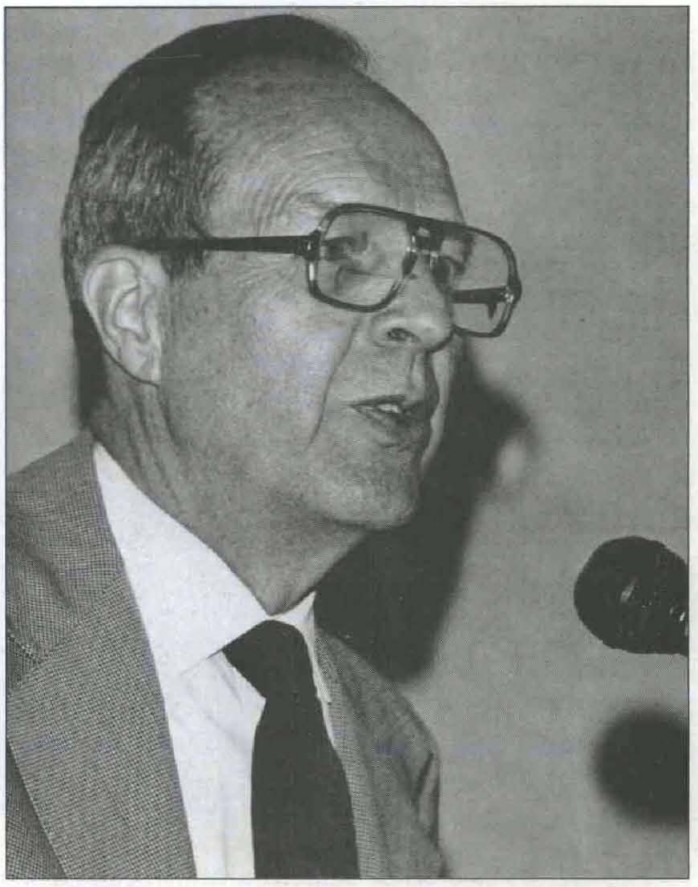

Photo by Don Parker.

Deputy Secretary of Defense Dr. William J. Perry gave the keynote address.

save time and money, and you're more likely to make your schedule early."

A briefing on the Technology Reinvestment Project was provided by Air Force LTC Steven G. Wax, chief of staff, Technology Reinvestment Project Office, Advanced Research Projects Agency. Project members are DOD, Department of Commerce, Department of Energy, the National Science Foundation, and the National Aeronautics and Space Administration. Wax acknowledged that there are areas where dual use is not practical. He said, however, that for those areas where technologies are common, we can no longer afford to develop independently from the defense side and the commercial side.

Dr. Herbert K. Fallin Jr., director, assessment and evaluation, Office of the ASA (RDA), spoke on analytic support of the acquisition process. He discussed his office's role in performing independent evaluations and analyses; monitoring program execution, cost performance and schedules; and in working with PEOs and PMs to resolve broad DOD acquisition issues.

The luncheon speaker was Dr. Thomas P. Quinn, deputy assistant secretary of defense for strategic and tactical command, control and communications. Quinn said that technology changes so rapidly today that it can be obsolete by the time it reaches the field. He called for a new approach to acquisition with limited sets of requirements, feedback from the user early in the process, and the use of commercially available technology and systems.

Assistant Deputy Chief of Staff for Operations and Plans MG Jay M. Garner provided a presentation on the modernization vision and streamlining requirements and acquisition. He noted that modernization will involve digitization, owning the night, smart ammo, and deep precision strikes. Garner suggested that in streamlining the acquisition process, leaders should be broader in defining requirements, and bring more simulation into testing.

A presentation on manpower was provided by William D. Clark, acting ASA (manpower and reserve affairs). In discussing requirements planning, he said, "We need to have a planning process that is not only credible within ourselves and to the people who work with us and for us, but credible to those on the outside who make decisions with regard to our resources." He said that as resources decline, the acquisition community will need versatile personnel who can retrain on the job if necessary.

BG Lon E. Maggart, deputy chief of staff for doctrine, HQ U.S. Army Training and Doctrine Command (TRADOC), discussed the new Field Manual 100-5, which was written in light of world changes since Operations Just Cause and Desert Storm. Maggart said, "This is still a soldier's book—it is written in soldier language, about soldiers, about units, and about how those

Photo by Don Parker

Dr. Anita K. Jones, director of defense research and engineering.

"We need to be able to react in the R&D community and in the acquisition community the same way we talk about reacting on the battlefield. We want the decision cycle to be shorter than the enemy's so that we can react more rapidly."

—Dr. Anita K. Jones

Photo by Don Parker.

LTG Peter A. Kind, director of information systems for command, control, communications and computers.

soldiers and units do their business."

Robert W. Young, acting principal deputy to the ASA (financial management), gave a financial management perspective. He described general trends such as infrastructure and modernization reductions, increased funding for AIDS and breast cancer research, and the movement of defense dollars to the domestic side.

MG Ronald V. Hite, deputy for systems management, Office of the ASA (RDA) chaired a panel discussion on the future of Army acquisition. Other panel members were MG Larry G. Lehowicz, deputy chief of staff for combat developments, TRADOC, and earlier conference speakers William D. Clark, MG Jay M. Garner, Robert W. Young and BG Lon E. Maggart. Topics of discussion included the Army's commitment to deep strike, the identification of critical acquisition positions, silver bullet procurements, and delayed fielding of equipment due to factors such as budget drills and the changing threat.

Dinner on the second day of the conference included awards presentations for the Project Manager and Product Manager of the Year. Project Manager of the Year was COL William S. Taylor, Multiple Launch Rocket System (MLRS), PEO Tactical Missiles, Redstone Arsenal, AL. He was cited for directing the MLRS family of programs to unparalleled successes in system performance, readiness, customer satisfaction and financial leveraging, and for demonstrating superior leadership skills.

LTC D. David Newlin, product manager for the Advanced Field Artillery System—Mobility System, PEO Armored Systems Modernization, was named Product Manager of the Year. He was recognized for his leadership, technical expertise, and management ability which led to outstanding accomplishments for this highly visible, unique and most complex acquisition program.

Guest speaker for the final dinner was Dr. Robert J. Hermann, senior vice president, science and technology, United Technologies Corporation, who addressed acquisition reform. He stressed that the current acquisition process is costly and lengthy. Hermann discussed possible solutions such as increased reliance on commercial industry, stating that competition is a tool which can be used to better serve the public.

The final day of the conference opened with a presentation by MG Lehowicz on battle lab integration and technology. He emphasized that in 1994, the battle lab focus will be on horizontal technology integration, distributed interactive simulation and advanced warfighting demonstrations.

Photo by Don Parker.

COL William S. Taylor received the Project Manager of the Year Award.

Photo by Don Parker.

LTC D. David Newlin received the Product Manager of the Year Award.

Lehowicz stated, "Battle labs are the bridge between how we fight today and how we will have to fight in the future."

Attendees were given the opportunity to choose two of the following breakout sessions: Team Concept/Business Planning by MG Dewitt T. Irby Jr., PEO—Aviation; Enterprise Strategy by LTC(P) Scott C. Long, project officer, Army Enterprise Strategy, DISC 4; Space and Strategic Defense Command (SSDC) Roles and Missions by COL Thomas L. Haller, assistant chief of staff for program analysis and evaluation, U.S. Army SSDC; Distributive Interactive Simulation by LTC Jan S. Drabczuk of the Simulation, Training and Instrumentation Command; Military Specifications and Standards by James Sullivan, general engineer, Concurrent Engineering Division, HQ Army Materiel Command (AMC); and Pollution Prevention in Army Acquisition by Luis E. Garcia-Baco, engineer, Army Acquisition Pollution Prevention Support Office, HQ AMC.

The luncheon address was given by VADM William C. Bowes, commander, Naval Air Systems Command, who spoke about needed improvements to the acquisition system, what naval aviation is doing, and joint projects. He said that the acquisition process could be improved by using communications and dialogue to build trust within the system. Bowes advocated joint efforts, stating, "Certainly the answer to our succeeding in the future has to be better understanding among the services and working together."

Photo by Don Parker.

MG Larry G. Lehowicz, deputy chief of staff for combat developments, TRADOC, discussed battle labs.

MG Otto J. Guenther, commanding general, U.S. Army Communications-Electronics Command discussed AMC support of the acquisition process, such as AMC's involvement with the battle labs in support of PEO programs, digitizing, and the reduction of functional requirements via roadshows, the third of which is currently being planned.

Army Acquisition Executive George E. Dausman provided brief closing remarks, recognizing the conference staff and requesting feedback from the attendees for use in planning future conferences.

AN ADVANCED CIVIL SCHOOLING ALTERNATIVE FOR ACQUISITION CORPS MEMBERS

The University of Texas at Austin Executive M.B.A. Program

By CPT(P) Steven E. Lopez and Dr. Jerry Davis

Three Army Acquisition Corps (AAC) officers were selected to attend The University of Texas at Austin (UT) Executive Master of Business Administration (M.B.A.) Program beginning last fall. MAJ Mike Pontius, CPT(P) Dick Hansen, and a coauthor of this article [CPT(P) Steven Lopez] are assigned to the Institute for Advanced Technology (IAT), an autonomous element of the University of Texas and the U.S. Army's Federally Funded Research and Development Center (FFRDC) for research and development.

IAT conducts long term basic and applied research in hypervelocity and electrodynamics in support of the Army's Electric Armaments Program. As a part of the M.B.A. Program, these officers work in the institute's Education Division, which develops education and training programs for the AAC. The officers attend the Executive M.B.A. Program while continuing to work full-time at the institute.

The UT Graduate School of Business is a world-class institution, consistently ranked among the top 20 business schools in the nation. The UT Executive M.B.A., also known as the Option II M.B.A. Program, is uniquely designed to meet the needs of mid-career executives. Classes meet on Friday and Saturday of alternate weekends, which allows students to earn an M.B.A. degree while continuing to learn on the job by managing a variety of acquisition-related projects.

The Option II Program brings together mid-level managers from a wide variety of backgrounds, with an average work experience of more than 10 years. Approximately 60 students are accepted annually into the two-year program. The class is divided into 10 study groups that work together on the program's many case studies, group projects and other assignments. Organizations currently represented include IBM, 3M, Motorola, Xerox, Shell Oil, USAA Insurance, Tandem Computers and the Office of the Governor of Texas. This year marks the first time the U.S. Army has been represented in the program.

The interaction with the other students, especially within study groups, is one of the highlights of the program. The corporate world is dealing with many of the same issues confronting the Army, such as downsizing, Total Quality Management (TQM) efforts, technology management and coping with a rapidly changing environment.

Classes are taught by senior faculty members of the Graduate School of Business. Each professor has an excellent academic reputation and a wide range of business experience. Many have won numerous awards for teaching excellence. "Case studies are used to teach course objectives. The benefit of this method is we not only learn theory, but actual application. The entire program is a superb experience, and I

highly recommend this graduate degree option to other Acquisition Corps officers," explains MAJ Pontius.

The specific objectives of the Option II M.B.A. are to develop a top management perspective, competence in key functional areas of business, skills in interpersonal and group relationships, and an understanding of the economic, social and political responsibilities of management.

A central feature of the program is a set of four executive seminars. The first seminar precedes the fall semester of the first year and provides a framework for the intensive study of management science, macroeconomics and financial reporting. The second seminar is a focused examination of business problems and strategies from an international perspective. The third seminar begins the study of finance, marketing, operations management and strategic management. The final seminar is held in London, England. It is a concentrated exploration of approaches to business opportunities in the European Economic Community, Eastern Europe and the former Soviet Union.

The corporate world is dealing with many of the same issues confronting the Army, such as downsizing, Total Quality Management efforts, technology management and coping with a rapidly changing environment.

One of the highlights of the program is the way the officers are able to apply what they learn in class to the ongoing projects they manage at IAT. MAJ Pontius, for example, has completed a pilot study in risk management of acquisition test strategies, using techniques learned in Option II's Management Science Class. CPT Hansen is conducting a study of technology transfer and defense conversion issues. He recently presented a briefing on that subject to an international symposium in Stockholm, Sweden.

The Option II Program requires extensive use of computer software programs—everything from spreadsheets to sophisticated software packages in decision analysis, statistics and simulation. This experience is being used extensively in the development of a simulation exercise to support IAT/UT's Senior Service College Fellowship Program.

All three M.B.A. Program selectees are currently working together on a statistical analysis of bore damage in an experimental electric gun, using techniques learned in the Option II Statistics Course.

"The real beauty of the Executive M.B.A. is it allows an Acquisition Corps member to get some extraordinary hands-on experience in project management as well as research and development in electric armaments and other Strategic Technology for the Army (STAR) Programs. This experience avoids the heavy cost associated with completely removing our officers from the Army's RD&A community to attend a standard degree program," says CPT Hansen.

Said MAJ Pontius: "I wish I had been in this program before my last assignment. The professors are tops in their fields and very talented in presenting the subject matter for all to grasp. The material presented in the program is readily applied in the Army Acquisition Corps."

The three officers will graduate in May 1994 and are looking forward to applying their hard earned knowledge in the acquisition field. "I'm [CPT(P) Lopez] convinced that what we're learning in this program will greatly enhance how we perform in the future as project and program managers."

For more information on the Option II, Executive M.B.A. Program, please call Dr. Jerry Davis (512)471-9060; or address correspondence to his attention at the Institute for Advanced Technology, The University of Texas at Austin, 4030-2 W. Braker Lane, Austin, TX 78759-5239.

CPT(P) STEVEN E. LOPEZ is assigned to the Education Division at the Institute for Advanced Technology (IAT). He is a member of the Army Acquisition Corps and a distinguished graduate of the Materiel Acquisition Management Course. Lopez holds a B.S. degree in business administration from the University of Colorado, and is enrolled in the Executive M.B.A. Program at the University of Texas at Austin.

DR. JERRY G. DAVIS is the IAT assistant director for education. He has spent more than 20 years in the Active Army and Reserve Components, and is a lieutenant colonel (P) in the U.S. Army Reserve. A graduate of the U.S. Army War College Fellowship Program at Tufts, he holds a Ph.D. in higher education from Ohio State University. He has also completed post-doctoral work at Harvard and Tufts.

ARMY ACQUISITION CORPS OFFICERS IN TRADOC

By MAJ Stephen R. Hesler

Evolving World Picture

Significant changes have occurred in the U.S. defense community during the past several years. As a direct result of the shifts in global and national politics, the United States has been forced to develop a new national military strategy. This strategy will aim increasingly at equipping a smaller and lighter Department of Defense force structure dedicated more to peacekeeping and non-combatant missions in an unstable world.

As the threat to American security has become ever more foggy, the role of the Army Acquisition Corps (AAC) has increased. This group of highly trained officers and civilians is on the cutting edge of developing the best light, lethal, and highly survivable force for future missions.

Despite the critical role AAC people will play in preparing the U.S. Army for the future, membership in the corps is not without inherent dangers. This article discusses two challenges facing junior officers in the AAC. The first challenge is to ensure that our forces are equipped with the finest equipment available at an affordable cost. The second challenge is survival and career advancement within the AAC for officers seeking to remain well-grounded in the most current requirements of their branches.

AMC/TRADOC Paradigms

In the past, the U.S. Army Materiel Command (AMC) and the U.S. Army Training and Doctrine Command (TRADOC) established clearly defined roles in the Concept Based Requirements System (CBRS). Since 1992, however, with the Army chief of staff's implementation of the six battle laboratories, there is a strong emphasis on early TRADOC involvement in technology base efforts. This is in contrast to a previous focus by TRADOC on engineering development, testing, and fielding.

AMC now shares oversight with TRADOC on many elements which were previously on their "turf." Science and Technology Objectives (STOs), Advanced Technology Demonstrations (ATDs), and prioritization of tech base efforts at the research, development, and engineering centers are areas in which TRADOC now not only shares an interest, but provides input.

The U.S. Army's tools for dealing with the new paradigms for the future are dynamic in their intent and aim. The battle laboratories, the Warfighting Lens Analysis, Louisiana Maneuvers, and enhanced CBRS are just a few of the means by which the U.S. Army is preparing for the next century. AAC officers, with their special skills and training, will be well suited towards understanding and implementing this evolving way of doing business.

> AAC officers are a logical source of expertise on materiel acquisition because of their operational background, specialized training, advanced degrees, and repetitive assignments in acquisition related positions.

AAC Role in TRADOC

For an organization facing a downsizing, such as the U.S. Army in the 1990s, fewer people will be given responsibility for a greater share of the materiel system developmental programmatics. Trained personnel, already well-versed in materiel acquisition and being groomed for program and product management positions, will be at a premium in such a constrained environment. AAC officers are a logical source of expertise on materiel acquisition because of their operational background, specialized training, advanced degrees, and repetitive assignments in acquisition related positions.

AAC Career Monitoring

Junior AAC officers, much like other U.S. Army officers, must closely monitor their careers—fighting for the right jobs, appropriate training and experience, and avoiding certain areas. Like all officers, AAC officers must learn from those who preceded them to

avoid their obstacles and select successful career paths.

At its inception, the AAC envisioned a period when senior captains and majors would return to troop units. The intent of this program was sound—reacquaint future PMs with the positions and priorities of their basic branches one final time so they could better represent and understand the user's needs later.

The "regreening" program was short-lived, however, as word spread that such a tour had cut a few careers short. AAC members were soon convinced they would be rated unfairly by brigade commanders who were saving their best senior rater evaluations for future battalion commanders and not program managers.

The current AAC officer development program requires an officer to progress through his or her basic branch through roughly the seventh year. Following entry into the AAC, officers continue their civilian and military education while serving in a variety of utilization tours offering acquisition familiarization. This includes attendance at the Combined Arms Service and Staff School and Command and the General Staff College, alongside their basic branch contemporaries, and completion of graduate studies. No return to troop units is recommended, and may be denied if an officer is serving in a utilization tour following graduate school.

With opportunities for assignment to troop units severely restricted, senior captains and majors in the AAC need an opportunity to refamiliarize themselves with their basic research skills prior to senior program management positions. To this end, TRADOC, as the user's representative, has become the largest employer of AAC officers outside of the AMC community.

Unlike AMC, TRADOC duty offers AAC officers an opportunity, if not to lead troops, then at least to work close to them. As staff officers at battle labs, Combat Development Directorates, and TRADOC System Manager Offices, AAC officers receive ample opportunity to hone materiel acquisition skills, while working first-hand on developing school positions and priorities for materiel related programs.

Potential AAC Opportunities

TRADOC schools have long understood the necessity of refamiliarizing individuals prior to assignment to critical positions. Each school now runs pre-command courses (PCC) for those officers about to take command of battalions and brigades.

Unlike AMC, TRADOC duty offers AAC officers an opportunity, if not to lead troops, then at least to work close to them.

Project and program manager designees would benefit as well from attending PCC programs at the branch schools. Updated information on requirements and renewed branch awareness would broaden understanding of the total impact of materiel programs on operations and training for AAC officers. During the PCC, they would be immersed in the most current school thoughts on doctrine, training, leadership, organization, materiel, and science and technology issues.

In addition, AAC officers would make important contacts, both with their counterparts going to field units and the school command and staff. Future commanders would benefit as well by meeting and establishing working relationships with their materiel development counterparts. Potentially, there would be continued dialogue, as perceptions and recommendations on improvements to existing and future systems are exchanged between the field commander and materiel developer.

Present Situation

One problem still to be resolved is the continued assignment of AAC officers to TRADOC schools. A policy change in 1992 required schools to begin coding AAC positions as 4M or 4Z. While on the surface this appears to be a simple process, a flurry of messages from the schools stated their concerns that AAC coding, by being branch neutral, could lead to disruptions.

The schools felt that AAC coding could potentially open the door to branch immaterial assignments by PERSCOM. For example, branch immaterial AAC assignments could lead to a 4M armor major being placed in a critical combat developments position at the Aviation School—a position in which the officer would lack operational training and expertise. Few schools could support such a personnel policy; many would likely prefer getting a same branch officer with no acquisition experience, as opposed to a branch immaterial AAC officer. At the Infantry School, for example, this philosophy has resulted in the coding of only three AAC positions in both the Dismounted Warfighting Battle Lab and Directorate of Combat Developments.

Hopefully, TRADOC schools will remain open as opportunities for the development of future AAC officers. An assignment policy by PERSCOM, stating 4M positions will be filled by branch officers, will help ensure TRADOC remains available for AAC officers hoping to refamiliarize themselves with their branch prior to program management positions.

Summary

As the U.S. Army organizational design and materiel fielding plans evolve during the coming years, the AAC is postured to provide a significant return on investment. Its officers and civilians will be the professional, highly trained, and well-rounded group needed to take the tough jobs and quickly apply their skills to providing soldiers the best equipment in a constrained environment. But, to offer the best service to the soldier, AAC officers must continue to speak with credibility—a commodity gained through recent troop experience and continuous training.

MAJ STEPHEN R. HESLER is an infantry officer assigned to the U.S. Army Infantry School as the chief of the System Priorities and Integration Division in the Directorate of Combat Developments. Hesler holds a bachelor's degree in economics and sociology, and a master's degree in business administration. He is also a graduate of the Command and General Staff College.

FOCUSING ON SOLDIER SURVIVABILITY

By Al Sciarretta

Introduction

Advanced technology has made warfare extremely fascinating—not just to military leaders, but also to the media and even Hollywood. We must be wary, however, of becoming so mesmerized by new technology that we forget the soldier and, in particular, his or her survivability.

In the wake of Operation Desert Storm, one of the more important lessons learned was that incidents of attack from friendly fire (fratricide) had to be reduced. It was also reaffirmed that increases in enemy detection and recognition capabilities, coupled with the expanding lethality and range of modern weaponry, could seriously limit the ability of the U.S. soldier to survive future battles. The Army chief of staff has stated that the Army cannot accept casualties that can be prevented by proper research, development and acquisition (RDA). Thus, attention must be focused on soldier survivability.

This concern prompted numerous studies involving organizations throughout the Army, including the assistant secretary of the Army (RDA), the U.S. Army Materiel Command, the U.S. Army Training and Doctrine Command, PM soldier, and PM survivability. As a result, some gains in soldier survivability, especially anti-fratricide, are being achieved. Without question, these efforts will benefit the current and future survivability of the battlefield soldier.

However, soldier survivability still needs more focused attention. A recent review of materiel acquisition regulations and draft documentation revealed little emphasis is placed directly on soldier survivability. Most of the guidance published on survivability is written with system hardware in mind.

The concern with survivability is almost totally focused on the threat as opposed to aiming some of that concern on friendly fire. One has to very broadly interpret the law and regulations to include the soldier as an integral part of the weapon system. So, where is soldier survivability defined?

Many believe that soldier survivability is a subset of system survivability. System survivability has been historically oriented toward hardware survivability; generally accepting the thought that if the system survives, then the soldier survives. Is this really true? Shouldn't soldier survivability always

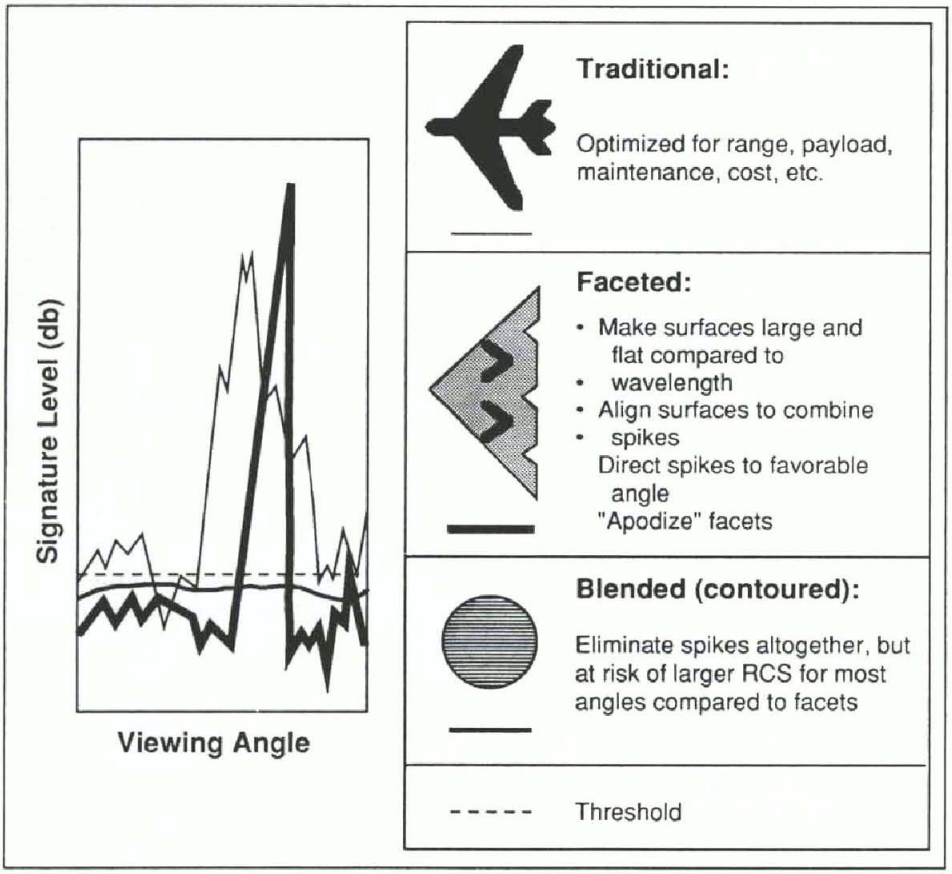

Figure 1.
The effect of various shapes on the signature of radar cross sections at various viewing angles.

have a higher priority than system hardware survivability? And how does the dismounted soldier fit in this thinking?

In response to this dilemma, the Army's Deputy Chief of Staff for Personnel (DCSPER) LTG Thomas P. Carney proposed a way to resolve this whole issue—include soldier survivability as a seventh domain in the Army's Manpower and Personnel Integration (MANPRINT) Program. This approach would provide written guidance and a means of assessing soldier survivability enhancements being introduced into new materiel and soldier systems.

As a result of the DCSPER's personal interest, a full integration effort from the point of view of the soldier has begun. The feasibility of implementing this new MANPRINT domain was evaluated. Soldier survivability, the assessment criteria, and the interaction of MANPRINT agencies with other "soldier as a system" agencies were defined. Additionally, test assessments were conducted on two acquisition systems—the Land Warrior (The Enhanced Integrated Soldier System and the Armored Gun System).

The MANPRINT community, as well as the entire acquisition community, needs to consider soldier survivability as a separate and extremely important element of all military systems and the Army's modernization plans. In order to do so, a definition of soldier survivability is provided for consideration and evaluation of systems.

The Definition

Soldier survivability is that characteristic of soldiers that enables them to withstand (or avoid) adverse military action (both friend and foe) or the effects of natural phenomena that would result in a loss of life or capability to continue effective performance of the prescribed mission.

Survivability must be achieved without sacrificing the ability of the soldier to perform his mission within constraints. Some realistic trade-offs may be necessary between survivability and other aspects of effectiveness such as reliability, mobility and lethality. Survivability should not detract from the Army's mission to win a battle.

Survivability is more than vulnerability (a quantitative measure of a soldier's susceptibility to damage) and vulnerability reduction (measures to reduce or eliminate the effects of combat damage mechanisms). Survivability of the soldier is a combination of, but not limited to:

- reducing fratricide;
- reducing the detectability of the soldier;
- preventing attack on the soldier;
- reducing vulnerability;
- preventing further injury; and
- reducing physical and mental fatigue.

Reducing Fratricide

The U. S. Army's Training and Doctrine Command's Fratricide Action Plan states: "Fratricide is the employment of friendly weapons and munitions with the intent to kill the enemy or destroy his equipment or facilities, which results in the unforeseen and unintentional death or injury to friendly personnel." In order to reduce fratricide, vehicle, aircraft and soldier systems should be designed with improved anti-fratricide systems. This can be accomplished through the use of Identification of Friend or Foe (IFF) and "situational awareness" systems. Additionally, each system which is potentially vulnerable to fratricide should be able to ward off a friendly attack once it has been initiated. Anti-fratricide is woven into the next two components of soldier survivability.

Reducing Detectability

Every effort must be made to prevent the visual, acoustic, electromagnetic, infrared/thermal, radar, millimeter wave, etc. detection of the individual soldier. Some examples of detectability reduction include the use of low observable technology (see Figure 1), mufflers, smoke, training (use of concealment) and doctrine. Reducing detectability must also offer capabilities that allow a friendly soldier to detect an enemy soldier outside the enemy soldier's detection capabilities.

Considered in this evaluation is anti-fratricide—all efforts to ensure that soldiers (both mounted and dismounted) are not detected as enemies by friendly soldiers and weapon systems. This may be accomplished through the use of Identification of Friend or Foe (IFF) systems, embedded IFF training devices, or situation awareness technology.

Preventing Attack

In spite of all types of efforts to avoid detection, some of our soldiers and materiel systems will be identified and fired upon. Once detected, it then becomes increasingly important to prevent enemy soldiers and weapon systems from attacking our soldiers and materiel systems. Some examples of preventing attack are: training (use of cover), designing less bulky equipment (thus, reducing the silhouette), decoys, warning sensors (for ballistic, nuclear, chemical, biological, or laser attacks) (See Figure 2), counter attack systems (e.g. quickly returned harassment fire, jammers and active armor), designing maximum effective ranges of friendly weapon systems outside the enemy's maximum effective range, and evasive action (moving to cover, moving outside the enemy's effective range).

Anti-fratricide is also included in this

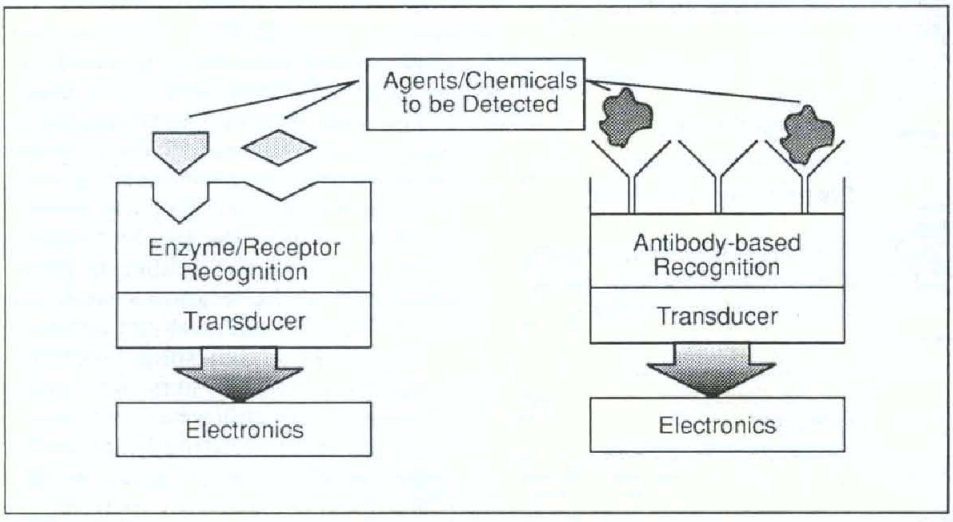

Figure 2
Warning Sensors

measure. Efforts should be made to alert soldiers (both mounted and dismounted) of attacks by friendly weapon systems and possibly give them a means of warding off the attack. Besides IFF transmitting devices, the friendly soldier should be able to shut off a smart minefield or divert the attack path of smart/brilliant munitions.

Reducing Vulnerability

The classic approach to improving the survivability of soldiers and materiel systems has been to reduce the vulnerability of soldiers and systems to enemy fire. This includes not only protecting the soldier from damage due to traditional threats such as bullets, shrapnel, cutting instruments, blast and burn, but also preventing attack from chemical, biological, nuclear, laser, high-powered microwave and acoustic systems (See Figure 2). Additionally, the soldier should be protected from natural phenomena such as temperature extremes or deep water.

The mounted soldier has to be considered separately from vehicle vulnerability, since the soldier may be harmed even though the vehicle may not be severely damaged. Some examples of vulnerability reduction measures are: armored compartments for mounted soldiers, fire suppression systems, ballistic protection jackets, nonflammable fabrics, chemical protective clothing, prophylaxis drugs, vaccines, insensitive munitions, visors with tunable laser protection, cooling vests, cold weather clothing and built-in self-inflatable life vests.

Preventing Further Injury

If the soldier is injured, efforts have to be made to maintain the soldier's life, prevent fatal injury or physical disabilities, and evacuate the soldier quickly and efficiently to medical treatment facilities. Examples of casualty reduction measures are: first aid packets, bodily function sensors connected to a vehicle or personal computer/communications system, antidotes, clothing which automatically applies tourniquets where needed, environmental control systems, trauma treatment at the squad/crew level, vehicle on-board life support systems, auto-control systems (artificial intelligence systems which can take control of an aircraft or ground vehicle until it has landed or is behind cover) or something as simple as vehicle escape/evacuation hatches.

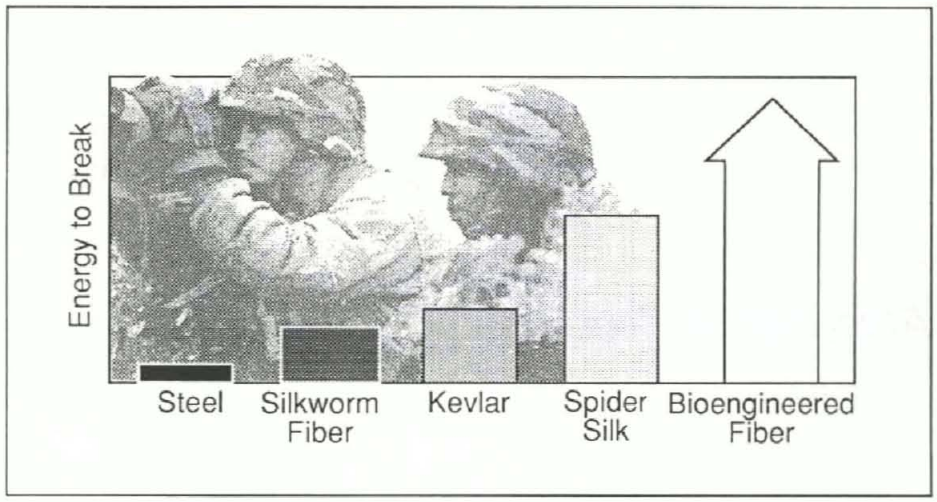

Figure 3.

Reducing Fatigue

Soldiers must receive proper sustenance and be equipped with the clothing and equipment which maintains physical capabilities and enhances mental alertness. Also, vehicle, aircraft and soldier systems must not increase psychological stress on the soldier. Considerations in this area of survivability include lightweight protective clothing (See Figure 3), highly nutritious rations, on-board hygiene systems, vehicle seating which maintains a "buddy" within eyesight, reduced noise levels, crew comfort, chemical protective suits which "breathe" and all efforts to reduce anxiety in combat (e.g. human factors engineering considerations, training systems, sensor technologies which provide opportunities to sleep, sleeping pills and decision aid systems—which can handle a high data rate battle). Many considerations in this part of survivability are closely interwoven with the other domains of MANPRINT.

Conclusion

The recent increased concern for soldier survivability has prompted various improvements to doctrine, tactics, training, organizations and materiel systems. The plan to include soldier survivability in the acquisition process as a seventh domain of MANPRINT will complement these improvements.

This seventh domain will expand emphasis on all aspects of survivability—reducing fratricide, reducing the detectability of the soldier, preventing attack on the soldier, reducing vulnerability, minimizing further injury, and reducing physical and mental fatigue—for both the mounted and dismounted soldier. This will ensure that the soldier will not be forgotten nor neglected as advanced technologies continue to proliferate the battlefield.

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A Year in Review...

THE NATIONAL AUTOMOTIVE CENTER

By CPT Matthew J. Barr

Introduction

Located in the heart of the U.S. automotive community, the Tank-Automotive Research, Development and Engineering Center (TARDEC), in Warren, MI, has established an organization whose purpose is to link government, industry, and academia in collaborative research and development efforts. In the face of sweeping military, political and economic changes, Dr. Kenneth J. Oscar, TARDEC's director, saw the need to have closer ties with these organizations. Thus, the seeds for the National Automotive Center (NAC) were planted.

Dr. Oscar appointed Alexander Farkas to head a task force which would lay the ground work for this organization. Oscar's guidance was to "think big, be innovative, entrepreneurial, and have a future focus." A good analogy to this process is when Steve Jobs, founder of Apple computers, wanted to create an ultimate personal computer. Jobs took a small group of dynamic individuals and then guided them to success; the result was the Macintosh computer.

Formulation

A task force was assembled consisting of only five individuals, each had a particular expertise in one or more areas of research, engineering, manufacturing, human resources, and systems integration. A concept was formulated that focused on four areas: collaborative development, manufacturing development, professional development, and basic research.

Initial contacts were made with industry to discuss possible collaborative efforts. NAC members worked closely with the U.S. Council for Automotive Research (USCAR), a consortium of General Motors, Ford and Chrysler, which sponsors pre-competitive research. Other governmental labs that had success in technology transfer and cooperative agreements were also looked at.

We invited automotive executives and university officials to tour our unique facilities and equipment. These briefings on our critical areas of technologies yielded positive reactions and stimulated further follow-up meetings.

Simultaneously, we began to write our mission, vision, goals, and objectives. We then sent them to various departments and agencies such as the Departments of Transportation, Energy, and Commerce.

A meeting was then held with U.S. Senator Carl Levin (D-Mich), Commanding General of TACOM MG Joseph Raffiani Jr., Dr. Oscar, NAC members, vice presidents of the Big Three, and USCAR. At this meeting they endorsed our concept of the National Automotive Center (NAC). The NAC's mission is to act as a catalyst to attract and stimulate collaborative dual-use technology efforts between government, industry, and academia. At this meeting the USCAR was assigned the task of hosting, in coordination with the NAC, an automotive exposition. The goal of the exposition was to display defense labs critical technologies to the automotive community.

Accomplishments

In February 1993, the Automotive Exposition became a reality. More than

The National Automotive Center has been working closely with representatives from government, industry, and academia to forge the future in military automotive technologies.

15 defense labs exhibited their latest state-of-the-art technologies. More than 1,000 people attended the three-day event. Thus far, many cooperative research and development agreements (CRDA) have been formed as a direct result of the exposition. This was the first time in Michigan history that defense labs displayed their technologies to the automotive community.

The initial congressional funding for the National Automotive Center was to conduct or manage research activities for advanced automotive technology development. Working closely with defense technology plans and TARDEC, the NAC formulated a list of critical technologies and a Broad Agency Announcement was released asking for abstracts in critical areas such as materials, sensors, and design automation. Over 700 abstracts were received. A selection process narrowed the list down to 126 proposals. The NAC then funded 26 contracts in such areas as electronics, mobility, robotics, and software.

Throughout this project, the NAC has worked closely with its legal staff in establishing the NAC. One key accomplishment was the NAC Department of the Army Charter. The charter specifically includes the formation of an advisory board that consists of government, industry, and academia. The legal staff was also instrumental in creating a "Blanket CRDA" with both the big three and small business. The aim of these blanket CRDAs is to shorten the individual CRDA process to a few days instead of months.

Projects for the Future

The NAC is actively seeking projects that will project the Army, the automotive industry, and the nation into the 21st century. The NAC has been working closely with representatives from government, industry, and academia to forge the future in military automotive technologies. Some main areas of focus include:

Collaborative Development—The NAC plans to continue its pursuit of collaborative research and development of dual-use technologies. They will also begin building advanced demonstrators that integrate the new technologies as they mature.

Basic Research—The NAC is creating an "automotive research center of excellence" which conducts basic research through a consortium of universities. It is envisioned that this research will provide the building blocks for future dual-use defense and commercial applications.

Agile Manufacturing—This effort is geared to developing pilot programs to evaluate the broad spectrum of technologies, philosophies, and strategies associated with the agile manufacturing vision. These activities will lead to implementation of those aspects of manufacturing agility that best enable us to build and support equipment and soldiers in the field.

Professional Development—This effort is directed at establishing continued education, training, and development programs for TARDEC associates with an emphasis on having the best minds in the country conducting automotive research, development, and engineering on our military equipment.

Conclusion

Although not a new concept, the need for closer cooperation in these financially constrained times is self-evident. For example, the Advanced Research Project Agency's Technology Reinvestment Project has stimulated interaction among various organizations. When people from different backgrounds begin to explore their common goals and needs, and share their unique resources, the potential for new innovative technologies will result in the best equipment for our military. The NAC has positioned itself to serve as the catalyst that links government, industry, and academia in all aspects of automotive technology.

CPT MATTHEW J. BARR is an NAC project officer at the U.S. Army Tank-Automotive RD&E Center and a member of the Army Acquisition Corps. He holds a B.S. degree in business administration from Florida Institute of Technology and M.S. degrees in systems management, human resources management, and psychology from the University of Central Texas. He is also a doctoral candidate with Nova University.

Electro-Optical Systems...

SMART FOCAL PLANE ARRAYS

By Dr. James A. Ratches and Dr. John H. Pollard

Introduction

Desert Storm demonstrated in very clear terms that modern combat is and will be a high technology battlefield. Among the most effective weapons in the U.S. Army's sophisticated arsenal is its night fighting capability. The ability to deny the enemy the cover of darkness has a profound effect on the outcome of the battle.

The U.S. Army's capability to wage war on a 24-hour basis is due in large measure to two electro-optical technologies, image intensification and thermal imaging. Image intensification uses the principle of amplification of ambient illumination. Systems based upon it give the soldier the capability to maneuver on the battlefield and fire small arms or crew served weapons. Image intensifiers are comparatively low cost, light weight, short ranged and light level dependent.

Thermal imaging, equivalent to infrared (IR) viewer and Forward Looking Infrared (FLIR), senses infrared radiation that all objects emit since they are at temperatures above absolute zero. Most terrestrial bodies of interest to Army combat operations are at or about 300 degrees Kelvin, which have peak emitted radiation in the infrared spectral region. FLIRs are light level independent, but are typically expensive, big, and require a great deal of power. They do, however, permit very long range target acquisition for day or night operation.

Generations of Thermal Imaging

The heart of a thermal imager is the detector array. This component, which is usually made of a very sophisticated material, such as mercury cadmium tellurium (MCT), is the element which transduces the infrared radiation into electronic signals.

In the present generation of thermal imagers, which have been fielded in the tens of thousands, the detector is composed of 60, 120, or 180 MCT detector elements in a row in a dewar (vacuum flask) where they are cooled to 77 degrees Kelvin. The linear detector array is scanned across the infrared scene by a scanning mirror at a frame rate higher than the eye integration time to produce a real time image on a display after the signals from the detector have been processed by some electronics. IR systems based on this principle have been fielded for all Army applications, e.g. helicopters, combat vehicles, missile systems, and manportable devices.

Although first generation thermal imaging, also called Common Modules, has been so successful in providing the Army with a decisive advantage, the rest of the world, including our potential enemies, has learned the lesson and will attempt to acquire the same capability.

There are several countries other than the United States which have this technology and would be willing to sell it. Therefore, in order to maintain the edge, the U.S. Army has embarked upon an upgrade to its thermal imaging capability through the development and horizontal integration of second generation FLIR.

The second generation of thermal imaging uses the same detector material as first generation, but utilizes totally new material growth and processing technologies to make the detector array of 200 to 4,000 detector elements, which are smaller and more sensitive that first generation Common Module detectors. FLIRs based on this technology can be used for the broad spectrum on missions, such as target acquisition, surveillance, reconnaissance, fire control, and navigation. Staring versions of this more advanced technology, similar to TV image tubes, are also included in this generation for missile seeker applications.

In either scanning or staring systems, the detectors are bonded directly to the read out integrated circuits (ROIC) on the cold finger on the dewar. All the multiplexing is then performed in the dewar prior to the signals leaving the

dewar. There are only 63 leads for a 4,000-element second generation system compared to 180 detectors and 180 leads in the first generation.

Electrical leads in a dewar are the greatest source of heat loss in a cryogenically cooled system. The sandwiched arrangement of detector-bond-ROIC is called a focal plane array (FPA).

Another important feature of FPA-based second generation thermal imaging is, in addition to more sensitivity and higher resolution than first generation, that it is designed to be friendly to computers. Detectors on a second generation FPA are not interlaced, are DC coupled, and in the very high performance regime, they are oversampled, square pixels which are very compatible with automatic target recognizers. The processors or computers that will be interfaced with the sensors on the high performance weapons systems to aid or automate the target acquisition process require highly stable, uniform, oversampled, and otherwise high quality imagery in order to be useful.

The U.S. Army Communications-Electronics Command Night Vision and Electronic Sensors Directorate (NVESD) is the lead organization within DOD in development of thermal imaging technology. The maturity of the second generation, scanning mercury cadmium telluride is such that the Army has decided to incorporate it into all existing and future weapon platforms for target acquisition, fire control, and navigation.

The Army chief of staff has approved the initiation of a program of horizontal integration for second generation thermal imaging for all Army weapon systems where there is a requirement for all-weather, day/night target acquisition. These systems would, for example, include the Bradley, Abrams, Comanche, and Apache.

Smart Focal Plane Arrays

The impetus for the development of a third generation of thermal imaging is to embed a higher level of "smartness" on the FPA. In second generation, the only smart processing on the FPA is multiplexing which, by today's standards, is a great advance in sophistication.

More advanced material growth and processing technologies will permit much higher level processing in the future. Exactly what type of processing will be implemented is not certain at this time. However, examples of candidate functions under consideration are:

- Variable resolution across the image from high sensitivity threat warning sectors to high resolution target identification areas;
- Slewable foveal vision where the high resolution sector on the FPA can be moved around the entire image;
- Auto-cuing of targets;
- Aided target recognition;
- Target prioritization;
- Combat identification;
- Autonomous target engagement.

The above functions, if incorporated at all in the system, are performed to some level of confidence by a fully dedicated processor outside the dewar. The maturity of smart focal planes is such that systems with this technology are envisioned for the 2020 time frame.

The realization of third generation systems will be through anticipated advances in technologies such as infrared material growth techniques (e.g., molecular beam epitaxy), material and device processing (diodes and heterostructures), in situ and in vacuo testing (including laser and dry etching techniques), digital and optical processing, binary optics and microlens arrays, silicon read out circuitry, etc.

One possible configuration of a third generation FPA is shown in Figure 1. Incident multispectral radiation is focused on the FPA by the objective optics, probably reflective, where it is transduced into electronic signals.

There will probably be a microlens array to gather the radiation and give the focal plane array a near unity fill factor for detectors that are much smaller than a unit cell on the FPA. In addition, this will save real estate on the FPA for more processing circuitry and may allow the microlens array to perform some optical processing functions through a neural net concept, as well as optical protection.

The focal plane array will be sensitive to several or even variable spectral windows, e.g. ultra violet, visible, near through far infrared, and possibly millimeter wave via Gas quantum well structures. The output from the detectors would be digitized at some point and digital processing algorithms implemented. However, an unknown amount of optical processing can be envisioned during the complete processing chain.

Once the signal has been transferred to silicon via optical fibers or lattice matching with the detector material, very sophisticated and complex processing can be performed. The functions that can be considered at this point become limited only by silicon fabrication technology, optical processing technology and image processing algorithm maturity.

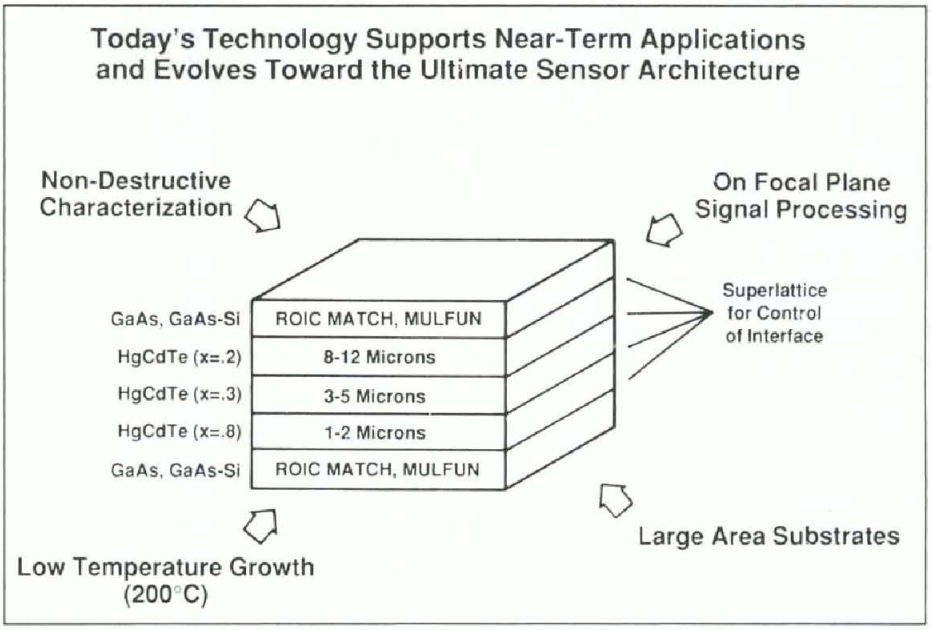


Figure 1.
Third generation monolithic multicolor smart focal plane array.

Smart FPA Microfactory

Developing smart focal plane arrays at an affordable cost has lead to new concepts in manufacturing techniques necessary to provide sophisticated capability and new device structures for the next generation of night vision imaging systems. Such concepts are being pioneered at CECOM's Night Vision and Electronic Sensor Directorate and unique facilities have been established providing the ultimate flexibility in manufacturing.

An extensive, ultra high vacuum growth facility—a microfactory, is shown in Figure 2. It provides separate interconnected chambers which allow the growth, under computer control, with in-situ real time analysis, of group IV, group III-V, and group II-VI semiconductor compounds without interchamber cross contamination. The growth method is a low temperature process using MOMBE/MBE (metal organic molecular beam epitaxy/molecular beam epitaxy). Other features allow the evaporation of metals, dry etching, laser sorbing, and selective area growth.

Another chamber provides detailed characterization with conventional electron and optical spectroscopies of the grown structures at various stages of the growth process. The eventual aim is to provide facilities that will have in-situ lithography and will allow the introduction of a substrate wafer and the removal of a completed focal plane array, including the readout circuitry, without removing from the vacuum.

Plans call for industry and academia to be close partners in future precompetitive developments that will yield world leadership in this technology. Lessons learned from the microfactory will be available to industry and will provide dual use for commercial applications. The facility will take full advantage of computer-aided design and manufacturing and will initiate the potential for realistic simulation of the manufacturing process that will be the key to success in future worldwide competition.

As previously noted, Figure 1 shows the implementation of a third generation smart focal plane array with multiwaveband detector layers integrated with the necessary readout circuitry in a monolithic structure. Superlattices are used between layers to improve the growth morphology and control the electrical interfaces.

Signal processing provided on the focal plane will be determined by the application and what is available from algorithm and device technology. Today in the microfactory, silicon and GaAs layers have been grown on silicon wafers and MCT layers have been grown on these substrates.

Within the next several years diode structures will be fabricated on specially designed silicon ROIC that will perform the smart processing described in the preceding paragraphs. As the manufacturing technology matures in the microfactory, it will be transitioned to industry. Beyond this time frame, new instrumentation will be introduced into the MOMBE that will permit the addition of automation to the processing steps in the microfactory.

Growth processes monitored in the vacuum chamber will be sensed and feedback loops will modify these processes to correct imperfections in the devices before the growth process has been completed. With real time adjustment of growth parameters, perfect specimens will be routinely obtained.

As the U.S. Army gears up to implement the horizontal integration of the second generation of thermal imaging systems, NVESD is looking to the development and producibility of the next generation capability and beyond. The tanks, helicopters, missile systems, and manportable target acquisition devices of the 21st century will have various levels of automation in small, compact packages for which the technology is being made producible today at NVESED.

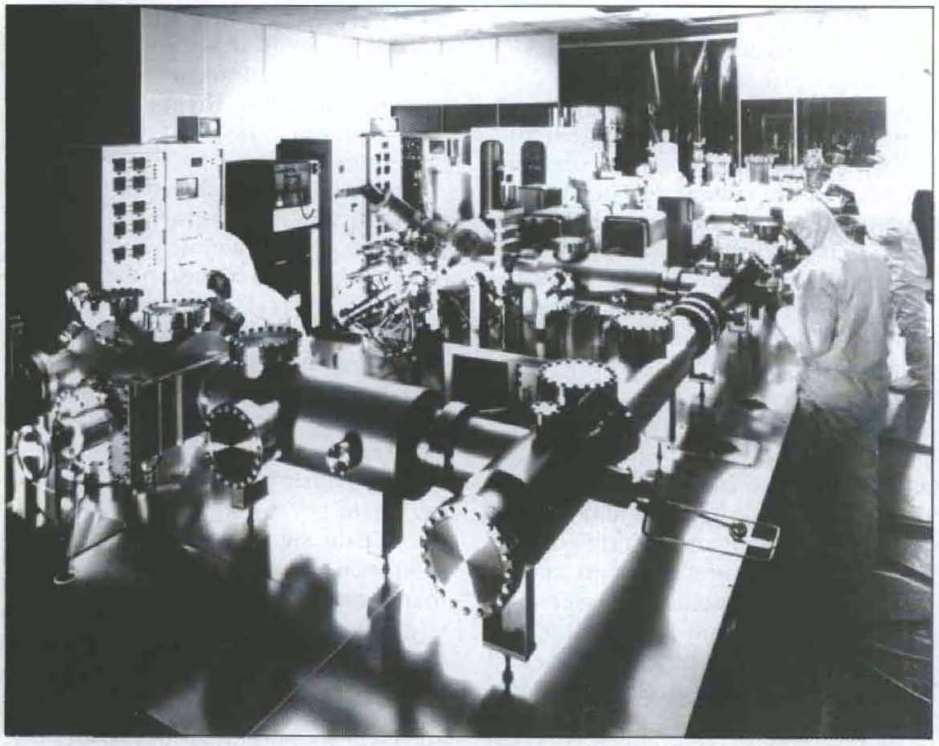
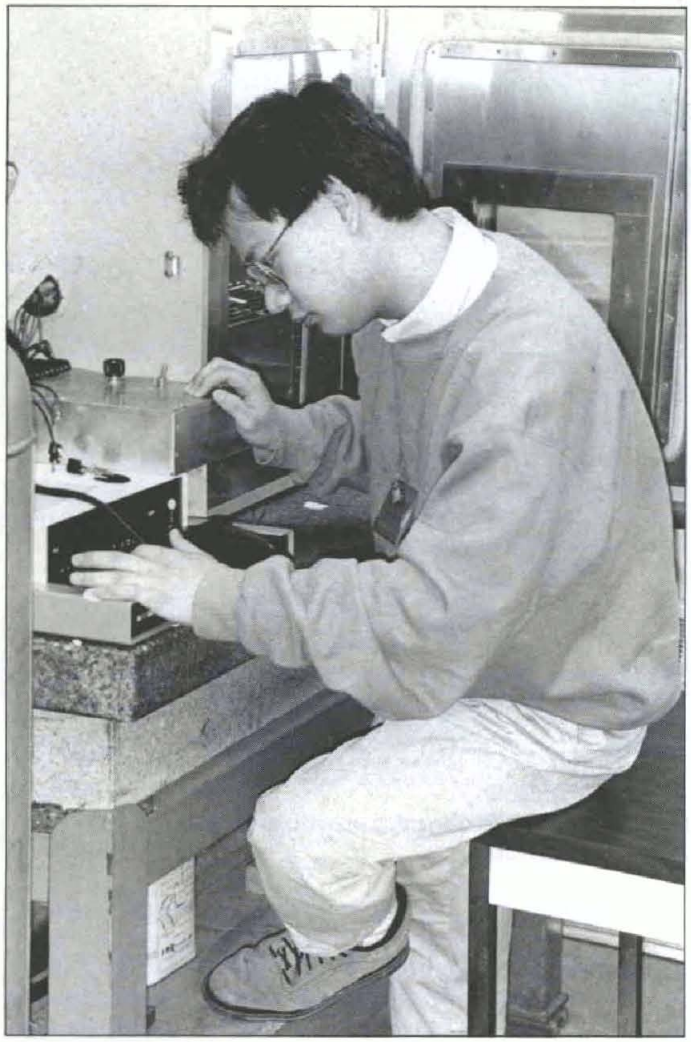


Figure 2.
Molecular beam epitaxy facility.

DR. JAMES A. RATCHES is chief scientist at the U.S Army Communications-Electronics Command's Night Vision and Electronic Sensors Directorate, Fort Belvoir, VA. He has been involved with electro-optics for more than 20 years and holds a B.S. degree from Trinity College and M.S. and Ph.D. degrees from Worcester Polytechnic Institute.

DR. JOHN H. POLLARD is acting associate director for science and technology in the Night Vision and Electronic Sensors Directorate, Fort Belvoir, VA. He received a B.S. degree in physics (with honors) from Bristol University, England in 1957 and his Doctor of philosophy from the University of Scotland in 1961.



Engineer Eric Ngo examines the electronic properties of ceramic materials.

ARMY RESEARCH LAB STUDIES CERAMICS

By Eric Hurwitz

Living in a metal world is not easy for a ceramist. Mike Slavin, of the Ceramics Research Branch at the U.S. Army Research Laboratory's (ARL) Materials Directorate in Watertown, MA, ponders his situation for a second, shakes his head and laughs. "There is hope for us. We are not as inflexible as the materials we work with," says Slavin.

Ceramics have been generally accepted in electronics, but less so in structural applications, as brittleness has often caused a lack of reliability, according to Dr. Dennis Viechnicki, chief of the Ceramics Division. Lately, however, progress has been made structurally and ceramics could soon become a totally accepted "niche" material, which means it will never take over all metal technologies, but will be consistently dependable in areas such as ceramic engines, glass technology and ceramic armor. Also, ceramics have become successful in commercial applications such as knives, hammers and golf club faces.

Ceramics have been defined in many different ways, but they generally have the characteristics of being derived from the earth, non-metallic, inorganic and typically brittle, and either made or used at high temperatures.

The theory behind using ceramics is that they have properties that make them resistant to intense heat, high ballistic impact, extreme wear, corrosion and erosion. Those properties, along with the wide availability of raw materials, make ceramics a very appealing and promising technology.

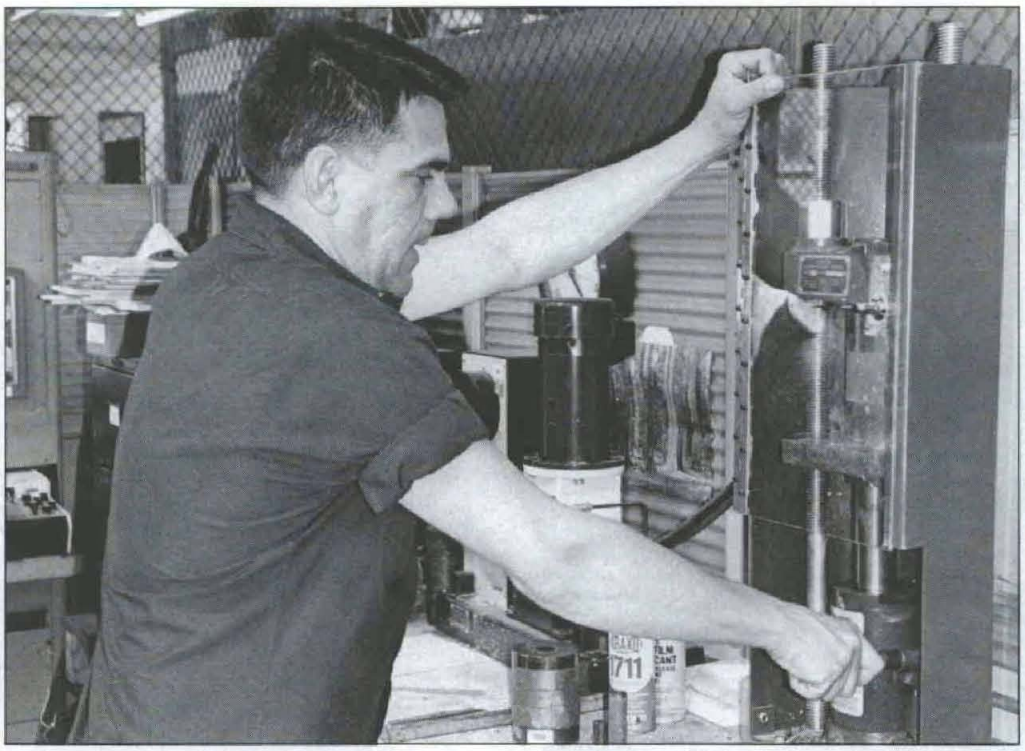
Until recently, many applications for high performance ceramics were unique to defense, with no immediate commercial markets to help reduce costs. Currently, ARL is working with the private sector to encourage interest in new processing technologies to lower the cost of such materials.

While Viechnicki anticipates continued progress with ceramics, he says that roadblocks to that success may include the "brittleness" problem and that many times "normal and conventional approaches" can't be made in trying to get around the problems of mixing metal and ceramics.

"You just can't substitute a ceramic part for a metal part," says Viechnicki. "Because there's a need for redesign with many applications, acceptance has been slower and more costly."

Slavin says a product manager will usually not want to use a brittle ceramic during the initial design, because he believes it might be too risky. By the time he finds out there is a performance problem with a metallic component, the system design precludes replacement with the ceramic. The overall system performance will be lowered.

"I'd like to clear up a common misunderstanding regarding brittleness. Ceramics are, in fact, quite stiff and



Science technician Bob Lancto works a machine that presses ceramic powders into pellet form. The pellets can be used in several applications.

brittle, but brittleness does not mean weak," says Slavin.

Ceramics have become stronger and tougher through fiber reinforcement. Stronger fibers have been weaved into the ceramics, so that it stops the cracks or breakage of the material. As a result, ceramics are now uniquely able to perform and survive in many extreme environments. Current research seeks better processing techniques to improve and control the properties of ceramics that make them resistant to intense heat, high ballistic impact, extreme wear, corrosion and erosion.

Applications include ceramic engine components (zirconia and silicon nitride), advanced ceramic armor (titanium diboride and silicon carbide), ceramic gun tube liners (silicon carbide, siALON and silicon nitride) and new glass technology (oxynitride glass, fiber and bulk).

The ARL-Watertown Ceramics Division has found diverse applications for ceramics. Take solid oxide fuel cells, for example. The fuel cells are being developed to produce silent electrical power from diesel fuel in ground vehicle systems. Dr. Thomas Hynes says that the fuel cell elements look like corrugated cardboard, but they are actually ceramics that "look flimsy, but on the contrary, are strong and can be mounted to withstand vibration."

The technology could reach fruition within five years. Hynes says that the Army looks at this program as a potential technology in reducing noise signatures and possibly fuel consumption. Several federal agencies have used fuel cells. NASA used fuel cells to power the Lunar Space Craft. The Department of Energy had also invested a lot of resources into the fuel cells.

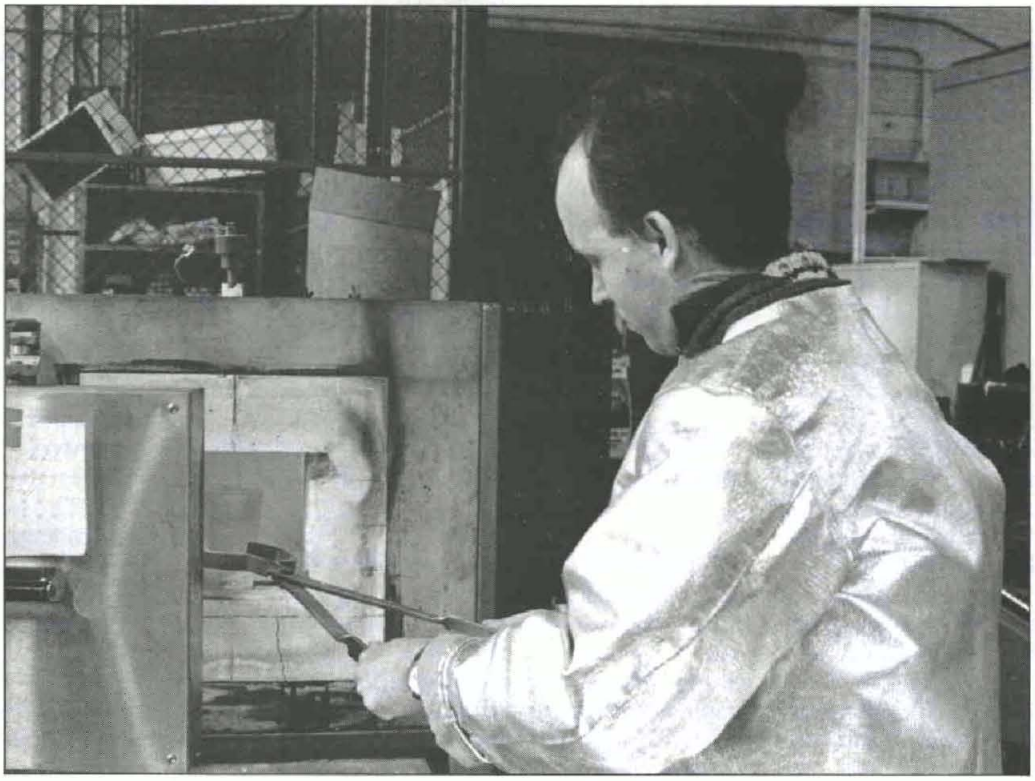
"The real problem is to economically manufacture the monolithic cells. I am encouraged, however, that we will solve all these problems as time goes on. We have to get through a few stages, and once we do, things will look very good," says Hynes.

The ceramics mission certainly doesn't end there. Phase shifters serve as another prime example of the headway being made with ceramics. Ceramic phase shifters are materials that may allow for the manufacturing of low-cost phased array radar antennae, which can be directed electronically rather than mechanically. Electrical engineer Dr. Louise Sengupta says the ferroelectric materials have electronic properties a thousand times better than prior state-of-the-art materials. They will also cost less to manufacture and will provide wider application.

"This program has a lot of potential. No one had been able to get this right before. The materials that had been produced were not of great quality. We have come up with fine materials, and think this project will progress greatly in the next few years," says Hynes.

Dr. Martha Fletcher has another promising program. Fletcher had a contract with the University of Michigan to produce fibers from pre-ceramic polymers, which resulted in the discovery of "a whole new chemistry." Some of the pre-ceramic polymers derive from waste materials; others are developed from materials as simple as beach sand and antifreeze. A contractor at the University of Michigan experimented with these materials until coming up with a low-cost, high-quality silicon carbide fiber for reinforcing engine ceramics. Fletcher also says that the Japanese, who have produced similar materials, cannot match the quality of the new material.

Unfortunately, the program is on hold, because of Army funding constraints. Fletcher says she hopes the program will start up again because this could serve as a real breakthrough in the strengthening of ceramics. Once again, the auto industry, as well as four domestic and foreign chemical companies, has shown interest in other



Engineer Steve Stowell heats ceramic powder.

applications of the materials. "It is a very promising technology. We hope to get the program started again," says Fletcher.

Ceramic thermal barrier coatings, which focus on thermal insulation material used in advanced low heat rejection engines, appears to be another winning technology. Targeted components are diesel engines—specifically the exhaust valve and piston ring—and gas turbine engines.

Dr. James Marzik and his solid-state science team (six employees) are depositing zirconium oxide onto glass, aluminum and cast iron materials. Currently, they are attempting to increase adherence of the coating to the targeted areas.

Laser glazing, which uses laser technology to modify coating surfaces, shows tremendous potential. Marzik says that a thin laser-glazed coating significantly improves coating life by "healing surface flaws." Also, the technique does not adversely affect other properties. Tests with a calibrated torch on a burner rig show a 50 to 100 percent improved coating life over non-laser-glazed material. Marzik also says that the technique does not significantly impact normal costs of producing ceramic thermal barrier coatings.

The Army has a contract with Rockwell International on this project, which, if it continues, could reach its full potential within three to five years, according to Marzik.

Marzik also reports that the ceramics group has participated in a joint working group involving the Japanese Defense Agency. The U.S. Army Tank-Automotive Command has also played a major role in the discussions. Marzik says group members have discussed engine combustion, low heat rejection engine design and high temperature materials.

The venture is in an early stage but Marzik says, "The exchange of ideas should help advance the technology leading to improved combat vehicle engines."

The ceramics branch certainly realizes its progress with all of these materials. Viechnicki and Slavin both say they look forward to further improvements. Slavin says ceramics have come a long way, but not far enough.

"Unfortunately, if you are starting from top-down, it's hard to say 'no' to it (ceramics) because there's so much potential. Unfortunately, the training base has been lacking. That's why we need better education," says Slavin.

Slavin notes that education may not be readily accessible, as "the advanced techniques required to design ceramics are usually not taught in undergraduate programs, which is the typical education level of most design engineers."

Still, progress has been made in the education field. "When I was going to school, you could count on one hand those who were teaching ceramics," says Viechnicki, who has worked at Watertown for 26 years. "Now there are many schools implementing ceramics into their program. Also in the schools, more women are taking ceramics courses. I'm not quite sure why, but that is also encouraging."

With a commitment to education and with engineers and scientists continuously finding ways to strengthen the material, the ceramic field may be well on its way to shedding the "brittle image." "It's an interesting field, and I feel we will be seeing some good things for the future," concludes Viechnicki.

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COOPERATIVE APPROACHES LEAD TO SUCCESSFUL DEVELOPMENT OF XM295

By Steven R. Harlacker and Mansfield M. Spicer

As a result of recent world events involving the use and potential use of chemical and biological warfare agents, the Army has placed a renewed emphasis on ensuring soldiers' abilities to survive, fight, and win on a chemical/biological-contaminated battlefield.

Though effective systems are available for decontamination of skin and larger items such as vehicles, an improved system designed specifically for the decontamination of soldiers' individual equipment (such as his weapon and helmet) was needed.

Recognizing this need, the Army chartered the Edgewood Research, Development and Engineering Center (ERDEC), formerly the Chemical RD&E Center, with responsibility for leading an effort to quickly develop an effective, durable item for decontamination of individual equipment. This item was known as the XM295 Individual Equipment Decontamination Kit. To best accomplish the program, ERDEC structured an effort which sought early and continued involvement from all participants in the development process.

At the outset of the program, initial planning and trade-offs concerning item requirements and evaluation criteria were agreed upon by the combat and materiel developers and the tester/evaluator. With the key requirements and trade-offs established, ERDEC awarded a development contract and relayed the information to its contractor.

With the assistance of a motivated development contractor who devised numerous and often novel concepts, initial design concepts were evaluated by development team members representing various disciplines (such as human factors and production engineering) as well as the combat developer.

The preferred features of various concepts were melded into a single concept design following several reviews and involvement with the development contractor and other interested parties. Prototypes were provided as was input on the relative ease of manufacture.

Once the concept was finalized, technical documentation (drawings and specifications) representing the item was prepared by the development contractor. The technical manual for the item was prepared in-house by ERDEC technical writers who solicited comments from the tester, combat developer, materiel developer, and logistician communities.

On completion of quality assurance tests at the contractor's facility and manuals at ERDEC, test items were fabricated, manuals were prepared and both were promptly provided to test sites.

Since the test schedule was compressed (the entire development was compressed into a period of only approximately 27 months), the tester/evaluator structured a test plan to provide the most important information earliest. This allowed a milestone III decision based on test data from the most important tests. The tester/evaluator's risk assessment concerning the less critical tests was also included in this decision.

The key tests were completed as planned and the XM295 performed better than expected. When shortcomings, all of which were relatively minor, were identified, prompt corrective actions were implemented with the support of the tester/evaluator.

Using these key test data, ERDEC prepared the milestone decision documentation. Along with the tester/evaluator's assessment of risk pertaining to the remaining tests, the documentation allowed the in-process review participants to make an informed recommendation to adopt the item.

Cooperation among the tester/evaluator, and the combat and materiel developers resulted in mutual understanding and agreement on the development program and the item's expected performance. A feeling of ownership and responsibility prevailed, contributing to the success of the effort. In the end, the field soldier benefits the most with an improved ability to survive on the battlefield.

M295 Individual Equipment Decontamination Kit.

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TEAMWORK, STREAMLINING SPEED FIELDING OF MINE DETECTOR

By Austin Chadwick

Introduction

One of the most harrowing experiences an individual foot soldier can face during wartime has to be entering a minefield. GEN H. Norman Schwarzkopf, in a memorable Operation Desert Shield/Desert Storm episode, described the intensity of the situation. He recounted how, as a young officer in Vietnam, he had to extricate a soldier trapped in a mined area.

Commenting on the desert war, Schwarzkopf remarked that it takes only one mine for the intensity to set in. In fact, there were enormous numbers of mines awaiting the coalition forces. Fortunately, they were able to avoid most of them.

Still, about half the U.S. fighting men and women who died during the ground phase of Desert Storm were killed by mines. What's more, the number of mines sewn in places like Afghanistan, Cambodia and Somalia is staggering. Worst of all, the ability to lay widespread minefields quickly has far outrun the ability to clear them.

The good news is that the Army is fielding a new hand-held mine detector: the AN/PSS-12. This new portable metallic-mine detector improves technologically on the AN/PSS-11. Its story is also a vivid example of how robust teamwork can produce smart acquisition.

Background

Locating and clearing minefields is difficult, and the methods often primitive. For many armies in the world, even now, soldiers getting down on their hands and knees and probing for mines with their bayonets is the accepted standard.

In the future, standoff systems may be capable of detecting and neutralizing minefields for the American soldier. Right now, tanks with plows and rollers are able to do some heavy clearing, and line charges can blast a lane free. The focus here is on individual soldiers and what they can do in looking for both anti-personnel and anti-tank mines that contain metal components.

The Office of the Army Project Manager for Mines, Countermine and Demolitions (PM-MCD), headquartered at Picatinny Arsenal, NJ, managed the effort to acquire the AN/PSS-12. An office of PM-MCD resides with the U.S. Army Belvoir Research, Development and Engineering Center (BRDEC) at Fort Belvoir, VA. BRDEC is an element of the U.S. Army Aviation and Troop Command (ATCOM), St. Louis, MO. ATCOM was formed from the merger of the U.S. Army Aviation Systems Command (AVSCOM) and the U.S. Army Troop Support Command (TROSCOM) in October 1992. The cooperation among these organizations made the acquisition and fielding of the AN/PSS-12 noteworthy for its speed and effectiveness.

History

The U.S. Army has had hand-held mine detectors since World War II. The AN/PSS-11, fielded in 1962, was aging and deteriorating after 30 years in the inventory. The inability to procure outdated electronic repair parts and replace worn rubber and cable components, prompted the Army to modernize the AN/PSS-11 in the early 1980s. After limited testing, the military-designed detecting set was type classified Standard "A" in 1984.

In 1986, the Army allocated funds to procure the AN/PSS-12. Two successive production contracts were awarded—and then terminated—because the contractors ran into technical and financial problems. Caught between the non-producibility of the AN/PSS-12 and the unsupportability of the AN/PSS-11, the Army abandoned its military design and went in search of a commercial unit.

In mid-1990, a worldwide NDI (non-developmental item) program began. The Army was looking for a set already in production that performed as well as the AN/PSS-11.

After an extensive source selection process and much technical and operational testing of two competitors, type classification took place in December 1991. The Austrian company of Schiebel Electronic Instruments G.m.b.H. was awarded a contract by TROSCOM, in December 1991, to supply 10,000 sets. The Army exercised an option for 6,000 more in November 1992.

Streamlining

The Army is especially proud it took less than 2½ years to bring its NDI approach to fruition, including test and evaluation, procurement and fielding. Normally, twice the time would be more likely. Here's how they did it.

Many manufacturers who make metal detectors have militarized their designs and are selling them as mine

detectors. The U.S. Marine Corps and several North Atlantic Treaty Organization (NATO) countries have exhaustively evaluated commercial mine detectors worldwide. In doing so, they identified candidates for the AN/PSS-12. The Army capitalized and built on the existing data in pursuing an NDI approach.

BRDEC took the 1984 type classified AN/PSS-11 design specification and rewrote it to a performance specification. They accomplished this by drawing on the available data and further testing of commercial detectors.

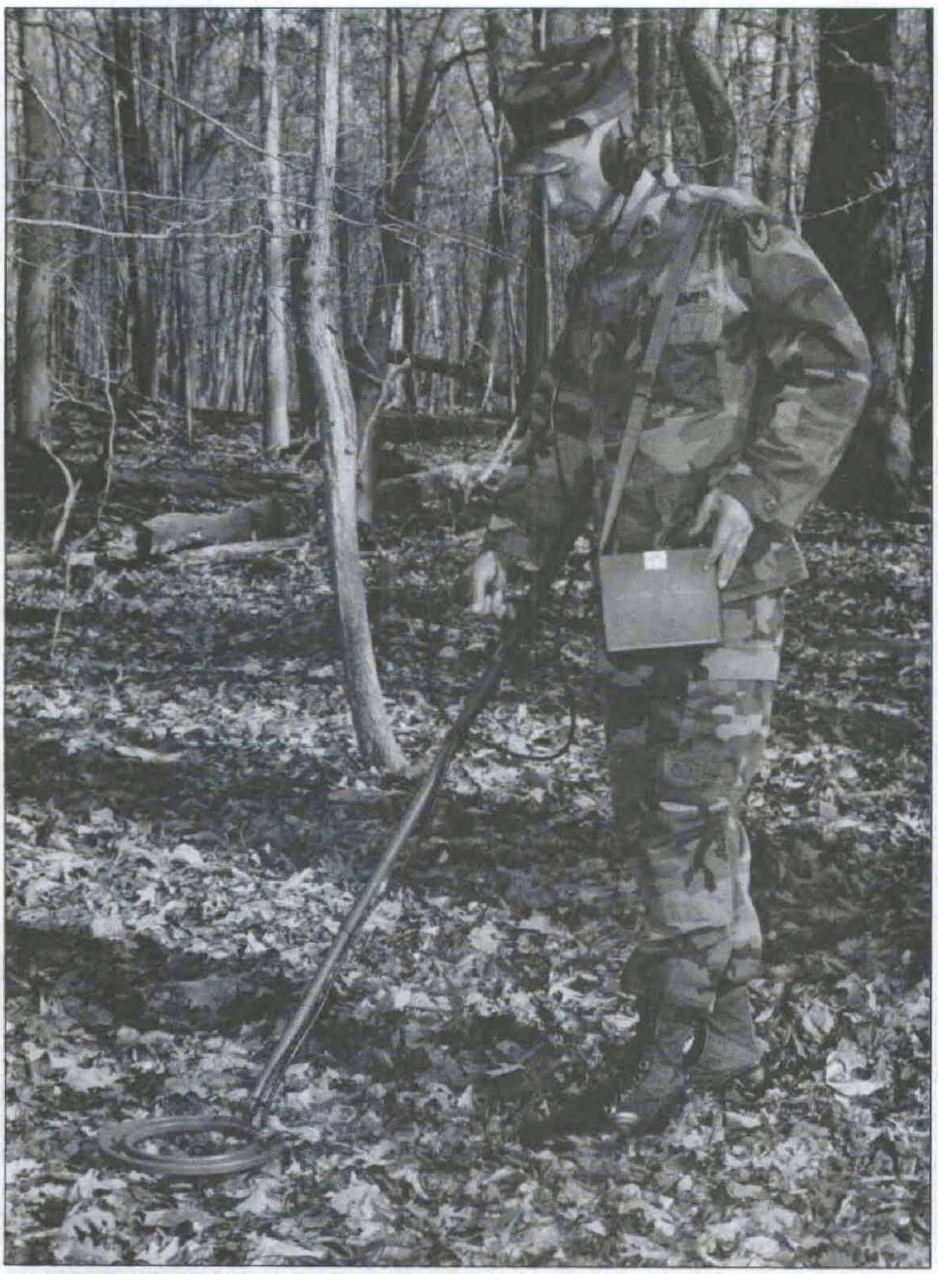
The U.S. Army Training and Doctrine Command approved the use of this performance specification in lieu of a requirements document in April 1990. This approach precluded the development of new requirements documents, which would have taken at least a year longer.

To further expedite the acquisition process, comprehensive test data and evaluations replaced a market survey to support the Milestone I In-Process Review. The innovative contract approach called for research, development, test and evaluation to be combined with production. The "best value" emerged from the multiple candidate contracts.

The AN/PSS-12 was also one of the first items to be type classified in accordance with the new Department of Defense 5000-series procurement regulations.

After type classification, a new operator manual was required to meet material-release standards. The responsible agencies and the contractor got together and, in two days, developed and produced the new manual. These two days included validation and verification, which normally take weeks.

The U.S. Army Test and Evaluation Command and the U.S. Army Operational Test and Evaluation Command met accelerated test requirements and provided timely reports in support of the type classification action.



A soldier listens for a signal in his headphone, indicating the AN/PSS-12 has detected a mine or other metallic object.

Description

The full nomenclature is the Detecting Set, Metallic-Mine, Portable, AN/PSS-12. The original Schiebel model was the AN/19-2. It consists of a search head, collapsible handle assembly, control box with associated electronics, power supply and connecting cables, headset, and transport case.

The set can detect extremely small bits of metal. This makes it effective even against nonmetallic mines, which encase the explosive in plastic. That's because such mines typically contain small metal parts. It also detects magnetic-influence-fuzed mines without activating them.

The AN/PSS-12 can operate in salt water and any climate. It runs on standard D-cell batteries. An operator can get the unit operational in about three minutes. An audible signal to the user's headset indicates a metallic object near the search head.

The soldier using the AN/PSS-12 moves the search head in a semicircular pattern at the rate of about three feet per second. Because of the low mutual interference of detectors, several individuals can search in overlapping patterns to cover larger areas. When the operator detects a mine, he runs the search head in a crosswise pattern above the spot. The signal in his headphone is strongest when the search head is directly over a piece of metal.

This mine detector can be used by individual soldiers in all units for a number of countermine missions. These include route clearance for infantry and

A portable AN/PSS-12 metallic mine detecting set.

vehicles; off-route, beach, and inland clearance; surf zone, stream, and lake countermeasures; and reconnaissance detection and sampling.

It can operate a minimum of 16 continuous hours without degradation on one set of batteries. Soldiers can use it in NBC (nuclear, biological, chemical) MOPP4 (mission-oriented protective posture/level 4) gear, cold-weather clothing, or helmets and flak jackets.

Fielding

Fielding began in April 1992. The initial issue of 241 units went to the 82d Airborne Division and the 20th Engineer Brigade of the XVIII Airborne Corps at Fort Bragg, NC.

In December 1992, 119 mine detectors were shipped to Fort Drum, NY, in support of Operation Restore Hope in Somalia. At the same time, 113 sets were dispersed to U.S. Army Forces Command units via accelerated fielding.

In all, more than 200 units arrived in Somalia. They had been purposely diverted from ongoing fielding for use by our troops deployed to Operation Restore Hope. The troops knew they would encounter a significant mine threat in Somalia because of the many years of fighting there.

The overall strategy to issue as many units as possible, as soon as possible, includes rapid fielding to entire installations.

Maintainability

Fielding has begun in earnest for the AN/PSS-12. The good news coming from the field is that soldiers like the detector because it's lighter, more reliable and easier to maintain than its predecessor. In terms of Total Army Quality, this equates to a very satisfied customer—the soldier.

Maintenance is simple because the set uses common parts such as flashlight batteries. That makes the mine detector economical, as well.

NATO interoperability is another big plus, since the Schiebel detector is used by some other members, including the United Kingdom, Germany, Canada and the Netherlands. Several armies in the Middle East also employ the AN/PSS-12. It has seen service with the United Nations in Afghanistan and Lebanon, and has aided clean-ups in Kuwait and Angola.

In addition, the AN/PSS-12 NDI program is the first to qualify an overseas contractor in statistical process control (SPC) methods.

Summary

The Army's new hand-held metallic-mine detector, the AN/PSS-12, has already begun to make its mark with rapid fielding to high-visibility units like the 82d Airborne Division and troops that were deployed to Somalia.

It's a success story driven by an urgent need to replace the aging and deteriorating AN/PSS-11. Several organizations mounted a concerted response to this requirement, resulting in a fast and effective NDI program.

In doing so, they've supplied our troops in the field with an important piece of equipment to address the continuing worldwide proliferation of landmines.

Austin Chadwick is a public affairs specialist at the U.S. Army Belvoir Research, Development and Engineering Center. He has B.A. and M.A. degrees in English from the University of Rhode Island.

DIAGNOSTIC ANALYSIS AND REPAIR TOOL SET

By Dr. Li Pi Su
and Charles D. Bosco

Introduction

Concurrent engineering is a process-oriented approach that integrates system development efforts of design, manufacturing, and support. Until recently, these three efforts were not considered concurrently, partially because there were no adequate tools to support this approach. As a result, three main logistics problems occurred:

- The influence of system design for testability was insufficient;
- The development of system test programs (TP) was difficult, costly and time consuming; and
- The TPs were often ineffective.

Designing a system that can be diagnosed and tested is an important facet of the concurrent engineering process. It is an up-front design activity that makes an integrated diagnostics approach realizable.

The Army currently invests heavily in the procurement of automatic testing and diagnostics to support its weapons systems. The major cost driver in this investment is associated with the development of test program sets (TPS). Traditionally, the TP development process is very labor intensive, hence, very expensive.

As Army weapon systems become more complex, the time and cost associated with developing accurate test and diagnostics increases exponentially. Some of the causes for these problems are insufficient design data, instability of the unit under test design, and the developed TP intimately tied to both the weapon system design and the specific test equipment.

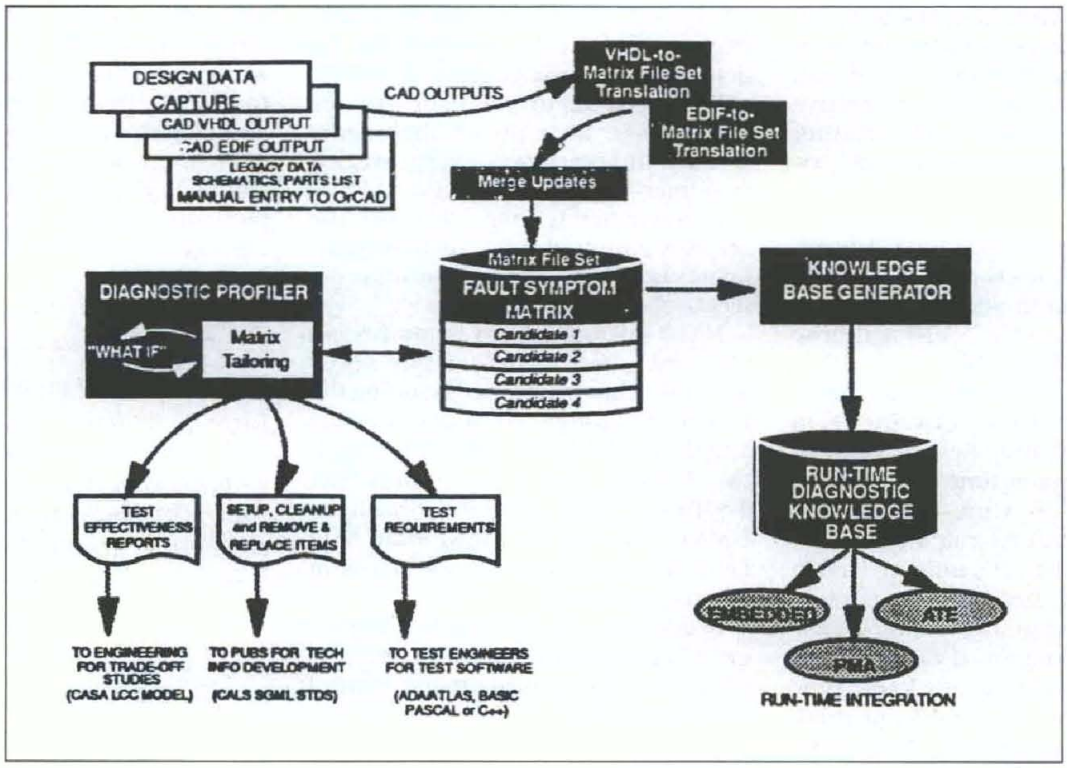


Figure 1.

Near Future

In the near future, advanced software and hardware technologies will provide much lower costs with a more effective diagnostic capability for Army weapon systems.

The "Soldier's Computer," and Army initiative of the Communications-Electronics Command's Advanced Systems Concept Office, is focused on providing highly portable computer resources and computer-based information to the soldier in the field.

The U.S. Army Test, Measurement, and Diagnostic Equipment Activity is investigating the use of the soldier's computer as a portable maintenance aid (PMA) for field-level repair and check of weapon systems. This will provide the field level technician with significant benefits over today's less portable test, measurement, and diagnostic equipment. To accrue these benefits, the soldier's computer must host intelligent, adaptable diagnostic software systems. The adaptable diagnostic software model has many applications. It can:

- Provide accurate and efficient test and diagnostic capability for development of TP to support Army weapon systems;
- Be embedded within the prime system as a portion of the built-in test;
- Be used in conjunction with a PMA, such as, the Army's Contact Test Set (CTS) or a Soldier's Computer System (SCS) with voice recognition and helmet display; or
- Be embedded into a piece of automatic test equipment, such as the base shop test set.

Investment Strategy

One of the primary responsibilities of the Advanced Technology Office (ATO) is the development, demonstration, and transition of technology which enhances the Army's ability to provide accurate and efficient test and diagnostic capabilities. The investment strategy is focused on leveraging high pay-off technologies.

The ATO has extracted and integrated the diagnostics concepts, standard, and methodologies of the Navy's Integrated Diagnostics Support System, and the Air Force's Generic Integrated Maintenance and Diagnostics Specification and completed development of a concurrent engineering diagnostic tool set called the Diagnostic Analysis and Repair Tool Set (DARTS).

Elements of DARTS were employed to successfully embed diagnostics in the Navy's Seawolf submarine. IBM Federal Systems Company has been instrumental in providing development support for this tool.

Model-Based Technology

The DARTS is a model-based approach that addresses the basic problems associated with what a TP is and how it is developed. It translates the actual design of the system into the engineering representation in software. Using the engineering representation of the unit under test (UUT), DARTS develops a fault/symptom matrix for the UUT.

Fault/Symptom matrix maps the propagation of failures in the design and identifies each possible fault where

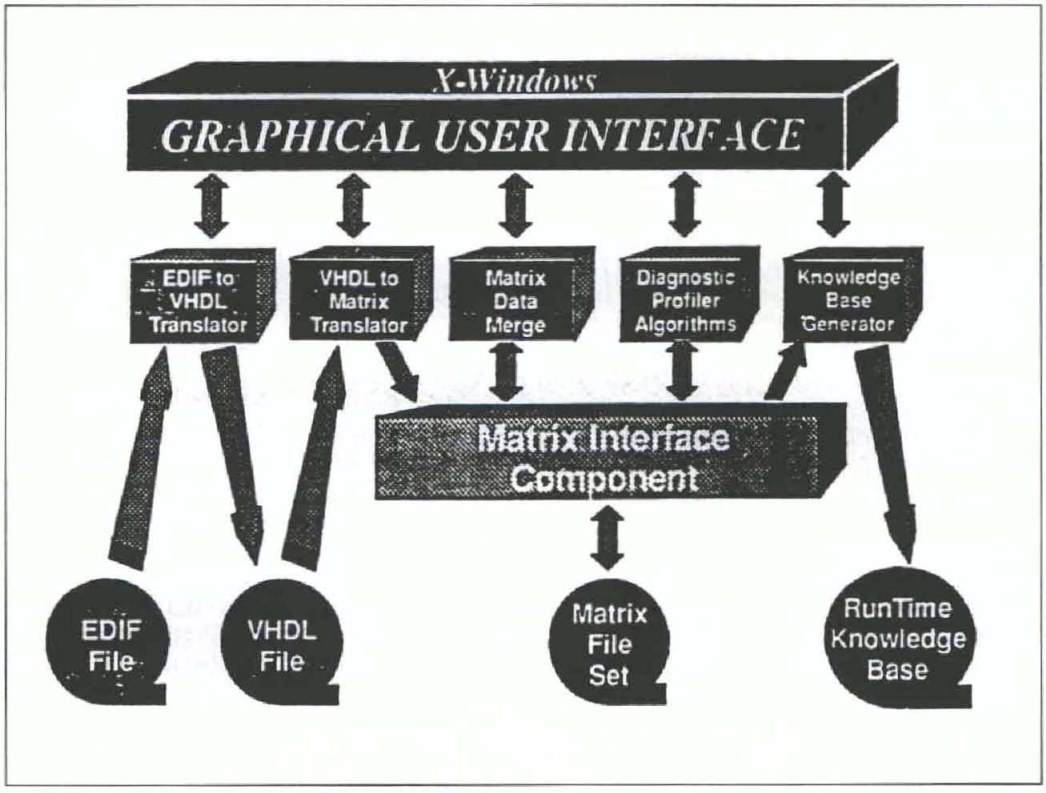


Figure 2.
Diagnostic Analysis and Repair Tool Set Concurrent Engineering Tools.

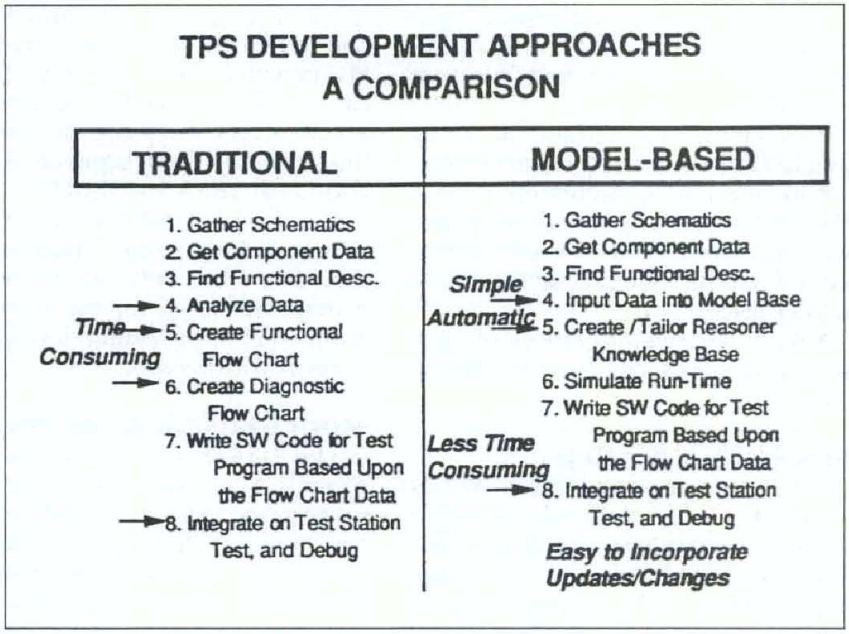


Figure 3.
Comparisons on model-based and traditional test programs development processes.

the symptoms will be observed and measured. Using the fault/symptom matrix, the model is able to analyze test results and locate the exact cause (fault) from the observed and measured symptoms.

The model does not care where symptoms come from. It operates with any source of symptomatic data: the prime system itself (1553 data bus or built-in test), the automatic test equipment (ATE), or operator observations. That is, DARTS generates a diagnostic knowledge base independently of the test platform. Hence, the reasoning and diagnosis can be developed concurrently with the design of the UUT. This allows test capability analysis and diagnostic strategies to be performed and developed up-front. As a result, the UUT can be designed properly for supportability.

Moreover, this approach uncouples the diagnostics logic from the test program; therefore, the ATE need not be built to initiate diagnostic software development. This is the key to facilitating a concurrent engineering approach.

Diagnostics

The key to concurrent engineering of support is the software package, Dynamic Reasoner, automatically generated by DARTS. This interacts with the systems engineering team (reliability, maintainability, availability, testing capability, integrated logistics support, safety, human factors engineers) to generate the diagnostic subsystem concurrently with the design and manufacturing process. It is the single knowledge base for test capability enhancement, built-in test (BIT) design, embedded diagnostics, production test, portable maintenance aids, depot diagnostics, and portable field diagnostics test.

An overview of the process and tools which make up the DARTS are provided in Figure 1. The tools are resident on an 80486 personal computer. The Graphical User Interface for the DARTS is X-Windows with Motif format. The interfaces are software modules which display both text and graphics on a terminal screen and accept user inputs from a keyboard and pointer device (usually a mouse). X-Windows is the defacto standard on all UNIX based systems and the only one that completely supports networks. X-Windows based applications software can generally be ported to any UNIX based workstation.

The DARTS tools are defined in detail as follows:

• **Design data capture tools.** These tools capture initial design data. They allow a flexible data capture process for diverse applications. Design data can be captured from a Computer-Aided Design (CAD) data base in either the Electronic Design Interchange Format or the Very High Speed Integrated Circuit Hardware Description Language (VHDL). DOD requires all new digital designs to be documented in VHDL (IL-STD-454M).

• **Diagnostic Profiler.** This set of programs interactively analyzes circuit designs. It allows the user, based on the mission and maintainability requirements and available test resources, to develop the optimum diagnostic profile(s).

• **Diagnostic Knowledge Base (DKB) Generator (DKBG).** This is a software algorithm to create a system/unit under test for specific diagnostic modules to be used in a run-time environment. The DKBG analyzes design and operational information and pre-computes data needed for diagnostics. It formats the results into a Runtime Knowledge base.

• **Diagnostic Runtime System (DRS).** This software tool allows DKB to run in simulation mode. It is also used for verifying and integrating products of DKBG. The DRS utilizes an artificial intelligence set covering techniques to identify causes of faulty UUTs in a runtime environment.

Combining DKB and DRS creates a *Dynamic Diagnostic Reasoner (DDR).* The DDR can diagnose a faulty UUT from available data. It uses BIT results, user observations, Automated Test Equipment functional test results, and test points' test results to perform diagnostics.

These tools are very robust and may be used as stand-alone tools or together. Figure 2 provides a complete development flow of the concurrent engineering process and the output products of each step.

Model-Based Vs. Traditional Processes

In a TP development effort, the quality of UUT input data, such as a Test Requirements Document (TRD), is a major risk factor. The government spends a great deal of money to capture the design engineer's intimate knowledge of the design through a TRD. Unfortunately, as design changes and updates are made, the TRD loses its accuracy. Moreover, in the traditional TP development process, one piece of erroneous or missing data can have far-reaching, negative impacts on the entire end item TP.

In a model-based TP development approach, the UUT model is developed as a series of finite, hierarchical logical blocks which represents the design.

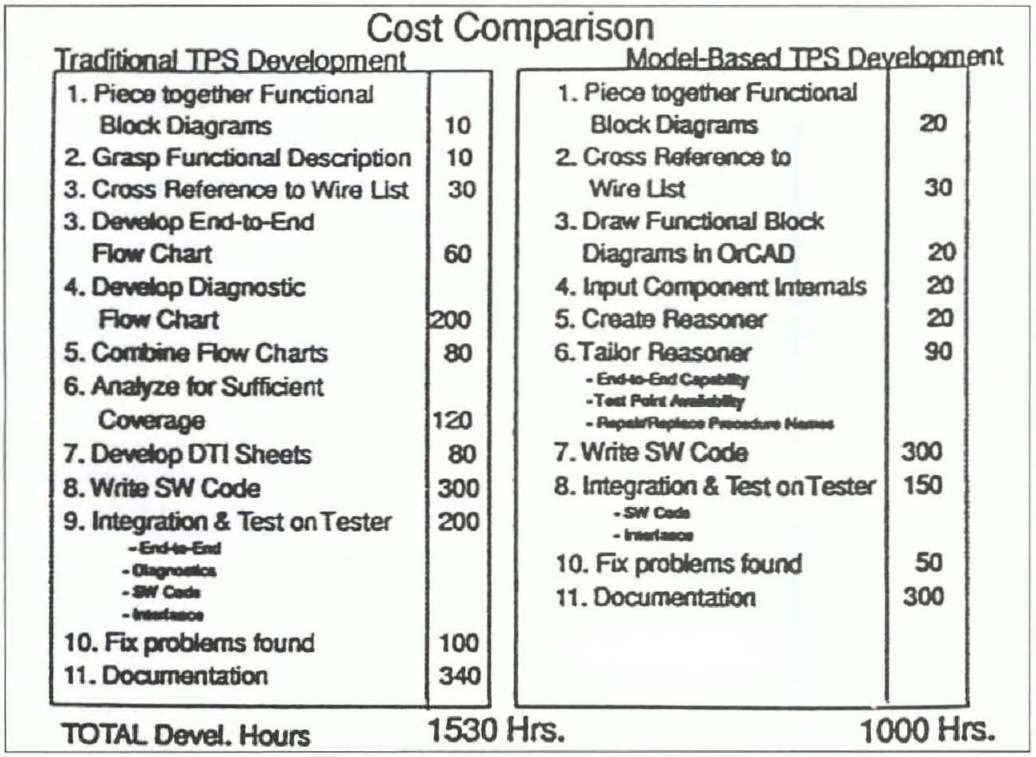


Figure 4.
Cost comparisons on model-based and traditional test programs development.

The UUT modeling can be initiated with incomplete data and evolves throughout the development and tailoring process to fully reflect the actual UUT design. This greatly reduces risk and cost and can be quickly and easily updated at any time.

The comparison of traditional versus model-based TP development processes and costs are provided in Figures 3 and 4.

Benefits

The model-based TP development approach provides a low risk solution to develop diagnostics for both line replaceable units and shop replaceable units. It can be utilized in embedded built-in test, off-line test, PMAs such as the CTS, or a SCS. It applies to both electronic and mechanical systems.

The DARTS improves diagnostics and reduces run-time. It uncouples "diagnostics software" from "test software." It provides the following opportunities not available in conventional TP approaches: deployment lead time reduction; organic support capability at reduced cost; TPS development cost reduction; no obsolescence of diagnostic software due to UUT or ATE updates; improvement of diagnostic effectiveness; throughput improved in field; and, manpower effectiveness enhanced by "reasoner."

Transition Plan

A transition strategy includes prerelease of the software tool set (Version 0.9) for use on demonstration and application programs. This will get early input from users with respect to use of the tools, benefits, and implementation issues.

A "Tiger Team" consisting of in-house Army personnel responsible for TPS development from Tobyhanna Army Depot, the U.S. Army Missile Command Test Program Set Center, the U.S. Army Armament Research, Development and Engineering Center TPS Center, and U.S. Army Armament, Munitions and Chemical Command TPS Center is being established to conduct demonstration programs in the FY 93-94 timeframe. Detailed hands-on training workshops will be conducted for these groups by the ATO, and DARTS and applications support will be made available.

Conclusion

The DARTS is a model-based concurrent engineering tool set for diagnostics. It is useful, effective, and will lower the cost of development of TPs and embedded diagnostics. In order to support use of these tools in the Army, a detailed process must be defined to accommodate the Army policy.

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TARDEC'S LIAISONS/TRADOC BATTLE LABS TEAM UP

By Rae A. Higgins

The battle lab concept represents a new way of doing business and provides a focus for solving future battlefield challenges.

Indirect and Vertical. Power Projection. Combat Service Support. *"What do those terms mean,"* you may inquire. Just ask MAJ Tom Vaught, chief of the Tank-Automotive Research, Development and Engineering Center's (TARDEC) Liaison Officer Operations. He can tell you all about TARDEC's Battle Lab Liaison Program, the teams, and how the liaison officers (LNOs) are helping the U.S. Army Training and Doctrine Command's (TRADOC) battle labs, centers and schools provide support to our nation's soldiers.

According to Vaught, TARDEC's LNO effort is organized around six teams aligned with the TRADOC battle labs, which were established in May of last year. These organizations include the Mounted Warfighting Battlespace Lab headquartered at Fort Knox, KY; the Dismounted Warfighting Battlespace Lab, Fort Benning, GA; the Combat Service Support Battle Lab, Fort Lee, VA; the Depth and Simultaneous Attack Battle Lab, Fort Sill, OK; the Battle Command Battle Lab, Fort Leavenworth, KS; and the Early Entry, Lethality and Survivability Battle Lab, Fort Monroe, VA.

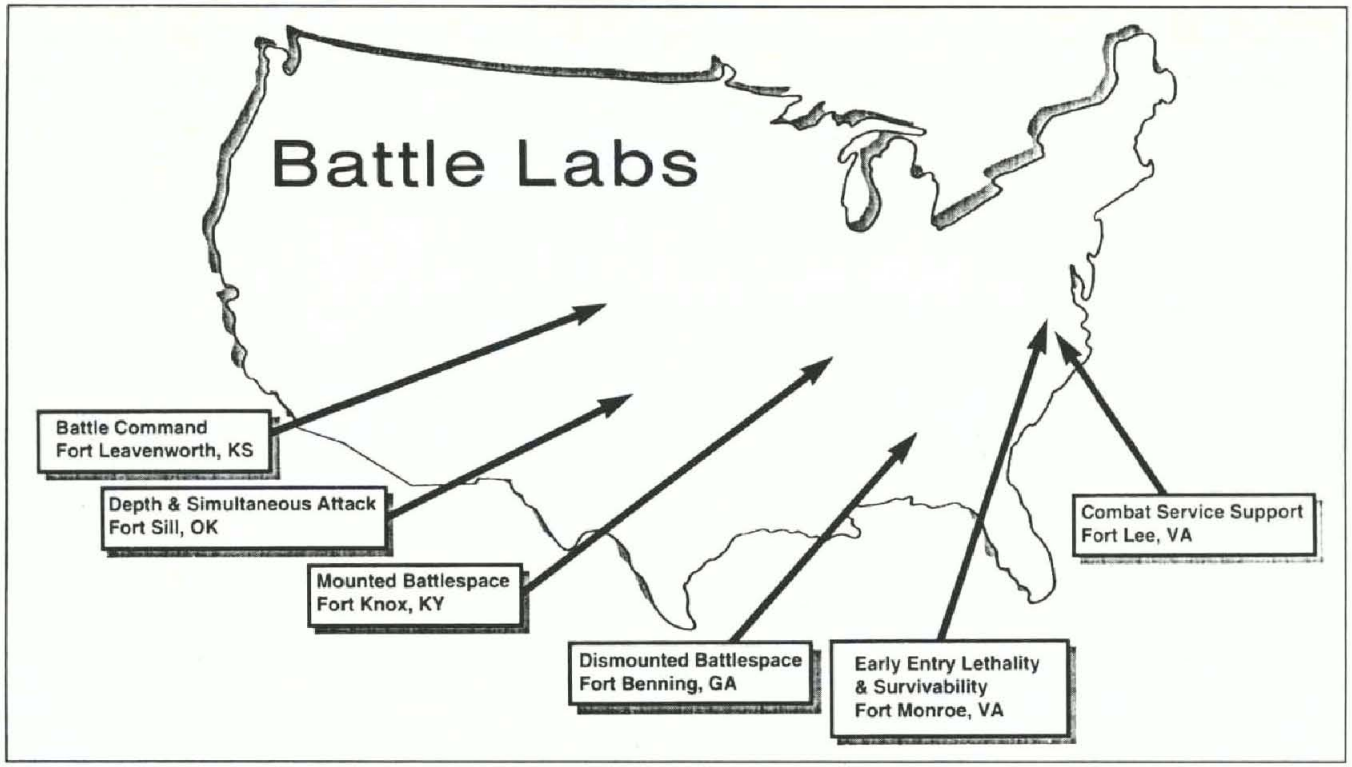
The battle lab concept represents a new way of doing business and provides a focus for solving future battlefield challenges. Perhaps the largest challenge is shifting gears from a Cold War framework highlighted by theater strategies, containment philosophies, limited tactical and operational options, known threats, and a fixed pattern between services and coalition partners, to a new era of global strategies, a mix of new and unpredictable threats, and applying doctrine in a number of highly unpredictable scenarios.

At the Association of the U.S. Army's Winter Symposium on Modernizing a Force Projection Army, TRADOC Commander GEN Frederick M. Franks Jr. told attendees that after Operation Desert Storm, the Army's modernization plan had to adapt to battlefield experiences, sustain or create a continued "delta" in force capabilities, focus on high battlefield return on investments, and protect the force against vulnerabilities.

Thus, the labs are the link between battle dynamics and modernization requirements. Their relationship to the Army's current modernization objectives are very clear:

- The Battlespace Labs at Forts Knox and Benning are working to help the Army dominate the maneuver battle;
- The Combat Service Support Lab is concentrating on projection and sustainment;
- The Depth and Simultaneous Attack Lab focuses on conducting precision strikes;
- The Battle Command Lab zeroes in on "winning the information war;" and
- The Early Entry Battle Lab deals with force projection, protection and sustainment, as well as dominating maneuver battle.

Franks also explained the battle lab method. The method is characterized by:



• Analyzing capabilities while considering the vision of future battlefields;
• Conducting experiments by harnessing simulation technology or by using actual prototypes;
• Experimenting with real soldiers and real units; and
• Horizontally integrating new and evolving warfighting concepts and technology.

"Horizontal integration is important because it emphasizes commonality," Vaught said. "By focusing on horizontal integration of technology across the force, battle labs are able to conserve resources," he added.

To ensure that interested parties are not left "out of the loop," the battle labs maintain a high level of interconnectivity with organizations such as the Department of Defense, the U.S. Army Materiel Command, the TRADOC centers and schools, the Louisiana Maneuvers Task Force, industry, and academia. Most importantly, the labs rely on input from soldiers in the field to identify new ideas, experiment with emerging concepts and technology, and develop integrated solutions for implementation.

As an AMC organization, TARDEC is integrally involved with the battle labs. TARDEC's six liaison teams are actively involved in fulfilling the vision of future battle. The Mounted Maneuver Team is responsible for the Mounted Warfighting Battlespace Lab, and the U.S. Army Armor and Engineer Schools. Vaught said that TARDEC is AMC's lead organization for this lab.

TARDEC's Ted Vician is a member of the Dismounted Maneuver Team and works at Fort Knox about one week a month. "As the lead research, development and engineering center for the Mounted Warfighting Battleship Lab, we're responsible for assisting in the development of more than just vehicles. Now we work in concert to develop the doctrine, tactics, and equipment to allow the U.S. Army to control the battlefield, while increasing the soldiers' safety," said Vician.

The Dismounted Maneuver Team, responsible for the Dismounted Battleship Lab at Fort Benning, also assists the Infantry, Chemical and Military Police Schools, as well as the JFK Special Warfare Center. The Combat Service Support Team interfaces with the CSS Battle Lab and the Combined Arms Support Command located at Fort Lee, and the Ordnance, Transportation, Quartermaster and Aviation Schools.

TARDEC's Indirect and Vertical Team deals with the Depth and Simultaneous Attack Battle Lab at Fort Sill, in addition to the Field Artillery and Air Defense Schools. The Power Projection Team is charged with working closely with the Early Entry, Lethality and Survivability Battle Lab at Fort Monroe, the Battle Command Battle Lab, Fort Leavenworth, TRADOC headquarters, the Combined Arms Command, and the Intelligence and Signal Schools.

The interaction between the TARDEC LNOs, battle labs, and TRADOC centers and schools is synergistic. TARDEC's liaison program is vigorous and allows our engineers and scientists to better refine requirements for new technology and weapons systems.

"The battle lab method allows tomorrow's technology to be inserted into today's operations," said Vaught. "For example, technology, not sheer numbers of soldiers gave the U.S. the decisive edge in the Persian Gulf War. However, that technology is now proliferating around the world, so the Army must leverage new leap-ahead technology—this is important as the Army is reshaped. When all is said and done, we must be able to maintain and modernize a balanced Army force. Battle labs are helping us do that," Vaught added.

RAE A. HIGGINS is a publicist with the U.S. Army Tank-Automotive Research, Development and Engineering Center's Marketing Office. She holds a bachelor's degree in communications from Oakland University, Rochester, MI, and is an associate member of the Public Relations Society of America.

FLEXIBLE COMPUTER INTEGRATED MANUFACTURING

By Stanley Williamson

As the Army heads into the next century, its missions, personnel requirements and equipment needs will change significantly. Sometimes these changes will be indistinct, occurring over a long period of time, while other changes will be dramatic and rapid.

During this same period, the Army will be "downsizing" both personnel and physical property assets. With this shrinkage, the Army must improve the efficiency of its installations and at the same time lower the operating cost of those facilities.

One strategy that will enable the Army to realize this goal in the equipment maintenance and repair field is the Flexible Computer Integrated Manufacturing (FCIM) concept.

It is also readily apparent that no DOD installation can operate as a stand alone entity and still be competitive in today's business world. Installations must combine their strengths with those of other DOD facilities and private industry. Anniston Army Depot (ANAD) and Rock Island Arsenal (RIA) have already moved in this direction as partners in implementing FCIM.

The Department of Defense Joint Center for FCIM selected the RIA/ANAD team as the Army Process Validation Enterprise (PVE) FCIM site for manufacturing mechanical parts. The selection followed the signing of a Memorandum of Agreement (MOA) earlier this year making them "partners" at a PVE site.

The cooperative agreement contained in the MOA further established RIA and ANAD as a single corporate enterprise. The partnership's PVE effort identifies and removes barriers in the acquisition process. A barrier is defined as anything which hinders or adds unnecessary costs to the production of repair parts and could include legal, policy, technical, and funding barriers as well as others. This undertaking modifies the way both installations do business and further increases the use of modern technology in the provisioning process.

PVE sites will evaluate the methods DOD currently uses to acquire repair parts and define a baseline for measuring the gains achieved using FCIM technology. Evaluation of the current acquisition system will determine the existing lead time needed for obtaining replacement parts. The plan is to streamline the DOD acquisition process so needed parts can be obtained quickly and economically and ultimately reduce the lead time for obtaining replacement parts to 30 days or less. The information gained from this evaluation period will be used to measure the FCIM system's performance.

The Team Concept

Cooperation leads to the creation of a new set of standards for defense customers that cover process capabilities, technological expertise and human resources. Cooperation achieves the following:

- It distributes proprietary knowledge contained by the individual sites into a new body.
- It broadens the resource base for attacking problems in parallel or concurrently.
- It accelerates technology transfer.

Anniston and Rock Island have complementary mission elements. Between the two installations, work covers the spectrum from automotive and tracked vehicles, artillery, recoil mechanisms, small arms, basic issue items and tool kits. Both installations also have complementary core competencies such as: general purpose foundry and investment casting; full forge and heat treatment; plating, finishing, painting, welding, sheet metal fabrication, machining fabrication and assembly; electrical and electronic support; and system assembly and overhaul or repair capabilities.

Concept of Operation

The ANAD/RIA PVE site established a corporate board composed of the commanders and civilian executive assistants at both installations to lead the management team. Customers contact a customer control point at Rock Island, which identifies requisite information concerning the order. This information is then provided to a site manager at both ANAD and RIA.

As partners in the competitive field of manufacturing, both installations work together in developing bids for workload, but there may be times when they will be bidding against each other. This should make both installations more competitive in their efforts to minimize costs while producing high quality products. ANAD and RIA will submit their bids to the customer control point which then makes the work site determination. This bid information is then given to the customer by the customer control point along with

the cost and estimated lead time needed to fill the request.

In cases where the anticipated workload is more than ANAD or RIA can handle alone, a joint bid is submitted to the customer control point. If necessary, either installation can subcontract parts of the workload to local manufacturing firms. As in the single bid concept, this information is provided to the customer control point which informs the customer of the costs and lead time.

Advantages for the Customer

The nature of the ANAD/RIA missions makes this team more cognizant of customers concerns and needs. The partnership provides a much-needed source of quality parts at competitive prices as well as extensive reverse engineering capabilities.

Another advantage is the improved readiness of a unit when there is a dependable source for spare parts readily available. Concurrently, the risk of non-performance is reduced. The teaming concept offers the customer a new set of capabilities accessible through a single control point where customers get the best price and response time offered by both installations. The PVE sites are challenged to become time-sensitive competitors which translates into direct customer benefits.

Todd King, a machine tool operator at Anniston Army Depot, uses an Electrical Discharge Machine to cut a product out of a steel bar. This machine emits electrical energy in a special water solution to cut through all types of harden metals.

Less inventory will be needed and the customer can make real time purchase decisions, thereby reducing the risk of obsolescence created by "just in case" ordering philosophies.

Also the potential for requirements to diminish after production has commenced will be reduced significantly and the cash flow can be better controlled since parts will only be ordered when they are needed.

First Savings

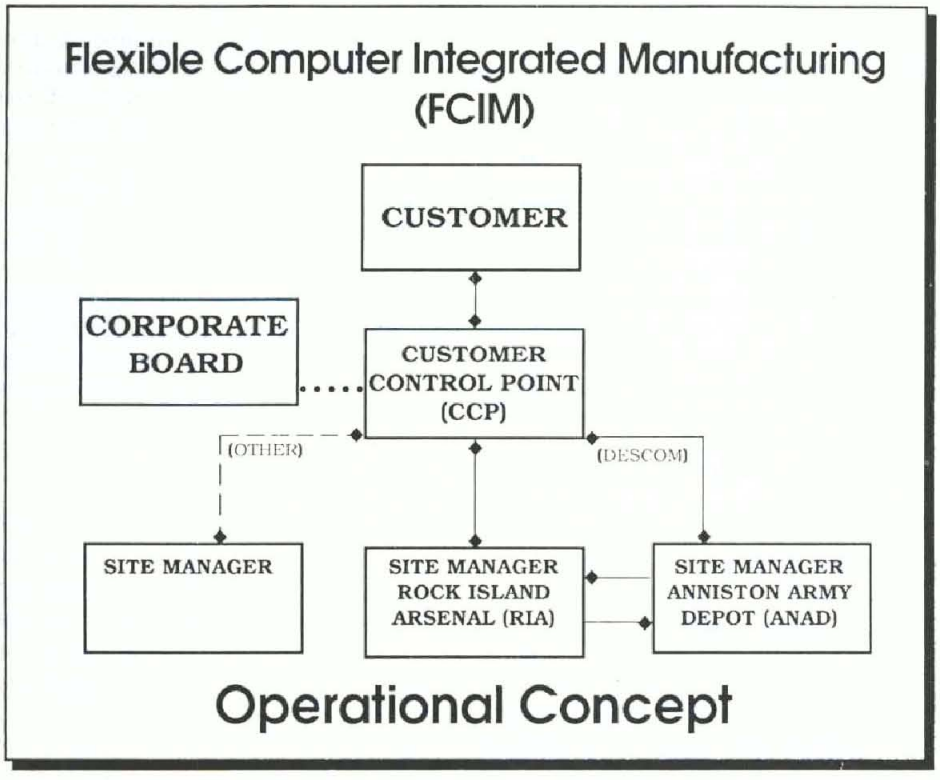
Recently, a decision was made to cancel a $750,000 order for a new computer numerically controlled vertical lathe for Anniston when it was learned RIA already had this capability. Now, both sites are beginning to use each other's capabilities and are interchanging roles as vendor and supplier to one another. Because RIA has extensive tooling capabilities, they will support casting and forging requirements for ANAD on selected programs.

The Tested System

The two installations recently teamed to test the electronic information transfer system. RIA transmitted digitized data to Anniston for the manufacture of a mechanical part. ANAD successfully manufactured this part without the benefit of drawings, but rather as a direct result of the electronic transfer. This was a critical first step in implementing Anniston's FCIM capability and the teaming concept between the two installations.

Anniston and Rock Island continue to seek new ways to improve efficiency in the production of quality products for their military customers. These combined efforts could well be the vanguard for similar programs throughout the Department of Defense in the years ahead as budgets shrink and we all strive to "do more with less!"

To learn more about this joint venture and to take advantage of its potential for meeting your parts requirements, call the customer control point at Rock Island Arsenal on DSN 793-5330 or commercial (309) 782-5330.



STANLEY WILLIAMSON is a public information specialist at Anniston Army Depot.

CRREL ENGINEERS DESIGN AND TEST ANTARCTIC SNOW TUNNELER

By Richard Broussard

The National Science Foundation (NSF) plans to construct satellite facilities approximately a mile from the South Pole station. However, at very low temperatures, moving between the main laboratory and the new facilities can be extremely difficult—even life threatening. This is especially true during winter, when temperatures not only drop drastically, but it becomes easy to go astray in the constant darkness of the Antarctic winter.

At NSF's request, engineers and technicians from the U.S. Army Cold Regions Research and Engineering Laboratory's Engineering Resources Branch have designed and built a system to excavate tunnels in Antarctica to provide a safe personnel passageway between the main South Pole Station and the satellite facilities. An unlined concept was selected over several other alternatives as the most effective means of constructing these tunnels. Although the tunnel will have a temperature of approximately -60 F, this is far more comfortable and safer than the surface, where temperatures can reach -100 F (not accounting for wind chill).

Don Garfield, project manager and engineer, said, "NSF experimented with a number of different methods over the years for moving people around on the surface. But they decided to come to us in hopes that we could design some sort of tunneling system that would eliminate the need to trek back and forth on the surface."

Machinery has been designed to excavate a 6-foot-wide by 10-foot-high rectangular tunnel. The carriage for the excavation system is fabricated from a Bobcat Model 231 tracked mini-excavator. The dipper stick arm and bucket have been removed and replaced with a hydraulically powered cutting drum, 6 feet wide by 2 feet in diameter, attached to the end of the excavator boom. The original Bobcat tracks have been extended 2 feet to provide greater stability and lower ground pressure.

A conventional snow blower has been attached to the front of the excavator to pick up the milled snow and blow it to the rear of the tunneler. From there, it is transported by a vacuum exhaust system to the surface for disposal. A 50-horsepower electric motor has been added to the excavator to drive the machinery, thus eliminating the problem of exhaust fumes in the tunnel during operation. At maximum anticipated tunneling rates of 200 feet per two-shift 20-hour day, the tunneler is expected to mine 195 tons of snow per day, or about 450 cubic yards per day.

A skid-mounted generator on the snow surface will provide power for the excavator through cables extending down a series of drilled holes to the tunnel, 25 to 30 feet below. The system is designed to tunnel at an average rate of 10 feet per hour, including transport of the resulting 10 tons of excavated snow to the surface.

"This whole project has given our mechanical people a major lesson in hydraulics since practically the entire machine is moved by an electrically powered hydraulic system. Solving all the problems associated with moving snow pneumatically was another positive experience for our people," said Garfield.

Other parts of the snow tunneler package include a small, skid-mounted warm-up shelter that accommodates three people. The shelter will also house the electrical transformers and distribution boxes for all tunnel electrical systems. A 205-kW, 480-volt generator will provide the system's electrical power. The generator will be pulled along the surface of the snow in a ski-mounted module, along with a fuel tank and appropriate electrical switch gear.

Also on the surface will be a CRREL-built workshop equipped to handle most required field repairs. Moving out in front of the surface equipment will be a diesel-powered drill rig used to drill the 12-inch diameter access holes, as well as the 36-inch diameter escape hatch holes.

A diesel-powered drill rig will be mounted on wheels, with detachable skis for transportability over most terrain. It will be used to drill the 12-inch diameter access holes, as well as the 36-inch diameter escape hatch holes. The drill rig will be equipped to drill 12-inch holes to a 40-foot depth.

This past February the machinery was tested at the Dartmouth Skiway, which is located only 12 miles north of CRREL.

"Originally we had planned to pack the whole thing up and send it to northern Maine or the Upper Peninsula of Michigan at considerable expense. However, when the Skiway authorities assured us they could pile up all the snow we needed for tunneling, we decided to go with them," said Garfield.

The arrangement paid off; the Skiway provided more than enough snow at a fraction of what the cost would have been had the test been performed elsewhere. Also, the fact that the Skiway is close to the laboratory was beneficial when equipment repairs and modifications were necessary.

When the system is deployed at the South Pole, the plan is to run two shifts of five persons each, with each shift lasting 10 hours during a six-day work week. The estimated project duration is four weeks, assuming that the tunnel can be advanced 200 feet per day. Estimated fuel consumption is about 350 gallons per day.

Funded by the National Science Foundation at an approximate cost of $1 million, the tunneling equipment will be sent to the South Pole for use during the austral summer of 1993-94.

RICHARD BROUSSARD is the public affairs officer for the Army Corps of Engineers Cold Regions Research and Engineering Laboratory in Hanover, NH. He has a B.A. degree from Colgate University, Hamilton, NY.

RED RIVER ARMY DEPOT DEVELOPS VEHICLES FOR COMBAT TRAINING

By Cecil Green

Members of the Red River Army Depot (RRAD) workforce are involved in the early stages of a new combat vehicle program, designing and fabricating armored vehicles that may soon test soldiers' skills in training exercises on simulated battlefields.

For years, work at the depot near Texarkana, TX, has centered around continuing programs to repair and rebuild such vehicles as the familiar M113 armored personnel carrier, which entered the Army inventory about 30 years ago, and the Bradley Fighting Vehicle (BFVS), which gained fame during Operation Desert Storm.

The new vehicle now rolling out of the RRAD workshops is a hybrid, combining parts of both the M113, the Bradley, and locally fabricated components to form what is officially dubbed an M113/BMP-2.

One of the unique features of the M113/BMP-2 is that it is designed to resemble the BMP-type of armored vehicles used in large numbers by former Warsaw Pact countries and in the armed forces of many other countries throughout the world. The BMP was one of the armored vehicles frequently faced by U.S. and coalition forces during Operation Desert Storm fighting in Iraq, and is a type of vehicle likely to be encountered on any future battlefields.

However, unlike its real-world counterpart, the M113/BMP-2 has no real weapons systems, just a simulated gun barrel and an array of laser tracking equipment that give it an air of reality. "And it's that realistic appearance that the people at Red River were trying to achieve," said Nancy Bevers, a logistics program manager in the depot's Integrated Logistic Support Office.

If approved for large-scale production, the M113/BMP-2s will be used at the Army's combat training centers to replicate a generic enemy force, fighting mock battles with U.S. Army units being trained there.

The training centers now located in the U.S. are the National Training Center (NTC) at Fort Irwin, CA, and the Joint Readiness Training Center (JRTC), now located at Fort Chaffee, AR, but soon moving to Fort Polk, LA, during 1993.

Known as the Opposing Force (OPFOR), the "enemy" at these training centers are specially-trained soldiers who wear distinctive uniforms, use visually modified vehicles, and employ non-U.S. tactics to create a realistic training challenge.

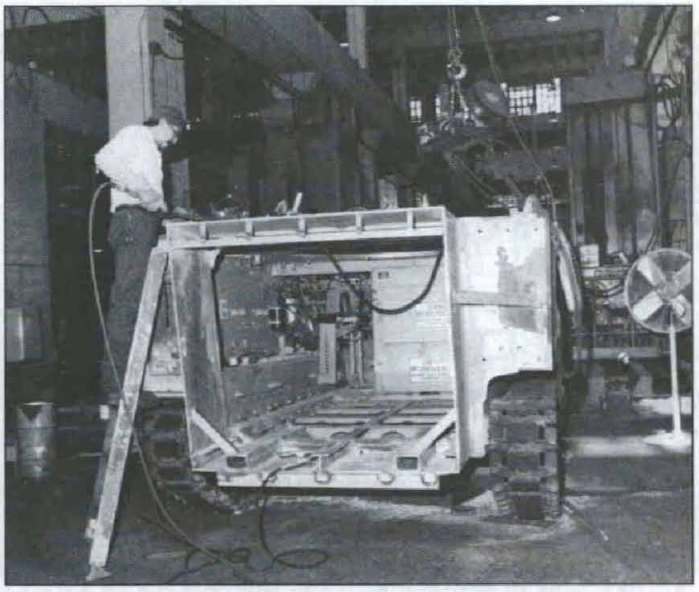
According the Army officials, realism at NTC and JRTC is important because that is where soldiers are placed in a demanding, stressful environment to develop the skills and confidence they need to survive on a modern battlefield.

Currently, the NTC uses visually modified M-551 Sheridan tanks to replicate the BMP-type of vehicles. However, the Sheridans have no capability to carry dismounted infantry, as the BMP does, therefore they create an unrealistic portrayal of combat activity during OPFOR offensive operations. "The M113/BMP-2 solves that problem because it looks like a BMP when we're through with it, and it can carry a load of infantrymen, like a BMP does. And, because it's made from U.S. vehicles currently in use, the M113/BMP-2 should be easier to maintain, with any needed repair parts readily available," Bevers said.

Initial meetings to discuss the project began in 1990. However, the program actually began in February, 1991, with the first prototype vehicle completed five months later.

Army agencies involved in the growth and development of the project included the Threats and Training office of the Combined Arms Command at Fort Leavenworth, KS; the Program Manager for Training Devices, located at Orlando, FL; and the Program Managers for the

This is one of the prototype M113/BMP-2 vehicles designed and fabricated at Red River Army Depot. The vehicle is built on the chassis of an M113 armored personnel carrier, and uses components from the Bradley Fighting Vehicle and other locally-built items to achieve its unique appearance.



A worker at Red River Army Depot works on an M113 chassis, extending the rear of the armored personnel carrier to make it more closely resemble a BMP type of vehicle.

M113 and BFVS, both part of the Tank-Automotive Command at Warren, MI. All of the commands and RRAD are concerned with meeting the Army's current and future needs for realistic, meaningful training.

As early plans moved toward reality, the design of the M113/BMP-2 became a unique project in itself. No blueprints of the BMP were available, and the only thing Red River Personnel had to go on were some simple line drawings and some pictures of actual MPs on an Army poster.

"Our engineers developed specifications based on those drawings. Then, after reviewing an actual BMP at Aberdeen Proving Ground, MD, the technicians and machinists in Red River's Maintenance Directorate fabricated what was necessary to get the right appearance. As the work developed, almost every office on RRAD, plus the local Defense Logistics Agency offices, got involved with various types of support. It was a real team effort," said Bevers.

The M113/BMP-2 began as a combination of an M113A2 chassis, various Bradley components and, with RRAD, designed and fabricated visual modifications. A stripped-down M113 hull was modified to accommodate a combination of Bradley and depot-designed turret. The rear of the hull was extended about two feet, visually distinctive rear doors were designed and installed, a sharply ilted metal nose was added, and side panels were attached. Interior components from a Bradley and other RRAD-designed parts were used to make the turret operational, and the simulated weaponry was added to complete the appearance.

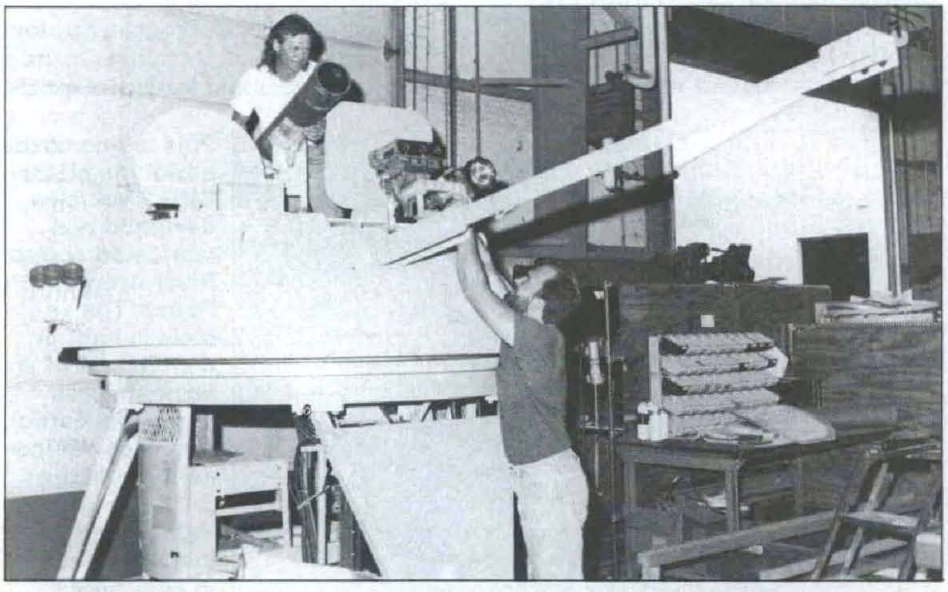
A rollout of the first operational prototype was held at RRAD in July, 1991, and a go-ahead for the production of two other prototypes was authorized at that time. Two of the prototypes were shipped to Aberdeen Proving Ground later in 1991 for technical testing and evaluation.

"Three prototype vehicles now exist, and all meet the necessary safety and operational standards," Bevers said. "Because all of our additions and fabrications are made of heavy metal or aluminum, we feel our M113/BMP-2 is safer and easier to maintain, ship and store than other visual modification procedures, which primarily use molded fiberglass or wood."

The three prototypes completed a field test at the NTC this past summer, going through two training rotations under what will be normal working conditions. Also going through the test for comparison purposes were the Sheridans now used at NTC and an actual BMP obtained for use during the test.

Army officials point out that it would be impractical to use real BMPs or other foreign equipment in U.S. training because of the lack and cost of repair parts, and the intensive training that would be required for soldiers to operate the vehicles. Another reason not to use the real BMPs is that they do not meet U.S. safety standards.

Red River Army Depot, when given approval to go to full production, may be required to modify and fabricate about 190 of the new M113/BMP-2s during the next four years, "but that is still to be determined," Bevers added. Until then, the Red River work force points to the M113/BMP-2s with pride, knowing they have created something through their skills and talents that contributes to Army training.



Workers at the Red River Army Depot install the simulated weapons onto a turret that will be used on a prototype M113/BMP-2 vehicle.

CECIL GREEN is the public affairs officer at Red River Army Depot, Texarkana, TX. He holds a B.A. degree in journalism and an M.A. in mass communications, both from Texas, Tech University.

Maintaining Our Industrial Base...

DEPOT MAINTENANCE AND THE PRIVATE SECTOR

By Dan C. Heinemeier
Vice-President, Government Division
Electronic Industries Association

Among the most critical issues facing the defense electronics industry today is evolving government policies on public-private competition in performing depot maintenance and laboratory research functions.

Industry is downsizing rapidly to better compete in a smaller future market, with companies restructuring and closing facilities to streamline their operations. Logically, one would expect all components of the defense base to be downsizing in a similar manner. Instead, we in industry see government laboratories and depot maintenance facilities expanding, seeking new missions, and spending millions of tax dollars in facilities improvements. Our fear is that this public sector expansion at the expense of the private sector may force a spiral where industry downsizes to a point below which we may be unable to recover critical capabilities of design, systems integration, and production.

To sustain a healthy private sector base capable of contributing to both our national security and our economic growth objectives, Congress and the administration must change the way the Department of Defense (DOD) manages weapons systems acquisition and support. Government policy should be to maintain only a minimum inherently-governmental core capability with all remaining weapons systems modification, upgrade, and depot maintenance work being accomplished through competitions *within* the private sector.

Industry believes that the concept of government-industry competition is deeply flawed, and should be phased out because costs can never be made comparable. Additionally, that work which is more appropriately performed in the private sector—such as weapon system modifications and upgrades—should come back into the private sector from the government facilities into which it has migrated to fill their excess capacity over the past few years.

Several important points frame our industry's arguments in this area. Increased modification and depot maintenance work are essential to the health of the national technology and industrial base. America must retain industrial capability to design, develop, and produce new weapons systems whenever those systems might be needed. Government facilities are performing an increasing amount of maintenance and upgrade work, with little capability to design, develop and produce new systems without the help of industry. The resultant reduction in available business for industry may jeopardize our role in maintaining capabilities which reside only in the private sector.

The transfer of depot maintenance workload back to the private sector also will help sustain economic growth. The private sector is and always will be the engine that supports long-term job growth, generates tax revenues, and produces profits used for reinvestment in the development of new technologies. This cycle of job creation, tax generation, and profit reinvestment for long-term economic growth has no counterpart in the public sector.

Current government policy pertaining to how weapon systems are supported is jeopardizing these defense and economic security goals. Congress passed legislation last year stipulating that 60 percent of the maintenance and upgrade workload can only be performed by the government! This type of protectionist action appears to be an attempt to shield excess or duplicative government facilities from the rigors of cost-benefit analysis and the likely outcome of further downsizing. We view this arbitrary work allocation as extremely harmful, and have urged Congress to repeal the 60/40 split.

A fall 1992 Joint Chiefs of Staff-commissioned study of "depot maintenance consolidation" by an independent group of retired senior executives from government and industry seems to bear out our concerns. This study, which focused solely on the public sector, found that the single-shift operating capacity in the government depot system had excesses of 25-50 percent above that needed to accomplish the Services' missions for the future. It recommended closing additional facilities in the 1993 base closure round. Unfortunately, the study did not examine the relationship between public and private sector capabilities in this area. We strongly endorse the study team's suggestion that a further review of the entire industrial base, public and private, is needed.

Many have suggested that the solution to excess capacity is to promote public-private competition for depot maintenance work. In our view, such "competitions" are seriously flawed. Industry competitions with government depots incorporate a built-in conflict of interest because the authority selecting the winner has usually been a member of the government organization which stands to benefit from the award. We do not believe that this type of conflict of interest can be lessened by policy treatment to further "level" the playing field for such competitions. The internal pressures on government evaluators to choose their own facilities obviously are enormous.

These competitions are also inequitable because the government does not include key costs in its bids. Private sector companies doing business with the government must comply with numerous statutory and regulatory requirements

as to how they record, allocate and recover their costs. These include an allocable share of corporate or home office expense, amortization of facilities, and interest on borrowed money, among other factors. Finally, private industry is responsible for cost overruns if it is operating under fixed-price-type contracts, for liquidated damages for late deliveries, and for correction of defects at its own expense if found to be at fault.

We believe that the correct policy from both a national security and long-term economic growth perspective should be to consider the needs of the national technology and industrial base *first:* narrowing the definition of core governmental responsibility, with the performance of the majority of depot maintenance and all modification and upgrade work where the long-term capabilities reside, in the private sector. Government-industry competition should be replaced with industry-only competitions for depot maintenance and modification work, with inter-service competition for the small "core" of work determined to be inherently governmental.

In order to facilitate this policy, we have proposed the following recommendations:

- The Department of Defense should carry out public sector reductions in modification and depot maintenance capabilities as fast or faster than the private sector.
- The government should not be permitted to make additional capital investments in its depot-level facilities until a more realistic division of labor between government and industry has been determined for this type of work.
- We support Secretary Aspin's "bottom-up" review, and urge that it include identification of minimum essential capabilities that need to reside within government facilities.
- Congress should eliminate the existing arbitrary 60/40 percent limitation on private sector performance of depot maintenance workloads.
- Government-industry competitions should be replaced by competitions within industry for the majority of the workload.
- Government facilities and their management should be penalized when they experience cost overruns on depot work awarded competitively; past performance should bear on evaluations of bids for new work. The current practice of rolling cost overruns into the next budget cycle should be prohibited.

There is too much at stake in terms of the defense base and economic growth to permit retention of the status quo for defense modification and depot maintenance work. Without a policy that states a priority for preservation of national technology and the industrial base, the defense industry may rationalize and downsize beyond the point at which critical design and development capability for the future can be maintained.

Varnado Gets AAC Scholastic Achievement Award

The first Army Acquisition Corps Award for Scholastic Achievement in Systems Acquisition at the Naval Postgraduate School has been presented to CPT Frank Varnado. Varnado is currently assigned to the U.S. Army Tank-Automotive Research, Development and Engineering Center, Warren, MI. The award was established to recognize academic excellence at the Naval Postgraduate School.

Award Recipients Named

The following Army Acquisition Corps and acquisition support personnel are recent recipients of key awards. **Army Acquisition Executive Support Agency:** MAJ John D. McVey, Program Executive Office, Intelligence and Electronic Warfare (PEO-IEW), Meritorious Service Medal (MSM); CPT Bradley E. Penn, PEO-IEW, Army Achievement Medal (AAM); COL Thomas L. Vollrath, PEO-IEW, Legion of Merit (LOM); CW4 Gary L. Ames, PEO-Aviation, LOM; SFC Horace E. Arnette, PEO-Aviation, MSM; CPT Mario Garcia Jr., PEO-Aviation, MSM; MAJ Robert H. Lee, PEO-Aviation, MSM; MAJ David Marck, PEO-Aviation, MSM; LTC Peter R. McGrew, PEO-Aviation, MSM; SFC James A. Woods, PEO-Aviation, AAM; COL Franklin Y. Hartline, PEO-Armaments, LOM; COL Richard H. Johnson, PEO-Armaments, LOM; LTC Foster G. Nickerson, PEO-Armaments, MSM; LTC(P) Raymond Pawlicki, PEO-Armaments, MSM; COL Richard C. Williams, PEO-Armaments, Distinguished Service Medal; LTC Charles G. Walls, PEO-Missile Defense, MSM; LTC(P) Robert E. Armbruster, PEO-Tactical Missiles, LOM; COL Jack D. Conway, PEO-Tactical Missiles, LOM; LTC(P) William D. Knox, PEO-Tactical Missiles, MSM; LTC Paul V. Pinkerton, PEO-Tactical Missiles, LOM; COL Stephen C. Rinehart, PEO-Tactical Missiles, LOM; MAJ Donald J. Burnett, PEO-Armored Systems Modernization (ASM), MSM; MAJ Stephen P. Cooper, PEO-ASM, MSM; MAJ Harold M. Frailey, ASM, MSM; LTC Charles D. Moore, PEO-ASM, MSM; and MAJ John C. Roddy, PEO-ASM, LOM.

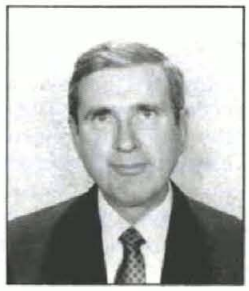
Campagnuolo Named Engineer of the Year

Dr. Carl J. Campagnuolo, from the Army Research Laboratory's Sensors, Signatures, Signal and Information Processing Directorate, has been named the Army Materiel Command Engineer of the Year. He is one of 31 federal agency engineers recognized by the Professional Engineers in Government, a division of the National Society of Professional Engineers, as the top engineer for their agencies.

Campagnuolo was cited for using his broad engineering background in a number of projects including the design of an auxiliary power unit for the M1 Abrams tank. This device can power all equipment in the M1 tank when the main engine is shut off, saving an estimated $50,000 per year per tank.

Correction: *In the July-August 1993 issue of* ***Army RD&A Bulletin,*** *LTC(P) Dennis A. McGaugh was listed as receiving an LOM. Actually, he received an MSM. We apologize for the error.*

How Would You Assess Your Experience in the Acquisition Corps Thus Far?



Dr. James Edgar
Acquisition Program Management Officer
Office of the Assistant Secretary of the Army (Research, Development and Acquisition)
The Pentagon

I have been a member of the Army Acquisition Corps since March 1992 and have been most pleased with progress to date. One of the primary reasons I came to work for the Army, in addition to the satisfaction of the job itself, was the opportunity to be a member of the AAC. The Army is committed to developing its AAC members through executive-level training and development. Relative to this, I give the Army high marks for the quality of its AAC executive seminars and development programs, e.g. Brookings, Harvard, Wharton, the University of Texas, and for maintaining its commitment to its people. This program has been a particularly rewarding aspect of AAC membership. Another benefit of AAC membership is the opportunity to attend and participate in AAC conferences and meet with senior members of the Army's acquisition leadership.

We have and are continuing to "ramp up" the AAC and related programs to support implementation of the Defense Acquisition Workforce Improvement Act (DAWIA). After Oct. 1, 1993, only members of the AAC may be assigned to critical acquisition positions. I believe the greatest rewards and challenges lie ahead of us. This includes placement of the best qualified individuals in demanding and exciting acquisition assignments, and establishment of a comprehensive and logical professional development program for AAC members that provides cross-training and career broadening through assignments in a variety of fields.

Linda M. Gentle
Chief, Program Management Division
Multiple Launch Rocket System Project Office
Redstone Arsenal, AL

I have just completed an eight-month developmental assignment in the Office of the Under Secretary of Defense (Acquisition), Tactical Systems, Deep Strike Systems. The training broadened my experience base in Service acquisition oversight and included OSD policy objectives and management of cross-Service/across Agency initiatives, an increased awareness of congressional operations, and sharpened my skills in critical technical acquisition program management of FOFA/Joint Precision Interdiction (JPI) system acquisition management.

The assignment enhanced and broadened my understanding of DOD acquisition procurement, programs, plans and policies. I coordinated Office of the Secretary of Defense staff views prior to Defense Acquisition Executives Summary (DAES) reviews, Defense Acquisition Board (DAB) reviews, and Conventional Systems Committee (CSC) reviews of assigned programs. I was involved in the full spectrum of program management, planning, and budgeting activities ranging from full staff preparation of the budget reviews, formulating office positions of DAES, CSCs and DABs. I was involved in utilizing a complementary mix of analyses, validating computer models/simulations and studies to accurately evaluate and evolve the engagement potential these dynamic time sensitive operations have. I was involved in a study plan to analytically examine the contribution of future technologies of the JPI aspects of conventional warfighting for the U.S. and other national forces.

I was responsible for administrative coordination and management of the Defense Science Board (DSB) Task Force on JPI wherein I coordinated with the co-chairmen to conduct the meetings and provide complete and accurate minutes that capitalized the members thinking and evolved into the final report.

I was the OSD Action Officer (AO) for the Department's annual submission of the Joint Standoff Weapons Master Plan. As AO, I provided coordination, oversight, and analysis of all Service participants culminating in a comprehensive address of this very sensitive, compartmented plan.

The development assignment allowed me to work with people in the AO level, to get them to perform, meet objectives and timelines, as well as work with and coordinate efforts of senior department individuals, particularly the members of the DSB.

The developmental assignment provided extremely beneficial, broadening, and productive training. It helped prepare me for future AAC assignments beneficial to the Army and Department of Defense. I have also received approval of tuition reimbursements for post-graduate (doctoral candidate) courses. I encourage members to take advantage of the many AAC developmental training opportunities.

COL Richard D. Nidel
Policy Staff Officer
Office of the Director for Acquisition, Education, Training and Career Development
Office of the Under Secretary of Defense (Acquisition)
The Pentagon

One of the key impacts of the Army Acquisition Corps on senior officers concerns which key senior military positions, for example at flag rank and command positions, are Corps members eligible to compete for. This is especially important since Corps members are no longer eligible for branch command. As the stability of product and project manager positions is subjected to uncertainty in our reduced

RD&A budget environment, the availability of acquisition commands becomes of more keen interest. We must continue to have a viable program that gets officers over the promotion hurdle to 0-6. Otherwise, we'll never be able to grow qualified project managers.

In the broader sense, the Army Acquisition Corps will have greater impact on more junior officers to better enable them to plan and manage their careers. This is a major step forward from the PM Development Program and the MAM Program. Our civilian acquisition corps members will also greatly benefit from the enhanced education, training and assignment benefits offered to Corps members, heretofore somewhat limited to officers. We are already seeing that effect in greater civilian attendance at the Program Management Course and at the senior acquisition course at the Industrial College of the Armed Forces (ICAF).

The overall key to the success of the Army Acquisition Corps is and will continue to be the commitment of the Army leadership. If that should ever waver, all of our best individual efforts will be for naught.

Bobby G. Bowles
Chief, Product Assurance
Tri-Service Standoff Attack
Missile Project Office
Army Missile Command
Redstone, AL

The experience I've had with the Army Acquisition Corps to date has been truly exciting. After acceptance as a member of the Corps, I wondered how my life would be different and what membership would mean to my career. I was almost immediately accepted as a fellow in the Senior Service College Fellowship Program at the University of Texas Institute for Advanced Technology (IAT). This was a 10-month program sponsored by the Army Acquisition Corps and open only to Corps members. Participation as a fellow allowed me to audit courses at the University of Texas taught by such world renown figures as Drs. Walt and Elspeth Rostow (Dr. Walt Rostow was the national security advisor in the Kennedy-Johnson administration and Dr. Elspeth Rostow was OSS during World War II and participated in the Geneva conference), ADM Bobby Inman (deputy Central Intelligence Agency director during the Reagan-Bush administration), the late Texas Governor John Connally and Ambassador Robert Strauss (ambassador to Russia until December 1992).

The Distinguished Speakers Program exposed me to the thinking of present and past leaders in the Department of Defense. Examples of active leaders were George Singley, deputy assistant secretary of the Army for research and technology, MG Paul E. Funk, commander of the Infantry School, MG Fred F. Marty, commander of the Artillery School, and LTG William H. Forster, director of acquisition career management. Leaders from the past included retired LTG Dale A. Vesser, at the time deputy secretary of defense for national security policy, and retired LTG Odoms, an acknowledged expert on intelligence operations.

Dr. Richard Lawrence, the executive director of IAT and a retired lieutenant general, prepared and presented a series of seminars on national security policy covering everything from the creation of the Department of Defense to the Chairman's Base Force. To broaden our knowledge of security matters, Dr. Lawrence brought in numerous subject matter experts from the Pentagon, the Army War College, and the World Affairs Council in San Antonio, TX.

It is hard to imagine that continued participation in the corps can measure up to my recent experience. However, I believe that this program has prepared me for the challenges which I will face in the future. I look forward to applying the knowledge and insight I have acquired through this program in my present job and in subsequent assignments.

MAJ(P) Patrick D. Linehan
Army Acquisition Corps Proponency Officer
Office of the Assistant Secretary
of the Army (Research, Development
and Acquisition)
The Pentagon

The Army Acquisition Corps (AAC) has only recently been established, however my experience in acquisition work precedes this event. The most significant aspect of this work has been the variety of opportunities presented. I have been challenged to use technical and engineering skills as well as business and management skills. Of course, as with all positions in the AAC, leadership skills are a must. In my present position on the Army staff I am able to use the knowledge and experience that I have gained through my years of acquisition assignments to help develop policy concerning career progression for officers and civilians in the Army Acquisition Corps. Each assignment has built upon the previous ones to provide ever increasing challenges.

The Army has provided me training and schooling to build and develop these skills. These include attendance at the Defense Systems Management College's Program Management Course at Fort Belvoir, VA, and completion of a master's degree in contracting and acquisition management. I've also been able to maintain my military perspective by attending the Command and General Staff college at Fort Leavenworth, KS, and by completing a two-year assignment with the 4th Infantry Division at Fort Carson, CO.

Additionally, the Army Acquisition Corps has enabled me to work with many Department of the Army civilians and to see their role in our total force. I've also worked closely with the defense contractors who design and produce the equipment that we use and have been able to gain an appreciation of their role in the process.

The Army had established an Acquisition Corps prior to the passage of the Defense Acquisition Workforce Improvement Act but this law provides more impetus to the Army's initiatives. The AAC enhances the opportunities for a rewarding career and now provides acquisition-related career paths for officers to the highest levels of the Army. Officers in the AAC are now able to focus on becoming members of an elite corps of acquisition professionals who provide the soldier with the equipment that we need to perform our mission.

CPT Richard D. Hansen Jr.
Project Manager 13/51
The Institute for Advanced
Technology
The University of Texas at Austin

My experience during this initial year has been extremely challenging and professionally rewarding, although limited to the exceptional education and training opportunities involved in preparation for my first day of acquisition "live-fire."

I was fortunate to be assigned to the Institute for Advanced Technology to gain some research, development, and acquisition experience, while simultaneously attending the Option II MBA program at the University of Texas at Austin (see related article in this issue). This tour combines the enrichment gained from both advanced civil schooling (ACS) and training with industry (TWI).

SPEAKING OUT

The executive MBA program allows professionals to maintain their full-time employment responsibilities, in my case, an initial functional area tour. The two year tour at IAT, a federally-funded R&D center focused on the Army's electric armaments program, provides a unique mix of comprehensive hands-on acquisition experience (the fun stuff) and rigorous yet dynamic academics (the necessary evil).

In the past year, I've been actively involved in the RD&A community. My colleagues and I have conducted some specific research on and received tremendous broad exposure to the electric armaments program. Electric armaments is a fundamental revolutionary technology of interest to fire supporters and the armor and air defense communities and thought to be the weapon of the future. I've also been fortunate to develop and help coordinate some of the education and training opportunities available to the Army acquisition workforce. It is very encouraging to witness the persistent efforts by the Acquisition Career Management Office towards continuous professional development for the entire acquisition team. Finally, I'm a grateful beneficiary of some terrific mentoring from a close association with both military and civilian senior service college fellows, the distinguished team members at IAT, and some prominent leaders in industry, government, and academia.

I must caveat all this with some frustration. I have yet to spend a day in what I perceive as the *real* Acquisition Corps, "line" men and women on what I'll call the FEBA (Forward Edge of Battle - Acquisition) or FEPA (Forward Edge of the Procurement Area), managing a product or service during phases of its life cycle. Although I am apprehensive about this exploration away from troops, I am quite pleased with my initial 51 assignment as it has met and in many ways exceeded my expectations. Additionally, I am eager to get dirty applying this experience in a PM shop during my greatly anticipated first day on the FEBA.

PERSONNEL

Arnold Assumes Duties as Assistant DCSPER

MG Wallace C. Arnold, former commanding general of the U.S. Army Reserve Officer Training Corps Cadet Command, Fort Monroe, VA, has assumed new duties as assistant deputy chief of staff for personnel in the Office of the Deputy Chief of Staff for Personnel, HQ Department of the Army.

Backed by more than 31 years of active commissioned service, Arnold served earlier as CG, First Reserve Officer Training Corps Region, Fort Bragg, NC, and as director of personnel, J-1/Inspector General, U.S. European Command.

Arnold holds a B.S. degree in industrial education from Hampton Institute, and an M.A. in personnel management and administration from George Washington University. His military education includes the Air Defense Artillery School Basic and Advanced Courses; the U.S. Army Command and General Staff College; and the Naval War College.

Arnold is the recipient of many decorations and badges, including the Defense Superior Service Medal, the Legion of Merit with Oak Leaf Cluster (OLC), the Bronze Star Medal with OLC, and the Meritorious Service Medal with four OLC.

Boutelle Takes Over as FATDS Project Manager

COL Steven W. Boutelle has assumed duties as project manager, Field Artillery Tactical Data Systems (FATDS), at the U.S. Army Communications-Electronics Command. Prior to this assignment, he served four years in the Organization of the Joint Chiefs of Staff Office, Washington, DC.

The FATDS Project Office is responsible for the Advanced Field Artillery Tactical Data System (AFATDS), Fire Support Ada Conversion (FSAC), Interim Fire Support Automated System (IFSAS) and the Forward Entry Device (FED). The AFATDS program will reach Milestone III in FY 94. FSAC, IFSAS and FED are being fielded to active and reserve components this year.

Moore Becomes AFATDS Product Manager

LTC Stephen Moore has been named product manager of the Advanced Field Artillery Tactical Data System (AFATDS) at the U.S. Army Communications-Electronics Command. His previous assignment was as operations research analyst and speech writer for the commanding general, U.S. Army Materiel Command.

As product manager of AFATDS, Moore will manage the development of AFATDS software, the acquisition of Army Command and Control System (ACCS) Common Hardware and Software, the incorporation of ACCS Common hardware and software into AFATDS, the planning for management of developmental and operational testing of AFATDS, and the fielding of AFATDS as a system.

CAREER DEVELOPMENT UPDATE

Program Management Course Selectees Announced

The director of Army acquisition career management is pleased to announce that the following civilian members of the Army Acquisition Corps were selected to attend the Program Management Course, Class 93-2, which began July 26, 1993. The class is scheduled for completion on Dec. 10, 1993.

Ninety-three nominations were submitted for PMC 93-2; of these, 48 nominations were selected as primary candidates. The next PMC class is scheduled to commence in January, 1994. Candidates who were not selected for Class 93-2 are elegible for reconsideration by the next PMC board, scheduled to convene in September, 1993.

NAME	ORGANIZATION
Abrams, Kenneth	PEO COMM
Baiter, Paul	PEO CRS MSL
Ball, John	AMC
Benson, William	PEO COMM
Bevel, Libby	AMC
Boster, Donald	PEO MSL DEF
Bryneldson, Robert	PEO CCS
Butler, Robert	AMC
Carpenter, Judd	PEO MSL DEF
Chan, Kin	PEO STAMIS
Chen, Nickie	PEO CCS
Collier, James	PEO TACT MSL
Cooper, John	ASA (RDA)
Deadwyler, Richard	AMC
Denneny, Marvin	AMC
Dery, Susan	ASA (RDA)
Dwyer, Kevin	ASA (RDA)
Easton, Patrick	AMC
Eminov, Sandra	ASA (RDA)
Foley, Eileen	AMC
Garcia, Bernard	PEO ARM
Godell, Joseph	PEO ASM
Gormont, Ronald	PEO AVN
Grannan, Michael	SDC
Hartwell, Michael	AMC
Hennings, John	SDC
Hitchcock, Gary	AMC
Hosler, Mary	PEO CCS
Holmes, Henry	SDC
Hughes, Brian	PEO IEW
Jiranek, Victor	PEO IEW
Jones, Ronald	AMC
Kraus, Kenneth	PEO IEW
Malatesta, Edward	AMC
McElveen, Wesley	AMC
Moore, Dale	PEO MSL DEF
Morris, Robert	AMC
Moreira, Robert	AMC
Mlinarchik, Ronald	ASA (RDA)
Puent, Ronald	AMC
Purdy, Phillip	PEO ARM
Robertson, Thomas	PEO IEW
Ross, Mary	ASA (RDA)
Thacker, David	PEO CCS
Thompson, Andrea	AMC
Treadwell, Thomas	AMC
Von Husen, Robert	AMC
Woodbury, Donald	AMC

Educating the Corps

Five members of the Army Acquisition Corps recently became the first graduating class of the Senior Service College Fellowship Program at The Institute for Advanced Technology, The University of Texas at Austin. This War College (MEL 1) equivalency program has been specially designed for Army Acquisition Corps members. The academic approach is a structured, trilateral study of relationships between national security policy and process, the emerging technologies and the defense industrial base and policy. Pictured (left to right) are: LTC(P) Paul Wolfgramm, project manager, Defense Communications and Army Transmission Systems, Fort Monmouth, NJ; Bobby Bowles, chief of product assurance, Tri-Service Standoff Attack Missile Project Office, Army Missile Command, Redstone Arsenal, AL; Dr. Ashok Patil, division chief for environment control and systems support, Belvoir RDE Center, Fort Belvoir, VA; LTC(P) Chester Rees, project manager, Utility Helicopters, St. Louis, MO; and LTC(P) Edward Harrington, project officer, Office of the ASA(RDA), Washington, DC.

AAC Reserve Components

Previous articles in *Army RD&A Bulletin* have discussed the Army Acquisition Corps—Reserve Components (AAC-RC). (See "Is There a Role for the Reserve Components in the Army Acquisition Corps?" by COL James L. Carney, January-February 1993 issue.) In June 1993, instructions for implementing the AAC-RC were issued by the Office of the Assistant Secretary of the Army (RDA) through the DCSPER and the deputy chief, Army Reserve.

The basis for the creation of the AAC-RC is the 1991 National Defense Authorization Act. Included with the act was a section called the Defense Acquisition Workforce Improvement Act (DAWIA). DAWIA requires that by Oct. 1, 1993, all critical acquisition positions be filled by members of the AAC.

Formation of the AAC-RC will take place in several phases. The first phase is the mailing of a detailed survey to those officers with potential for membership in the AAC-RC.

CAREER DEVELOPMENT UPDATE

This mailing was being finalized at the time this article was submitted. The next phase, which was scheduled to occur at the end of August while this issue of *Army RD&A Bulletin* was at press, is the Qualification, Validation, and Certification Board.

The action for establishing the AAC-RC for Individual Mobilization Augmentees (IMA), Troop Program Units (TPU), and Active Guard/Reserve (AGR) will be managed through the Ordnance Branch at the Army Reserve Personnel Center (ARPERCEN), St. Louis, MO.

The QVC board will assign the designator codes, 4M (AAC-Developmental) and 4Z (AAC), to qualified officers. After Oct. 1, 1993, officers in the grades of lieutenant colonel and colonel must be 4Z to be assigned to IMA, TPU, or AGR positions with duty codes of 97 (Contracting), 51 (Research and Development), or 53C (Automation Management), unless a waiver is granted.

Potential AAC-RC officers desiring additional information may contact MAJ Niels Zussblatt at DSN 892-2139 or commercial (314)538-2139. MAJ Zussblatt is a personnel management officer at the Army Reserve Personnel Center. He currently manages both Functional Area 51 and 97 officers.

New Training/Experience Guide Published

The director, acquisition education, training and career development recently published a guide, *Mandatory Course Fulfillment Program and Competency Standards*. This guide, which contains a self-assessment form, will help employees evaluate and document their training and experience and apply it towards satisfying mandatory acquisition work force course requirements. The guide also lists the competencies required for certification at the various levels of each of the acquisition functional career paths. For more information, contact Jim King at (703)693-7323.

LETTERS

Remote Detection and Mapping of Hazardous Objects in the Field

Ever since land mines have been a threat to both personnel and equipment alike, sweeping them from a position on the ground has been the most common way to both detect and dispose of them. Because they are usually laid fairly shallow, their ferromagnetic characteristics are generally detectable from the surface; however, they are usually found when those sweeping them are practically on top of the mine, or at least somewhere in its general proximity. (Unlike sweeping mines at sea with a helicopter, which drags its detection and demolition equipment at a "safe" distance behind the aircraft, or so the crew hopes.)

An attribute desirable in sweeping and disposing of mines would be in their remote detection and disposal via a remotely piloted drone with inertial navigation for accurate mapping (and perhaps a Global Positioning System) of buried objects (i.e. mines) detected by an onboard search radar and have this data transmitted to a satellite, or high altitude aircraft for demolition by the field artillery, or whoever else may deem their destruction necessary. The reason for having the data transmitted directly to a remote location is to reduce the opposition's ability to triangulate on the position of those who are to utilize this information. The positional data coordinates would be in Universal Transverse Mercator (UTM) coordinates and in mils, which is considerably more accurate then degrees, minutes and seconds. UTM is a commonly utilized map projection with no negative coordinate reference points.

With this information, an artillery unit could dispatch entire mine fields prior to a crossing by friendly troops without loss of life, reducing injury and preserving equipment. Mines with a proximity fuse could be dealt with by ordinance which tends to scatter itself over a wide area; thereby affecting as many targets as possible with a single round. Pressure types would probably require a more direct brute force barrage of low calibre, high trajectory ordinance.

The key here is in the radar detection and mapping of hazardous metallic objects in the field, such as land mines. How anyone chooses to dispatch of the mines is up to them and anything I've mentioned along that line is purely a suggestion.

David J. Kisor, AE-2 U.S.N.R. (R)
VFA-305, W/C 220
NAWS Point Mugu, CA 93142

AATD Awards Contract for VISEO Detection Analysis

A 24-month, $1,116,274 contract for a visual/electro-optical detection analysis has been awarded by the Aviation Applied Technology Directorate (AATD), U.S. Army Aviation and Troop Command, Fort Eustis, VA, to Georgia Tech Research Corporation.

"The goal of this program is to develop a visual/electro-optical (VISEO) detection model to simulate the 'man-in-the-loop' detection of rotorcraft against terrain by operators using these VISEO systems. The completed analysis methodology will be used as a tool to evaluate the effectiveness of passive signature reduction techniques against VISEO systems," explained Ray Wall, project engineer.

TARDEC Builds Roadside Tire Changer for M747

The U.S. Army Tank-Automotive Research, Development and Engineering Center, (TARDEC), Warren, MI, has built and demonstrated a mobile tire-changing station that may someday make life easier for troops who use the Army's M747 Heavy Equipment Transporter (HET). The HET is a semitrailer that is used to transport and recover M60- and M1-series tanks and other heavy tracked vehicles.

The Army currently does not have equipment in its inventory suitable for mounting and dismounting the M747's 15-inch-wide tires in the field. When a tire replacement is necessary, troops have two options. One is to use three large crowbars to force the new tire onto the wheel, a procedure that often results in destroying the tire. The other is to remove the wheel from the vehicle and have the tire replaced commercially at a cost of $60 to $80 per tire.

When the Army sent troops to Somalia late last year, the Tactical Vehicle Division of TARDEC's Systems Engineering Directorate conducted an investigation to find out if that country had facilities equipped to handle such large tires. The search revealed there were none. So the division decided to pursue development of a mobile tire-changing station that had been started during the Persian Gulf War and canceled when the war ended abruptly after lasting only 100 hours.

A team of TARDEC engineers and technicians from the Systems Engineering Directorate and Design and Manufacturing Technology Laboratory completed the design and fabrication of the station in February. It consists basically of an M128 5-ton cargo trailer that has been modified to carry all the equipment needed to mount and dismount tires and wheels.

Features include a 10-kilowatt generator, a high-capacity air compressor, a Model 5000 Coates pneumatic tire changer and a safety cage for holding tires during inflation. There is also an electric winch that aids in loading and unloading tires from the trailer and moving them into position for vehicle mounting.

According to Leslie O'Neal, chief of the Design and Manufacturing Technology Laboratory's Testing Support Division, the mobile station will handle any tire size the Army uses. "Except for the Coates tire changer, which we had to go out and buy, all the items on this trailer are already in the Army inventory," said O'Neal. "They have just never been put together in one package before."

Though the project to develop the mobile station was considered a success, it appeared for a short time that the work that went into it would be a wasted effort. When the trailer was ready to go to Somalia, the relief operation was winding down, which meant plans to ship it there had to be canceled. But Gary E. Schultz, chief of the Systems Engineering Directorate's Tactical Vehicle Division, and O'Neal, who jointly coordinated the project, decided that it would be worthwhile to let troops evaluate the mobile station. "The trailer is a cost-effective way of changing tires for all Army equipment, particularly the M747," Schultz said. "And we felt sure that soldiers would find it very useful once they got their hands on it."

Fort Hood, Texas, which has an ongoing working relationship with TARDEC that enables troops to evaluate TARDEC-developed equipment innovations, agreed to let its First Cavalry Division try it out.

The trailer arrived at Fort Hood on April 5, and O'Neal and several others from TARDEC were on hand to demonstrate it to First Cavalry troops and other Fort Hood officials. The demonstration consisted of removing and replacing four M747 trailer tires—each replacement taking about 30 minutes to complete.

"Everyone there was extremely excited about this trailer," said O'Neal. "I talked with one major who said he wants me to send him a cost estimate for the trailer because he thinks he will be asking for at least 12 of them to be built immediately."

O'Neal added that Steve A. Lernyei, a civilian with the 2nd Infantry Division in Korea who also saw the demonstration, said there is a great need for this equipment in Korea, and he plans to tell his division commander about it. "I feel pretty certain we will want at least three trailers," Lernyei said.

When asked to speculate whether the mobile tire-changing station will someday be adopted Army-wide, O'Neal said, "There are no plans under way to do this yet. But Fort Hood has agreed to take the trailer we loaned them out to the National Training Center at Fort Irwin, CA, to demonstrate it. And we believe that once the word gets out how well the equipment works, the Army will want to buy it across the board for everybody."

The preceding article was written by George Taylor, a technical writer-editor for the U.S. Army Tank-Automotive Command, Warren, MI.

TARDEC Unveils Advanced Chassis

The world's most advanced tank-automotive chassis was unveiled earlier this year by the U.S. Army Tank-Automotive Research, Development and Engineering Center. The Component Advanced Technology Test-Bed (CATTB), a multi-command test-bed, was received with positive response

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at the Annual Armor Conference at Fort Knox, KY.

Most attendees were impressed with the new technologies and overall design of the vehicle. Some of its most exciting features include:

- the new standard Army vehicle electronics architecture (VETRONICS);
- significantly reduced fuel consumption;
- reduced space claim of the entire powerpack;
- space savings and weight reduction;
- lockout and adjustable height features of the hydropneumatic suspension system; and
- driver's controls and displays consolidated into a single unit.

REMR-II Field Review Group Meets

The 5th REMR-II Field Review Group Meeting was convened earlier this year in Omaha, NE. Ongoing work units of the Repair, Evaluation, Maintenance, and Rehabilitation (REMR) Research Program were reviewed and new directions addressed. General sessions were open to the public.

The primary purpose of the REMR Research Program is to develop technology that will add service years to the nation's aging hydraulic infrastructure. Almost half of the Corps of Engineers' 270 lock chambers along inland waterways will soon be 50 years old, at which time they will exceed their design service life. Program research has already yielded significant benefits to both the U.S. Army Corps of Engineers and the private sector in terms of cost savings and extension of serviceability of existing structures.

Recent projects under the REMR Research Program have included the use of blended chemical high temperatures to restore collector wells at a superfund site in Michigan, installation of precast concrete stay-in-place panels to rehabilitate the lock chamber at Troy Lock in New York, and the application of the STREMR numerical model to predict flow velocities in a 25-year flood event for the Mud River in West Virginia.

A REMR-developed concrete mixture for placement underwater was employed in the repair of the service tunnel flooded by the Chicago River in April 1992.

Managed by the U.S. Army Waterways Experiment Station (WES) in Vicksburg, MS, the REMR Research Program was designed to involve many different disciplines and all four Corps R&D installations (WES; the Construction Engineering Research Laboratory, Champaign, IL; the Cold Regions Research and Engineering Laboratory, Hanover, NH; and the Topographic Engineering Center, Fort Belvoir, VA). Six broad problem areas are targeted for research: concrete and steel, coastal, geotechnical, hydraulics, electrical and mechanical, and operations management.

The technology transfer plan for the REMR Program received the Federal Laboratory Consortium Award for Excellence in Technology Transfer in 1986 and since that time has served as a model for other research efforts. In addition to several publications and technical reports, REMR technology transfer methods include workshops, symposia, courses, and video reports. The REMR materials data base offers on-line information about specific repair products.

For additional information on the REMR Program call Lee Byrne on (601) 634-2587 or write Director, U.S. Army Engineer Waterways Experiment Station, ATTN: CEWES-SC-A/Lee Byrne, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199.

CONFERENCES

Power Generation Workshop Scheduled

A workshop on "Millimeter Wave Power Generation and Beam Control" will be held on Sept. 14–16, 1993, at the University of Alabama in Huntsville (UAH). The workshop is sponsored by the U.S. Army Missile Command, the U.S. Army Space and Strategic Defense Command, the U.S. Naval Air Warfare Center, and the U.S. Army Research Office.

Industry, government and academic representatives will address issues of concern for Army and DOD weapon applications, and will identify and prioritize research efforts needed to advance the technology to a more mature level.

For more information about registration, please contact Susan Tackett Caldwell at UAH at (205)842-6352 or (205)895-6343 ext. 277.

Spectral Sensing Symposium Highlights Emerging Technologies

Leading scientists from government, industry, and the academic community convened late last year for the first international conference recognizing the emerging science of spectral sensing from remote distances. The International Symposium on Spectral Sensing Research (ISSSR) in Maui, HI, showed that significant changes are occurring in spectrometry, and they can significantly improve environmental monitoring to counternarcotics efforts.

Spectrometry—the science of identifying materials from the intensity of light they reflect or emit at specific wavelengths—is not new. Criminologists often rely on this branch of science to identify materials. But in recent years, the ability to obtain the unique spectral signature of a material has moved out of the laboratory and into the field. Today, as shown at the conference, it is possible to obtain the "fingerprint" of materials at extraordinary distances, even from a satellite.

Several recent practical applications show the potential for spectral research. During Operation Desert Storm, spectral signatures from satellites were used to identify and track the oil spill in the Persian Gulf. And both U.S. and coalition forces gained valuable desert terrain information by sorting out the data contained in spectral bands of U.S. satellites such as Landsat. According to Dr. Jack N. Rinker, a scientist in the Army Corps of Engineers Topographic Engineering Center, who worked alongside U.S. forces during the conflict, "The spectral information available from the satellites allowed us to give Army and Marine units terrain information needed to plan military operations."

CONFERENCES

The experts at the ISSSR meeting agreed that the potential for this technology is greater than most people realize. Following a hurricane such as Andrew, high resolution spectral measurement systems in an aircraft or helicopter could be used to identify vegetation that was damaged beyond recovery in a matter of hours, even though this would not be visible to the eye for several days. Spectral signatures of potentially hazardous materials leaking from ruptured storage vessels could be detected in nearby waterways, even though the amount of pollutant is extremely small, and not visible to ground teams.

High resolution systems that can be carried on lightweight aircraft and helicopters are being used today for applications ranging from mineralogical searches to wetlands monitoring, and all indications are that satellite use will increase. Pollutants disposed of illegally can be detected by spectral sensors overhead. They will collect hard evidence of both the type and amount of materials being released from specific locations.

The symposium was hosted by the U.S. Army Corps of Engineers, and co-sponsored by the corps and more than a dozen other government agencies. More than 300 scientists and professionals from around the world participated.

Upcoming Conferences

• The Fifth International Seminar on Battery Waste Management will be held Nov. 1-3 in Deerfield Beach, FL. Sponsored by Dr. S.P. Wolsky, Ansum Enterprises Inc., the seminar will continue the discussion of the important issues relating to the management of battery wastes.

The discussion will cover manufacturing and user wastes of the important primary and secondary battery systems with the focus on lead acid, nickel cadmium, metal hydride, alkaline manganese, lithium and lithium ion and others such as sodium, sulfur and polymers, potentially important for use in electric vehicles. The seminar will treat technical, economic, administrative and general management concerns.

• The Third International Seminar on Double Layer Capacitors and Similar Energy Storage Systems will be held Dec. 6-8, 1993, in Deerfield Beach, FL. It will be sponsored by Dr. Sumner P. Wolsky, Ansum Enterprises Inc. and Dr. N. Marincic, Battery Engineering, Inc. The seminar will bring together individuals and groups from around the world in a unique forum to discuss the research, development and application of double layer capacitors and similar energy storage devices.

For additional information on either of the above conferences, contact Dr. S.P. Wolsky, 1900 Cocoanut Road, Boca Raton, FL 33432; (407) 391-3544; fax (407) 750-1367.

• The Fourth Annual Camouflage, Concealment and Deception (CCD) Symposium will be held Oct. 12-15 in Fort Walton Beach, FL and Eglin Air Force Base, FL. The symposium is sponsored by the Camouflage, Concealment and Deception Section, Combat Survivability Division of the American Defense Preparedness Association (ADPA). The theme, "CCD for Joint/Combined Contingency Operations," will address current domestic and international issues, trends, requirements and advances in the survivability of combat units in limited conflicts as the result of CCD enhancements. For additional information call Tracy Stuckrath or Donna Alexander at ADPA, (703) 522-1820.

• *Structural Carbons,* the Ninth Annual Conference on Materials Technology, will be held Oct. 26-27 at Southern Illinois University, Carbondale, IL. Topics of the sessions will include carbon fiber technology, structures in carbons, carbon-carbon composites, and chemical vapor infiltration and oxidation of carbons. For more information, contact Karen Palmer, Materials Technology Center, SIUC, Carbondale, IL 62901; (618) 453-1167; fax (618) 453-8216.

BOOKS

Government Printing Office Releases Publications

The following publications are available from the Government Printing Office. For additional information on any of these books, contact Mr. Thompson, U.S. Government Printing Office, Dept. SSMC, Washington, DC 20401; Telephone (202) 512-2413.

Medical Service in the European Theater of Operations, by Graham A. Cosmas and Albert E. Cowdrey
Edition: 1992
Stock Number: 008-029-00228-1
Synopsis: Although readily admitting the importance of combat service support forces, military students and historians alike tend to concentrate on combat and combat support units when studying operations, giving only passing attention to the vital work of the logisticians, signalmen, transport troops, and the rest. This is regrettable, for the operations of combat service support units—especially in a global conflict like World War II with its vast distances and varied terrains—have much to teach us about modern warfare, lessons that remain of surpassing importance to our profession. This publication supports the proposition that the experience of medical personnel in war directly stimulates advances in medical science.

After the Cold War—Living With Lower Defense Spending
Edition: 1992
Stock Number: 052-003-01274-0
ISBN 0-16-036108-7
Synopsis: The dissolution of the Soviet Union and the end of the Cold War have profoundly changed U.S. defense needs. Just what a prudent U.S. national defense system will be in the post-Cold War era is not yet clear. But it will almost certainly require less money and fewer people than it did in the 40 years when this nation faced a hostile and obdurate military superpower with a huge army poised at the borders of Western Europe. Welcome as these changes are, they have serious implications for the people, companies, and communities that have depended on defense spending for their livelihood. The changes also raise some potentially

troubling questions about adjustment for the nation as a whole.

Annual Report to the President and the Congress (Department of Defense)
Edition: 1992
Stock Number: 008-000-00599-1
ISBN 0-16-036132-X
Synopsis: A year ago, the United States was at war in the Middle East, communist hard-liners in the Soviet Union had cracked down violently on Baltic independence movements, and the USSR continued its strategic modernization program. Even so, the Department of Defense announced plans to reduce dramatically America's armed forces pursuant to a new defense strategy. The new defense strategy recognized that fundamental changes were already taking place in the international security environment and therefore focused on regional rather than global threats.

Egypt: A Country Study
Edition: Revised 1991
Stock Number: 008-020-01271-8
Synopsis: This edition of *Egypt: A Country Study* replaces the previous edition published in 1983. Like its predecessor, the present book attempts to treat in a compact and objective manner the dominant historical, social, economic, political, and national security aspects of contemporary Egypt.

Weapon Systems
Edition: 1992
Stock Number: 008-020-01275-1
ISBN 0-16-036138-9
Synopsis: The goal of the Army technology base program in close combat is to provide the technology for overmatching air and land systems to give our soldiers the winning edge on the battlefield. The demonstrations described are focused on advanced technologies to provide increased lethality, survivability, mobility and sustainability, both for upgrades to fielded systems and for next generation systems. Lessons learned from operations such as Desert Storm have led the Army to focus on both evolutionary and revolutionary technologies that can improve force projectability and provide a decisive advantage in future operations.

Commanding Generals and Chiefs of Staff, Portraits & Biographical Sketches, by William Gardner Bell
Edition: revised 1991
Stock Number: 008-029-00240-0
ISBN 0-16-035912-0
Synopsis: On June 14, 1775 the Second Continental Congress, meeting in Philadelphia, adopted a resolution under which 10 companies of expert riflemen would be immediately raised, six in Pennsylvania, two in Maryland, and two in Virginia. The "compleated" companies were to "march and join the army near Boston, to be employed . . . under the command of the chief officer of that army." On the following day the Congress elected George Washington, Esq., of Virginia to be general and commander in chief "of the forces raised and to be raised in defense of American Liberty."

Problems of Communism, January-April 1992
Edition: 1992
Stock Number: 725-002-00040-8
Synopsis: This special 40th anniversary issue of *Problems of Communism* contains proceedings from the conference "Toward a Postcommunist World," held in Washington, DC, Oct. 22-23, 1992. Ambassador Jeane Kirkpatrick, Senator Richard Lugar, and Czechoslovak Vice Premier Vaclav Klaus offer assessments of the transition from communism throughout the world. The international gathering also addressed the propects for democracy in Eastern Europe, the former Soviet Union, China, and the rest of East Asia; European security; Africa's Second Liberation; the future of the Latin American left; and the roles of international organizations, Islam, nationalism, and the national state in the contemporary world.

U.S. Army Special Operations in World War II, by David W. Hogan Jr.
Edition: 1992
Stock Number: 008-029-00248-5
Synopsis: In the past decade, special operations have achieved an enhanced role in the missions of all of the armed services. The Army has enlarged its Ranger force to a regiment of three battalions, expanded its Special Forces to five groups, further developed its capabilities in psychological operations and civil affairs, established a new First Special Operations Command to supervise these units and activities, and developed new doctrines and training techniques.

Commercial Practices for Defense Acquisition Guidebook
Edition: 1992
Stock Number: 008-020-01273-4
ISBN 0-16-036135-4
Synopsis: Standard commercial acquisition practices, procedures, and contracts differ from those used by the government and, in many instances, differ from those used by commercial businesses to sell to the government. Different goals and objectives are an underlying cause for the differences in practices between the commercial and government sectors. For example, in the private sector prices are established by competitive demand in the open market, not by cost analysis as is often done when the government is the buyer.

Glossary—Defense Acquisition Acronyms & Terms
Edition: 1991
Stock Number: 008-020-01276-9

Synopsis: *Glossary* contains most acronyms, abbreviations and terms commonly used in the weapon system acquisition process within the Department of Defense and defense industries. *Glossary* focuses on terms with generic DOD application and a few service unique terms that others might deal with, and thus require reference. While *Glossary* identifies and highlights many terms, it does not intend to be all-inclusive, particularly regarding military department and other organizationally unique terms.

Technology Against Terrorism - Structuring Security
Edition: 1992
Stock Number: 052-003-01272-3
ISBN 0-16-036061-7
Synopsis: Terrorism is not a new phenomenon, but it has become more prominent during the past two decades. Terrorist attacks have included not only political assassinations, but also large-scale attacks, often aimed at third parties, causing massive casualties. Two well-known examples are car bombings, employing hundreds of kilograms of high explosives, and attacks on commercial aircraft around the world. The U.S. government and the American public became acutely aware of terrorism after the bombing of Pan American Flight 103 over Lockerbie, Scotland in December 1988. The recent war in the Persian Gulf heightened fears of renewed terrorist attacks on U.S. targets, both overseas and at home.

Japan - A Country Study
Edition: Revised 1991
Stock Number: 008-020-01272-6
Synopsis: Japan in 1990 was a modern, thriving democracy, yet it retained a long and esteemed imperial tradition. The Japanese took great pride in being "unique," yet much of Japanese civilization was composed of selective borrowings, from the Chinese written language in the sixth century to U.S. semiconductors in the latter half of the 20th century. Although Japan lacked almost all raw materials, it was a highly urbanized and industrialized economic power supplying vast export markets.

NASA Engineers and the Age of Apollo
Edition: 1992
Stock Number: 033-000-01111-3
ISBN 0-16-036174-5
Synopsis: The 20th anniversary of the landing of an American on the moon occasioned many bittersweet reflections. Sweet was the celebration of the historic event itself, and sweet to space enthusiasts was President George Bush's call for a new era of human space exploration—back to the moon and on to Mars.

Distribution of Personnel by State and By Selected Locations, September 30, 1991
Edition: 1992
Stock Number: 008-000-00604-1
Synopsis: Data are provided on the number and operating locations of DOD active duty military and direct hire civilian personnel in each of the 50 states, by state, according to defense component. The number and percent distribution of DOD personnel in each state and in the country as a whole are also provided. Detailed data are shown in a separate table for major installations and selected cities in each state, according to defense component.

Understanding Soviet Naval Developments
Edition: 1991
Stock Number: 008-047-00396-0
Synopsis: The growth of Soviet naval and maritime strength has been one of the most dramatic military developments of the post-war period, especially from the perspective of American security interests. From the end of World War II until the early 1970s, the United States maintained unquestioned naval supremacy, providing one of the West's primary shields against the threat of aggression and affording great flexibility in foreign policy. Today, despite the unprecedented good relations between our countries, the Soviet Union's existence as a sea power continues to pose a potential challenge to the U.S. Navy.

Finding A Balance
Edition: 1992
Stock Number: 052-003-01278-2
ISBN 0-16-036188-5
Synopsis: Our nation's intellectual property system is intended to strike a balance between private incentives and protections of public interest. This report examines the rapid and complex technological changes and trends in computer software technologies and their possible effects on the nation's intellectual property system. An effective policy must foster technological innovation to preserve economic competitiveness of the U.S. software industry in the face of changing technologies and markets.

Prime Contract Awards by Region and State, Fiscal Years 1991, 1990, 1989
Edition: 1992
Stock Number: 008-000-00605-9
Synopsis: This report contains data on the net value and percent distribution of DOD prime contract awards for the latest three fiscal years, by census region and principal state of performance. In addition to summary data, information is provided on awards for the seven major hard goods and on awards within the 25 major procurement programs, by state. Individual tables show the net value and percent distribution of awards for research, development, test, and evaluation (RDT&E) work, by region and state, according to type of contractor for the latest three years.

BOOKS

1993 Directory of Certified 8(a) Contractors

ISBN O-9636853-0-9 $90.00
Soft cover, 742 pages.

Available from the Tennessee Center for Research and Development (TCRD), 830 Corridor Park Blvd. Suite 200, Knoxville, TN. Produced and distributed by TCRD in cooperation with the Tennessee Valley Authority. Requests for additional information should be directed to Dan Maynard at the TCRD address cited above or by calling (615) 966-5430 or Fax: (615) 966-7302.

Synopsis: Full page profiles of 501 certified 8 (a) contractors headquarted in Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, and Virginia. Includes point of contact, radius of operation, bonding levels, capabilities statements, and number of scientists and engineers. Updated in March 1993. Extensively indexed to identify firms by federal product and service codes, including R&D codes; services; manufacturing/supply, or construction. Indexes identify firms located in FY 93 labor surplus areas.

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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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Call for Papers

19TH ARMY SCIENCE CONFERENCE

A call for abstracts of papers proposed for presentation at the 19th Army Science Conference June 20 - 24, 1994, has been issued by the Deputy Assistant Secretary of the Army for Research and Technology. One-page narrative summaries, which will serve as the basis for selecting papers for presentation, must be submitted by November 1, 1993.

The conference, which will be held in Orlando, FL, is sponsored by the Assistant Secretary of the Army for Research, Development and Acquisition. Papers must present recent original work by Army civilian and military R&D personnel and should address the role of science and technology in assuring the competitive edge for soldiers in the 21st century.

Questions regarding format, guidelines, submission topics, and the address for submitting narrative summaries and papers should be directed to the attention of Dr. Joe Sattler, Army Research Laboratory, AMSRL-SS-S, 2800 Powder Mill Road, Adelphi, MD 20783, telephone (301) 394-2002 (DSN 290-2002), FAX (301) 394-5410.

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