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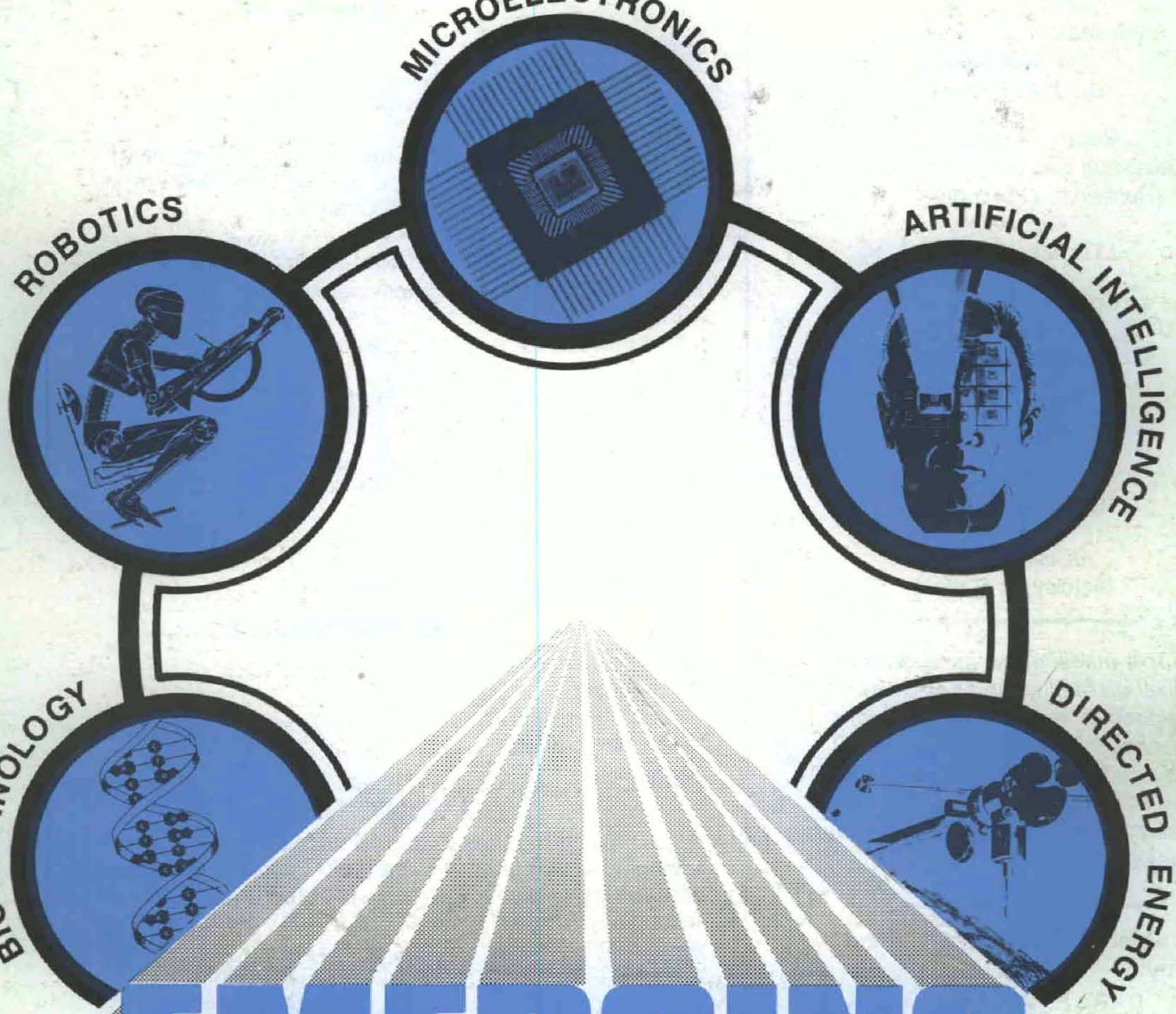

EMERGING TECHNOLOGIES

ARMY
Research
Development
Acquisition

RD&A

PB 70-88-4

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PROFESSIONAL BULLETIN OF THE RDA COMMUNITY

This medium is approved for the official dissemination of material designed to keep individuals within the Army knowledgeable of current and emerging developments within their areas of expertise for the purpose of enhancing their professional development.

By order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

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Brigadier General, United States Army
The Adjutant General

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FEATURES

DEPARTMENTS

ABOUT THE COVER

The front cover is associated with a feature article on some of the critical technologies which may have a major impact on the future battlefield. The back cover shows an artist's concept of the New Jersey National Guard High Technology Training Center at Fort Dix, NJ, which was officially opened last year. Graphics support for covers was provided by Joe Day, AMC Graphics Branch.

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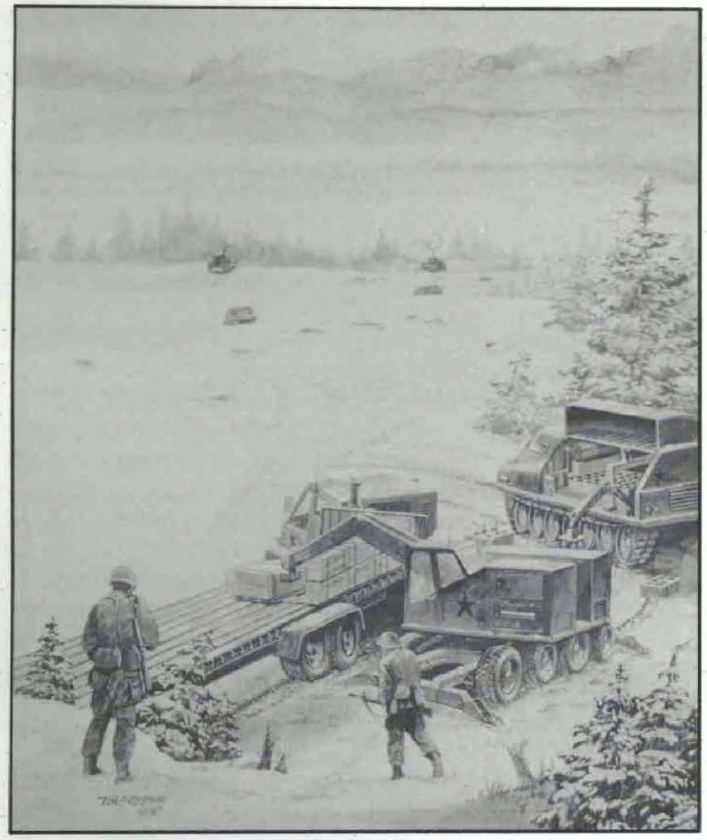


The Field Materiel Handling Robot under development by Martin Marietta Aero and Naval Systems is designed to move palletized loads up to two tons in a load cycle time of 20 seconds. The robot arm has a 27-foot reach.

EMERGING TECHNOLOGIES

By Paul F. Case

Critical technologies could make today's visions become realities on tomorrow's battlefield

Visions of the future battlefield and the types of exotic weapons that it might accommodate by the year 2015 are as irresistible to the military mind as is a flame to a moth. Currently, the Army is looking with high hopes into the kind of critical technologies that might produce these weapons — automated sensors and sensor fusion, directed energy weapons, microelectronics and integrated circuits, propulsion and conventional warheads, and robotics and machine intelligence.

"Emerging technologies seem to promise scientific advances that could directly affect combat power on the battlefield," says the Army's Posture Statement for FY89. "Developments in pulse power and electromagnetic guns and an associated increase in lethality could change the nature of our armored force. Breakthroughs in electromagnetic armor could make our vehicles impervious to today's most powerful mines and tank killing weapons. Advances in artificial intelligence, including expert systems, might provide a powerful new approach to automating such battlefield functions as situation assessment reconnaissance, target recognition, and battlefield planning. Improvements in microprocessors, sensors, and communications systems could revolutionize the commander's ability to see and affect the battle."

Research and development is not a goal, says the Posture Statement, it is a national imperative. "We must have a R&D establishment that can extract maximum benefit from modern technologies to assure the Army's qualitative edge over potential enemies in the future."

Army Chief of Staff GEN Carl Vuono puts it more succinctly: "We must use what we have smarter and find other ways to get research accomplished." Vuono's words were prompted by recently announced cuts in the Army's five-year funding program (Program Objective Memorandum, 1990-94).

In the face of these fiscal constraints, the Army Materiel Command (AMC) in general and the Army Laboratory Command (LABCOM) in particular institutionalized a comprehensive strategy to sharpen the focus of technology base activities and to guide decision making at all levels.

Because there are too few research dollars chasing too many emerging technologies, only the most promising technologies can be supported. Fully half of the LABCOM budget is earmarked for next generation/notional systems (NG/NSs). These especially, said a spokesman, have been "extremely powerful" in focusing technical base resources on technical barriers through technical demonstrations.

In a unique effort to identify notional or future weapon systems — some called it an "unusual experiment" — 500 users and developers from government, and academia recently took part

in a two- week meeting designed to exploit emerging technologies. Sponsored by LABCOM under controlled-access conditions, the Technology Base Investment Strategy (TBIS) conference was held Feb. 22 - March 4 in the retreat-like surroundings of the Johns Hopkins University's Applied Physics Laboratory. Here is how one attendee described that meeting and a followup session:

"We had experts in each field present papers on the technologies so that the audience could understand both the potential and time perspective associated with each technology. We then had our (LABCOM) people convene in working groups to develop long-range notional or future systems using these technologies.

"Two weeks later, a smaller group of users and developers conducted a war-game exercise to gain some insights as to the relative merits of different kinds of systems.

"Along the way, we got some unexpected benefits. Not only did we forge a much better link between the developer and user, but we found some totally new systems and concepts we hadn't envisioned earlier.

"We're sorting all of this out, and we expect it will provide some guidance for our long-range research efforts, and may also stimulate the development of some new battlefield concepts as well."

Following are summaries of some of the more stimulating TBIS discussions.

Space as 'New High Ground'

To the Soviets, space is the main arena of future wars. Remote sensing satellites will generate data on terrain, weather, nuclear, biological and chemical (NBC) warfare, and aviation. According to the Central Intelligence Agency (CIA), the Soviets are developing a satellite-to-submarine communications link and, shortly into the next century, will mount a man-to-Mars mission.

The United States must prepare for conflict in the fourth dimension by designing space assets to operate in a combat environment. Gallium arsenide solar cells could power space stations. We already know that space-borne laser radar techniques provide an unprecedented resolution of ocean and land surfaces. Space is not a sanctuary but a tactical battlefield, a theater of war, a global "plus" purchased at great cost and distance. Today, only one country is "king of the gravity mountain" — and it is not the U.S.

Directed Energy Weapons

These weapons fall into three broad categories — lasers, particle beams, and radio frequency (RF energy) weapons or devices. They are characterized by beams of coherent light or atomic particles or RF energy. Because of cost and complexity, their lethality is difficult to demonstrate in the field. Do they have real military potential or are they Buck Rogers' fantasies?

Lasers make "soft" kills at long ranges. They remain the greatest immediate threat to the individual soldier and to electro-optic sensors, as well as being the current primary option for DE weapons.

Charged particle beams are released as instantaneous bolts of high energy electrons or atomic particles traveling at or near the speed of light. They may cause catastrophic damage, can operate in most weather conditions, and have no known vulnerability to countermeasures. Military experts have noted: "The impact of any weapon with a very large magazine, virtually zero reload time, and speed-of-light delivery of destructive energy could be as revolutionary or as much of a surprise as the introduction of the long bow or musket — but only if affordable and not easily countered or rendered inoperative by bad weather or other obscurants."

Advanced Signals Processing

Advanced signals processing allows a greater number of complex arithmetic operations to be performed per second. Gallium arsenide semiconductor technology, superconductivity, and optical and acoustic processing technologies are all part of the drive to reduce the data collected from a variety of sources into meaningful information. Digital technology bears the brunt of the signal processing load now. Even as other technologies take over more of the processing load, digital will continue to bear at least 90 percent of the load into the year 2000. Digital technology is more accurate than analog, and will revolutionize smart weapons over the next 20 years.

There is going to be an evolution in multi-sensor target acquisition. Advanced sensor/multi-sensor aided target recognition is developing across the board, and is the cornerstone of our competitive strategy concept (in Europe). As sensors collect data from scenes containing targets and clutter, knowledge bases will be fine-tuned by a man-machine interface that will assess the scene and dictate action. Artificial intelligence will provide those fine-tuning functions now performed by an operator.

Artificial Intelligence

While an intelligent machine cannot now defeat the world's chess champion or pass a medical board exam, it can enhance, extend, and emulate human processes. By the year 2000, an autonomous vehicle with on-board computers and remotely controlled by voice command will be able to detect tanks. An advanced ground vehicle with cameras could conduct remote reconnaissance. A multi-sensored vehicle, remotely controlled and consisting of a refueler/ammunition resupplier, could solve low-risk, manpower-intensive logistics problems.

"Intelligent machines are feasible now," said one presenter. "You can obtain sufficient computing systems nearly off the shelf. Early in the next century we may see very intelligent robots as autonomous as human beings."

Robotics/Unmanned Aerial Vehicles

By doing useful work in uncertain environments — logistics, surveillance, weapons delivery, command and control — a robot can reduce risk to the soldier and extend the might of existing forces.

There are two design alternatives. The first would keep the man in the loop with teleoperations, using a broad band data link and an off-board processor. The second would let the soldier exercise control with a narrow band data link and an on-board processor.

Unmanned aerial vehicles (UAVs) can fly at 200-300 miles per hour while traveling at low altitudes — 500 to 1,000 feet. They are hard to see or hear, especially if power gliding on solar cells. A UAV may loiter over enemy air defenses, then home in and destroy enemy radar.

The Air Force is producing a pro-

grammable bomb in an automated factory. The Marines have a remotely operated airborne device that weighs 82 pounds with a two-kilometer, two-hour range.

"Naturally, there are technical barriers," said one presenter. "A small (UAV) engine is unreliable in cold weather, and target-seeking optical sensors give poor resolution and cost a lot. The human eye, for example, has very high resolution, yet cannot distinguish a car from a truck at 15,000 feet. Try it the next time you fly. The vehicles are just dots."

Smart Minefields

Minefields on the future battlefield will combine the technologies of artificial intelligence, robotics and command and control. Two way data links and mines that can change operating modes can be exploited with local intelligence control units. These units would merge mine threat reports into a battle picture and then select and transmit to the mines an appropriate action based on preprogrammed expert rules for managing breach attempts without requiring commander intervention.

Microelectronics

The trend is toward multi-sensors, multi-modes, and multi-functions, with ultra-miniaturized platforms and onboard maintenance. Electronics will account for 40 percent of future military budgets. Research in very high speed integrated circuits (VHSIC) began 10 years ago. In another couple of years, we will have spent a billion dollars on VHSIC.

From 1968 to 1988, data processing capabilities grew at an exponential rate, quadrupling every three years. Thanks in large part to VHSIC, by 2002 there will be one billion bytes on a memory chip. The processing speed will be 10 million floating point operations per second. By 2003, in just 15 years, there will be a chip set capable of one billion floating point operations per second.

Advanced Materials

A quantum improvement will be needed in materials and components to support directed energy weapons. Smaller and lighter power sources are critical to the future battlefield. In 1980 it took 100 cubic inches of bulk to permit the production of 100 watts of power. Today it takes 10 cubic inches of bulk for 90 watts. By the 1990s it will take one cubic inch of bulk for 80 watts of power.

Nineteen percent of all technical barriers are materials-related. The characteristics of materials — lighter weight, lower maintenance, reduced manpower, increased functions and capabilities — impact on 73 percent of the LABCOM mission. Ceramics, for example, have unique magnetic and optical properties that make them useful in aircraft and rocket components. Only the cost is limiting their application. The hull and armor composites of the Bradley Fighting Vehicle weigh 25 percent less than the original version. An upcoming composites' demonstration promises to dramatically change ground vehicle design and future field capability.

Summarized one presenter: "We must reduce the lead time (to produce composite materials), which is now 15 years from discovery to implementation. Ideally, we'd like to cut that by half."

Biotechnology

Biotechnology involves the application of biological processes to produce useful products. There has been an explosion in biotechnology in the past five to 10 years. You take a molecule from one organism and duplicate it in another organism. You can grow plants resistant to insects or drought. Within the DOD, most efforts involve medical applications.

One non-medical effort would microbiologically synthesize silk and rubber, producing silk fibers eight times stronger than steel. Through bioengineering, chemicals and other materials could be grown right on shipboard, reducing the logistics tail. Biolubricants could replace oil in turbine engines and increase the thrust-weight ratio by 50 percent by operating at higher temperatures. Moreover, biolubricants are nontoxic, noncorrosive, and biodegradable. Biodetergents could be used on oil spills and for water cleanup control. A biopolymer coating reduces drag and permits a ship's hull to slip through water like a dolphin. The potential is awesome.

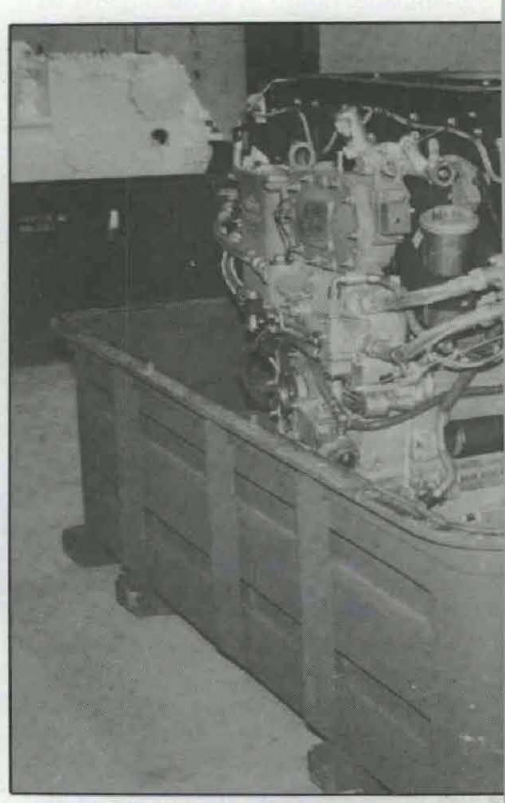
Conclusions

Dr. George Heilmeier, vice president and chief technical officer at Texas Instruments, told engineers to ask themselves these kinds of questions about their research: "What are you trying to do? How is it done today? What is new in your approach? Assuming you are successful, what difference does it make?"

In the words of an AMC spokesman, "During a period of decreasing financial and personnel resources, we need to sharpen our focus on truly worthwhile systems and concepts."

In other words, the Army wants to make sure that the visions it conjures up today will become the realities of tomorrow.

PAUL F. CASE is a public affairs specialist at the U.S. Army Laboratory Command, Adelphi, MD. He is a 1962 graduate of the University of Maryland and has a bachelor's degree in journalism.



HIGH TECHNOLOGY TRAINING CENTER OPENS

By WO Roman M. Martyniuk

Introduction

On Oct. 7, 1987, Governor Thomas H. Kean, the commander-in-chief of the New Jersey National Guard cut a ceremonial ribbon signifying the end of construction and the official opening of the New Jersey National Guard High Technology Training Center (HTTC) at Fort Dix.

This facility was first conceived about four years ago when LTG Herbert R. Temple Jr., then director of the Army National Guard and MG Francis R. Gerard, the adjutant general of New Jersey, first dreamed of creating a state-of-the-art training center that would use the most modern equipment and technology to help National Guardsmen, Reservists, and active component soldiers overcome the restrictions of limited training space and inadequate range access.

Units of New Jersey's 50th Armored Division were able to fire the 105mm main guns on their M48A3 tanks only during annual training at Fort Drum, thereby seriously hampering the types and quality of training possible during inactive duty training.

Modern weapons systems, combined with the increased combat mission for the National Guard, put heavy demands on today's citizen soldiers. Most commanders agree that the current schedule of 39 days a year makes training soldiers in the Reserve components difficult at best.

If the National Guard and Reserve are to perform their national defense role effectively, every individual soldier, every company size unit, every battalion, brigade and division element must be adequately trained and able to successfully complete their respective combat missions.

MG Gerard appointed COL Henry E. Harper, now the commandant of the high tech center, as project officer. COL Harper traveled across the country visiting virtually every training installation in the United States, examining, studying and evaluating the existing training technology, focusing primarily on armor equipment systems. Eighteen months later, within budget and on schedule, one of the most modern, best equipped training facilities in the U.S. Army opened for business.

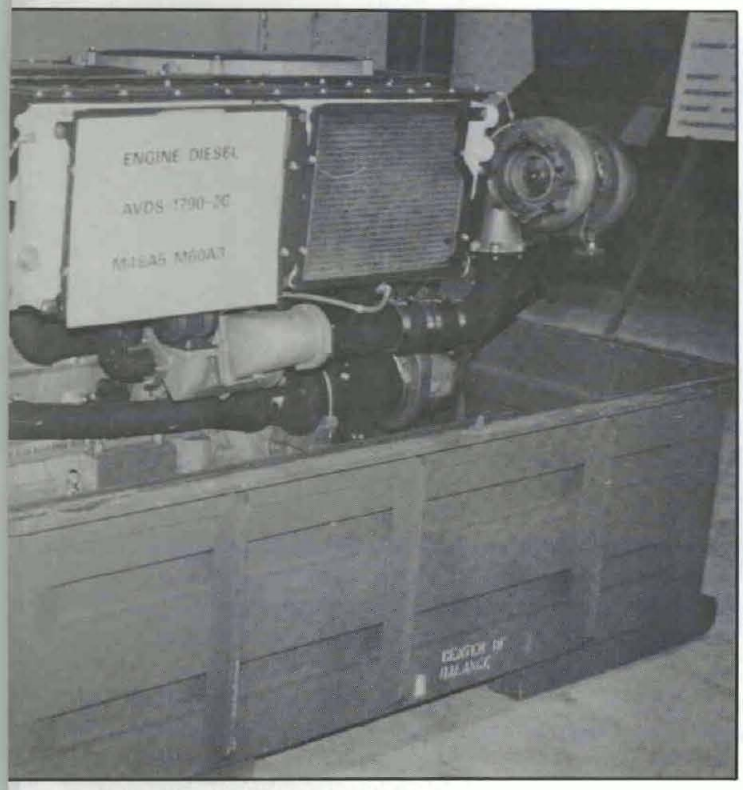
Advantages

The high tech center has a number of advantages previously unavailable. It provides a variety of systems and training opportunities under one roof. Soldiers can now train on armor, artillery and maintenance. Also, tank crews, forward observers and maintenance personnel no longer have to travel thousands of miles to active Army training installations to get the best training in their specialties or MOS.

With McGuire Air Force Base collocated with Fort Dix, soldiers from throughout the northeast can easily travel to the high tech center using military aircraft for transport on weekend drills as well as for the two-week courses of instruction. The training center can accommodate 250 full time students during the week and an additional 200 during inactive duty training (weekend drills).

More than 33 percent of the population of the United States is situated within a 300 mile radius of Fort Dix. The concentration of National Guard and Reserve units is predicated upon population density, thereby making the First Army area the ideal beneficiary of such an installation. There are five Army National Guard combat divisions within 75 miles of Fort Dix, representing more than 30,000 Guardsmen. This area also includes a wide variety of geographic styles from inner city urban to rural/agricultural.

There are many diverse specialties in



Left, the Regional Maintenance Training Site function of the HTTC features training opportunities for every tank engine from the M48A5/M60A3 to the M1. • Above, a warrant officer, on loan to the High Tech Center from HQ First U.S. Army, demonstrates MICROFIX, the computer graphic/PC combination used to analyze and project movement of enemy forces based upon intelligence information.

the Guard and Reserve critical to our national defense. More than 73 percent of combat support services of the total Army come from Guard and Reserve units. Units that must be ready to go "now."

Facilities

The high tech center features a number of simulation devices, panel trainers, computer graphics systems, Multiple Integrated Laser Engagement System (MILES) and the largest assortment of subcaliber training devices in the Army inventory.

The indoor firing range is capable of accommodating two tanks parked side-by-side. Flexible heating tubes drop from the ceiling to keep the crews warm in the winter without having to use the vehicle engines. Remote controlled pop-up and moving targets provide realistic, reduced size, exact scale silhouettes of enemy equipment.

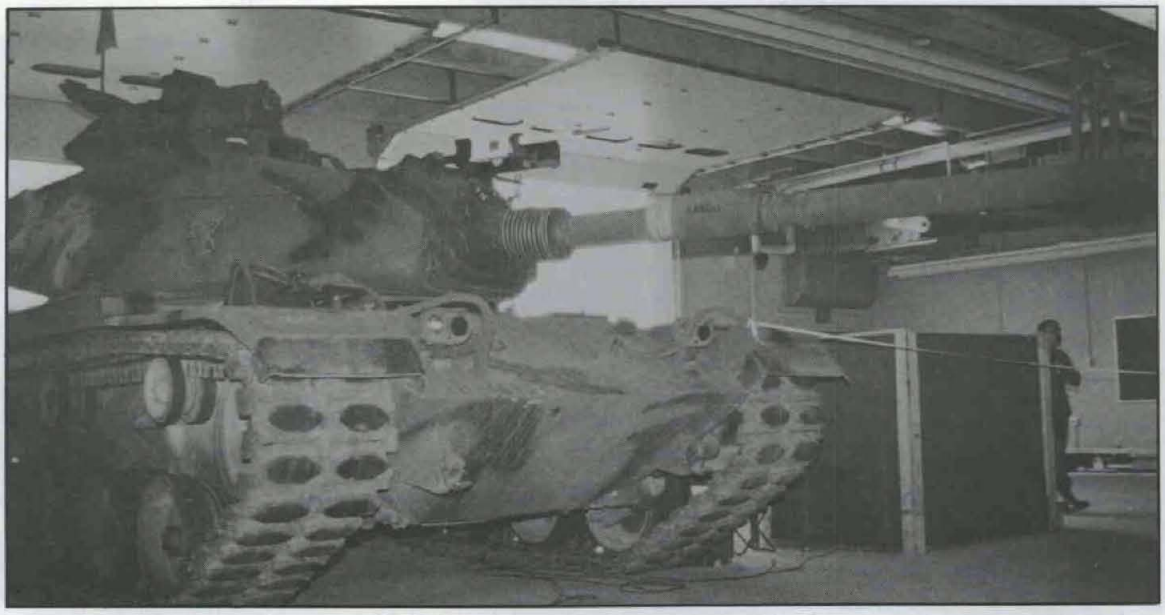
The Maintenance Training Laboratory features the M60A3 Training Panel comprised of a display panel combined with personal computers linked to videocassette recorders. A mainframe allows the computers to interact with students while they train in tank and track repair trouble-shooting techniques assisted by the complete training repair manual for that specific piece of equipment. (The program of instruction is determined by the student's demonstrated level of experience).

According to COL H. Earl Harper, commandant of the facility, "Before simulation technology, you had to put a piece of equipment out of commission to conduct training. Anytime you do that, you have unnecessary wear and tear on the equipment and you can't field the system. We can now train mechanics to repair the equipment without first breaking it."

The four bay maintenance training room has a cement floor and includes a 25-ton bridge crane that can lift turrets or heavy engines with ease. Students and observers can survey instructional activity from a mezzanine at one side of the room.

Some of key resources of the High Technology Training Center are:

- The Target Set Fire Observation system is a multi-tiered, auditorium-style classroom that appears to be a lecture hall straight out of a college campus. Instead of focusing on a professor, the students use specially calibrated binoculars to view combat scenes projected on a large screen by 11 computer-driven, 35-millimeter slide projectors. Students will determine adjustments to artillery fire, taking into consideration key variables such as weather, smoke conditions and the effective range of ammunition. Sound effects add an element of realism to the visual reinforcement when targets are hit.
- A Mobile Conduct of Fire Trainer (M-COFT) is housed outside the building in rather innocuous-looking tractor trailers. Tank commanders and gunners "engage" targets utilizing computer graphics that simulate actual combat. The M-COFT duplicates exactly the position, function and location of equipment inside a working tank.
- The Army Training Battle Simulation (ARTBASS) will allow battalion level staffs to practice battle strategy utilizing a computer instead of thousands of troops. The effectiveness of their strategy will be known immediately based on feedback from the system on casualties, fuel consumption and other categories of personnel and material resources.
- MICROFIX is a computer graphic combination used to project on a video monitor changes in the combat scenario based upon the most recent intelligence data gathered during battle. Topographic map sections are revealed



A careful look at the area above the base of the 105mm main gun reveals the presence of a laser system used with the M48A3 and M60 A1 tanks to allow firing practice at an indoor range.

on a video display indicating, with various symbols, terrain features, enemy troop movements, etc.

- A Videodisc Gunnery Simulator also incorporates video screens and computers in simulating actual combat scenarios, thereby allowing commanders the opportunity to react to the challenge of novel battle situations.
- The Electronic Information Delivery System (EIDS) is an individual learning center much like a language lab. Separate compartments equipped with head sets and video monitors allow students to explore the wealth of information available from the high tech center's extensive tape library.
- MICRO TICCIT represents $1 million in computer training equipment. Tank commanders can hone and test their skills using light pens on video screens to follow combat strategies. This system is also adaptable to the EIDS.

Totaling more than 70,000 square feet, the training center has an abundance of dedicated space available for training use; three 75-student classrooms, one 50-student classroom, two 25-student classrooms, and 10 15-student classrooms. The center also has a cafeteria with vending machines serving hot and cold beverages, and a general purpose room for large group or "hands on" equipment training.

Each classroom has a television monitor for viewing from ¾-inch or ½-inch tapes, a 35mm slide and overhead projector, a mounted projection screen, blackboard, bulletin board, and a rear projection screening system for teleconferencing. This system can be used for briefing up to 150 individuals and will be utilized by the proposed "School of the Air."

The Learning Center is equipped with six Bessler's with head sets and 18 carrels (individual study areas for students). This area is also equipped with six Caramates which enable the student to review 35mm slides at the carrels as well.

The on site library has training manuals, field manuals, and other related manuals arranged in numerical order for use by students and instructors. Also available is a large selection of technical tapes.

A Barracks Learning Center was created and consists of three Besslers, three carrels and assorted technical tape lessons for use by students during their off-duty hours. Students attending the training center and various courses are housed at the HTTC billets and fed at the HTTC dining facility.

The training center also encompasses a Training Technology Field Activity (TTFA). As a result of a "think tank" concept, research is ongoing to create and improve computer software which may later be exported to other Army facilities to improve training. Staffed by a number of personnel with doctorate degrees who are on the Army payroll, the TTFA is involved in the monitoring and analysis of all software training packages. Any instructional system, therefore, can be modified or improved to further increase the effectiveness of the respective program.

Training Devices

The training center also has a large variety of subcaliber training devices available, many of which were designed and developed in New Jersey. COL Lawrence A. Bryant (ret.), NJARNG, and SGM Jack Walentine, together with CWO John Miller, a National Guardsman from Ohio and William E. Guiette III, another Guardsman from California, pooled their talents and resources and have fielded a caliber .50 inbore device.

SGM Walentine, who is the operations sergeant at the HTTC, recently traveled to Europe and Korea to demonstrate the effectiveness and accuracy of this invention. Utilizing a .50 caliber round, the subcaliber device provides an exact ballistics match, at distances under 1,400 meters, to the 105mm main gun round of the M48A3 and M60 tanks. This represents an unbelievable accomplishment considering the cost ($350) of the 105mm round versus the caliber .50 ($3.50).

The added benefit to subcaliber devices is that gunners actually get the satisfaction of putting a hole in the target, of hearing a bang, of seeing and smelling the puff of smoke. . .it's the real thing only smaller.

MAJ Richard Schlegel, one of the permanent NJARNG staff at the HTTC, demonstrates the use of MILES with the M16A1.

Subcaliber devices require the same loading procedure, crew coordination and firing sequence as does the actual weapons system thereby preserving the highest level of realism.

The resulting low cost of training rounds virtually guarantees that every gunner of every crew of every unit can fire unlimited rounds. Subcaliber devices can also be used at indoor ranges with scale model, remote controlled moving targets.

The value of subcaliber training was shown when the U.S. Army Europe, Canadian Army Trophy Team trained with the caliber .50 inbore device prior to their biannual competition against armor crews from other NATO countries. The U.S. team won the competition.

Economic Impact

The economic impact of the High Tech Training Center is of great interest to Congressman James Saxton, U.S. Representative, 6th Congressional District of New Jersey and his constituents within the Bulington County area. The building itself represents approximately $5 million for construction alone, with $750,000 expended on furnishings, office equipment, etc. An additional $12 million in training devices, computers and communications equipment were also in place before the end of calendar year 1987.

The New Jersey National Guard estimates additional operating costs of $120,000 per year for utilities and $600,000 per year in contract dining expenditures. Combined with a $1,850,000 annual payroll for the 59 full time personnel, the high tech facility will inevitably be a positive influence on the local community.

When the High Tech Training Center was originally planned, it was intended to be one of several such facilities across the country. It is the first and, due to budget cutbacks, the only state-of-the-art, multipurpose training site in the United States.

Conclusion

Why a High Tech Training Center for the National Guard? The answer is simple and logical. It overcomes training restrictions caused by limited ranges and it maximizes training time for Guardsmen and Reservists thereby extending the one "weekend" per month scheduled. It also eliminates excessive fuel consumption and most important, provides extremely realistic training.

In addition to servicing the needs of the "part-time" soldiers, the center also provides necessary training for full time maintenance support personnel. These mechanics and technicians are responsible for keeping the awesome arsenal of military equipment combat ready at all times. Indeed, this is a critical mission in today's rapidly changing world situation.

WO ROMAN M. MARTYNIUK is the command information officer for the New Jersey Department of Defense. He has been a member of the New Jersey National Guard for more than 17 years, has completed public affairs courses at the Defense Information School and holds a master's degree in clinical psychology.

LIVE FIRE TESTING ADDRESSES CREW CASUALTY ASSESSMENT

Live fire testing has shown that crew casualties can play a major role in system vulnerability assessments

By James F. O'Bryon, Dr. Wayne S. Copes, Dr. William J. Sacco, and Dr. Howard R. Champion

The Live Fire Test Program mandated by Congress in the FY 87 Military Authorization Bill calls for realistic testing of major U.S. conventional weapons systems and platforms. It further provides for "primary emphasis on testing vulnerability with respect to potential user casualties and taking into equal consideration the operational requirements and combat performance of the system."

Most U.S. weapons platforms require personnel to operate them. These personnel can be categorized into five groups: exposed crews (dismounted infantry, airbase support personnel); armor crews; aircraft crews; naval crews; and tactical vehicle crews (i.e. trucks).

Live Fire Testing of the Bradley Fighting Vehicle and other systems as well as recent combat incidents have indicated that crew casualties play a major role in the overall assessment of system vulnerability. To date, assessments have been limited to the incapacitating effects of crew injuries, but the lethality and long term effects (e.g., length of required hospitalization) also have important implications. Experts agree that current methods and knowledge on which those assessments are based need to be improved.

Crew injury has many causes. Some of the more significant causes affecting a soldier's ability to fight and even survive are: fire, blast/overpressure, fragments/spall, laser eye damage, flash, heat stress, toxic fumes, blunt trauma, shock/acceleration, and psychological effects. Modeling the effects of these factors individually is complex and the complexity is heightened when they occur simultaneously.

The shock trauma centers across this nation offer a unique opportunity to examine this problem since many of the injury causes listed above occur in civilian life (albeit they have different frequencies of occurrence than in combat and their sources vary). Data on patients resulting from criminal attacks, gunshot wounds, attempted suicides, burns, explosions, and industrial and highway accidents are well documented and are being analyzed for the Live Fire Office. This data base consists of many single and some multiple damage sources among those named above, descriptions of injuries sustained, medical treatment, and short/long term prognosis.

Recognizing the critical need to improve crew casualty assessment, and the unusual opportunity that this shock trauma data base offers, the Live Fire Test Office contracted with the Medlantic Research Foundation to do the following:

- Task 1: Critically review military criteria for predicting the serious and lethal effects of penetrating injury from fragments and burns;
- Task 2: Specify data to be collected from near-term live fire tests needed to assess the serious and lethal effects of fragment injuries and burns; and
- Task 3: Utilize contemporary data and methods to validate/update serious and lethal injury criteria for fragments and burns as necessitated by Task 1 findings.

The following paragraphs describe preliminary efforts relating to penetrating injury.

Criteria for Serious and Lethal Injury from Fragment Wounds.

Criteria relating the mass and striking velocity of a fragment to the probability of a "serious" or lethal injury were first published in 1969. These criteria are used in the evaluation of protective equipment or devices intended to reduce the vulnerability of U.S. troops to fragmenting munitions or spall. Serious and lethal injury criteria evolved from the criteria for predicting the incapacitating effects of fragment wounds. Incapacitation criteria were derived through an extensive program of fragment firings, analyses, medical assessments, and time-consuming wound tract projections onto cross sections of the human anatomy.

The probability of a lethal (or serious) injury given a hit is modeled as a function of the mass and impact velocity of the striking fragment. In the model for multiple fragment wounds, the effects of individual fragments are presumed to be statistically independent. The model excludes synergistic effects and was believed by developers to underestimate lethal probability.

The development of scientifically acceptable criteria relating injury level to human response is difficult. We believe that there are important differences between the modeling of incapacitation and serious/lethal injury and, therefore, the evolution from incapacitation criteria was inappropriate. Other concerns about the existing serious and lethal criteria and the methods used to derive them are discussed below:

- Nondiscriminating criteria: The definition of serious injury, i.e. "requires hospitalization," includes injuries that require short hospital stays and no specialized care as well as those requiring lengthy stays and much specialized treatment. Thus, the criteria are of little value in medical planning and the diversity of injuries called "serious" could obscure reductions in injury severity afforded by improved protective devices.
- Wound Assessments: The process used to derive serious and lethal fragment injury criteria had limited physician input, involved subjective estimates only, and was not documented in government reports.
- Assumptions in Assessments: Current methods assume that only the single most serious organ or tissue injury per wound tract is important in estimating human response. Efforts devoted to assessing multiple injury severity do not support this assumption. Also, assumptions regarding quality of care and elapsed time between injury and treatment are important but unstated.
- Criteria Not Current: The development of improved medical diagnostic equipment has facilitated rapid diagnosis and hence affected lethal probability. Also, recently developed improved conventional munitions (ICMs) have significantly different fragmentation characteristics than the classic high explosive projectiles upon which most of the current criteria are based. These ICM's result in an increased frequency of multiple fragment impacts from smaller, higher velocity fragments.

In summary, our review of existing serious and lethal wound criteria for fragments indicates that they and their supporting data need substantial improvement and we are working with the Services to assure that this is accomplished.

Civilian Injury Research and Applications.

Injury is a public health problem of vast proportions. It is

SUMMARY MTOS DATA

	Number	Percent
TYPE OF INJURY		
blunt	35037	74.9
penetrating	11740	25.1
unknown	0	0.0
DISCHARGE STATUS		
live	41850	89.5
die	4915	10.5
unknown	12	0.0
CAUSE OF INJURY		
motor vehicle	15456	33.0
motorcycle	3324	7.1
pedestrian	3789	8.1
gunshot	5774	12.3
stabbing	5207	11.1
fall	6473	13.8
other	6669	14.3
unknown	85	0.2
Patient Sex		
male	34521	73.8
female	11927	25.5
unknown	329	0.7

Table 1.

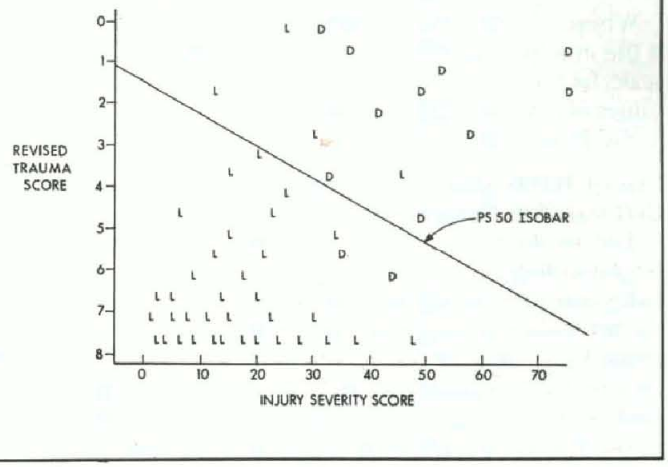


Figure 1.

the leading cause of death for persons under 44 years and the fourth leading cause of death for all ages.

In response to this problem, trauma centers and care systems have been established and their ability to reduce preventable deaths has been documented. In 1982, trauma surgeons agreed to pool data on injured patients and to develop and test survival probability norms based on severity indices considered to be "state-of-the-art." This effort, coordinated by the American College of Surgeons Committee on Trauma (ACSCOT), is the major Trauma Outcome Study (MTOS).

Since 1982, demographic, severity and outcome data on more than 80,000 trauma patients have been submitted to MTOS by 150 U.S. and Canadian hospitals, most of which are trauma centers. The data are analyzed periodically and confidential results are sent to participating institutions to support evaluations of patient outcomes and quality assurance activities.

A demographic summary of 46,777 patients analyzed in May 1987 is presented in Table 1. Approximately 25 percent of MTOS patients have penetrating injuries and 75 percent of patients are males. The average age of MTOS patients is 31.8 years. The observed mortality rate is 10.5 percent.

In MTOS, mathematical norms (equations) relate patient survival probability to the Injury Severity Score (ISS), an index of the severity of anatomic injuries, the Revised Trauma Score (RTS), a physiologic index of severity, and patient age. The norms are used to identify patients whose outcome (survival or death) is unexpected.

Figure 1 is a scattergram (called a PRE chart) for a patient set, e.g., blunt-injured patients, 15-55 years of age. Survivors and deaths are indicated by L's and D's respectively. Patients whose ISS-RTS coordinates are on the diagonal line are estimated to have a 0.5 survival probability. Coordinates above (below) the line have estimated survival probabilities that are less than (exceed) 0.5. Survivors (L's) above the line and nonsurvivors (D's) below it represent patients with the unexpected outcomes worthy of peer review.

In MTOS, a z-score compares the number of an institution's survivors with the number expected from outcome norms.

$$z = (A - E) / S$$

Where A is the actual number of survivors in a patient set; E is the number expected based on outcome norms; and S is a scale factor that accounts for statistical variation. Absolute values of z greater than 1.96 indicate that differences between A and E are statistically significant ($p < 0.05$).

Use of MTOS Data to Update Serious and Lethal Criteria for Fragments.

The major trauma outcome study has accumulated the largest comprehensive injury data base in existence. It provides quantitative descriptions of injury (based on state-of-the-art indices) and outcomes for contemporary patients treated primarily in North American trauma centers. Based on submissions through 1987, MTOS now includes data on almost 20,000 patients with penetrating injury. We propose to use the MTOS data base in conjunction with Army computer models of injury to update criteria for predicting the serious and lethal nature of fragment wounds in the following way:

- Patient survival/death and lengths of stay in the hospital and in the intensive care unit will be used to describe patient outcomes.
- MTOS data will be used to relate severity measures of anatomic (multiple) injuries, e.g., the ISS, to patient outcomes.
- The Army has developed a computerized representation of human anatomy cross sections. Based on data obtained during the derivation of incapacitation criteria, the "computerman" can be used to generate hypothetical random wounds caused by fragments with specified mass and velocity. The computerman software will be modified to produce the injury codes that would permit calculation of the anatomic scores for such wounds.
- Outcomes for such injuries will be inferred from relationships identified using the MTOS data base.

Some reservations about the proposed methodology should be noted. First, MTOS patients are not injured by fragments. Thus, the approach assumes that the injury, and not its etiology, is important in the prediction of outcome. Second, outcome predictions will be based on descriptions of anatomic injury only, as information on casualty physiology will not be available.

Recent research has identified limitations in the Injury Severity Score. As a result, the authors are developing improved indices of anatomic injury severity that attempt to overcome or reduce the effect of ISS limitations. Preliminary results indicate that a revised index which considers the number, location, and severity of injuries will improve the accuracy and reliability of outcome predictions. Finally, MTOS patient outcomes are a result of generally rapid transport of the injured patient to modern trauma centers. Such rapid and effective care may not be available in wartime.

Thus, the use of civilian injury data is not a panacea. Results derived through the proposed methodology will, to the extent possible, be checked against data collected by the Army's Wound Data and Munitions Effectiveness Team-Vietnam, now at the Uniformed Services University of the Health Sciences. The proposed method will provide criteria developed from an objective and auditable data base that could be subjectively modified to better reflect the realities of combat casualty care in the evaluation of shipboard, aircraft, combat or tactical vehicle, and unprotected infantry fragment casualties.

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TEST ENGINEER'S ASSISTANT

Embedding testability early in the system design phase

By Robert R. Drummond and MAJ Kevin J. Cogan

Introduction

High technology has become our nation's cutting edge on the modern battlefield. Superior weapon systems give commanders the ability to win outnumbered. These same weapon systems have also become extremely complex to test and maintain in terms of trained technicians and the associated test equipment.

Next generation systems will have self-contained tests and test equipment for diagnostics and notional systems will have artificial intelligence-based prognostics. To realize these next generation/notional systems, a computer-aided design tool, known as Test Engineer's Assistant (TEA), is being developed to embed testability early in the system design phase.

Background

The Army uses many varied methods for testing and maintaining fielded systems. Some of these methods are: manual test techniques, application of general and special purpose test equipment, use of embedded on-board diagnostics, isolation of a fault by the removal and replacement of components, and combinations of all of these.

However, it remains a fact today that the diagnostics used for weapon systems have not been very successful. Recent reports and studies show that automatic fault diagnostics for weapon systems are not meeting standards. For example, the April 1987 GAO report on "Weapon Systems Shortfalls in Automatic Fault Diagnostics" revealed that the level of fault detection and fault isolation is less than 50 percent as opposed to the minimum 90 percent as desired.

The technical reasons for this are complex, but some of the often stated reasons are inadequate training, poor technical manuals, and inadequate test equipment. All of these are true to some degree, but in many cases the most serious deficiency is "bad design."

Bad design does not mean operational or functional shortcomings. The advanced technology incorporated into our weapon systems is second to none. The deficiency comes from the lack of design for testability in a serious structured manner. More often than not, test considerations are the last consideration in the design cycle.

What is needed is a computer-aided design (CAD) methodology that inserts testability early in the system design phase. Self-testable systems will provide accurate and timely fault detection and fault isolation with minimum impact on mission performance.

There is general agreement that the need for sophisticated built-in test (BIT) is growing. But this matter does not receive the necessary attention due mainly to the cost of today's systems and the lower priority given to testability versus mission performance. However, the problem is more than one of low priority. The fact is that test technology has not kept up with weapon systems technology.

We do not have the capability to design weapon systems that are large and complex concurrently with BIT. Present tools are few in number and far from adequate. The designer faces a bewildering array of tradeoffs that are not black and white, but rather shades of gray. He must determine:

- weight, cost, and size penalties to meet diagnostic requirements;
- allowable degradation of system reliability and performance; and
- acceptable false alarm rates.

Further, the designer must meet all rules that apply to good system design, reliability, maintainability and testability. Manually tracking just the design rules is a considerable undertaking. The problem is getting worse as new technologies evolve.

The introduction of Very High Speed Integrated Circuit (VHSIC) technology into weapon systems will dramatically impact testability. It increases complexity and makes 100 percent testing with today's test systems virtually impossible. These are the basic reasons that drive the requirement to develop programs such as the Test Engineer's Assistant.

The TEA Program

TEA will be a highly interactive (user/machine) program. It will meet testability/diagnostic requirements by making them an integral part of the design

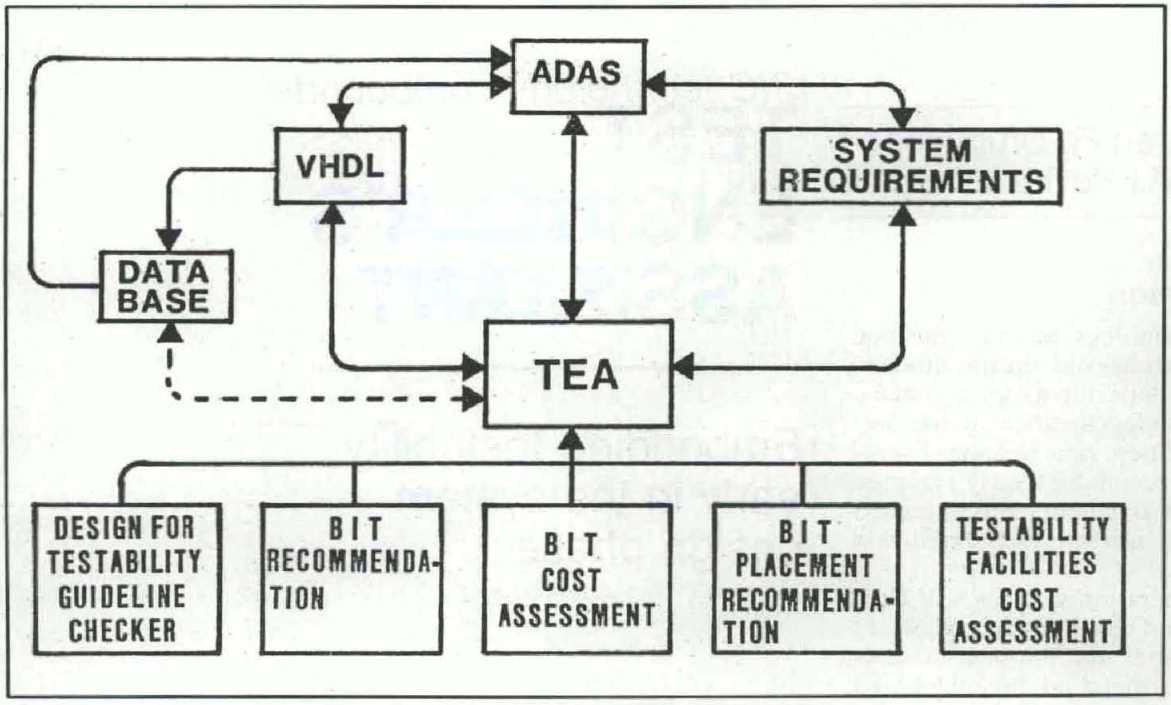

Figure 1. The TEA System and Its Interfaces.

process. To accomplish this, TEA will interface with an existing operational software package called the Architecture Design and Assessment System (ADAS).

ADAS provides the designer with high level system design support by making software/hardware tradeoffs as the design progresses. TEA will interact with ADAS to develop the testability aspects of the design.

The accompanying figure shows the TEA interfaces with system requirements, a data base, and the VHSIC Hardware Description Language (VHDL) which describes the system in software. The TEA development program consists of two phases — basic and enhanced. The basic phase will develop a proof of concept using the following modules: Design for Testability Guideline Checker Module, a BIT Hardware Recommendation Module, a BIT Cost Assessment Module, a BIT Placement Recommendation Module, and a Testability Facilities Cost Assessment Module.

This basic phase will encompass the design process from printed circuit card to system level. Research Triangle Institute, Burlington, NC, is the developer of both TEA and ADAS.

TEA System Operation

The Design for Testability Guideline Checker will be called at the option of the designer as will all the other TEA modules. This module will analyze the design for conformance/compliance with certain testability rules such as those in MIL-STD-2165. It will inform the designer whether there is enough information to run the module. If there is, it will query the data base and enumerate the violations/constructs of the design for testability guidelines. The module will also make this identification in the design graphs.

The BIT Recommendation Module ensures that the proper information is available before executing. It then takes the board and subsystem information and generates a query to run the BIT recommendation guidelines. This module advises whether deterministic or pseudorandom BIT techniques are required. A report describes deterministic or pseudorandom testing techniques available along with their pros and cons.

The BIT Cost Assessment Module software generates a query to determine the cost of a particular BIT technique. The module makes a determination of how much BIT and additional I/O ports are needed to incorporate the technique. It then itemizes and reports the costs associated with implementing the BIT technique on a board. The user can build a comparative cost report if the tool has been run previously on the board or subsystem.

The BIT Placement Recommendation module insures that the proper information is available to determine BIT placement recommendations. The system queries and guides the user to select a BIT technique and place the modules for that technique. Finally, the process computes the cost of the imple-

VHSIC technology compounds the testability problem unless built-in test can be inserted in the early stages of system design through the use of sophisticated CAD tools.

mentation. Based on BIT placement information, relative location information is gathered from a wiring checklist to aid the user when adding BIT modules and test point outputs.

The Testability Facilities Cost Assessment module compares attributes of ADAS data bases. It determines the incremental changes in modules and I/O and lists the incremental costs of implementing BIT.

Projected TEA Users

Both system developers and system evaluators are expected to be the primary users of TEA. System developers will use it to ensure meeting system diagnostic requirements. Developers who already have their own computer-aided design systems will probably not transition immediately to TEA. Government system evaluations, however, will be TEA based, requiring any non-TEA developed systems to go through an additional step.

Non-TEA designs will be submitted in a specified format such as the Data Interchange Format or VHDL. The specified format will be the gateway for system evaluation under TEA.

Enhanced TEA

The notional TEA system will incorporate a full-up design for testability (DFT) computer aided design tool known as Enhanced TEA. It will have the following additions:

- fully populated DFT rules, BIT techniques, and BIT modules data base;
- fully automated artificial intelligence based module interfacing;
- fault tolerance design capability;
- design for prognostics capability; and
- extension of TEA for Monolithic Microwave Integrated Circuits to be known as TEAM.

Summary

The ability to field high technology weapon systems on the battlefield will hinge on the ability to maintain them. Maintenance is highly contingent on testability. VHSIC technology compounds the testability problem unless built-in tests can be inserted in the early stages of system design through the use of sophisticated CAD tools. The Test Engineer's Assistant will be such a tool by interfacing expert design modules with system requirements, ADAS, VHDL, and a data base.

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THE ARMY ENGINEER TOPOGRAPHIC LABORATORIES

Introduction

Throughout its history, the U.S. Army Engineer Topographic Laboratories (USAETL) has been an innovator, using its expertise in the topographic sciences to make many valuable contributions to the U.S. Army. USAETL applies innovative approaches to an ambitious research and development program designed to aid commanders in making timely and accurate decisions on the battlefield where real-time knowledge of the terrain is essential.

USAETL researchers have pioneered efforts in the application of digital image processing and computer image generation to enhance topographic support. One outcome of this research will be new technology which provides responsive, easily interpreted representations of terrain using computer-generated imagery.

USAETL also is on the leading edge of artificial intelligence research which will provide the Army in the field with autonomous vehicles capable of performing reconnaissance missions and other duties hazardous for soldiers to perform.

USAETL is recognized as an armed services leader in topographic R&D, supporting the Army and the Department of Defense (DOD) with expertise in a wide range of scientific and engineering disciplines. These efforts include mapping, charting, terrain analysis, geodesy, remote sensing, point positioning, surveying and land navigation. USAETL researchers also assess the environmental effects on military equipment and support the Army Space Program Office. In addition, researchers apply expertise gained through military R&D to support the U.S. Army Corps of

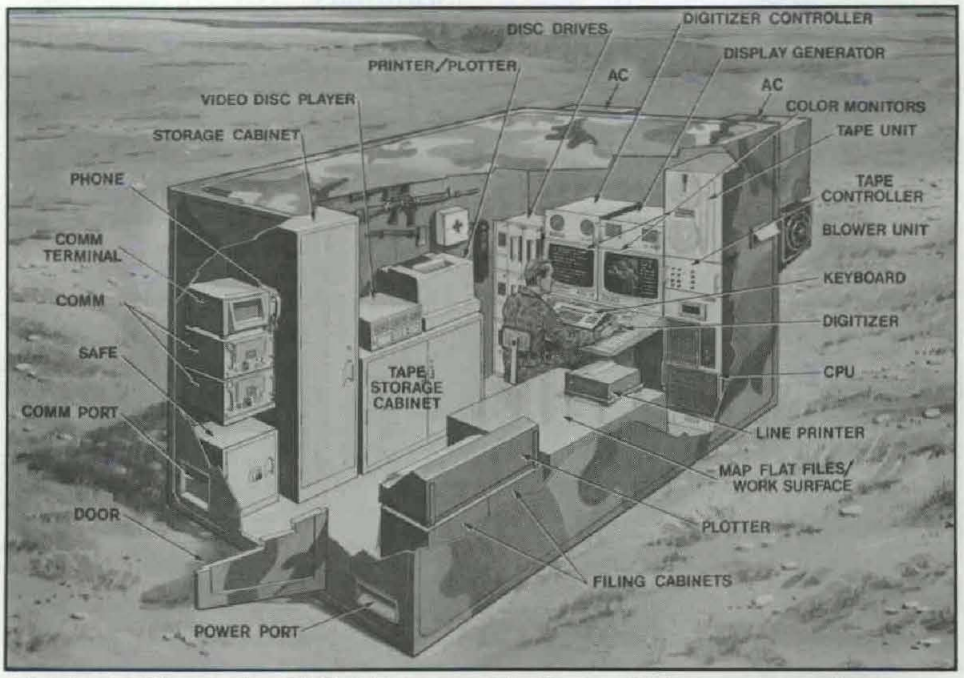
By Elaine M. Sevy

Engineers (USACE) Civil Works and Military Construction Programs in surveying, positioning, remote sensing, and image analysis.

Concurrent with its R&D mission, USAETL has an operational mission which is performed by the Terrain Analysis Center. This center produces specialized terrain products, water resources information and digital terrain data in response to the requirements of a broad range of customers.

USAETL has a work force of approximately 330 civilian and 12 military personnel. Approximately 70 percent of this work force fill scientific, engineering, and technical positions. Engineers and scientists of many disciplines work on sophisticated systems in state-of-the-art laboratories.

Most of USAETL's work is military funded. USACE funds approximately 50 percent of the work with the remaining 50 percent funded on a reimbursable



Soldiers will use the Digital Topographic Support System to analyze terrain data and generate terrain graphics. Shown above is an internal view of the system.

basis by approximately 25 other Army and DOD customers. Among USAETL's larger customers are the U.S. Army Materiel Command, the Army Space Program Office, the Joint Tactical Fusion Program Management Office and the Defense Advanced Research Projects Agency (DARPA). USAETL serves as one of DARPA's technical agents.

In 1986, USAETL underwent a reorganization to keep pace with its customers' changing needs. USAETL's new look consists of three R&D laboratories, a center for basic research and a center for terrain analysis production: Geographic Systems Laboratory, Topographic Developments Laboratory, Space Programs Laboratory, Research Institute and Terrain Analysis Center.

Each of USAETL's five elements has its own specific mission. A brief discussion of each element and its major functional area follows.

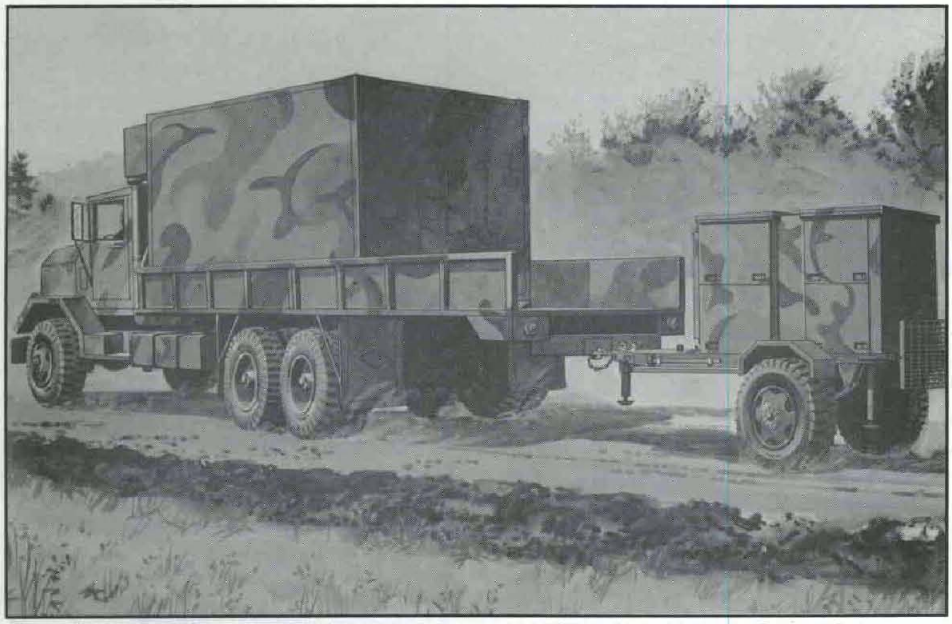
Geographic Systems Laboratory

The Geographic Systems Laboratory (GSL), USAETL's largest laboratory, develops military geographic information production systems. One of GSL's primary objectives is to replace the current manual methods of terrain analysis with a new system that will add speed and flexibility to the process. The Digital Topographic Support System (DTSS), scheduled to be fielded in 1992, will give Army terrain teams the ability to manipulate digital terrain information and generate tactical terrain graphics.

This laboratory also serves as demonstration manager and system integrator for the AirLand Battlefield Environment (ALBE) demonstration program. The ALBE program will help the Army build equipment, train soldiers, and develop strategies for fighting in a realistic battlefield environment. This program provides a vehicle for transitioning technbase products, developed in Army laboratories, into the field via systems such as the DTSS which are currently fielded or under development. The ALBE program supplies an innovative, efficient way of providing commanders with the ability to understand not only the terrain but also other environmental aspects of the battlefield including weather, climate, atmosphere, background signatures, battlefield-induced contaminants and natural obscurants.

In another related effort, GSL will field a series of in-house developed computer programs, called the Battlefield Environmental Effects Software (BEES), on the DTSS. User-friendly BEES programs will help commanders and their staffs identify the environmental conditions they'll face on the battlefield and predict how these conditions will affect military equipment, personnel and operations. To assemble BEES, GSL scientists drew on the laboratories' extensive collection of climatological data and adapted special programs developed by other organizations for use with the software. BEES programs will enable analysts to rapidly assess the effects of the environment on military operations.

Along with efforts to modernize terrain analysis techniques, GSL scientists are improving topographic reproduction capabilities which have changed little since World War II. Toward this goal, GSL is developing a mobile, combat-oriented, low-volume color copier called the Quick Response Multicolor Printer (QRMP). Through the combination of color xerographic techniques and laser technology, the QRMP will quickly produce cost-effective, multicolor topographic maps and related terrain products from either hard-copy originals or digital data.



The Digital Topographic Support System will put automated terrain analysis capabilities in the field.

Topographic Developments Laboratory

One very important mission of USAETL's Topographic Developments Laboratory (TDL) is to provide technical advice and recommendations to materiel and combat developers and to the Department of the Army (DA) staff concerning the coordination and analysis of Army requirements for digital terrain data (DTD).

In an effort to identify DTD needed to support many Army tactical computer-based systems, including the DTSS, USAETL formed the Concepts and Analysis Division (CAD). CAD serves as the Army's center of technical expertise for all military applications of DTD.

CAD's early findings revealed that the Army had a widespread need for an electronic map background display capability. CAD personnel initiated research to define the minimum essential elements of the Army's need for such a display. As a result of this initiative, the developers of 19 Army systems stated electronic map data requirements.

CAD prepared and coordinated a single consolidated Army requirements document which was sent through DA staff to the Defense Mapping Agency for review and product testing. It is antici-

Engineers from the U.S. Army Corps of Engineers' Mobile District and USAETL use global positioning system equipment to perform a geodetic survey.

pated that this effort will save millions of dollars in current and future development costs!

In other DTD-related efforts, TDL researchers are investigating the applications of Computer Image Generation (CIG) for terrain analysis and battle management functions. State-of-the-art simulator technology has been incorporated into a CIG hardware/software test-bed. USAETL scientists are developing state-of-the-art CIG capabilities on which software using DTD will produce realistic battlefield terrain scenes in near-real time.

TDL researchers also are developing techniques for performing high-precision surveys for Corps of Engineers civil works and military construction applications. One application will help detect small movements in large structures using advanced electronic distance measuring systems. Information from a satellite-based global positioning system will aid researchers in determining if large, man-made structures, such as dams or levees, are moving.

Other TDL surveying developments will help troops maneuver in the field and orient their weapons to fire on enemy targets. One project, the Modular Azimuth Position System, quickly computes a weapon system's position and orientation so soldiers can hit a target on the first round, move out and fire again before the enemy locates them.

Research Institute

Scientists within USAETL's Research Institute (RI) strive to find new and improved methods to overcome labor-intensive procedures currently used in extracting physical, cultural and tactical information from imagery.

This information is extracted from several wave bands, such as infrared and radar, using digital imagery analysis techniques. Other wave bands are being investigated to determine which ones can provide information on natural terrain features such as vegetation, soil types and soil moisture content.

Another RI effort, a project which is part of DARPA's Strategic Computing Program, is aimed at developing the technology to create autonomous vehicles. The program will develop a technology base using advances in artificial intelligence, computer science and microelectronics.

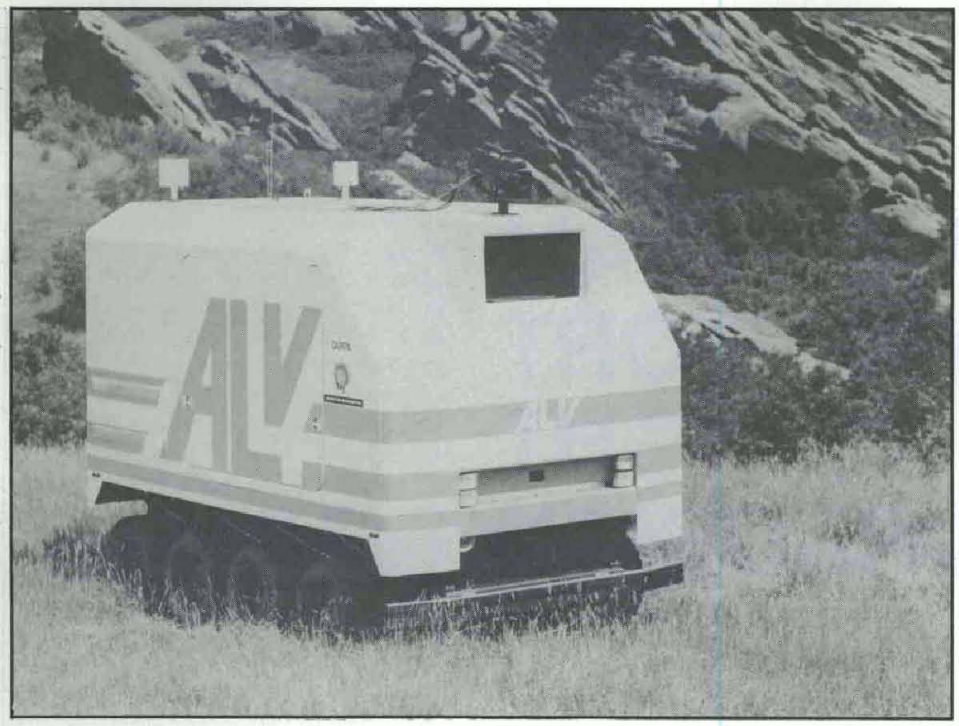
RI's research in artificial intelligence is geared toward developing the computer vision techniques needed by robotic and autonomous vehicles to perform reconnaissance missions and other hazardous duties. RI scientists are primarily concerned with the vehicle's navigation and terrain-dependent aspects, which include route and mission planning, navigation, and simulation.

The goal of the Autonomous Land Vehicle (ALV) project is to create a machine "smart" enough to guide itself on a planned route over rough terrain, avoid obstacles and, if necessary, replan its route.

Research Institute scientists are also supporting the development of robotic vehicles that can be controlled by remote operators. The technology developed for the ALV and robotic vehicle programs is being shared to enhance both program capabilities.

Space Programs Laboratory

USAETL's Space Programs Laboratory (SPL) researches and develops tactical military equipment and systems to support the tactical commanders in the field. SPL also administers USAETL's role as the U.S. Army Corps of Engineers executive agent for space. In this capac-



Unmanned cross-country movement is the primary objective of the Autonomous Land Vehicle program.

ity, SPL coordinates the space and space-related R&D efforts of the Corps of Engineers' laboratories and other participating organizations.

SPL's Star Tracker experiment is designed to research the capabilities of solid-state sensors as star trackers for precise autonomous attitude determination for spacecraft. SPL scientists are designing, fabricating and integrating the experiment's hardware package. It will be delivered to the National Aeronautics and Space Administration (NASA) this year for integration with the Spartan Shuttle orbiter for manifest and flight as part of DOD's Space Test Program.

SPL's involvement in other space initiatives includes providing technical support for the NASA shuttle-based TERRA GEODE Military Man in Space experiment. In the TERRA GEODE experiment, a geologist on the space shuttle will determine the types of information available from direct observation of the earth's surface as opposed to extracting information from sensors.

Terrain Analysis Center

USAETL's Terrain Analysis Center (TAC) supplies specialized combat-oriented terrain information and products to aid commanders in planning and executing military operations. The terrain analyses produced by TAC include both graphic and narrative material. To prepare a typical terrain study, analysts must first assemble basic information about the geographic area involved. They consider such natural elements as surface configuration, soils, geology, vegetation, drainage, surface water, ground water and climate. They also identify cultural or man-made features such as built-up areas, highways, roads, railroads, pipelines, ports, harbors, airfields, electric power lines and water storage facilities.

After analysts compile this basic data, they then prepare the evaluative portion of the study. By combining the information gathered on natural and cultural features, they identify military aspects of the terrain such as the availability of cover and concealment for troops and equipment, cross-country mobility, landing and drop zones, and possible avenues of approach. Products are tailored to meet the specific needs of the users.

TAC is also developing an automated worldwide water resources data base that will provide information on the location of both surface and subsurface water in arid parts of the world. In addition, TAC manages DOD's Water Detection Response Team (WDRT). This interagency team of on-call experts is available for short-notice mobilization to support military well-drilling teams by locating and evaluating potential ground-water sources.

The WDRT has improved the readiness of Army, Navy and Air Force well-drilling assets by directing the units to carefully selected sites with high potential for producing ground water. The team also provides on-site consultation during well drilling and development stages.

USAETL's five organizational elements work together to provide an innovative R&D program which is a mix of basic research, and advanced and engineering development. The program is accomplished according to mission and customer requirements. This mix of technology development and application makes USAETL a complete Army R&D facility.

Summary

USAETL's ongoing in-house research and its close affiliation with research activities in the public and private sectors puts it in a unique position to capitalize on the full spectrum of emerging technology. This technology will support future commanders who will have only minutes or at most a few hours to develop their strategy. USAETL's R&D efforts will give commanders and soldiers in the field access to real-time knowledge of the terrain. This knowledge will be a true force multiplier, enhancing their ability to fight and win!

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MTL TEAM AIDS EFFORT TO FIGHT CORROSION

By Chuck Paone

In Panama, where saltwater, high humidity and heavy rainfall provide an excellent breeding ground for corrosion, protecting and maintaining sophisticated aircraft can be an onerous task. A team of specialists from the U.S. Army Materials Technology Laboratory (MTL), Watertown, MA, recently set out to lighten that burden for the First Battalion's 228th Aviation Unit at Fort Kobbe, part of the Army's Southern Command (SOUTHCOM), which has its headquarters in Panama. The team traveled to Panama during the last week of February to address corrosion problems that had been plaguing UH-1, UH-60 and CH-47 helicopters there.

The MTL team, comprised of members from MTL's Materials Technology School (MT-School) and its Corrosion Center of Excellence (CTX), wanted to offer as much immediate support as possible. They provided training for aircraft maintenance personnel, reviewed current maintenance practices, surveyed and documented the unit's total corrosion problem and provided comments, advice and some on-the-spot solutions. They also formed a nexus with the unit to work on long-term corrosion solutions.

CTX members first visited the 228th in December of 1986 on a regularly scheduled survey, which they are mandated to conduct every four years. This site was placed near the top of the list because its environment was so corrosive. "We told them who we were and what we were about at that time," said Curtis Fossum, a corrosion specialist who works with the CTX. At that time, the CTX specialists also told the regiment about the MT-School and the corrosion courses they offered.

CPT Jeff Gallagher, the Aviation Maintenance Officer for the 228th, called the MT-School in November of 1987 requesting training. "They wanted to solve their problem, and training was one very good way to help them do that," said Paul Buckley, an instructor with the MT-School who designed and taught much of the course given to the 228th.

Buckley and other team members wrote a course that, while basic, was tailored to the unit's specific needs. The team conducted three six-hour training sessions. "We covered the fundamentals of corrosion and the basics of preventive maintenance," said Buckley. "We explained why certain things work [to prevent corrosion]."

The course was geared to mechanics, not engineers, so that the information could be understood and utilized by the people directly responsible for maintaining these aircraft. Instructors Buckley and Fossum stressed preventive maintenance techniques like thoroughly preparing surfaces before painting.

SGT David Chambers of the MT-School designed and demonstrated several in-class experiments to illustrate points. The instructors showed videos of relevant corrosion problems and a film furnished by the Army Aviation Systems Command (AVSCOM) that showed specific corrosion repairs on the UH-60s.

The MTL team realized that, although training was extremely important, a comprehensive effort was needed to best aid the 228th. According to MT-School Chief John Plumer, who headed the trip: "Both short and long-term solutions needed to be sought. Training was key, but not all-inclusive."

Plumer requested that the 228th send him a list of their major concerns. MT-School and CTX personnel reviewed the list and the unit's proposed field solutions. They examined the problems and proposed solutions in relation to what the technical manuals (TMs) called for; then they asked AVSCOM for permission to discuss new corrosion solutions incorporated into TMs that had not yet been released. One such solution called for replacing zinc-chromate primers with epoxy primers, which have demonstrated far greater corrosion resistance.

The unit was experiencing its most severe problems with the helicopter engines and gear boxes, especially the magnesium components, though fungus growth on aluminum air frames was also a major problem.

"Of any material used on the aircraft, magnesium has the highest propensity for corrosion," according to CTX corrosion specialist Dr. Daniel Verdonik. Material choice, he said, quite often determines how extensively corrosion will strike.

Stainless steel spherical bearings and bifiler washers are examples of parts found to be corroding in Panama as a direct result of material choice. The alloy used is one of the least corrosion-resistant stainless steels, but it is extremely hard, which is needed in these cases. "Obviously there are a lot of other things to be considered during design than just resistance to corrosion," Verdonik said. "It's a trade-off, and in the past corrosion has been low man on the totem pole." The team agreed, however, that today's greater awareness of corrosion's destructive powers will now increase emphasis on corrosion resistance during design.

The Army is now aware that it must improve its aviation systems' ability to withstand corrosion, even in the most severe environments. "The extreme conditions in Panama demonstrate the

shortcomings derived from past materials choices," said Plumer. "Seldom was materiel designed to operate specifically in an extreme environment."

Structural design choices can lead to corrosion problems just as material choices often do. "We found some parts that just allow water to sit in them," Verdonik said, noting that improper drainage can be devastating to equipment.

Another problem discovered during the corrosion survey involved packaging major aircraft components. The unit showed the CTX corrosion specialists a UH-60 main transmission they received, which when removed from the packing crate was already corroded beyond tolerable limits. This part had to be returned and replaced. In addition to the monetary expense created, this corrosion problem resulted in extensive down-time for the helicopter waiting for the new transmission.

To follow up on this, MTL will track Quality Deficiency Reports (QDRs) and Equipment Improvement Recommendations (EIRs) and address packaging and inspection through upcoming MT-School courses. "We've taken the first initiative to address [corrosion-related] packaging problems," Plumer said.

Sophisticated equipment is generally not required for detecting corrosion. "The best way to see corrosion is with the naked eye," said Verdonik. Sometimes, even though signs of corrosion are visible, it goes undetected because people are unable to identify it. "Not everyone knows all forms of corrosion when they see them," says Fossum. "For instance, everyone recognizes that orange and brown stuff on their cars as being corrosion, but how many people know the white powder they see on an aluminum ladder is also corrosion?"

In Panama, the MTL team taught the aircraft maintenance personnel how to identify corrosion and stressed the importance of detecting it early before problems intensify to where the aircraft have to be grounded for lengthy and expensive repairs.

Fossum, a former Army sergeant and instructor, reminded the soldiers that they need to report corrosion findings to major subordinate commands via QDR/EIRs. When similar problems from various units are reported, standardized maintenance and repair procedures can be developed to offset such problems, and design modifications can be introduced, with the hope of preventing similar problems in the future.

The MTL team coordinated the assistance visit with SOUTHCOM's Army Field Assistance and Technology (AFAST) Science Advisor Stan Carts. MTL and the unit have now established a long-term relationship through the AFAST network, which should prove mutually beneficial.

The 228th and MTL have launched an aviation-corrosion research program, facilitated by this coordination with AFAST. As a part of this program, a "bird bath" is planned for construction at the unit. This automated cleaning facility will allow the aircraft to be taxied in and sprayed with an even and consistent amount of water. The unit has agreed to monitor maintenance changes as a result of this new, thorough washing method.

MTL and the unit also agreed to conduct field tests of new corrosion-resistant components developed by MTL and approved by AVSCOM. "This is the essence of technology integration," said Verdonik, "taking what's available in the lab and integrating it into the field." Again, the unit will track how well these parts perform and report the information to MTL.

The unit has also agreed to initiate programs to more accurately document maintenance procedures and help track the cost of corrosion and to report that data to the MTL specialists. "This is all extra work for them," Verdonik points out, "but they're willing to do it to help solve their corrosion problems."

All the data that MTL receives from this unit will be very helpful for the CTX as they continue to study the Army corrosion problem. They hope to be able to apply what they learn from these long-term studies to other units.

"Training was our way of giving something back to the field units we kept bothering," said Fossum. He said that since the CTX constantly visits these units trying to compile information, offering them training was, in addition to all other benefits, a way of repaying soldiers for their cooperation.

The U.S. Army Training and Doctrine Command (TRADOC) is planning to develop training courses in corrosion prevention and control based on information in the TMs, which are currently being updated to include more corrosion information. What the MT-School is working on now, TRADOC will be doing in the future.

These courses need to be conducted now because the Army's corrosion problem is extensive and the cost staggering. According to Dr. Joseph Wells, chief of MTL's Materiel Durability Branch, which includes the CTX, corrosion currently costs the Army more than $2.5 billion per year.

Several units have requested the same training as that offered to the 228th, and the MT-School is developing two new courses which will allow each unit to begin their own corrosion prevention and control teams, as the new Army Corrosion Regulation, AR 750-XX, mandates.

All corrosion problems obviously can't be solved in the field. Proper training, however, certainly will help achieve the goal of substantially reducing corrosion problems. Thorough washings, more frequent visual inspections, use of water-displacement techniques and touch-up paint coatings are just some of the practices that field maintenance personnel can implement to help prevent and control corrosion.

The MTL-CTX team has reviewed the 228th's draft maintenance SOP on corrosion prevention and control. Once members from the 228th receive corrosion control officer and corrosion awareness training from the MT-School, they will be even better equipped to wage the war on corrosion.

The response to the MTL support was overwhelmingly positive, according to Buckley. "They're more aware and more enthusiastic about corrosion prevention," he said. "Now they're more motivated to take the necessary steps."

The unit participated eagerly and cooperated fully, demonstrating an awareness of the seriousness of the problem and their strong desire to overcome it. Plumer said, "Our confidence was renewed that the war on corrosion can be won with cooperation and enthusiasm such as that displayed by the 228th.

CHUCK PAONE is a public affairs specialist at the U.S. Army Materials Technology Laboratory, Watertown, MA. He holds a B.S. degree in journalism from Suffolk University, Boston, MA.

U.S./GERMAN ARMAMENTS COOPERATION

By LTC Armin Simbuerger

Since the U.S. armed forces have restructured their project management organization, it might be of some interest to have a look at the armaments organizations of other countries, particularly the Federal Republic of Germany. At the same time, a survey will be given regarding German-U.S. armaments cooperation.

German Armaments Management

An essential goal of the new U.S. organization is to untangle the individual steps of the decision-making process by dividing them into functional and programmatic decisions. The intent is to have these decisions made by different organizations and, hence, to straighten the decision-making process.

In Germany, this decentralization of responsibilities in armaments management has been standard practise since establishment of the Federal Armed Forces (Figure 1). This "dialogical principle," as we call it, differentiates between military system elements which are the responsibility of the Chief of Staff of the Army (FueH) and the subordinate General Army Office (HA) on the one hand and, on the other hand, the technical and economic system elements, which are the responsibility of the Armaments Division (Abt. Rue) and the subordinate Federal Office for Military Technology and Procurement (BWB).

The user's interests, as well as technical and economic concerns, are coordinated within the group of the system manager. This group is composed of the following permanent members who represent the military and the technical-economic areas of responsibility on ministry and command levels.

System Manager. The System Manager belongs to the Division of the Assistant Chief of Staff for Armament and is the authorized representative of the Army Chief of Staff. He is the chairman of the working group and, during all phases of the development process, is responsible for integrating all weapon system elements necessary for combat prior to fielding. These elements include components, integrated logistics support, the infrastructure, training simulators, and personnel.

Chief of Project Section. He belongs to the Armament Division of the Ministry of Defence and is responsible for the technical and economic elements of the weapon system. Among the many tasks are evaluation of the technical and economic contributions made by the BWB, control of the cost development, and the representation of the technical and economic interests within the steering committees in case of international projects in particular.

System Officer. He belongs to the staff of the General for Army Armaments in the General Army Office. His responsibilities include the preparation, control and supervision of the military system elements, such as personnel, training, command and control, operations, organization, logistics and the infrastructure.

Project Manager. The Project Manager is the authorized representative of the BWB and the main link to industry. His major responsibilities are budgeting, contracting, and controlling of the technical and economical performance of the project.

The responsibility of the System Manager's working group is limited to the development and procurement of the weapon system. It does not include responsibility for the readiness of the fielded weapon system. This task is assigned to the Readiness Manager whom we find in the Division of the Assistant Chief of Staff for Logistic and the subordinate Army Materiel Office. He is a permanent member of the System Manager's working group so that he can represent all aspects of ILS during the development phase.

The German organization can hardly be compared with the U.S. organization. The most essential difference between the Armaments Directorate of the German Ministry of Defence and the U.S. Army Acquisition Executive as well as between the BWB and the Army Materiel Command (AMC) is that both German organizations are responsible for the development and procurement of materiel for all three Services. They have been organized into technical branches. Thanks to their centralized technical responsibility, it is possible to avoid parallel developments and provide maximum transparency regarding potential technical solutions.

German Liaison Organization in the U.S.

In addition to the German embassy there exists two further independent liaison organizations in the U.S.

The German Liaison Office for the Armament Sector (GLOAS) is responsible for armaments cooperation with all three U.S. Services. The head of the Land Materiel Section is responsible for the Army area and, at the same time, is the German Liaison Officer to AMC. Subordinate to him are the German Liaison Officers to the Army's Tank-Automotive Command, Test and Evaluation Command, Missile Command, Communications-Electronics Command, and the Armament RDE Center.

Activities of the liaison office cover the whole field of U.S.-GE armaments cooperation. In particular, this includes participation in joint projects, promotion of interoperability of national projects, and the procurement of equipment and spare parts from U.S. firms.

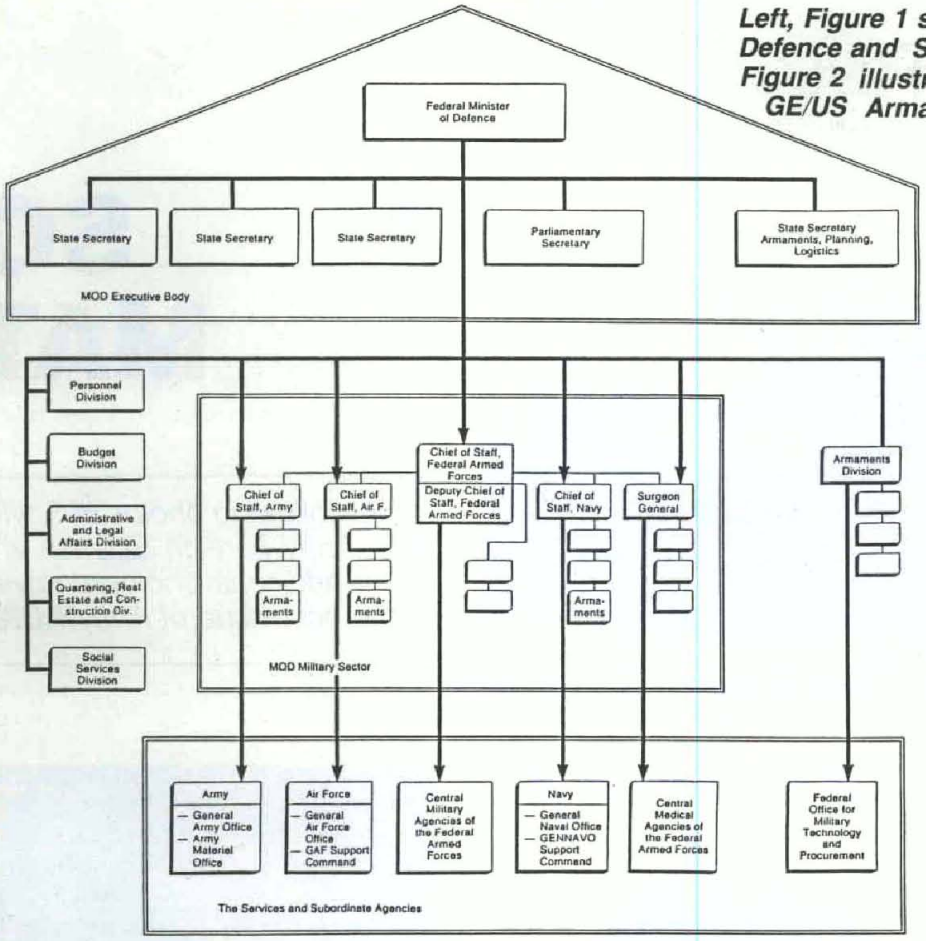
Although GLOAS is a subordinate office of the BWB, it also supports all the other agencies which are engaged in the development, procurement and utilization of defence materiel.

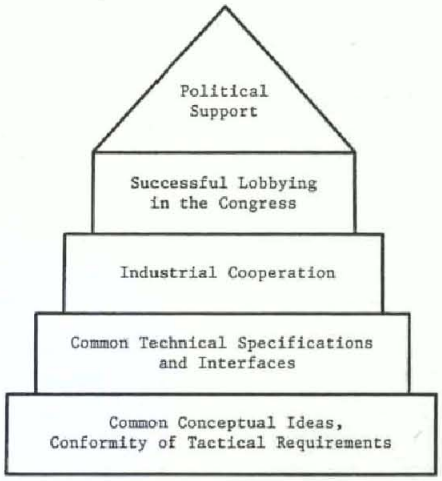
In addition, there is the Army Main Liaison Staff at the Army Training and Doctrine Command for the areas of basic concepts and training, with its subordinate liaison officers to the schools and centers. This staff has been assigned to the General Army Office.

German-U.S. Cooperation

There is a large variety of joint committees, programs and agreements within the scope of GE/U.S. armaments

Left, Figure 1 shows the Federal Ministry of Defence and Subordinate Agencies. • Below, Figure 2 illustrates Conditions for Successful GE/US Armaments Cooperation.





cooperation. The most important of these are:

- Concepts: GE/U.S. Army General Staff Talks and Steering Committee;
- Armaments Cooperation: Army Armaments Working Group;
- Technology: Data Exchange Agreements;
- Armor Concept: Armor Concept Development Exchange Program;
- Armor Technology: Future Armored Vehicle Research Program;
- Joint Projects: Multiple Launch Rocket System, STINGER, Autonomous Precision Guided Munitions, etc;
- Interoperability: Hazards of Electromagnetic Radiation Ordnance/ Maneuver Control System, ADLER/ Advanced Field Artillery Tactical Data Systems, SEM/Single Channel Ground and Airborne Radio System, Leopard 1/ M1 Harmonisation, Palletized Loading System, etc;
- Training: Scientist and Engineer Exchange Program; and
- Industrial Cooperation: AIPS Program, Heavy Equipment Transporter, Advanced Combat Rifle, etc.

Armaments cooperation between Germany and the U.S. is characterized by a large variety of contacts established in parallel between various agencies at many individual levels. Although there is a very intense and successful cooperation between these areas, tighter coordination could possibly make the utilization of personnel and time even more efficient.

The following seems to be of some importance, since there will be new challenges to GE/U.S. armaments cooperation in the future:

- Owing to the INF treaty, the conventional superiority maintained by the Warsaw Pact military forces will take on increased significance.
- More and more, the Warsaw Pact is capable of not only being superior in quantity, but also of being our peer in quality. It will be essential to exploit all technological resources of our alliance. Here, the Nunn Amendment has led to significant progress.
- Because of limited budgets our two countries will no longer be able to develop and procure all required weapon systems. Procuring weapon systems from an ally in order to close our own armament gaps appears to be a cost effective alternative to expensive national developments.
- The ever-increasing technological advancements, such as in the C3I area, have resulted in automation of functions which were previously performed by man. This will limit possibilities for cooperation in the future if interoperability of the individual national technical systems cannot be ensured in the first place. Interoperability is of similar importance in the fields of ammunition supply and logistics. For this reason, implementation of interoperability has become the point of main effort for the Army Armaments Working Group.

To meet these new challenges, armaments cooperation has to receive new emphasis. Figure 2 shows the prerequisites of successful armaments cooperation as seen from a liaison officer's point of view. These prerequisites must be complied with to achieve successful cooperation. The task assigned to the German Liaison Office with AMC is to support this goal.

LTC ARMIN SIMBUERGER has served as German Liaison Officer with AMC for four years. Before that, he was a member of the Leopard 2 Project Management Team and commander of a corps maintenance battalion. He graduated from the Darmstadt Institute of Technology and holds a Ph.D. in mechanical engineering.

SOV
MATE

The following photos of Soviet mi
U.S. Army Foreign Science and Te
Some additional photos of Soviet an
in the next issue of Army RD&A Bu

BMP-2 Infantry Combat Vehicle

The BMP-2 is the main ICV used by the Soviets. It is a tracked vehicle with excellent mobility. The vehicle mounts a coaxially mounted machine gun and an antitank guided missile.

MTR 80 Armored Personnel Carrier

The BTR 80 is the most recent version of this wheeled 8X8 amphibious armored personnel carrier. This vehicle provides wheeled mobility and armored protection for the combat soldier. The BTR 80 is armed with a 14.5mm machine gun.

152mm Field Gun M76

Employing a walking beam suspension for great stability and enhanced mobility, the M76 provides Soviet general support artillery forces with an accurate and lethal weapons system.

120mm SP

Unique among modern artillery systems, the 2S9 combi
and mortar in a single armored, full tracked vehicle.

VIET
ERIEL

itary equipment were provided by the chnology Center, Charlottesville, VA. Chinese equipment will be published letin.

lowitzer 2S9
nes the characteristics of a close support gun, Howitzer

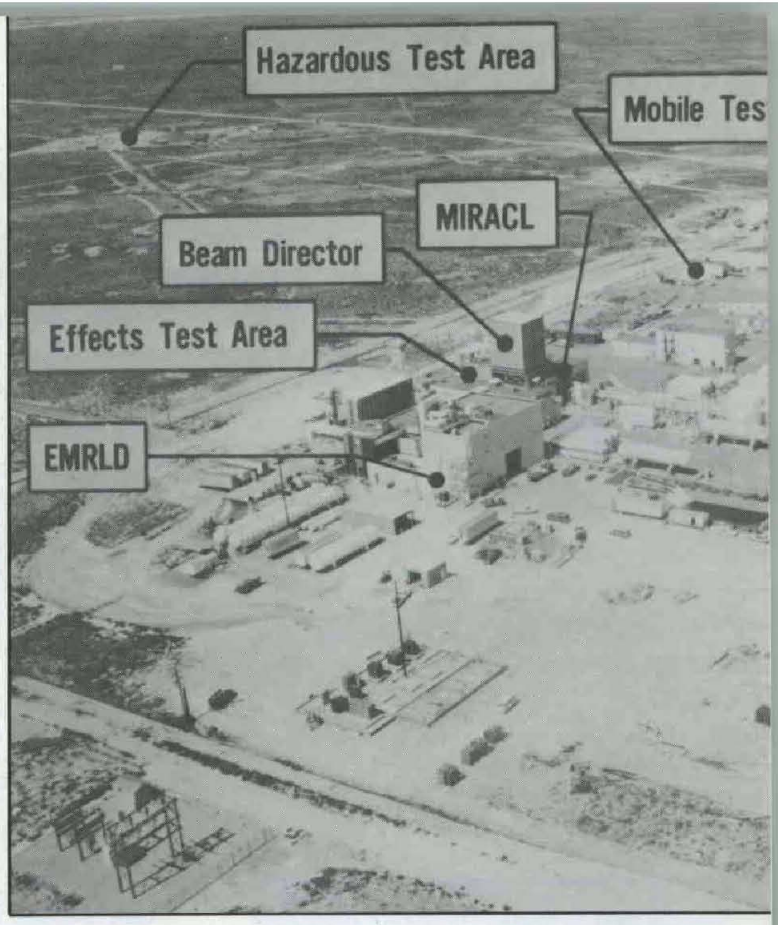
T-80 Tank with Reactive Armor
Reactive armor provides protection from High Explosive Anti-Tank rounds (HEAT). While unaffected by small arms fire, boxes will explode when hit by the jet of a HEAT round. Metal plates inside the boxes are set in motion by the explosion and then deflect the HEAT round jet before it penetrates the main armor.

MT-LB MTD 82mm Automatic Mortar Vasilek
Adapting the rapid fire Vasilek to a mobile chassis provides Soviet close support artillery with an enhanced ability to ship fire, keep pace with the movement of troops in combat, and survive.

BMD
The BMD is an airborne amphibious combat vehicle. This vehicle is used in support of airborne missions. The BMD mounts a 73mm gun and an antitank guided missile.

THE HIGH ENERGY LASER TEST FACILITY

By CPT John L. Martin



The White Sands Missile Range High Energy Laser Systems Test Facility (HELSTF) was established to support the test and evaluation of high energy laser systems, subsystems, and components, and to support the conduct of damage and vulnerability tests on materials, components, subsystems, and systems.

History

During the 1970s, the need became apparent for a test site to support the continued development of lasers as weapon systems. Location of such a site at a test range was imperative in order that testing could be conducted against threat-realistic targets. Several test ranges were considered, with White Sands being selected as the site and the resulting facility being known as HELSTF (Fig. 1).

The first principal user of the facility was to have been the Navy SEALITE program, a self-defense lethality demonstration using the Mid-Infra-Red Advanced Chemical Laser (MIRACL) developed by TRW. Congress canceled the SEALITE program in the fall of 1983, and directed that the MIRACL be installed at HELSTF to support damage and vulnerability tests for DOD.

MIRACL is a continuous-wave, deuterium fluoride laser operating at 3.8 microns. HELSTF will also house the Air Force Excimer Raman Shifted Laser Device (EMRLD), a smaller device currently being fabricated and installed by Avco Research Laboratories. The EMRLD, a technology development experiment, will also be able to support damage and vulnerability testing at the facility.

The HELSTF became operational on Sept. 6, 1985 when the Air Force conducted the first Lethality and Target Hardening program test for the Strategic Defense Initiative Organization (SDIO). Since that time, HELSTF has supported the Community Laser Measurement Program, AH-1S Laser Hardened Components tests, Air Force High Irradiance tests, Navy Conventional Defense Initiative, PM Smoke tests, plus significant MIRACL and beam director tests in support of SDIO efforts.

Management

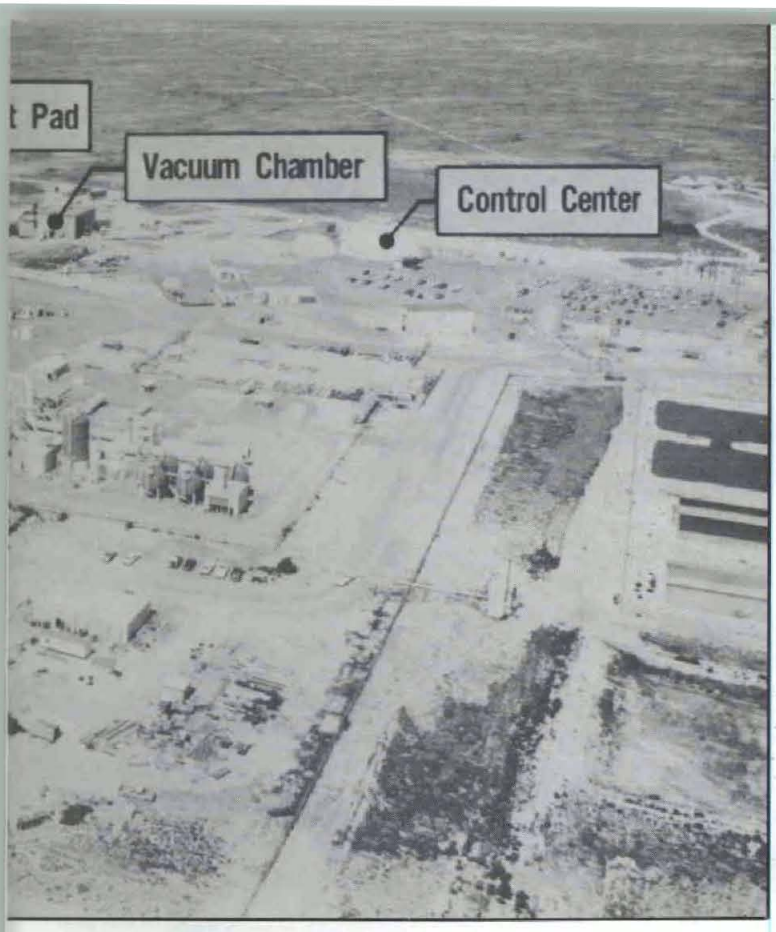
The HELSTF is managed by the U.S. Army, and is a part of the Major Range and Test Facility Base. It is under the command of the commander, White Sands Missile Range, and provides test support to DOD, industry, and foreign governments under appropriate agreements.

The White Sands Missile Range Directed Energy Directorate is responsible for operation, maintenance, and future development of HELSTF. Primary support for operation and maintenance of HELSTF is provided by the HELSTF Support Services Contractor, currently Lockheed Engineering and Management Services Co.

Capabilities

The HELSTF's primary source of laser energy is the Navy's MIRACL laser device, the free world's most powerful laser. MIRACL is capable of providing a range of power from less than 10 percent to full power. This capability allows the facility and the user tremendous flexibility during testing.

A Beam Transfer Area (BTA, Fig 2), essentially a laser beam switch yard, allows HELSTF to move the MIRACL beam to a variety of indoor and down-range test sites. Located inside the BTA are two fast shutters capable of turning the MIRACL's continuous wave beam on and off within five milliseconds. The shutters work in conjunction with the facility's Target Cassette Indexer and down-range mirrors to provide precise laser beam exposures to test materials. Switch mirrors in the BTA allow both



Left, Figure 1: An Aerial View of the High Energy Laser Systems Test Facility. • Below, Figure 2: The Interior of the Beam Target Area.

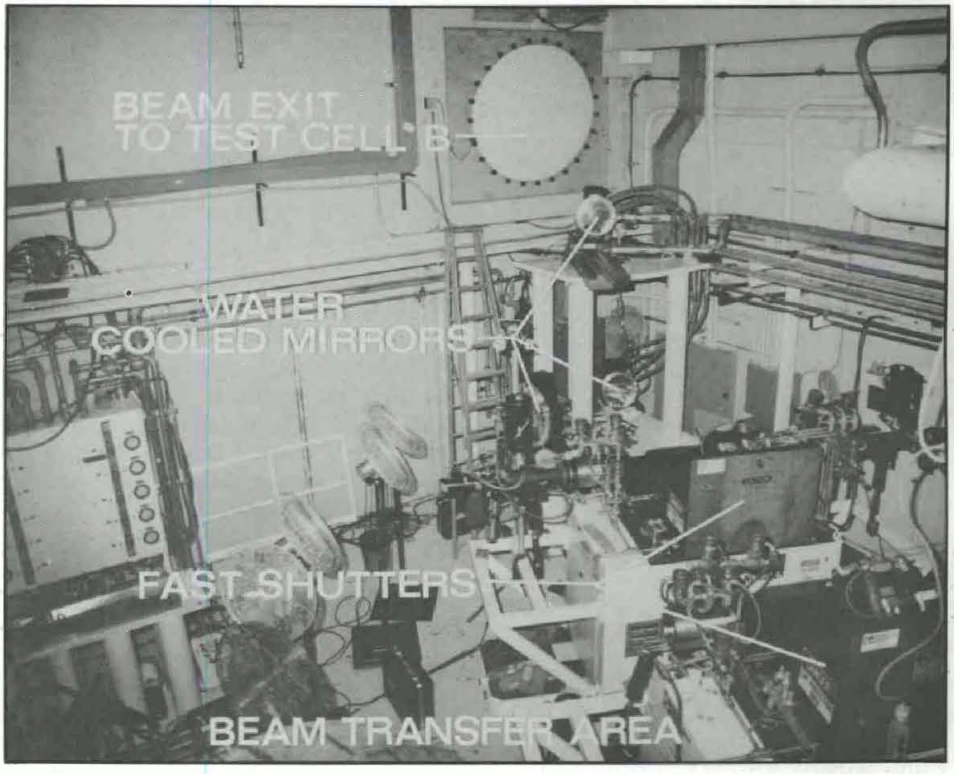
testing inside and down range during a single test run.

The Target Cassette Indexer (Fig 3) is located in the HELSTF Effects Test Area (ETA) and allows testing of up to 17 target material or diagnostic samples during a single laser run. The indexer inserts the samples into the beam path as the fast shutters turn the beam on and off.

An improved indexer, known as the Target Material Handling System, is capable of handling up to 60 each 10 inch by 10 inch by 2.5 inch or 30 each 10 inch by 10 inch by 5 inch thick samples. Both indexers are equipped with a side wall wind tunnel capable of providing a variety of gas flows and speeds across the target surface. Potential gasses are air, nitrogen, or other inert gases.

Located down range is the Test Cell B test site. This test site uses a slewable 60-inch mirror to irradiate various targets on the test pad. Recent tests demonstrated the ability to irradiate over 45 target samples during a single run. For explosive targets, Test Cell B is rated for the equivalent of 20,000 pounds of TNT. Other down range test sites include a two kilometer test site and a moving target test track.

A new 50-foot diameter Large Vacuum Chamber (LVC) is scheduled to be



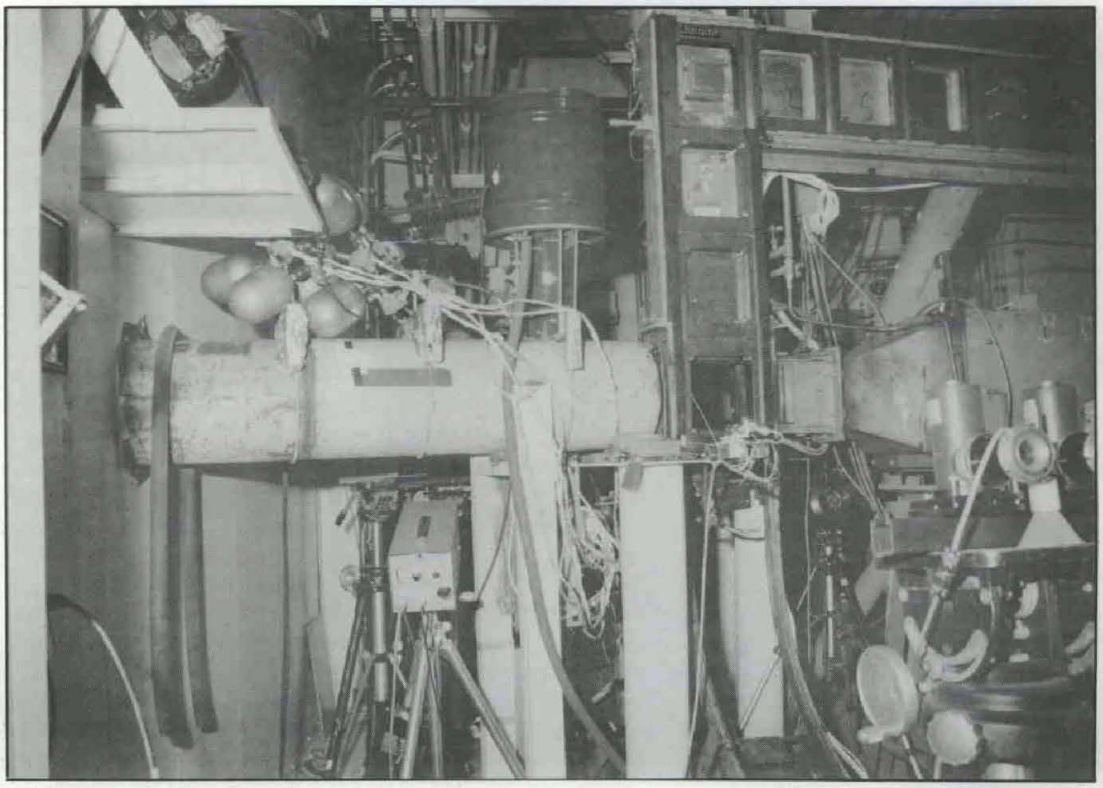


Figure 3
Target Cassette Indexer. Notice test instrumentation and Side Wall Wind Tunnel.

on line shortly. The LVC is designed to accept materials up to one half the size of the Space Shuttle bay. The LVC will also be equipped with a Target Material Handling System with the same capabilities as the one in the Effects Test Area. The LVC will be able to produce vacuums equivalent to a 300,000-foot altitude.

Available at all of the test sites at HELSTF is a wide variety of diagnostic and test instrumentation. Additionally, a wide variety of motion picture and fixed camera support as well as video camera support is available to the user. A High Energy Laser Data Acquisition and Processing System acquires the data provided by the instrumentation and processes it into the form required by the tester. Data are normally provided to the user in 12-and 24-hour packages after each test.

The Small Tester

In the past, testing at HELSTF was limited to single users or test items. Consequently, testing was prohibitively expensive for the small tester. However, improvements at the facility now provide unique opportunities for the small tester.

By using the TMHS or the slewing capability down range, many small testers can "piggyback" on a single test. This will allow each user to share costs and afford tests that they could not afford had they been the only tester. For example, five different testers, each with five samples, could be accommodated during a single test run at Test Cell B. New site flexibility will also allow some testers to test in the Effects Test Area while others conduct their experiments down range.

The Directed Energy Directorate maintains several project engineers that can further describe site capabilities and work with the tester to establish a testing program. Interested testers should write to Commander, White Sands Missile Range, ATTN: STEWS-DE, WSMR, NM 88002, or call AUTOVON 258-1930 or commercial (505) 678-1930.

CPT JOHN L. MARTIN is an armor officer assigned as the executive officer of the White Sands Directed Energy Directorate. He holds a B.A. degree in economics from Ohio State University and is pursuing an M.S. degree in systems management from the Florida Institute of Technology.

UNDERSTANDING THE TWI PROCESS

By MAJ James E. Moffett

When I learned of my assignment to an information systems Training With Industry (TWI) Program, I knew it would be different. This is a natural follow-on assignment for an officer intimately involved in acquisition-related duties and possessing aspirations of becoming a program manager. Several previous assignments requiring direct interface with DOD contractors and assorted suppliers preceded this year-long TWI experience.

This article describes the TWI program and points out the mandatory elements of any successful TWI program. These are: industry orientation, job assignments, program diversity, and supportable learning objectives. Each of these will be discussed briefly.

Industry Orientation. There are two phases to a TWI program: Industry orientation and job assignments. Industry orientation is approximately five weeks in duration with the first two weeks devoted to an overview of the industry and familiarization through briefings and tours from the operating divisions. The remaining three weeks are termed "management internship." During this period, each TWI student is assigned a mentor. This is a key assignment because the mentor plays a decisive role in the TWI student's program development as well as acting as the student's personal advisor. All mentors are seasoned managers in positions to significantly influence their respective programs and organizations.

Remember college days when your advisor played a key role in the development of a course of study? In similar fashion, the mentor assists with establishing a rigorous training program which accomplishes mandated as well as personal learning objectives.

Learning Objectives. The required learning objectives are developed and provided by the officer's proponent branch. These objectives act as guidelines around which the student develops a training program addressing each criterion of the learning objectives. The learning objectives must be carefully generated to ensure they are commensurate with the industry's ability to support them.

Job Assignments. Following development of a training program, the student is given the first of at least three job assignments. Initial job assignments are usually made in close proximity with the student's mentor. This is a very helpful practice because it enables the student to work closely with the job sponsor and mentor during the early stages of the TWI tour. At this point, the student has been assigned for five weeks and still has more questions than answers. The nearness of the mentor enables the student to "get started on the right foot."

Successful job placement depends upon a variety of factors ranging from the student's background and follow-on assignment, to the student's personal desires. Most TWI programs recommend a variety of job assignments to expose the student to a wide range of management techniques and current processes.

TWI students may be assigned to several different industries. Usually the industry has a wide collection of government contracts, many of which will contain some aspect of the student's area of interest. This could be software engineering, artificial intelligence, or communications.

My fields are communications and

MAJ Moffett (second from right) briefs Air Defense Systems team members on pedestal mounted STINGER program. From left to right are: Tim Hansen, air defense program manager; Mike Rowbottom, program scheduler; and Virgil Minter, MAJ Moffett's mentor.

TWI Program Schedule

Orientation	9-25 September 1987
Management Internship	28 September-9 October 1987
Cross-Functional Seminars Begin	8 October 1987
First TWI Job Assignment	12 October 1987
TWI Training Program Outline/Travel Schedule	15 October 1987
Technical Issues Seminars Begin	5 November
Thanksgiving Holiday	26-29 November 1987
Current Issues Seminars Begin	3 December 1987
First TWI Student Report	23 December 1987
Christmas-New Year Holiday	24 December 1987-3 January 1988
Second TWI Job Assignment	6 February 1988
Second TWI Student Report	30 April 1988
Third TWI Job Assignment	9 May 1988
Technical Issues Seminars Completed	25 May 1988
Memorial Day Holiday	28-30 May 1988
Current Issues Seminars Completed	2 June 1988
Independence Day Holiday	2-4 July 1988
Final TWI Student Report	15 August 1988
TWI Graduation	15 August 1988

Source: Boeing Participation with Industry 1987-1988 Yearbook

research and development. During my assignment, I have been an information systems analyst supporting the Pedestal Mounted Stinger (PMS) Air Defense System. I first assisted with a review of communications equipment requirements and later was sole point of contact for a prospective teaming agreement between firms. There has not been a dull moment.

Program Diversity. A viable TWI program must provide sufficient program diversity for placement of its students. The mentor plays a key role in this process, and must have a working knowledge of all company programs to properly advise the student. Examples of program diversity at my particular company are shown in the following list: Air Launched Cruise Missile (Air Force); Short Range Attack Missile II (Air Force); Airborne Warning and Control System (Air Force); Inertial Upper Stage (Air Force/NASA); Space Station (NASA); Multilevel Secure Local Area Network (Boeing); P-3 Update IV (Navy); C3I Systems Technology (Boeing); Airborne Optical Adjunct (Army); and Pedestal Mounted Stinger/Avenger (Army).

The industry must be diverse enough to provide the capability to place the student in a variety of technically challenging job assignments. Without this capability, the full benefit of the assignment is not realized.

One method I have used to maximize the TWI assignment is to identify two items, concepts, or terms per week for increased understanding. What does this really mean? In my field of data communications and local area networking, one of the newer emerging concepts is called fiber distributed data interface (FDDI), commonly referred to as a "FDDI Ring." This new technique for linking local area networks promises to improve communication speeds at ranges up to a 60 mile radius.

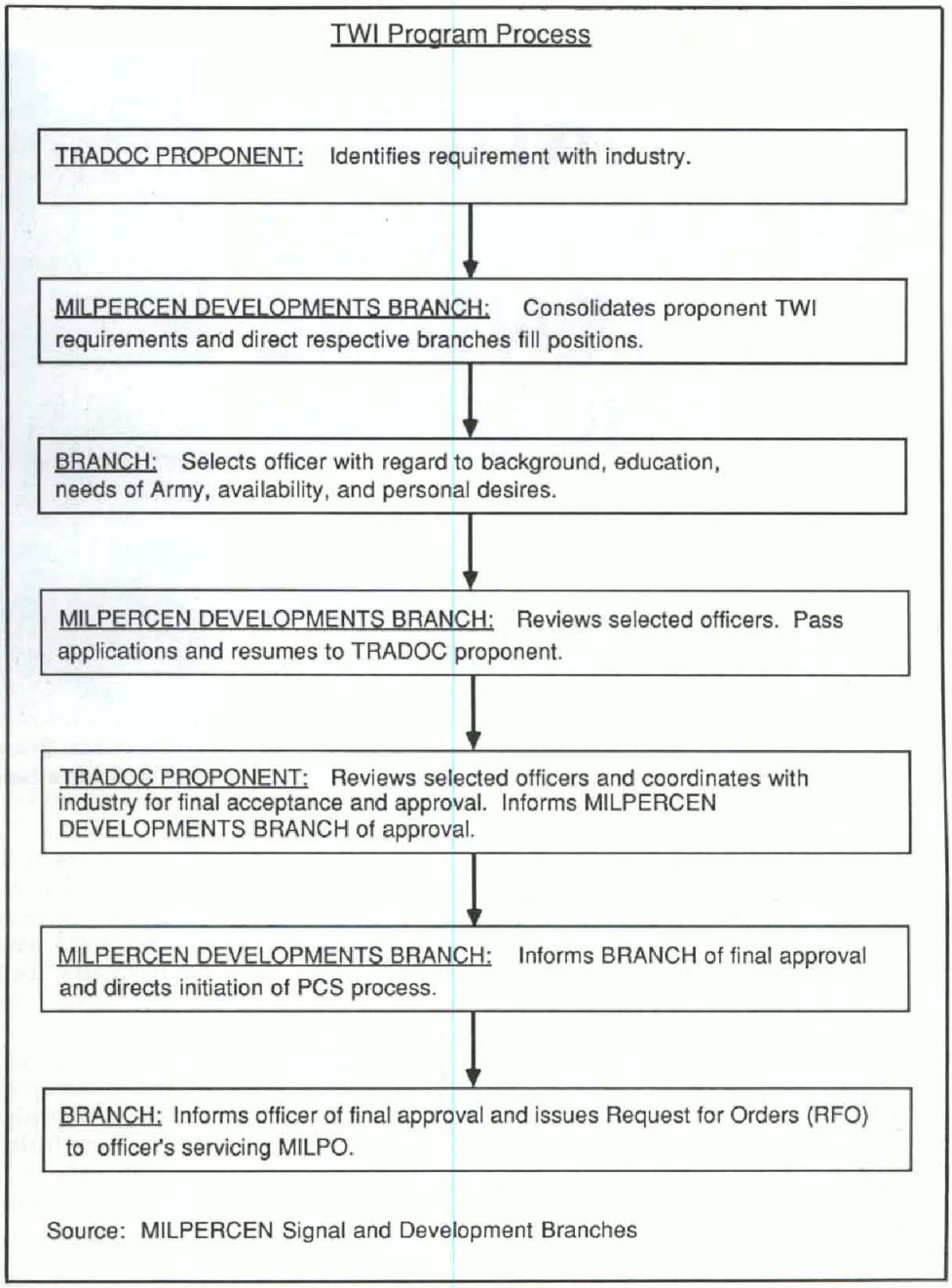
In my current job assignment, I have devoted one week to increased understanding of the FDDI Ring. Next week will be a different concept. This example demonstrates one method to get the most from the TWI assignment.

A second method to maximize the TWI assignment is to make a special effort to enroll in as many seminars or on-duty classes as practicable. Each industry usually offers a variety of seminars and two to three-day short classes for employees. Take advantage of this opportunity.

Many TWI program managers will schedule a cross section of seminars to acquaint students with the latest in various technologies. This is very helpful. The students should not wait for this, however. There are also large technical libraries at most industries which contain a wealth of information to keep you abreast of the latest trends. Use them. The TWI program is what you make it.

The Boeing TWI program schedule is shown in the accompanying chart.

There are several U.S. Army functional areas and branches scheduled for TWI programs for FY89: 15T Aviation Logistics, 25 Communications-Electronics Engineering, 31 Physical Security, 44 Finance and Accounting, 46 Public Affairs and Marketing, 49 Marketing and Artificial Intelligence, 51 Research and Development, 53 Software Engineering and Artificial Intelligence, 88 Transportation, 91 Ord-



nance, 92 Quartermaster, and 97 Procurement.

Selection to the TWI program is an involved process. It is a cooperative effort of the Army Training and Doctrine Command (TRADOC) Proponent, Military Personnel Center (MILPERCEN) Developments Branch, the respective branch, and the gaining industry. Factors influencing selection are civilian and military education level, previous assignments, the officer's functional area and branch, the needs of the Army, the officer's availability, and personal desires.

Once selected, the officer must submit DA Form 1618-R, "Application for Detail as Student Officer at a Civilian Educational Institution or at Training With Industry," and a resume. Following final approval by the industry, the officer is notified and the PCS process begins.

To summarize, there are several key elements to a successful TWI program. They are: Thorough industry orientation, the correct job assignments, adequate program diversity, and supportable learning objectives.

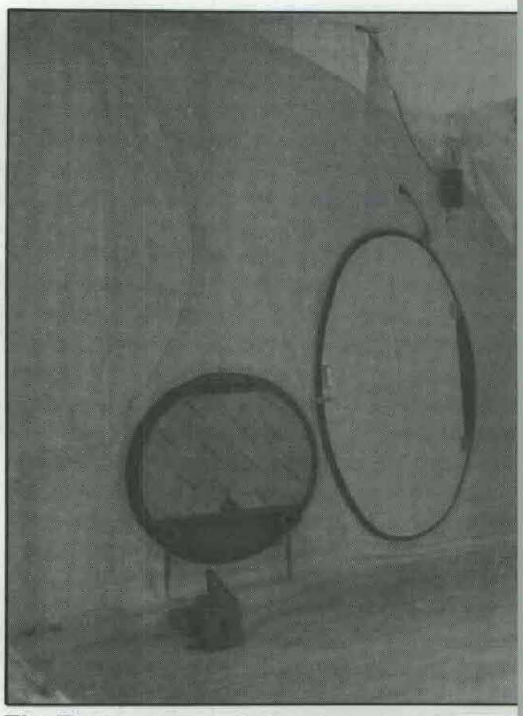
A TWI assignment offers a unique opportunity to interface with "well-placed" DOD contractors and industry leaders. It provides DOD personnel the background and experience needed to better understand a vital American resource — the free enterprise system. Talk to your branch assignments officer.

The author wishes to thank Lee R. Sovie, Boeing TWI program manager, for his assistance in the preparation of this article.

MAJ JAMES E. MOFFETT is currently an information systems TWI participant at the Boeing Aerospace Co., Seattle, WA. He holds a B.S. degree in science education and an MS degree in contract and acquisition management.

NATICK'S C/B HARDENED TENTAGE PROGRAM

Providing shelter to U.S. soldiers in the event of chemical warfare



The Tentage Branch developed a pressuri and provides twice the floor space.

Introduction

There is a probability that in the future, U.S. Army infantrymen could face the threat of chemical warfare. For example, there are now 11 nations, excluding NATO and Warsaw pact countries, that have stock piles of chemical weapons and systems which can be delivered with considerable mobility and range.

Engineers at the U.S. Army Natick Research, Development and Engineering Center's Tentage and Organizational Equipment Branch (T&OE) deal with implications of this threat daily. They are the material developers for state-of-the-art chemical/biological (C/B) protective shelters which provide collective protection to U.S. soldiers in the event of a chemical attack. These shelters range from a tent for a crew of three soldiers in a vehicle to a 400-bed Corps Hospital.

Collective Protection

Collective protection is required to provide a safe environment for soldiers to efficiently carry out tactical functions such as medical care, and command control, and communications without the encumbrances of C/B protective clothing. The highest level of such protection is Mission Oriented Protective Posture (MOPP IV) gear, which consists of an overgarment, over boots, mask/hood, and gloves.

Because of body heat build up, and basic human needs, the overgarment cannot be worn for an indefinite period. Therefore, to maximize efficiency and decrease casualties, soldiers must periodically be relieved from wearing individual protective equipment to eat, sleep, and perform personal hygiene.

Collective protection is established by providing a continuous, positive-pressure flow of clean air into a protected enclosure to maintain an interior air pressure that is slightly higher than the ambient air pressure. The overpressure results in a continuous outward flow of air to the atmosphere through openings in the shelter and prevents the infiltration of outside contaminants. Entrance to such a shelter requires a dual purpose airlock to maintain internal pressure and help eliminate vapor contamination.

REDLEG Exercise

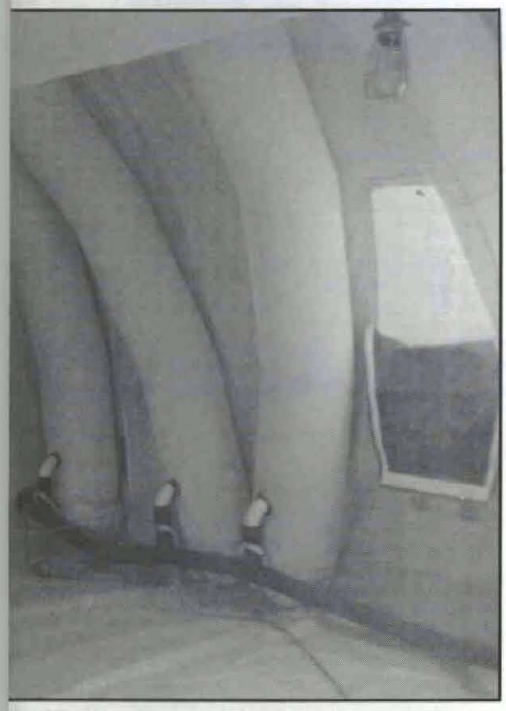
In October 1985, Natick participated in the REDLEG exercise at Fort Sill, OK. This exercise demonstrated the latest in C/B life support technologies. Natick provided several rest and relief, chemically protective tents developed for crew members in a vehicle. The intent is to provide a tent that quickly deploys and attaches to and shares the microclimate of a vehicle. This gives the soldier a clean rest area outside the vehicle and allows more room for movement.

Three tents were demonstrated for this purpose at the REDLEG demonstration. Two were Natick designs and fabrications, and one was a modified commercial shelter. The tent preferred by the soldiers was Natick's A-frame because it is sturdy, light, and not bulky. It also took little time to erect. For example, the A-frame was erected within 5-10 minutes by two soldiers in MOPP IV gear.

The success of REDLEG exercise resulted in a Marine Corps request for Natick to design and develop a Portable Collective Protection Equipment system. The shelter will provide five day continuous liquid and vapor chemical protection. It will accommodate 12-15 soldiers in a 300 square foot floor area and weigh less than 280 pounds with a volume of 60 cubic feet when packaged. The shelter deploys in 15-20 minutes and the entry and exit provide passage for 13 soldiers over a two-hour period.

M-51 Deficiencies

The objective of a medical shelter is to provide mobile medical treatment in a chemically-free enclosure. Histor-



ed rib design that is lighter than the M-51

ically, the only suitable enclosure for a chemically hardened shelter was the M-51. However, the Medical Corps found many deficiencies with the M-51 shelter, including excessive weight, deployment time and bulkiness, insufficient floor space and the lack of prime movers. Based on these deficiencies, the Department of the Army requested Natick to develop a replacement shelter.

Natick developed three concepts and, in conjunction with the Academy of Health Sciences, evaluated them at Fort Sam Houston. A pressurized rib design that is lighter than the M-51 and provides twice the floor space was selected as the most promising concept. The High Mobility Multi-Purpose Wheeled Vehicle (HMMWV) ambulance will be the system's dedicated mover, towing a ¾-ton trailer which contains lighter weight, more efficient power and environmental control systems. In addition, when no C/B threat exists, windows on the Natick design can be opened for ventilation, a feature not available on the M-51.

In the interim, the Natick RD&E Center is developing a 300 square foot shelter, called the Trailerless Collective Protection Shelter, which is permanently attached to a HMMWV ambulance. All the ancillary equipment is housed within the ambulance shell and, since a trailer is not needed, the mobility of the HMMWV is not impaired. Type classification could be as early as FY89.

Ongoing Efforts

At present, Natick is working on a first-time attempt to provide chemical protection to a mobile facility on a mass scale. The concept was shown for the first time at the Corps Hospital Demonstration, Fort Sam Houston, San Antonio, TX. A 5,800 square foot complex, comprised of interconnected TEMPER tents (Tent, Extendable, Modular, Personnel) and expandable rigid wall ISO Shelters, was chemically hardened through the use of barrier materials and filtered overpressure.

The Natick concept for tentage in this instance was to take standard Army issue shelters, insert baggie type liners and overpressure in a balloon-like fashion. This insures that any linear penetration results in air flow out of the system rather than contamination flow into it. The first generation liner design required 1,000 cfm of pressurized, filtered air per 1,200 square feet module to meet the design criteria. The Chemical Research, Development and Engineering Center is currently finishing the second generation liner design which will cut that requirement to 600 cfm. The new design will utilize a composite barrier material composed of layers of high- and low-density polyethylene and Saranex and will provide protection from both liquid and vapor contamination.

Another first at the Fort Sam Houston Demonstration was the use of an external "remote mechanical room" supporting C/B operations in the rigid wall ISO shelters. Current technology places the support equipment and an airlock inside the shelter. This is necessary for stand-alone conditions such as command posts and communication centers. In the medical arena, ISO shelters are special function areas such as operating rooms and laboratories.

Because space is at a premium, access to the tentage modules is gained through a C/B hardened connector to the tactical shelter. This makes the current airlock design redundant and, when combined with the internal mechanical equipment, space intensive. The remote mechanical room eliminates unnecessary components and maximizes floor space. Another benefit which is especially important during surgery, is a reduction in vibration and noise.

In an effort to provide a general purpose tent for use in a chemical or non-chemical environment, the Natick Chemically Hardened Tent was designed and built at the Natick RDE Center. The design incorporates the TEMPER frame with a new chemically resistant fabric developed by Natick scientists. This new lightweight laminated fabric consists of three layers: polyester for abrasion resistance, Tedlar for chemical resistance, and Kevlar for lightweight strength and low flammability. The one-piece fabric body uses 16 feet of TEMPER frame for external support, and is quickly attached with straps. This new Natick tent can be quickly erected, and provides environmental protection for both chemical and non-chemical use.

Conclusion

C/B threat protection must encompass a variety of shelters in response to a variety of needs. The Natick Center Tentage Branch is continually evolving and integrating state-of-the-art technology to successfully address these needs.

AMC Commander GEN Louis C. Wagner Jr. Discusses . . .

PERSPECTI
CURRENT ACQUISI

The following remarks, which have been edited slightly for publication, were initially presented at the Atlanta XIV Army/Industry conference in Atlanta, GA. GEN Wagner addresses some of the concerns expressed by industry at last year's Atlanta meeting and some key initiatives that have been undertaken to insure that high quality materiel gets to the soldier in the field.

I'm happy to see you all here this morning and appreciate your taking the time to meet with us. That you are here today tells me that you feel that the Atlanta meetings are important — that you see, as I do, the need for continuing our dialogue and continuing to build a common base of understanding. The business we're involved in is vitally important to this nation and deserves our best efforts.

What I hope to see as a result of this meeting are improved relations between the Army and the industry people we rely on. Since I assumed command of AMC just one year ago tomorrow, I've pushed hard to get rid of what I call the "we-they" syndrome in the Army — the destructive idea that the fighters and the supporters are somehow in different lines of work and have different missions.

This distinction is especially destructive when AMC, as the Army's logistician, is unfairly singled out for abuse when something goes wrong. Of course, we sometimes deserve it — I'll admit that. The end result is to chip away at the soldier's confidence in those who equip and support him. That confidence in his weapons and equipment is a critical element in his winning on the battlefield.

I see a similar "we-they" syndrome growing between those of us involved in Army acquisition and the companies that we work with. I would be pretty naive to think that we can change all of the policies and procedures that cause us disagreement and that tend to build up a "we-they" mind-set, but I think we have a good deal more common ground than some might think. I want to concentrate on that common ground this morning.

First of all, let me summarize what I saw as your main concerns last year. They all seem to focus on the amount of risk you face when doing business with the Army.

You were worried about program stability and the stability of your business base. You reported that profit policies and progress payment rates are reducing your profitability.

You expressed strong concern about having to make greater program investments and take greater risks, to include more capital investments in facilities for new weapon systems and larger front-end R&D investments on NDI systems.

You were also concerned that increased competition and the use of fixed price contracts were increasing your risks. In response, let me say that we hear you and agree with you on many — but not on all — points.

I have several examples to give you today that prove that by working together we have made positive and effective changes when we felt that the system had been overcorrected. In some cases, though, the jury is still out; and where we still disagree, we need to keep talking, no matter how intensely emotional and highly charged our disagreements may be.

There's no question that we need to turn some rules around. There's also no question that some policies make no business sense. In fact, a few of them are contradictory. In some cases, we don't have enough hard evidence to press for changes and must continue to monitor and gather data.

Let me go into a few of the specifics that you expressed concern about last year.

Program Stability

Program stability and the budget are, of course, on everyone's mind. I can't say that we've made much progress in program stability, although stable programs without a doubt benefit both industry and the Army.

From my point of view one of the best examples we have of a successful and stable program is Mobile Subscriber Equipment (MSE) because we have both a long-term contract and congressional support. But we can't claim that magic combination for most of our programs, and I can only say that lack of stability is as frustrating and maddening for those of us in the Army who are

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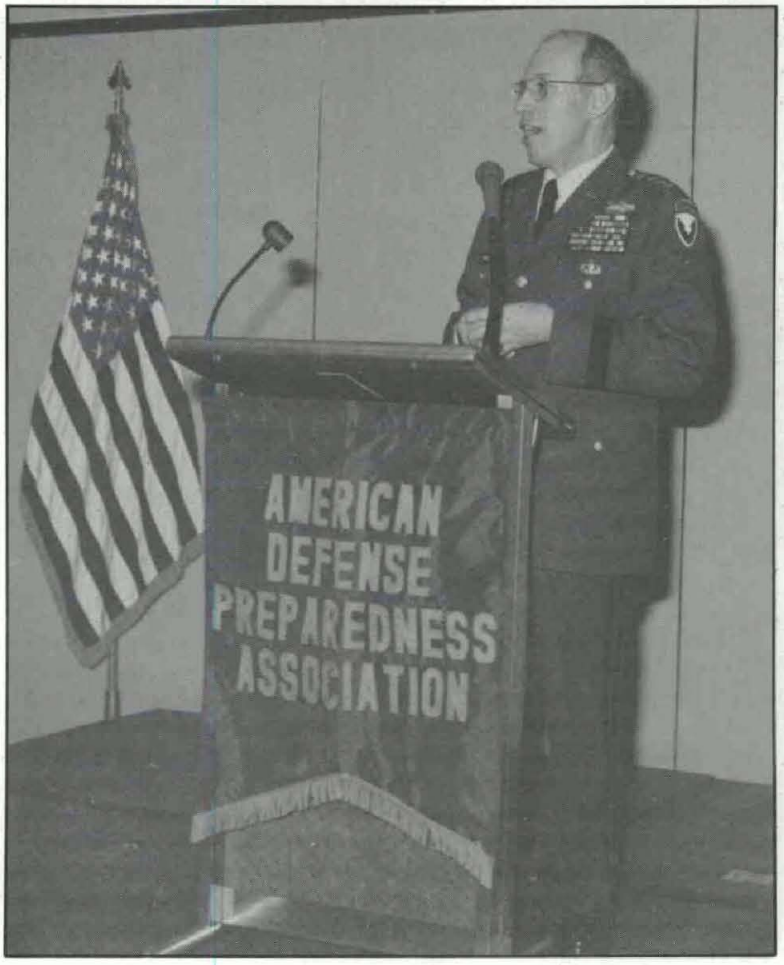
trying to put together a flexible and strong combined arms force as it is for our industry partners who are trying to do some long-term planning and investing.

In a talk to the Dayton, OH, ADPA Chapter in late January the secretary of defense expressed some optimism that we'll see a concerted effort in Congress to give the Defense Department the "managerial flexibility and authority it needs to do the job, [and] to provide authorization and funding for program stability;" but he noted that this will take something of a cultural change and won't come quickly.

As for the budget itself, it's true that the Army faces no-growth and even negative-growth years ahead of us that will demand program cuts and elimination of some programs altogether. That's pretty painful.

But we have a system in place that helps us set priorities among the deficiencies we want to correct; and if we use that system well, we can still field the strongest and most flexible fighting force possible.

My own view is that we've got some lean times ahead but that the sky really isn't falling. I also think that you'll still have plenty to compete for and that we'll all have even more reason to work hard for savings in how we manage and spend every dollar. We will simply get smarter about starting programs and about continuing those that might get into trouble.



GEN Louis C. Wagner Jr.

Profit Policy

Turning to profit policy, which was a pretty emotional issue in last year's discussion, I think we have something of a success here. First of all, I think most of your complaints about our changes in profit policy were directed at the October 1986 interim policy, which was changed considerably in the final policy last year. It was changed, I think, largely as a result of an attempt to put real incentives where we want them — not in labor- and material-intensive operations but in genuine management initiatives to provide capital investments in facilities and to improve productivity. We listened to your concerns. The Army Materiel Command was actively involved in revising that interim policy and will be actively involved in any future adjustments.

There's no doubt that we want our profit policy to weigh in on the side of

productivity and capitalization. While overall profits are expected to go down about one percent — as required by Congress — because of reduced weighting of labor and material input, the profit weighting for capital investment has been increased. Those firms willing to take capital investment risks should be rewarded.

I also need to mention that each contract still involves a separate negotiating process; so the impact of the new profit policy will be slightly different in each case.

As for future changes — while I think that the profit policy put in place last year corrects some real problems in the interim policy, we've had less than a full procurement cycle since then and don't know the full effect. We need about another year before we take a thorough look, with numbers to back us up. Those numbers are being automated now at DA; and we'll have a good idea of how our changed policy is doing by next April.

Progress payments are a related issue, and I share your concern. The current lower rates that were mandated by OSD bear close watching. Overall they seem less favorable than we would like. I know that cash flow is the bottom line. In the meantime, we need to gather data and get smarter. If we find that current rates are genuinely unfair, we may go to OSD and work for some changes. Let's keep talking on this one.

Special Tooling

Looking now at amortization of special tooling and test equipment, again we have good news. The fiscal year 1988 rule on amortization essentially eases the pressure on up-front costs and reverses the 1987 rule that was such a bone of contention last year. Again, this was largely a result of your concern and more proof to me that we have a number of areas where we agree.

We certainly agree that you can't be expected to wait forever to gain from you investments. In the future we must focus less on specialized tooling and get back to more general-purpose tooling.

To some extent our accounting rules have made specialization more attractive and boxed us in. Until those rules are changed, we can only administer them fairly and closely watch and track them. But overall I hope that we can get away from too much specialization.

There's no doubt that we want our profit policy to weigh in on the side of productivity and capitalization.

First of all, I think industry gains a good deal of flexibility to manufacture a variety of hardware, and this is some defense against program instability. Second, the Army certainly benefits from greater ease in changing models of systems in production and from a greater ability to surge and mobilize.

Our emphasis on general-purpose tooling is part of our renewed concentration on designing for producibility.

Our M1 tank plant is for the M1 and only the M1. In addition to its extreme expense, we didn't build in any flexibility for that plant itself, nor did we design a system that could be easily built elsewhere for surge and mobilization. We've proven to be a nation that is good at designing the end product but not as good at designing to produce; and we've simply got to get manufacturing engineers on that initial design team as full partners. We also need to enhance the prestige of our production engineers within the United States. They are highly regarded members of the team within Japanese industry.

Increased Capitalization

A concern you expressed last year — and in one of the best Atlanta presentations I've ever heard — had to do with increased capitalization by industry. I think this greater capitalization has a positive side, too. It actually gives you more control of design decisions, timing and size of the investments you make, and types of equipment you use. Again, we need to keep talking.

Since I'm on the subject of capitalization, let me mention that we have a major review going on right now of our current production base policies and strategies for both peacetime and emergencies. Retired MG Olenchuk and his board are looking at three main areas: capital investment policies, production base strategies, and industrial preparedness. As part of their review of capital investment policies, they're looking at how our policies are affecting levels of risk and the resulting impact on our production base. We're working now on getting industry input; and I'm looking forward to getting the board's recommendations.

As for worries expressed last year about large in-house R&D investments on nondevelopmental items, once again I must look at the plus side for industry.

It's true that you're on your own for initial investments for NDI. However, the payoff can be great. First of all, with NDI the Army is only one of your potential customers; we're not the company store. This gives you considerable freedom from dependence on our yo-yo budgets and programs. You also have the chance to link up with a variety of off-shore sources and customers.

Contracts

Turning to contract type, I'm glad to say that this is one area where you'll be seeing more flexibility. Although the Army strongly favors multi-year contracts, Congress rarely OK's them; but we can still select from a mix of cost and fixed-price in one instrument when we structure a program; and we can include priced options for future years, as we did for MSE.

I'm especially uncomfortable with fixed-price contracts for research and development and am glad that Congress and OSD are now in synch with us, at least with regard to R&D contracts over $10 million.

As for competition, which you see as increasing your risk even farther, I can only say that it's an essential part of the American marketplace, clearly the will of Congress, and has the firm backing of senior OSD and Army leadership.

But that doesn't mean that we're competing just for the sake of meeting our goals. Although we are expected to compete in most cases, with exceptions decided case by case, my guidance within the Army Materiel Command is to compete when it makes good business sense to do so. Our job is to now make sure that those in the trenches understand our commitment. We don't want sham competitions or to go through the motions to pump up the numbers. We want competition when it really means a savings while encouraging quality improvements; and we want competition that will strengthen our

industrial base.

I now want to mention two programs that need further recognition at highest management levels. Both offer us the opportunity to save resources, one during development and the other during production. Together they represent all of the programs we've initiated to help us work more efficiently and to get the right, high-quality materiel to the soldier in the field.

MANPRINT

The first is MANPRINT, which stands for Manpower and Personnel Integration. In my view, the soldier is the first and most important design element. Human factors engineering; manpower, personnel and training considerations, health hazard assessment, and system safety must come first if we are going to design the right system to do the job; and look at the time and money we can save by focussing on the soldier from the start.

In the past we haven't known quite how to treat MANPRINT in RFP's and in evaluations, but we're working on fixing that.

In this connection, I strongly endorse training with industry and encourage you to do likewise — ask to go out to the field to see how the soldier lives, trains, and fights. I saw how beneficial that can be when a bunch of computer wizards did just that at Fort Knox prior to developing SIMNET. The soldier was the real winner.

As for a production initiative that can really pay off for both the Army and industry, value engineering gives us a chance to make engineering changes and to then share the savings. Ultimately our costs are cut, which can certainly help without shrinking budgets. I encourage you to develop and submit value engineering change proposals.

MANPRINT encourages us to design it right from the start; and value engineering encourages smarter production later on.

Quality

An overriding factor in all of our Army-industry dealings must continue to be quality.

Dr. Costello, the Undersecretary of Defense for Acquisition, in his luncheon address to us at Atlanta XIII and on many occasions since then, has asked for our best efforts to make quality an inherent part of our thinking in all of our operations, and those of us in this room today must take the lead and manage for quality. As just one example, I have numbers to show how disciplined management can drive down the percentage of production cost eaten up by scrap and rework.

When comparing reports of armored vehicle contractors producing like products, the nonconforming materiel cost (scrap, rework, repair, and reinspection) when intensively managed was nine percent of production cost versus 15 percent when not so carefully monitored.

Similarly, in aviation, the nonconforming materiel costs as a percentage of direct labor costs varied from 3.3 percent to a high of 21.2 percent; and in communication electronics, intensive management of one program drove rework down from 34 percent to below 13 percent and scrap from over seven percent to under four percent in just one year.

An overriding factor in all of our Army-industry dealings must continue to be quality.

Some of these costs may still be too high, but with careful management they can be controlled.

But quality, to my mind, isn't just a set of programs, initiatives, or statistics, but a way of thinking about how we operate; and I've spelled this out in my recent AMC white paper, which we're calling "The Commander's Perspective."

The point I want to make is that in the Army Materiel Command, I'm asking for a real commitment to quality on the part of everyone. AMC must stand for quality! Our soldiers deserve it! And our workforce must be a quality assurance team that is responsible and accountable for its actions. We must take responsibility as team members with the PEOs and PMs for a problem when it arises and solve it willingly, without being bound by the past. Success demands flexibility and innovation.

I ask you to join in my commitment to the quality, dedication, and innovation we should all stand for.

The Army trains in peace for war. AMC is at war every day. We do in peacetime what we will do if we must go to war. The same is true of our PEO and PM partners; and you, as our industry partners, are a part of that team. We must continue to forge an open, no-nonsense partnership, and the American soldier and this nation will benefit.

A final note — we do have differing views on the subject of risk, and I don't think that should surprise any of us. You're not in business to take foolhardy risks but to take fair and reasonable risks in return for fair and reasonable profits and new business.

In turn, the Army has stringent budget restrictions and a complicated, often confounding acquisition system. We don't intend to place undue risk on industry, but we do operate within a marketplace where risk is a fact of life; and we, too, are looking for that balance between risk and reward.

Conclusion

We might be coming from different perspectives; but we have one ultimate objective — fielding the best, the most technologically effective, and the most ready fighting force in the world.

We've met here in recent years to openly and frankly discuss how we work together. We have made positive changes as a result of these discussions. I'm looking forward to more progress as a result of the Atlanta XIV meeting; so let's get on with it.

ASAP — FROM THE

By David G

Some people tend to view government initiatives to improve the materiel acquisition process with a certain wariness. They've seen them come, and they've seen them go. But the acquisition streamlining initiatives being used by the Army in its three pronged approach to streamlining business practices, acquisition strategies, and requirements are different. Not only do the initiatives make sense but they are being prompted by a growing attitude in the Army's acquisition community that it must get quality equipment into the hands of the soldier more quickly and at less cost. This calls for the streamlining of acquisition programs wherever possible if it makes sense in the context of that particular program.

In these pages over the past several months there has been much useful discussion of the Army Streamlined Acquisition Program (ASAP) that has assessed the benefits, background, and philosophy of the program from the Army's point of view. Another point of view, from someone on the industry side of the process, is not likely to be radically different since both parties are interested in, and benefit from, improvements to the acquisition process. None-the-less an industry perspective can be useful, and while this article is only the perspective of one person associated with one corner of industry, it gives a different slant on ASAP and perhaps illustrates where increased benefit can be gained.

Key Ingredients

Before addressing the Army's three approaches to streamlining, it should be noted that the streamlining state of mind and the streamlining initiatives themselves will not long endure without two key ingredients — common sense and trust. The need for common sense is fairly obvious and has been widely discussed with respect to acquisition streamlining. The element of trust is not usually highlighted, but should be because lack of trust has helped create the incredibly complex acquisition process that streamlining is attempting to simplify. Lack of trust fuels the continuing growth of reports, information papers and testimony that Congress requires of the Department of Defense (DOD) each year. Similarly, at the other end of the spectrum lack of trust has created the apparent need on the part of the government for an arsenal of over 2,000 management specifications to direct industry on how to manage its programs.

Any streamlining of the acquisition process must include the element of trust. We are not talking of a blind and foolish trust here but rather trust that is based on the assumption that we all are reasonably competent and are motivated by the desire to do the best job possible. This trust does not preclude management oversight. It recognizes that mistakes can always be made and that two minds are better than one, particularly when their points of view differ. On the other hand, this trust does preclude the intensive management that we often see today within the DOD and between DOD and industry.

It is interesting to note that equivalent management relationships within industry, that is, between a prime contractor and his subcontractors, are generally far less intense and complex. This less stringent approach occurs partly because each party understands and accepts the other's goals (for example, they must continue to do business), but mostly because unnecessary management means unnecessary costs, and unnecessary costs dull a company's competitive edge. So it may be that the commercial sector of the acquisition process best illustrates the proper balance between trust and oversight in management relationships.

Business Practices

Of the Army's three approaches to streamlining, many in industry would consider streamlining business practices to be the first of their concerns. The Army's efforts in this area cover a broad set of initiatives including changes in its management structure (the Program Executive Officer concept), increased emphasis on quality, streamlining the contractual process, and streamlining the contractual vehicle.

The last of these should most benefit the commercial sector because the contractual vehicle communicates the Army's requirements to industry. Since the objective of streamlining the contractual vehicle is to make it more comprehensible, then streamlining will help industry better understand the Army's needs and, by extension, increase the likelihood that a quality product will be provided. It is unfortunate that the teams responsible for developing requests for proposals (RFPs) do not have the opportunity to cross the fence and sit on a proposal team in industry. If they could, then they might more clearly see how daunting the inconsistencies, redundancies, vagueness, obscure tiers of references and sheer

A VIEW OTHER SIDE

Kirkpatrick

volume of a typically bad RFP are — especially to those whose job it is to determine what the government wants, if their company can provide it, and at what cost.

Concern with the size of RFPs has sometimes resulted in an effort to reduce the number of pages. Page reduction, however, isn't necessarily streamlining. A 500 page RFP that stands alone and is clear and well organized is preferable to a 250 page solicitation which incorporates several hundred other documents by reference. Page count is not the measure of goodness; clarity is. If a solicitation clearly communicates the Army's needs to industry, it is streamlined. If the final draft of a solicitation has half as many pages as the first draft, it may or may not be streamlined, depending on how well it is understood.

The Air Force recently undertook to streamline the system specification for a large procurement to make its needs more clear to industry. Starting with some 350 specifications that tiered out through referencing to about 7,000 specifications it ended up with about 400 specifications in the final RFP. A larger document, but those specifications stood alone; no specifications were called out by reference. The final system specification was longer than the original, but it was streamlined.

On the other hand, the idea of placing a reasonable page limit on the offeror's proposal has considerable merit. In any arena, one measure of competence should be a company's ability to communicate effectively in writing. Another virtue a company should possess is the ability to organize its work and ideas. These two abilities can be nicely demonstrated in a succinct, hard-hitting proposal that covers all the bases with the minimum of verbiage. It follows that shorter proposals should result in reduced evaluation time, thereby reducing procurement administrative lead-time. So limiting proposal length can provide the double-barreled benefit of being a source selection discriminator and an administrative lead-time reducer.

Strategies

As with business practices, some areas of streamlining acquisition strategies are of more interest to industry than others. The policy of choosing the path of least resistance to satisfy a materiel need, i.e. materiel change or nondevelopment item procurement (NDI) before development, makes sense in the context of streamlining. It also makes sense in a larger context as long as we don't neglect the research and development role that industry shares with government and academia in seeking out those technologies that will provide a "leap ahead" in our capability to deal with our adversaries.

A common strategy in streamlining is to rely on concurrency of activities to save time rather than to use a more conventional heel-to-toe sequential process. Concurrent development testing and operational testing can be very effective as long as the test community recognizes and accepts the fact that the contractor may have difficulty in meeting all of the needs of all the testers, especially since their test objectives are likely to be widely divergent. The test community must sometimes be willing to work with less than the whole enchilada.

Likewise, concurrent production and testing can work well if, and only if, critical test issues are identified and resolved before beginning production. That is easy to say — but far less easy to do. A good-faith effort by the test community, the materiel developer, and the contractor are required to assess the true weaknesses of the system in development. It calls for the coordinated efforts of all three groups to identify the potential "show-stoppers," and address them with a coordinated program that finds and fixes the problems that do exist prior to production.

What these concurrency approaches have in common is the need for close coordination and cooperation on the part of all players early in the process to ensure that the job gets done right. Then, when problems occur (and they always do) we need to avoid finger pointing and instead ask, "Okay, what do we need to do to fix this one?" Implicit in that question is the assumption that all parties are equally concerned with the final goal of fielding a quality product quickly.

Another streamlining initiative that is a two-edged sword is Continuous and Comprehensive Evaluation. Among other benefits, this policy provides early feedback to the developer on the operational capabilities of the system since user troops operate it very early in its development. The operational assessments that result from these tests are invaluable in helping the contractor correct problems early in development when changes are usually cheaper and easier to make. The price the contractor pays for this obvious benefit is premature exposure. By exposing the system to critical examination when it quite

naturally has a lot of rough edges it may get a undeserved reputation as a problem system or a system in trouble. And systems in trouble don't survive long in an environment of constrained resources.

One of the first of these early user tests was conducted some years ago on a weapon system being developed to replace its elderly predecessor. In the spirit of streamlining, user troops from a unit which owned the existing system were brought in to perform an operational assessment of the new system. The result of that assessment was a report that identified over 50 deficiencies and made only three positive comments. Now, many of these deficiencies had already been identified by the contractor and were being fixed, some others were trivial, but a few were "good catches" — making the whole effort worth everyone's time.

If a solicitation clearly communicates the Army's needs to industry, it is streamlined.

To the project management office the 50 to 3 ratio of negative to positive comments looked pretty grim — not exactly the results that were expected since the development program was going well and the system had been performing better than expected (considering its current state of development).

What had happened? The testers had done their job. The negative bias of the report is understandable since the testers had seen no need to dwell on positive comments. They had been asked to find problems and that is what they did.

But the project office was concerned. A hurried conference with the testers revealed that they had asked the user troops in a questionnaire if they preferred the new system to the old system. The answer to that question was a unanimous "yes." In fact they said they would like to have the new system, right now, warts and all.

The point is that the results of early user testing must in some way be placed in the context of the system's stage of development. It is interesting to speculate on what would have happened had that list of deficiencies gotten into the hands of an eager investigative reporter and been widely publicized out of context. It is conceivable that as a result of the ensuing furor a system the user needed (and has since proven itself in the field to be a first-rate product) might never have gotten to production.

Requirements

The third thrust of the Army's streamlining approach is to streamline user, contract, and test requirements. This effort focuses on eliminating unnecessary and unrealistic requirements or requirements that add only marginal value to the final product. In other words, to accentuate the positive, it focuses on developing "correct" or properly defined requirements. (See "The Streamlining-Quality Connection" by John Leslie, *Army RD&A Bulletin*, January-February 1988.)

The skeptic can point out that industry is least interested in this aspect of streamlining because the contractor gets paid if he meets the requirements, whether or not they are correct. That's true to some extent, but it is also true that contractors have an abiding interest in producing quality products, both to enhance their reputation and to satisfy the need any organization has to be proud of its work. So it is in the contractors' interest as much as it is in the interest of everyone else in the acquisition process to ensure that they are working to correct requirements. How? We must all challenge requirements that don't make sense or that provide only marginal benefit to the final product.

Another aspect of requirements and streamlining is the problem of changing requirements. This applies not only to development programs but also to nondevelopment item procurements. Consider for example the not atypical position of a company that sees a market for one of its products in a draft requirement for, say, a quiet generator. It knows one of its generators will meet the performance requirements and is rugged enough to stand up to the rigors of military duty.

If the company is not familiar with the vagaries of the materiel acquisition process, it will likely be surprised when it sees the requirement that finally "hits the street." So many bells and whistles have been added that its simple inexpensive generator no longer qualifies as a potential source. The only consolation the company might have is that none of its competitors have generators that qualify either.

This problem and others like it can be avoided, or at least minimized, if during requirements and technology base activities the prospective acquisition program is fully defined and all individuals or activities that are concerned with the acquisition are committed to the program as it is defined. Admittedly, to do this successfully requires a massive amount of up-front coordination, cooperation and selling of the program. Then selling the program must continue throughout development to guard against changes of heart and to convince new participants of the correctness of the requirements and acquisition strategy. To do otherwise increases the risk that the up-front effort to streamline requirements (or the acquisition strategy) will be negated by well meaning changes to make the program just a little bit better. Of course, these changes cause the instability that results in cost over-runs, schedule slips, and test failures that operate against the ultimate objective of satisfying the user's needs.

Four Rules

All of the above points really boil down to four simple streamlining rules

Too many requirements exist only because they were in a previous solicitation or program.

— rules simple to express, but not simple to implement.

- Don't let "better" be the enemy of "good enough." Success in streamlining the acquisition process rests in large part on our willingness to limit our objectives — to stick to mature technology when the temptation is to go for a high technology breakthrough. This rule does not mean that we should be satisfied with less than a quality product. It simply recognizes the old maxim that a bird in the hand is worth two in the bush.
- Maximize coordination and cooperation . Some may have the mistaken impression that streamlining will make

our jobs easier. It won't. To the contrary, it requires additional effort, particularly early in a program, to ensure that all bases are covered and everyone is in agreement with the program.

- Minimize verbiage. William Strunk Jr., a Princeton University professor in the 1920s and author of the popular little book, *The Elements of Style*, probably said it best, "vigorous writing is concise." Strunk is even reported to have presented the following lecture on conciseness: "Don't waste words. Don't waste words. Don't waste words. Class dismissed."
- If it doesn't make sense, don't do it. In streamlining, nothing is sacred. Too many requirements exist only because they were in a previous solicitation or program. Challenge them. Too many processes are worked through only because that's the way they were done before. Don't do them. If they provide no benefit or only marginal benefit to a program then they should be eliminated.

The above rules coupled with the ingredients of common sense and trust form the basis of effective streamlining. They apply equally to government and industry because both have the same fundamental goal — to get quality equipment into the hands of the soldier more quickly and at reduced cost. Streamlining can make it happen.

DAVID G. KIRKPATRICK is a senior staff member at Advanced Technology Inc., Reston, VA. He is currently supporting AMC in the development of an acquisition streamlining training course. He holds a B.S. degree from the U.S. Military Academy and an M.S. degree in aerospace engineering from the University of Colorado.

Acquisition Streamlining Course

The Acquisition Policy Branch, Office of the Deputy Chief of Staff for Development, Engineering and Acquisition, HQ AMC, with the assistance of Advanced Technology Inc. has prepared and is presenting a course on acquisition streamlining for the materiel acquisition community. The purpose of the course is to make the Army acquisition management community more fully aware of the Army's acquisition streamlining initiatives and to provide insights into how they can be used to improve the acquisition process.

The Army's approach to streamlining places emphasis on streamlining requirements, acquisition strategies, and business practices. The 3½-day ASAP course addresses these areas in detail through an examination of the basic streamlining principles and through in-depth instruction in the above three approaches to streamlining. The course instruction is reinforced by hands-on case studies which require the students to apply the knowledge gained in the classroom to actual programs.

An executive overview for senior management has also been developed to provide the contents of the course in capsule form.

Additional information about the course may be obtained from Glen Buttrey, HQ AMC, AMCDE-AQP, 5001 Eisenhower, Ave., Alexandria, VA, AV 284-5100, Commercial (202) 274-5100.

Development of the Tank

One of the major developmental innovations which came out of World War I was the tank. Its creation offers an interesting and instructive lesson in materiel development security and concealment.

By late 1914 and early 1915, allied military leaders realized that there had to be an alternative to the stalemate of trench warfare on the Western Front. Several postulations were made, all of which centered on the armored caterpillar tractor as the device best able to break this stalemate.

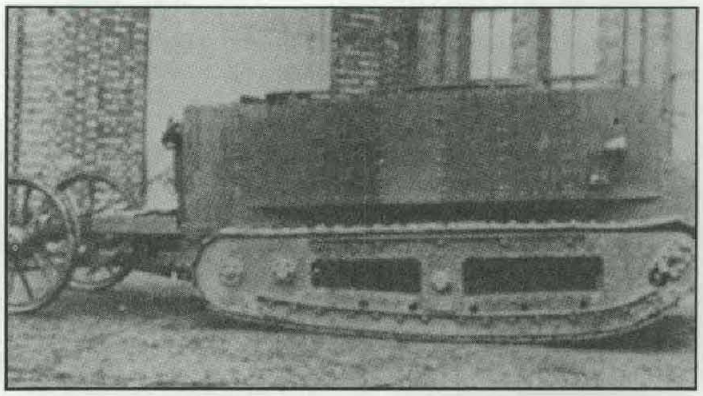
The major figures in the debate over the new weapon were mostly British and included such notables as Prime Minister Asquith, Winston Churchill, First Lord of the Admiralty and Field Marshall Lord Kitchener, Minister of War. The end result was the "land ship."

By December 1915, after a year of trial and error developmental testing, the, by now recognizably potent aggressive assault weapon, was about to be placed in production. A conference was called at the War Office on Christmas Eve 1915 to discuss "The Present and Future Situation regarding the Provision of Caterpillar Machine Gun Destroyers or Land Cruisers."

During the meeting, it was decided that this new weapon would be placed in the hands of a special committee with powers to deal with the various departments, Munitions, Ordnance, and so on, likely to be engaged in its production; in effect, the special committee was a sort of supra Program Executive Officer board.

Later the same evening, while drafting the final report of the conference, LTC Ernest D. Swinton and LTC Dally Jones, member and assistant secretary of the committee, respectively, discussed various deceptive cover names which would permit secrecy and also placate the factory workers who were building the prototype.

For the factory workers' benefit, the running gear had been called a "driving instructional chassis." The body was referred to as a "water carrier for mesopotamia," because it explained the rhomboidal shape when placed on a railwagon and covered with a tarpaulin. "Cistern," "reservoir" and "container" were dismissed as cumbersome and ambiguous. The workers themselves had been referring to the device as "that tank thing." Swinton and Jones decided to just use tank as being appropriate and succinct.



LITTLE WILLIE, first named "Tritton" after William Tritton.

Usually, the cover name disappears with the public display of a weapon, but it has remained in the case of the tank. Though the tank no longer resembles the rhomboidal shape of the original, it is still with us and its title is used and misused to describe a variety of models in today's armored fighting vehicle world. The nautical flavor of its naval beginnings under Churchill has also remained with us as tank sections are referred to as hull, bow and turret.

The use of cover and deception in materiel development is a time-honored practice employed by most of the industrialized world. The employment of cover names and cover stories, "appropriate and succinct" adds to the security of most projects.

The preceding was written by James W. Conlin, a senior analyst in the Threat Evaluation Division, Office, Assistant Deputy Chief of Staff for Foreign Intelligence, HQ, U.S. Army Materiel Command.

The Scanning Tunneling Microscope

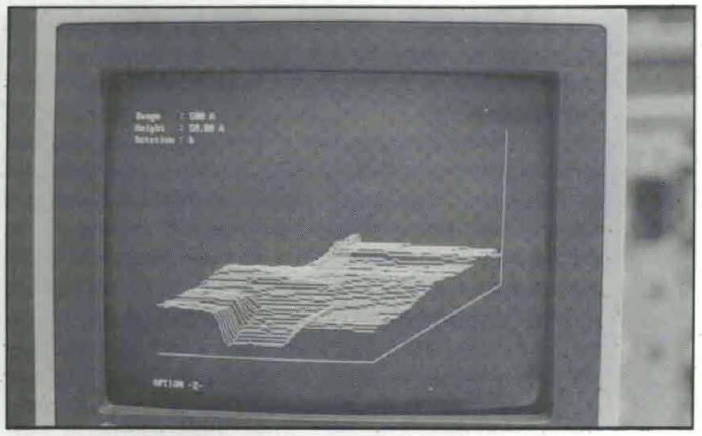
An Army physicist at the U.S. Army Armament RDE Center has introduced the first fully operational scanning tunneling microscope (STM) in the Army inventory and possibly within the Department of Defense.

Ruth Nicolaides, with the Precision Munitions Division, Fire Support Armaments Center, is responsible for performing failure analysis of integrated circuits, a task of microscopic proportions. Small is in style within the integrated circuit career field and circuits are destined to get smaller in the future.

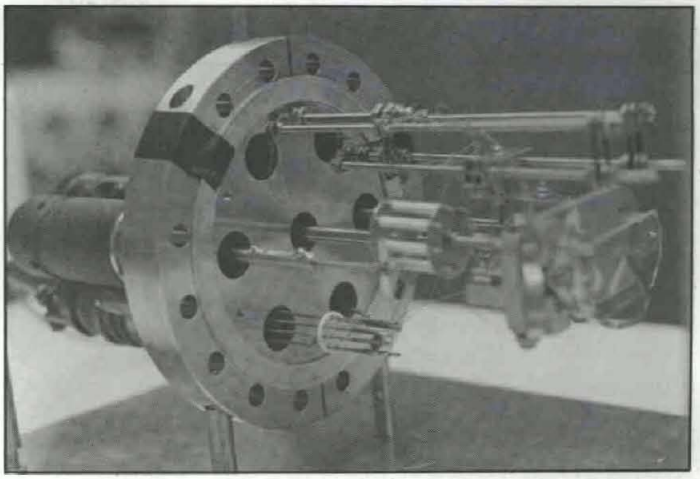
Problems in circuits are already often too small to be detected by the human eye or a light microscope that magnifies the surface features 1,000 times. That's not uncommon in the scientific community nor would it even be considered unique. Nicolaides has been using an electron microscope for many years which magnifies surface features 100,000 times, but that's not all. The West German native has developed and constructed an STM which gives her the capability of viewing surface features at magnifications to 100 million times.

You won't find her hunched over a microscope, at least not after the sample has been adjusted in the microscope field of view. The fine positioning and the data from the STM is translated to a computer screen for analysis via a system of sophisticated electronic circuitry. The technology for the STM was discovered by a team of IBM physicists, West German Gerd Binnig and Swiss Heinrich Rohrer, both of the IBM Research Laboratory, Zurich, Switzerland. The pair shared a 1986 Nobel Physics Prize for their 1981 invention.

The STM method of operation requires the microscope to scan the surface of an object at distances that make the scope and the surface to be examined seem to touch. They are not touching, but you couldn't know that because only a gap of about three atoms separate the two, that's about 10-billionths of an inch.



A computer's eye view is pictured here. The range on the X & Y axis is 500 angstroms full scale. Height is 50 angstroms full scale. This view is from the back (rotation b).



The Scanning Tunneling Microscope can resolve features smaller than a single atom.

"The surface scan," according to Nicolaides, "is like climbing up and down the Rocky Mountains." She's telling the truth here, a surface that seems smooth takes on the contours of the very atoms themselves and looks rocky.

The December 1986, *Research and Development Magazine* offered a comparison for non-scientists. "The scanning tunneling microscope works more like a record player than a conventional microscope. A (scanning) stylus, with a tip (perhaps) no wider than a single atom, is maintained at a constant distance from a sample's surface by the quantum mechanical effect of electron tunneling.

"Electrons (in a small electric field) disappear from the tip of the probe and reappear two atomic diameters away on the sample's surface. That tunneling creates a tiny electrical current, whose magnitude varies with the exact distance between the stylus and the surface. By (monitoring) the lifting and lowering of the stylus to maintain a constant current, scientists using the microscope can obtain an exact profile of the surface, replete with hills and valleys produced by individual atoms at the sample's surface."

For those who haven't got the complete picture yet, we're not dealing in optical images here, that wouldn't be possible. The average wavelength of visible light is about 2,000 times greater than the diameter of a typical atom, which is in turn about three angstrom units wide. One angstrom unit is one 10-billionth of a meter. The STM can resolve features that are only about 100th the size of an atom.

Nicolaides is not the only Army physicist that will be able to use the three dimensional pictures of sub-atomic surfaces. "It has applications," she says, "in surface physics, silicon, VHSIC and VLSI microelectronics, but for me the main thing is its use in semiconductor physics. It works well on most surface problems and in studies of surface phenomena."

Although she corresponded with Heinrich Rohrer, one of

the inventors, about construction of the STM, her design departed from the original. It had to integrate with the equipment she had, so it had to be adaptable. In cooperation with the Physics Department of Notre Dame University, particularly Professors John Dow and William Packard, she designed and built an STM to satisfy her requirements.

The STM is currently being operated in an open air environment, but when needed it can be put into a vacuum chamber. The STM is very sensitive to noise and vibration and the isolated environment offered by a vacuum is often necessary. Although it is smaller than the prototype developed by Binnig and Rohrer, Ruth's STM will need to get smaller in the future so that it may be used with a Scanning Electron Microscope.

She has already overcome the set-up time problem encountered by STM researchers. "In conversation with the foremost STM researchers, I learned that because of the delicate and precise nature of the STM it could take up to several hours just to set up the microscope and the surface to be examined. I can prepare everything in less than thirty minutes."

She also spoke to Binnig about future STM trends and applications in the field of gravitational waves and biotechnology. At the present time neither she nor Picatinny Arsenal have plans to build additional STMs. She has, however, received phone calls from other Army and DOD labs seeking her expertise.

Tobyhanna Supports TACJAM

Tobyhanna Army Depot employees have seen a large, tracked vehicle, bristling with antennae, travelling around the depot. Unlike other depot-supported communications-electronic systems, which normally use wheeled vehicles, this one is self-contained and integrated into a tracked vehicle.

"It's a high-tech system and it's on the cutting edge of technology," says David Galloway, director of supply, describing the AN/MLQ-34, a new depot project.

The system, also known as TACJAM, is a tactical jamming system that the depot is assembling, checking and packaging for shipment. Once deployed, it will prevent an enemy commander from telling his troops what to do.

"There are three statements of work connected with TACJAM," says Francis W. DeAngelo, configuration manager for the MLQ-34. "We have a marshaling statement which tasks us to put the components in the shelters and onto the vehicle, a statement of work to upgrade the test program sets and one to repair the circuit cards and line replacable units."

TACJAM is being fielded as part of the Army's modernization program. Many of the components were developed by private contractors, and sent here to be assembled, says Alexander E. Radkiewicz, a maintenance management specialist. "In a sense, we'll be presiding over the marriage of the various components," he says.

"This is a project that will involve several depot activities," says John G. Lesniak, deputy director of supply. Although Tobyhanna doesn't usually work with tracked vehicles, the testing will occur here because the depot is the prime maintenance site for the shelter and components, Lesniak says.

"We've upgraded the perimeter roads by adding gravel to handle the vehicle," says Galloway. "And they are now good for all-weather use. We also have a storage facility for the vehicles. We can handle some of the repairs, such as tread repair and basic maintenance," he says.

TACJAM will replace the AN/GLQ-3B, another system supported at Tobyhanna, which was mounted on a two-and-a-half ton truck. "The main thing with this particular program is that we're putting the equipment on a tracked vehicle, which has never been done at Tobyhanna. In theory, placing the system on such a vehicle will increase its mobility," DeAngelo says.

"This system represents the culmination of efforts begun in the early 1970s to provide the type of electronic warfare in intelligence equipment needed for the U.S. Army to execute the Airland battle," says COL William Campbell, program executive officer for intelligence and electronic warfare at the Communications-Electronics Command.

Davies Named AMC Engineer of the Year

Dr. John C. Davies, director, Directed Energy Directorate, White Sands Missile Range (WSMR), NM, has been named the U.S. Army Materiel Command Engineer of the Year for 1988. Chosen by a panel of AMC engineers, Davies competed with engineers from throughout the command for the AMC award. He has worked at WSMR for 30 years.

As AMC Engineer of the Year, Davies also competed with nominees from approximately 33 government agencies for the Federal Engineer of the Year Award sponsored by the National Society of Professional Engineers. He received his AMC award earlier this year during ceremonies in Crystal City, Arlington, VA.

U.S. Senator Pete V. Domenici, from New Mexico, invited Davies to his Capitol Hill office on the afternoon preceding the ceremony and congratulated him.

Davies' engineering achievements include work in the science, engineering, and management of high energy laser facilities and projects. His scientific and managerial expertise in the development of high energy laser technology has contributed significantly to the Defense Department's R&D effort.

Davies directorate is responsible for providing test support to all facility users, including DOD, industry and foreign governments. During the last three years, the facility has been used, among other things, to test the vulnerability of a Titan fuel booster and flying targets to laser energy.

Davies was instrumental in obtaining funds for a 50-foot diameter large vacuum chamber to be built at the WSMR facility, and the development of facilities to house the U.S. Air Force/SDIO excimer moderate-powered raman-shifted laser device which was installed in December 1987.

He received his bachelor's degree in electronic engineer-

Shown (left to right) are Harry Peters, technical director of TECOM; Dr. John C. Davies, 1988 AMC Engineer of the Year; Dr. Charles H. Samson, P.E., president, National Society of Professional Engineers.

ing from the University of Nebraska in 1955, his master's in electronic engineering from New Mexico State University (NMSU) in 1959, and his doctorate in industrial engineering from NMSU in 1973.

Besson Award Cites Acquisition Achievements

The Frank S. Besson Memorial Award for Procurement Excellence, sponsored by the American Defense Preparedness Association (ADPA), has been presented to three individuals in recognition of outstanding contributions to the Army's materiel acquisition process during the period Oct. 1, 1986 to Sept. 30, 1987. Named in honor of the U.S. Army Materiel Command's (AMC) first commanding general, the award was presented during special ceremonies at the Atlanta XIV Army/Industry Conference in Atlanta, GA.

Comprised of a plaque and a $500 check, the Besson Award recognizes one individual in each of three categories — civilian, military, and intern. The purpose is to cite individual achievements which materially improve acquisition planning, procurement policy, contracting lead time, competition, spare parts breakout, or procurement production management methods.

This year's awards were presented by AMC Commander GEN Louis C. Wagner and ADPA President LTG Lawrence F. Skibbie (USA Ret.). Recipients and their achievements are:

Ronald E. Boehme, chief of the Apache Program Management Office, AMCPEO, Combat Aviation, received the award for prior service as chief of the Procurement and Production Division, Advanced Attack Helicopter (AAH) Program Management Office. He was specifically cited for personally overseeing the definitization of the FY86 through FY88 production contract for the AAH. He also significantly reduced the acquisition lead time for the Apache's components and broadened the industrial base through increased competition.

CPT John H. Burchstead, was recognized for his accomplishments as a procurement management officer in Tobyhanna Army Depot's Directorate of Contracting. He was responsible for developing and establishing the depot's Competition Management Office and an advanced acquisition planning system. In addition, he was a key advisor on many diverse contracting procedures and greatly assisted his command in reducing acquisition lead times.

June M. Maginnis, a contract specialist in the Directorate of Procurement and Production, U.S. Army Troop Support Command, was cited for her achievements as an intern. She personally developed five separate production acquisition plans, all subsequently approved by the Department of the Army. She also played a key role in development and presentation of contracting officer's statements of fact for the General Accounting Office and a presentation on the Reverse Osmosis Water Purification Unit.

Shown (left to right) are GEN Louis C. Wagner Jr., Ronald E. Boehme, Mrs. Ronald E. Boehme, CPT John H. Burchstead, June M. Maginnis, and LTG Lawrence F. Skibbie (USA Ret.).

RD&A NEWS BRIEFS

Rigby Named AMC DCS for DE&A

BGP Joe Wiley Rigby, deputy director for Force Structure, Resource and Assessment, J-8, Organization of the Joint Chiefs of Staff, will succeed MG Lynn H. Stevens as deputy chief of staff for development, engineering, and acquisition, HQ, U.S. Army Materiel Command. Stevens has assumed new duties as commandant of the Defense Systems Management College.

A graduate of the U.S. Military Academy, Rigby has an M.B.A. degree in operations research and systems analysis from the University of Texas. He has also completed the National War College, the U.S. Army Command and General Staff College, and the Infantry School Basic and Advanced Courses.

From August 1986 to December 1986, Rigby served as director, Joint Analysis Directorate, Organization of the Joint Chiefs of Staff, following a tour as deputy director for materiel plans and programs, Office of the Deputy Chief of Staff for Research, Development and Acquisition, HQ, Department of the Army.

Other key assignments have included chief, Program Development Division, Programs, Analysis and Evaluation Directorate, Office of the Army Chief of Staff; commander, 2d Brigade, 2d Infantry Division, Eighth U.S. Army; and forces analyst, Manpower and Forces Program Analysis Division, Program Analysis and Evaluation Directorate, Office of the Army Chief of Staff.

CONFERENCES

Nondestructive Test Conference

The 37th Defense Conference on Nondestructive Testing (NDT) will be held Nov. 1-3, 1988 in Jacksonville FL. The host is the Naval Aviation Depot, Jacksonville FL. Camera ready abstracts of papers proposed for presentation at the conference may be sent to the host representative, John Lundeen, Commanding Officer, Naval Aviation Depot, ATTN Code 340, Naval Air Station, Jacksonville, FL 32212-0016.

The conference will provide a forum in which DOD agencies can disseminate practical information of NDT instrumentation and techniques. Additionally, it will provide potential solutions of nondestructive testing problems. Attendance is restricted to military and civilian employees of the U.S. Department of Defense and other U.S. Government agencies. The conference will be preceded by a one day seminar Oct. 31, 1988 consisting of a half-day forum on specifications and standards and a half-day forum on training and certification of personnel.

For additional information contact John Lundeen, AUTOVON 942-2165, Commercial (904) 772-4521 or S.O. McMillan, conference chairman, on AUTOVON 563-4517, Commercial (803) 743-4517.

Operations Research Symposium Announced

The 27th Annual U.S. Army Operations Research Symposium (AORS) will be held Oct. 12-13, 1988 at Fort Lee, VA. About 300 government and industrial leaders are expected to participate in the event.

The theme of this year's symposium is "Analysis in Support of Army Decisions." The symposium will foster communication and recognize the high quality work within the analytical community. Reports of new work and how it meets the needs of future analytical challenges will be presented to the conferees.

Attendance is limited to invited observers and participants. Papers will be solicited which address the theme of the symposium. Selected papers and presentations will be published in the proceedings.

The U.S. Army TRADOC Analysis Command, commanded by BG John D. Robinson, is responsible for overall planning and conduct of the symposium. For the 15th consecutive year, the U.S. Army Logistics Center, the U.S. Army Quartermaster Center and Fort Lee, and the U.S. Army Logistics Management Center will serve as co-hosts.

Symposium inquiries should be directed to Commander, U.S. Army TRADOC Analysis Command, ATTN: ATRC-FDA, Fort Leavenworth, KS 66027- 5210 or telephone Jody Shirley or Katie VanderStaay on AV 552-4011 or commercial (913) 684-4011.

CORRECTION

Due to a printing error on page 12 of the May-June 1988 issue of *Army RD&A Bulletin,* some text was transposed. The top of the middle column should have read: *woven into a unique configuration adapted to meet military requirements. We cannot and must not be satisfied with meeting only 70 percent of the soldiers' needs, but on the other hand, we must refrain from "gold plating" the system.* The third column should have begun with the first three lines from the second column and ended with the word exception.

ATTENTION AUTHORS

Do you have an article you would like to submit for publication in the Army RD&A Bulletin? If so, we would like to hear from you. We will consider all articles based on importance of the subject matter, factual content, timeliness, and relevance to the bulletin's mission. The following are general guidelines for submissions:

- Length. Articles should be about 1,500-1,800 words (8 double-spaced typed pages). Shorter or longer articles are acceptable, depending on what is required to adequately tell the story.
- 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 Information. Include a short biographical sketch of the author.
- Clearance. All articles must receive appropriate clearances and be approved for open publication. This may require reviews by the author's security/OPSEC and public affairs offices. A cover letter stating that these clearances have been performed must accompany the article.

Articles should be sent on 5-1/4-inch floppy disk in ASCII format. Articles should also be sent in regular mail. OPSEC clearances and photographs must be sent by regular mail even if articles are sent on floppy disks.

Letters. If you have a comment or view about an article we have published in a recent issue of Army RD&A Bulletin, feel free to submit letters to the editor explaining your views on the subject.

Mailing Address: HQ, AMC, Army RD&A Bulletin (ATTN: AMCDE-XM), 5001 Eisenhower Avenue, Alexandria, VA 22333-0001.

Telephone: Autovon 284-8977 or Commercial (202)274-8977.

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