# ARMY RESEARCH AND DEVELOPMENT

March-April 1977

## Walter Reed Army Institute of Research Builds Solid Base of International Fame

Feature Article, page 16

# SPEAKING ON . . .

## Evaluation of Soviets' Over-all Threat: Analysis of Potential Factors

Edward A. Miller

*Assistant Secretary of the Army (R&D) Edward A. Miller and Army Chief of Staff for Research, Development, and Acquisition LTG Howard H. Cooksey used an innovative approach in their FY 1978 budget proposal to the Committee on Armed Services, U.S. House of Representatives. They preceded their request with a presentation on Soviet philosophy, tactical concepts, characteristics and training of the Russian soldier, and the possibility of an intensive all-out surprise attack to gain victory in a short war, as follows:*

LTG Howard H. Cooksey

*...Every American spends about ten dollars a year on Army R&D, and will be paying a considerable amount more* to procure the weapons now under development. It is entirely appropriate, therefore, that every dollar spent should be subjected to close scrutiny and detailed questioning. The need for these programs, as well as our management of them, should be subject to periodic and intensive review.

There are, and will continue to be for the foreseeable future, two superpowers on this planet. Either can, and has in the past, achieved victories and sustained setbacks in various proxy confrontations around the globe, without radically altering the basic power equations that have existed for several decades.

Those equations will be upset, however, and changed irreversibly, by a confrontation—even a conventional one—between NATO and the Warsaw Pact in Europe. The forfeiture of a single inch of West European soil would instantly signal the acceptance by the United States of second-class power status, with the implications that acceptance would entail for this nation and the rest of the world.

It is not our function to predict whether such a confrontation is imminent or even likely, but it *is* our responsibility to insure a favorable outcome should one occur. Today we propose to inform the committee how the systems we are developing will help us do so.

An Oriental philosopher wrote over 2,500 years ago: "If you know the enemy and know yourself, you need not fear the result of a hundred battles." We propose, therefore, to provide the committee with some observations on the strengths and weaknesses of our adversary—both cerebral and mechanical. Some aspects of Soviet thinking and force structure are encouraging; others are sources of deep concern.

There are two echelons of the Soviet psyche that must be understood if we are to deal with them effectively. The first, and most important on a strategic or theater level, is the senior leadership; the second is the mind of the individual soldier and junior officer.

Many of the top level officers in the Soviet Armed Forces are veterans of "The Great Patriotic War," in which they saw almost constant combat of the most sustained and violent variety. However, with the exception of a few minor border clashes with the Chinese and the crushing of Hungarian, Polish, and East German insurrections, they have had no combat experience in three decades.

Many Soviet officers have expressed envy at the amount of combat experience the conflicts in Korea, the Dominican Republic and Vietnam have provided the American Army. An entire generation of career Soviet officers and NCOs is now retiring after 30 years of training, with only a few citations for "heroism" in disposing of old ordnance and minefields left behind by the Germans in World War II.

The Soviets learn their lessons well, but in many cases too well, and they may find themselves doomed to repeat history by paying too much attention to it. Virtually every major characteristic of the Soviet ground force structure and every attendant tactic is a result of a lesson learned (usually at great cost) during World War II. While (they are) diligent students of other nations' conflicts, and avid military scientists, the Soviets almost inevitably revert to the lessons of that war when the big decisions in armament and tactics are made.

We do not, of course, bank too heavily on the Soviets adhering to rigid behavior patterns; that can leave us vulnerable to surprise. However, we naturally design many of our weapons with an eye toward countering "heavy" aspects of their force structure, and the tactics that the structure seem to necessitate.

THE LIKELIHOOD OF SURPRISE, for example, looms larger and larger when European war scenarios are discussed. The opinion of the western intelligence community has lately been shifting inexorably toward the conclusion that there may very well be little warning time before a Warsaw Pact attack on Western Europe.

Pact strength and readiness in the border areas is such that it would be relatively easy to "roll off" a large scale "training" maneuver and head for the Rhine. Warning time for the West, if any, might well be measured in hours rather than days.

The Danes, several weeks ago, reported a Warsaw Pact exercise which illustrates the menace of the "roll off" option of attack on the west. Flights of up to 40 Pact bombers routinely streak toward Southern Denmark and veer off abruptly just before reaching the border. In case of an actual attack, they could merely continue on their course and be striking targets within minutes, giving the defenders virtually no time to react.

REQUIREMENT: WEAPONS MUST BE ABLE TO REACT RAPIDLY. We shall discuss our Patriot missile system later, but the situation described is precisely the threat it is designed to handle i.e., large numbers of ECM (electronic countermeasure) protected high-performance aircraft striking with little or no warning. Hawk or Nike Hercules would take a toll of the attackers before becoming saturated; Patriot might well clear the sky of all of them.

Soviet attitudes toward the employment of surprise are somewhat contradictory, and its value in warfare has been a subject of heated debate for decades. Employing the somewhat labyrinthine logic characteristic of them, they denied the critical importance of surprise because it was they who had been surprised by the Germans in June of 1941.

A decade after the war, however, a debate suddenly erupted in the military journals, and surprise suddenly was elevated in importance. Discussion of it presents something of a problem for the Soviets, because surprise implies aggression. Since the Soviet posture is that of a peaceful defense force standing between "militarist" NATO and the Russian motherland, it becomes difficult to discuss the desirability of blitzkrieg assaults in the open press without running into credibility problems. They do slip occasionally, however.

DEMONSTRATED ABILITY FOR SURPRISE ASSAULT. In 1955 Marshall of Tank Troops Rotmistrov, after reiterating the purely defensive mission of his troops, did mention the possibility of administering "...pre-emptive surprise blows of terrible crushing power" to the enemy. More importantly, the Soviets have demonstrated, on more than one occasion, their capacity for large-scale, tactically sophisticated surprise combined arms assaults—in Hungary (1956) and Czechoslovakia (1968).

The latter invasion was particularly disconcerting to NATO because of the rapidity and security which accompanied it. Although the Soviets had been preparing for several months, it was not until after T-62s were rolling through Prague that we knew the dimensions of the intervention.

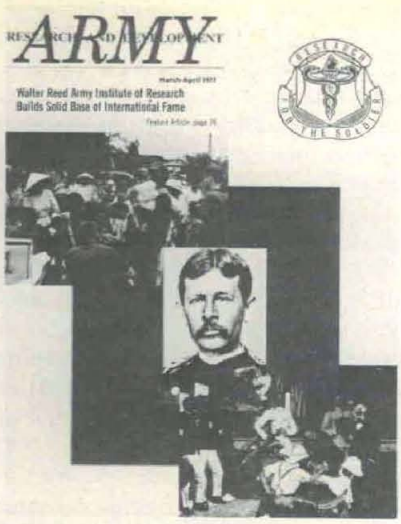
If further evidence of the feasibility of mass surprise assault is needed, one need only look to the Yom Kippur War of 1973 where an Arab army, maneuvering along one of the tensest and most volatile borders in the world, was able to achieve total surprise over a significantly more sophisticated foe with a renowned intelligence gathering capacity. The concept of the plan may well have originated in Moscow.

An attack on Western Europe may not be a surprise. A classic World War I type mobilization *may* well take place. We *may* have several days, or even months to prepare ourselves for attack. However, if we do not take into account the possibility of a precipitate, powerful, combined arms blitzkrieg against Western Europe, we risk losing everything. Reacting to such an attack requires weapons with distinct characteristics.

REQUIREMENT: FIGHT NIGHT OR DAY IN WEATHER FAIR OR FOUL. The possibility that a surprise attack would occur under cover of darkness, adverse weather, or both, appears strong. Over 40 percent of Warsaw Pact exercises are conducted at night, and, as the Ardennes offensive of World War II proved, bad weather can cloak the movement of surprisingly large forces.

The war in the Middle East saw large tank battles fought in pitch dark-

(Continued on page 21)




# ARMY RESEARCH AND DEVELOPMENT

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## ABOUT THE COVER:

*Memorializing the U.S. Army physician, scientist and teacher whose research resulted in successful immunization against the scourge of yellow fever in Cuba, Walter Reed Army Institute of Research is world renowned for its work to alleviate suffering in many lands where deadly diseases prevail. The upper picture shows immunization work in the Vietnam conflict. Below is an artist's concept of the yellow fever prevention in Cuba. Back cover shows some of the foreign facilities used by WRAIR medical teams - upper left in Malaysia; upper right, Bangkok, Thailand; center left and right, in Brasilia, capital of Brazil; center, use of U.S. Army-developed jet injector in Vietnam; lower left, Belem in Amazon Basin; right, in Kenya.*

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*Purpose:* To improve informal communication among all segments of the Army scientific community and other Government R&D agencies; to further understanding of Army R&D progress, problem areas and program planning; to stimulate more closely integrated and coordinated effort among Army R&D activities; to express views of leaders, as pertinent to their responsibilities, and to keep personnel informed on matters germane to their welfare and pride of service.

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# Selective Scanner

## Army Accepts M198 Howitzer After Field Use Tests


Designed to provide an increased rate of fire with much greater range than the M114A1 it will replace, the M198, 155mm towed howitzer was accepted recently for field use and is expected to be available for troop use "within a couple of years."

During service testing, the M198 demonstrated it has a 100 percent increase in range and is 85 percent more effective than the M114A1, one of the oldest howitzers in the Army inventory. Life-cycle cost is estimated at only 15 percent more.

Enhancing the range of about 30 kilometers (nearly 19 miles) is the capability of the weapon to change direction of fire rapidly. A hydraulically operated lift enables a full 360 degrees traverse in "minimal time."

Night-firing accuracy is increased greatly through self-illuminated sight optics that eliminate the need for batteries, wiring and other vulnerable components of fire control instruments currently in service. Normally, two men adjust the weapon for direction and range, but one man can accomplish both functions when necessary.

The designed weight of 14,600 pounds permits the M198 to be airlifted by Army or Air Force helicopters, an advantage over a similar howitzer being developed trilaterally by the United Kingdom, Germany and Italy.

## HDL Unveils Hand-Cranked Energy Generator

Believed the first device of its kind capable of producing 200 watts of electrical energy at 30 volts dc, a hand-cranked emergency power source developed by the U.S. Army Harry Diamond Laboratories was announced Apr. 26.

Weighing approximately 11 pounds, the device achieves its high-output levels by use of an alternator consisting of a multipole samarium magnet and a 3-phase multi-pole stator.

Optimum cranking speed is between 60-80 rpm, and the unit can be operated by one man for short periods or by a 2-man team in tandem. A harmonic drive increases the input rotational speed about 80 times, permitting the alternator rotor to turn at about 5,000 to 6,000 rpm.

Initially developed as a power source for radio communications at the request of the U.S. Army Institute for Military Assistance, the unit is also compatible with other electronic equipment and may be used to charge a battery pack.

## BRL's Dr. Freedman Gets ASTM Dudley Award

Development of a screening program for testing potential explosive hazards of new organic compounds has earned Dr. Eli Freedman the Charles B. Dudley Award from the American Society for Testing and Materials (ASTM).

He is a research chemist in the Propulsion Division of the U.S. Army Ballistic Research Laboratory, Aberdeen Proving Ground, MD.

Assisted by two award corecipients, Dr. Freedman developed the ASTM CHETAH Evaluation Program, expected to aid in analysis of numerous compounds having potential commercial applications.

The magnitude of new organic compounds precludes even rudimentary laboratory testing to isolate those having potential reactivity. The CHETAH program requires a minimal amount of data input to establish quickly and reliably compounds that are hazardous.

Assigned to BRL since 1960, Dr. Freedman received a BS degree (high honors) in chemistry from Carnegie Institute of Technology in 1947 and a PhD in 1952 from Cornell University.

His major area of expertise involves research on chemical mechanisms of sound absorption in liquids; chemical reactions in shock waves; reactions in microwave-induced discharges; and explosion limits of fuels in air.

Dr. Freedman is an affiliate member of the ASTM Committee E-27 on Hazard Potential of Chemicals, the American Chemical Society, American Physical Society, and the American Association for the Advancement of Science.

## DACOWITS Meet Examines 'Changing Roles of Women'

"Changing Roles of Women in the Armed Forces" was the theme of the semi-annual meeting of the Defense Advisory Committee on Women in the Services (DACOWITS), April 17-20, in Washington, DC.

Highlights included a keynote address by Army Chief of Staff GEN Bernard W. Rogers and a visit to Walter Reed Army Medical Center to gain first-hand knowledge of work performed by Army medics.

Sponsored by the Department of the Army, the DACOWITS gathering placed strong emphasis on finding ways to improve utilization of women in the Services and dealing with their problems.

Three new members appointed to DACOWITS are Mrs. Sally Keadle Richardson, executive assistant to the Governor of West Virginia; Dr. Mildred W. Glover, representative, Georgia Legislature and associate professor, Atlanta University; and Mrs. Polly Baca Barragan, representative, Colorado House of State Representatives.

DACOWITS is composed of 25 prominent civilian women from business, the professions and civic associations. Members are appointed by the Secretary of Defense for 3-year terms to serve in an advisory capacity not representing any specific group with which they may be affiliated.

## Army Studies Regional Food Preparation Centers

Regional food preparation centers for the U.S. Army, a concept of centralization of processing facilities similar to that used by airlines for in-flight meals, is being examined in tests scheduled for completion by early 1978.

Under the plan being studied, 24 food processing centers would serve all Army mess halls. Currently, the Army operates about 1,400 dining facilities that serve 241 million meals annually at a cost of $428 million.

Food prepared in regional centers would merely be reheated and served after arrival at mess hall destinations. Establishment of centralized dishwashing operations also is envisioned. If the plan is adopted, the first regional center could be operational by 1983.

A General Accounting Office report to the Department

of Defense indicated that the plan would undoubtedly save money. However, projected expenditures of $200 million over several years to modernize existing mess halls are in conflict with the regional plan.

Concurrently with the centralized test program, the Army will continue to build or modernize an additional 429 dining facilities with their own cooking equipment.

## Calibration Set May Aid CE Equipment Accuracy

Problems of maintaining accuracy of nearly 20,000 items of U.S. Army Communications Command test measurement and diagnostic equipment, used for its global network of communications facilities, are expected to be eased by a prototype calibration set.

Scheduled for testing by the Communications Command and the U.S. Army Materiel Development and Readiness Command (DARCOM), beginning in March, the prototype AN/GSM-259 is a modification of the GSM-256 that is expected to virtually double its capabilities.

Changes include addition of microwave calibration equipment, substitution of more accurate or wider range standards and deletion of some items now considered unnecessary. The new unit is designed to service about 96 percent of ACC's communications/electronics equipment—dispersed at about 1,400 sites worldwide.

Plans provide for production of 22 AN/GSM-259 units, costing between $175,000 and $195,000 each, and deployment by FY 1979 at sites in Europe, Korea, Taiwan and Okinawa.

## Army Calls for Cost-Cutting Management Ideas

Do you pride yourself on being creative, innovative, a managerial "good idea" type? Do you have a suggestion that might improve operating efficiency, manpower utilization or cost savings at your activity or installation? If so you have talents the Army wants to use during its Calendar Year 1977 management improvement program.

Army Chief of Staff GEN Bernard W. Rogers has called on commanders of all major Army commands and heads of staff agencies to encourage civilian and military personnel participation in "Project 77/77."

Project 77/77 was initiated to save $77 million in 1977 by putting improvement ideas to work for better use of manpower, money and military materiel. The emphasis is on RAM (reliability, availability and maintainability of weapon systems and equipment); also, increasing return-on-investment (ROI) in the materiel acquisition process.

Major commands and local activities have been directed to set their own campaign objectives for not less than 90 days. Commanders are encouraged to identify areas of effort in which management seeks improvement suggestions; also, to develop/provide special recognition for personnel whose suggestions result in first-year savings of $25,000 or more. Local commanders should provide recognition for first-year savings of $5,000 to $25,000.

Suggestions resulting in savings of $50,000 or more that have received local recognition will be forwarded to HQ DA (DAPE-CPL), Washington, DC 20310, for recognition.

## LTG Morris Recommends Canal Project Termination

Termination of all activities leading to completion of the 107-mile-long Cross-Florida Barge Canal Project has been recommended to the Secretary of the Army by Chief of the Army Corps of Engineers LTG J. W. Morris.

More than $70 million has been spent to complete about one-third of the project, including 25 miles of channel, three of five locks, three dams and four relocated highway bridges in north central Florida.

Canal construction began in 1964 but was halted by Presidential order in 1971 until further study could be made. Congressional action initiated restudy of the project in 1972.

LTG Morris recently recommended a supplemental study to determine the best disposition of existing canals and lands. This study would be in participation with the U.S. Departments of Interior, Agriculture, Environmental Protection Agency and the State of Florida.

Completion of the canal was opposed by the governor and Florida State cabinet. Economic justification for the canal is termed marginal when considered against potential adverse environmental impacts.

## Infrared Device Aids USAF Heat Loss Survey

Sophisticated infrared scanning equipment, developed by the Army to detect camouflaged vehicles and equipment in Vietnam, was used in a special Army-Air Force program designed to conserve energy.

Mounted in an OV1-D Mohawk reconnaisance plane, the AAS-24 Infrared Lined Scanner was used by CPT Don S. Callicott, pilot, and SP5 Dennis R. Deines, technical observer, to identify heat losses of facilities and buildings at 12 Air Force bases in the Continental United States.

At an altitude of 1,000 feet, the heat-sensitive infrared scanner (using 5-inch film) recorded radiation escaping from buildings, sewage lines and steam pipes. About 60 flight hours were required to complete the scanning, at a cost of $1,250 per base.

Information gained by the scanner was evaluated by image interpreters and reported to Air Force officials. Ground crews then went out to make necessary corrections at specific locations. The Air Force requested the tests after significant results were obtained last year in surveys of 65 Army installations.

## DoD Establishes New Military Airlift Command

Establishment of the Military Airlift Command (MAC), headquartered at Scott Air Force Base, Belleville, IL, as a command reporting specifically to the President through the Secretary of Defense, was announced recently.

Military airlift services will be provided by MAC during wartime situations, periods of crisis, during Joint Chiefs of Staff exercises, and as necessary to insure operational support to other unified and specified commands.

MAC Commander GEN Paul K. Carlton, USAF, will operate in the normal chain of command under the National Command Authorities while the USAF retains service responsibility for administrative and logistic support.

## B-1 Bomber Flight Tests SRAM Safety System

In preparation for weapons platform capability tests scheduled in June, a U.S. Air Force B-1 bomber made its first flight carrying an unarmed Short-Range Attack Missile (SRAM) above White Sands (NM) in a recent mission that originated and ended at Edwards Air Force Base, CA.

Except for its payload, the SRAM was comparable to an operational missile. The purpose was to check out the telemetry link between the SRAM's safety system and the White Sands Missile Range safety monitoring equipment.

Flight characteristics of the B-1 bomber already have been demonstrated successfully, as have various test drops of dummy SRAMs and gravity weapons.

# Ballistic Research Laboratory Achievements Earn Top Army 1976 Award

Technology breakthrough achievements in warhead concepts for the defeat of "newer and tougher threats," along with advances in ballistic protection, are credited to the Ballistic Research Laboratory (BRL), selected as the 1976 U.S. Army Laboratory of the Year.

Assistant Secretary of the Army (R&D) Edward A. Miller announced that the BRL won the award initiated in 1974 by his predecessor, Norman R. Augustine. In May 1975 Augustine moved up to Under Secretary of the Army, serving in that position until he resigned in January 1977.

Other nominations for the 1976 award recognized achievements of the Institute of Surgical Research at Brooke Army Medical Center, Fort Sam Houston, TX, and the Engineer Topographic Laboratories (ETL), Fort Belvoir, VA.

The ETL, however, was selected as the *Most Improved Laboratory of the Year,* a Special Award category. Other nominees for this honor were the Bioengineering Research and Development Laboratory, located at Fort Detrick, MD, as a part of the Medical R&D Command, and the Target Acquisition Laboratory, Electronics Command, Fort Monmouth, NJ.

*Awards for Excellence* will be presented to: Engineer Topographic Laboratories; Institute of Surgical Research; Medical Bioengineering R&D Laboratory; Ballistic Research Laboratory; Night Vision Laboratory, a Fort Belvoir element of the Electronics Command; Missile R&D Command Laboratories, Redstone Arsenal, AL; Human Engineering Laboratory, Aberdeen (MD) Proving Ground; and Combat Surveillance and Target Acquisition Laboratory.

Nominations for the awards were considered by a distinguished panel of judges under the chairmanship of Dr. Richard A. Montgomery, former vice chairman of the Army Scientific Advisory Panel (ASAP) and now with R&D Associates, Santa Monica, CA, as associate director of corporate development.

Other panel mambers were Dr. Herbert Ley, former commissioner, U.S. Food and Drug Administration, and currently an ASAP member; Deputy Director (Research and Technology) Dr. John L. Allen, Office of the Director of Defense Research and Engineering; Deputy Director Dr. Donald Looft, Defense Advanced Research Projects Agency; Deputy for Advanced Technology Dr. Walter Beam, Office of the Assistant Secretary of the Air Force (R&D); and Director of Navy Laboratories Dr. James Probus.

In selecting the BRL for the most prestigious award presented to an Army in-house laboratory (contact laboratories are not eligible), the judges noted achievements expected to have immediate and long-term results for the improvement of survivability and effectiveness of U.S. combat forces.

Other noteworthy accomplishments which helped BRL to win the award included: R&D of less vulnerable propellants and fuels; provision of critical vulnerability data, and data reduction techniques for major materiel systems such as the XM-1 tank, attack helicopter, and mechanized infantry combat vehicle.

Considered also were BRL's successful demonstration of the feasibility of an electro-optical system for measuring the in-bore balloting motion of projectiles; and "considerable progress" made in understanding the mechanism of gun barrel erosion.

THE SPECIAL AWARD citation of the Engineer Topographic Laboratories as the "most improved" among Army in-house laboratories during 1976 notes, in part: "...achievement of significant milestones in major programs to provide the Army and the Defense Mapping Agency with greatly improved capabilities for tactical and strategic mapping, precision location of weapons and targets, and analyzing the impact of terrain on military operations. . . ."

Mentioned also are ETL's establishment of "major new computer capabilities for handling and analyzing digital imagery . . . (also) responding rapidly and effectively to Army and Defense needs for terrain analysis products."

*(For a comprehensive review of ETL's capabilities, ongoing R&D programs, and outstanding achievements, the feature article in the January-February 1976 edition of the Army R&D Newsmagazine is suggested.)*

## Slammer VI Shows Lethal Saturation Capabilities

Evaluation testing of Slammer VI, the ground-based version of what was formerly the airborne 2.75-inch rocket, is demonstrating that it can rapidly saturate an area the size of several football fields with lethal fragments - as many as 114 rockets in less than 10 seconds.

Project Manager COL James L. Tow reports that testing to date has "gone very well," using a wheeled launcher mounting six standard helicopter M-200 rocket pods, each carrying 19 rockets.

Although mobile, multiple rocket systems are used by the armies of other nations, Slammer VI offers the first capability of its kind that will be available to the United States Army.

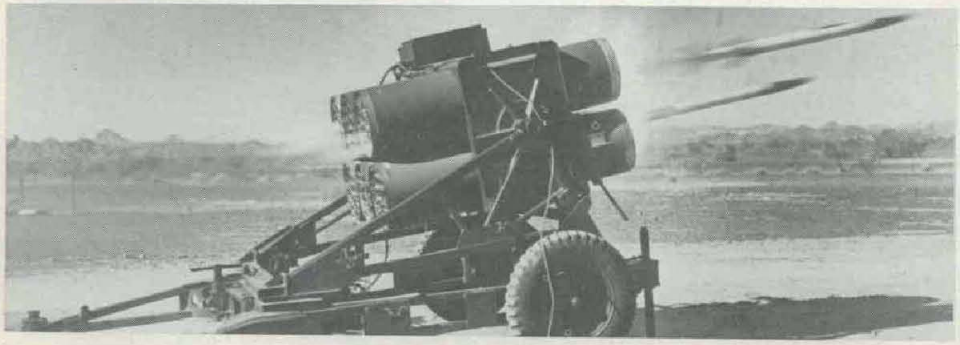
The launcher under test was developed originally to fire chemical rockets. Anniston Army Depot modified the 2-wheeled towed carriage to take the M-200 rockets, and the vehicle was soon in service at the Missile R&D Command's Redstone, AL, range. Later it was demonstrated in a large-scale operation at Fort Bragg, NC.

Senior Army leaders, impressed by the demonstration, gave the go-ahead for construction of five additional launchers used for safety and operational tests by the Army Test and Evaluation Command (TECOM) at Yuma Proving Ground, AZ, and in March at Fort Sill, OK, home of the Artillery School.

An advantage of the Slammer VI system is that it could be fielded on short notice at low cost since it uses readily available components. The rocket and the M-200 launcher are in Army stocks, as are many of the M-91 chemical launchers.

Use of the 2.75-inch rocket enables Slammer VI to accommodate all the varied warheads now operational with that system; also, warheads under development including smoke, multipurpose submunitions and illumination.

COL Tow's development team of MAJ Norm Patten, Bob Brock, Jack Still and Mel Bartlett foresee a system that would require about five soldiers to operate. Missions could include destruction of area personnel and materiel targets, suppression of air defense, artillery, antitank weapons and mortars.



Slammer VI

## MERADCOM Expands Tech Support With EPA Noise Control Office

Cooperation with the Environmental Protection Agency Office of Noise Abatement and Control is one of the least publicized activities of the U.S. Army Mobility Equipment Research and Development Command, Fort Belvoir, VA.

The scope of this support was expanded by an addition to an agreement reached initially in December 1975 between the EPA and MERADCOM.

That arrangement provided for technical support to the EPA in development of noise regulations for construction equipment, tracked and wheeled type bulldozers, and earth loaders. Additions are rock drills, pavement breakers and motorcycles.

MERADCOM areas of expertise in noise abatement include acoustic analysis, test procedures development, selection of materials, vibration isolation, and quiet equipment design. The agreement helps ONAC to accomplish its mission without resorting to other in-house laboratory or contractor support.

Using off-the-shelf instrumentation procurred from commercial suppliers, MERADCOM noise control researchers have participated in recent years in development of Society of Automotive Engineers (SAE) standards for measurement of noise of various types of equipment.

Data have been acquired for use in comparative testing, analysis of the impact of changing acoustical test methods, and determining the feasibility of various levels of noise control of equipment.

Project engineer Jerome Hoescher heads the MERADCOM effort with a variable staff of assistants ranging from five to eight.

# JLCs Charter New Fuze Management Organization

U.S. Joint Logistics Commanders (JLC) chartered a new Fuze Management Organization (FMO), consisting of a Fuze Management Board (FMB) and a Joint Fuze Task Group (JFTG), in December 1976.

The FMO mission is to maximize coordination of the Army, Navy and Air Force fuze research, development and engineering programs, including product improvement, for nonnuclear ordnance and munitions.

Empowered to decide for JLC on fuze development matters, the FMB members are: MG Harry A. Griffith, chairman, U.S. Army Materiel Development and Readiness Command (DARCOM) and director of Development and Engineering; Norman L. Klein, assistant deputy for Science and Technology, DARCOM; RAdm C. P. Ekas Jr., deputy chief, Naval Material (Development), Naval Material Command; RAdm H. D. Arnold, director, Tactical Air, Surface and Electronic Division, Office of the Director of Research, Development and Testing, Office of the Chief of Naval Operations; MG Robert C. Mathis, deputy chief of staff for Systems, AF Systems Command; and MG Gerald K. Hendricks, DCS for Science and Technology, AFSC.

The JFTG is an intensive management Tri-Service action arm of the FMB and consists of a chairman, a technical assistant, Army, Navy, and Air Force principal members, a program analyst and secretary.

The JFTG strives to identify and clarify management and technical issues, and attain Tri-Service accord. Problems which cannot be resolved at the JFTG level are referred to the FMB for decision. The JFTG will develop procedures and techniques.

The JFTG will then effect an orderly transfer of its responsibilities and methods of operation to the Joint Technical Coordinating Group (Munitions Development) Working Party for Fuzes. The FMB will continue to provide a decision and approval mechanism for DoD fuze development management.

JFTG duties include the formulation of a coordinated annual Joint Service Fuze Plan (JSFP), program monitoring, recommendations, studies and analyses - with a view toward eliminating unwarranted duplication of effort, and proliferation of fuzes in the stockpile. Potential benefits include inter-service commonality of fuzes and economy in production.

The FMO charter assigns initial lead Service responsibility to the U.S. Army, including chairmanship of the FMB and JFTG. The responsibility will rotate among the Services.

JFTG address is: Chairman, Joint Fuze Task Group, ATTN: DRCDE-JFTG, 2800 Powder Mill Road, Adelphi, MD 20783. The phone numbers are: Autovon, 290-2812; Commercial, 202-394-2812; FTS, 394-2812.

# M110 Product Improvement Expected to Save Millions

Materiel readiness objectives of Project Hand-Off - involving a warranty that starts after the receiving unit is satisfied each weapon system unit or item of major combat equipment is modified correctly - are expected to save millions of dollars on product improvement of the M110 howitzer.

Upgrading the present artillery system, instead of developing a new weapon system that could cost about $700,000 a unit, is being accomplished with modifications having a unit cost of less than $80,000. That is the report from the project manager's office at HQ U.S. Army Armament Materiel Readiness Command, Rock Island, IL.

Conversion of the M110 and M107 to the M110A1 is accomplished by the installation of the M201 cannon and the M139 direct-fire telescope. The M201 cannon tube is the first to be completely chrome-plated from chamber to muzzle for increased wear life. An autofrettage process increases strength and durability.

The 3d Battalion, 6th Field Artillery, 1st Infantry Division, Fort Riley, KS, was the first unit to be equipped with the M110A1 8-inch howitzer. Company B, 701st Maintenance Battalion, completed conversion of 12 weapons 32 hours ahead of book time.

The units were operational a few hours after conversion since firing aids and technical manuals were delivered with the conversion kits. Under Project Hand-Off, a team of experts was present to oversee modifications and handle unforeseen problems. This close working relationship between the project manager's office and the user is planned for the system's lifetime.

Chassis that were depot-modified to improve RAM (reliability, availability and maintainability) characteristics arrived coincidentally with the conversion kits. Modifications will be placed later on all M110A1 and M578 chassis.

Scheduled also is the addition of a muzzle brake designed to give the weapon a significant increase in range capability - a change that will redesignate the M110A1 as the M110A2.

When the muzzle brake and the XM650 8-inch rocket-assisted projectile are fully developed, the M107 175mm guns, which have the same chassis as the M110, will be converted to the new 8-inch howitzer.

# New Weapon Station Adds Protection for TOW Gunner

Protection of the TOW antitank system gunner, who has had to stand exposed to enemy fire while directing the tube-launched, optically tracked, wire-guided missile to its target, is provided by a new weapon station in an Improved TOW Vehicle (ITV).

The first 10 ITVs are scheduled for delivery this year under a $7-million low-rate initial production contract awarded last December to the Emerson Electric Co., St. Louis, MO. The modified M113A1 armored personnel carrier carries a large pod containing two TOW launchers, a day sight, a night sight and a target-acquisition sight.

The pod is lifted by hand-operated power controls, permitting the gunner to raise, lower or rotate the cupola a full 360 degrees. Lenses and prisms enable him to look into the TOW sights while protected within the ITV - in much the same way as a submarine periscope commands a surface view while the vessel is submerged.

When the pod is raised about four feet above the ITV deck, the gunner looks into the TOW sights, fixes the cross hairs on target, launches the missile and guides it to the target. The pod rests on the rear of the deck when TOW launchers are not in service.

The ITV is an improvement over the current system which provides protection for the gunner by placing the TOW on a pedestal.

The pedestal, as currently used, is raised through the APC cargo hatch and the gunner is exposed from the waist up while firing the missile. Initially, when TOW was fielded in the late 1960s, the gunner fired the launcher from a ground mount while exposed to counter fire.

The ITV contract requires delivery of 10 vehicles to the project manager by August for initial testing at White Sands (NM) Missile Range and at Fort Hood, TX. Provided test results are satisfactory, the Army will decide by December whether or not to exercise a production option for 550 additional ITV for introduction to troops beginning late in 1978.

Both the Improved TOW Vehicle and the TOW Cover Artillery Protection (TOW CAP) are being developed to meet an urgent need for protection of the gunner.

The ITV is the longer-range solution to the problem and TOW CAP is the intermediate response. Developed by the Natick Research and Development Command, MA, with assistance from the Human Engineering Laboratory, Aberdeen (MD) Proving Ground, TOW CAP is in production and is scheduled to go into service in the U.S. Army Europe this year.

Requirements for TOW CAP kits, however, have been reduced significantly by the rapid progress in the ITV program. TOW CAP is a nylon fabric ballistic blanket draped over a frame that can be mounted in the M1131A vehicle or used during ground firing.

**Improved TOW Vehicle**

# Satellite Communications Agency Orders 12 More Earth Stations

Exercising an option stipulated in previous purchase of 19 transportable earth stations, the U.S. Army Satellite Communications Agency recently ordered 12 additional systems under an $8.2 million contract.

Providing for a commitment to date of more than $37 million, the super-high frequency terminals contract initially ordered six installations for the U.S. Air Force. RCA Government Communications System, Camden, NJ, will provide 12 of the additional terminals in two configurations to meet Army requirements - seven AN/TSC-93 and five will be AN/TSC-85(V)2q units.

The AN/TSC-93 is a point-to-point terminal with 24 voice channels while the AN/TSC-85(V)2q is a multichannel system capable of simultaneously transmitting and receiving from six to 96 voice channels.

Headquartered at Fort Monmouth, NJ, SATCOM is the focal point for U.S. military satellite communications (SC), the Army's project management organization for SC, and the Army's agent for all international military SC programs.

# DARCOM Realignment Climaxes With ERADCOM, CORADCOM, CERCOM Decision

Decisions directing realignment of major commands within the U.S. Army Materiel Development and Readiness Command, renamed from the Army Materiel Command in February 1975, climaxed with recent formation of three commands.

Prolonged controversy, involving options for reorganization of the staffs and the functions of the U.S. Army Electronics Command, Harry Diamond Laboratories, and portions of Army Security Agency, now INSCOM, ended late in March with Secretary of the Army Clifford L. Alexander Jr.'s announcement of his decision.

DARCOM will have 15 major subordinate commands as a result. MG Charles D. Daniel Jr., special assistant to the DARCOM commander for almost two years, has moved to the former Harry Diamond Laboratories' complex at Adelphi, MD, to take command of the Electronics Research and Development Command (ERADCOM), Provisional.

What was formerly the U.S. Army Electronics Command, since the 1962 Armywide reorganization of five of the seven Technical Services into the Army Materiel Command, will be split between ERADCOM, the Communications R&D Command (CORADCOM) and the new Communications and Electronics Materiel Readiness Command (CERCOM).

CORADCOM headquarters will be at Fort Monmouth, NJ, where ECOM HQ has operated since 1962, as will the headquarters of the new Communications and Electronics Materiel Readiness Command (CERCOM). Selection of leaders of these commands had not been announced at press time.

Implementation of the over-all reorganization of the three commands is phased over a 3-year period. Secretary Alexander's press conference announcement said realignment will affect 1,009 civilian jobs, with 433 to be eliminated and 576 transferred. Involved also are 22 military jobs.

Projected benefits of the total realignment include reduction of annual operating costs by $6.5 million. One-time costs of the change are estimated at $14.7 million - $13 million for ERADCOM and about $1.7 million for CORADCOM and CERCOM.

In general, the realignments and functional transfers within the new commands follows the concept advanced in recommendations of the blue ribbon panel known as AMARC (Army Materiel Acquisition Review Committee).

The principal objective is to separate research and development as well as initial procurement of new weapons systems, along with product improvements, from management of logistic functions.

Created for electronics research and the development and acquisition of electronic materiel, ERADCOM will accomplish programs in atmospheric sciences, electronic warfare, nuclear weapon effects, ordnance electronics, signal intelligence and target acquisition and combat surveillance.

Other areas of ERADCOM concern include sensors, night vision, radar frequency and optical devices, electronic fuzing, fluidics, instrumentation and simulation, battlefield technical vulnerability analysis, and nuclear weapons effects simulation and vulnerability analysis.

ERADCOM will operate with facilities including a Target Acquisition Center (TAC), a Signals Warfare Center (SWC) and a Harry Diamond Center (HDC) - the latter memorializing the brilliant scientist who died in 1948, five years before his division of National Bureau of Standards transferred to the Army's Ordnance Corps.

This plan of organization was recommended by a Technology and Review Committee directed by Dr. Paul W. Kruse, Honeywell Research Center, and LTG (USA, Ret.) Austin W. Betts, former Army Chief of R&D who is now an executive with Southwest Research Institute.

Each center director will have authority to manage his own resources in RDE programs, the preparation and maintenance of Technical Data Packages (TDPs), and the initial procurement and fielding of developed items. TAC will be headquartered at Fort Belvoir, VA, the HDC at Adelphi, and the SWC will be at Vint Hill Farms Station, VA. The Electronic and Devices Laboratory will remain at Fort Monmouth and the Atmospheric Sciences Laboratory will stay at White Sands (NM) Missile Range.

ERADCOM's mission for the SWC is to integrate the electronic warfare programs of the Army Intelligence and Security Command, formerly the Army Security Agency, and ECOM's Electronic Warfare Laboratory at Vint Hill Farms Station, VA.

Project managers for REMBASS (Remotely Monitored Battlefield Sensor System), Firefinder (Mortar Artillery Locating Radar) and the pending SOTAS (Standoff Target Acquisition System) will be assigned to ERADCOM but remain at Fort Monmouth.

Except for lasers and related technologies relocation at Fort Belvoir, most of the work of the Combat Surveillance/Target Acquisition and all of the Electronic Devices Laboratory will remain at Fort Monmouth.

The functions of atmospheric sciences R&D now at Fort Monmouth will be transferred to the Atmospheric Sciences Laboratory at White Sands Missile range and be assigned to TAC.

CERCOM will consist of all of the logistics elements now at Fort Monmouth, Sacramento Army Depot, CA, and Fort Huachuca, AZ.

In a related action, the tactical computer software functions will be moved from the Computer Systems Command at Fort Belvoir to CORADCOM at Fort Monmouth with existing elements already there. Both CORADCOM and CERCOM will be headquartered at Fort Monmouth.

Estimated $14.7 million one-time cost of

*(Continued on page 12)*

# HDL Fluidic Sensor May Yield Huge Fuel Oil Saving

National concern about energy conservation action serves to accentuate the potential significance of a new temperature sensing devise developed by the U.S. Army Harry Diamond Laboratories and announced Mar. 15.

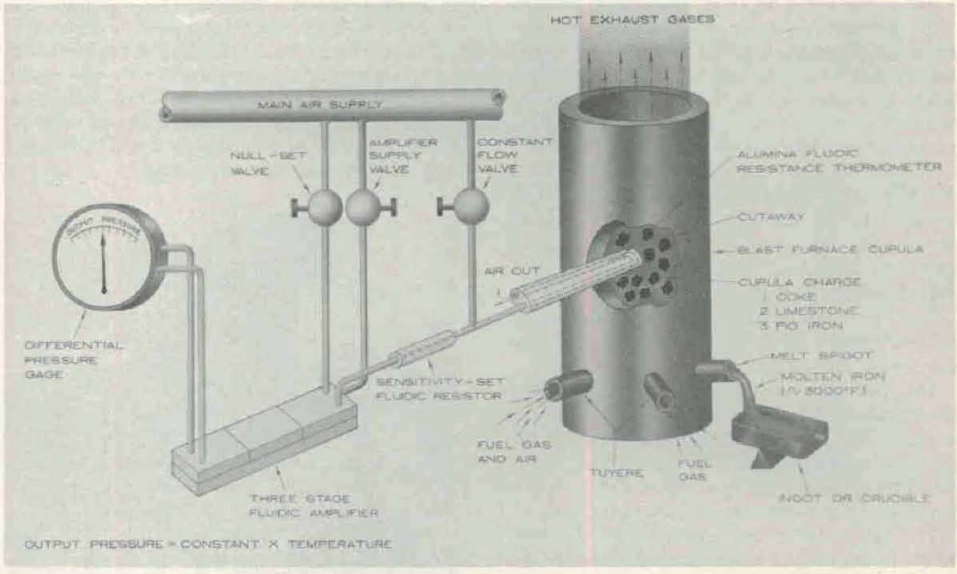
HDL engineers Dr. Ted Drzewiecki and Frank Manion have applied for a patent. The invention is described as a means of sensing temperatures with high accuracy and rugged reliability in "hostile environments."

In progress as this edition of the *Army Research and Development Newsmagazine* went to press was an initial application of the device for experimental research and evaluation in a blast furnace at Pennsylvania State University.

Envisioned is the possibility of industrial applications which experts believe offer a prospect of resultant daily savings of millions of barrels of fuel oil. The applications would include metal and oil refineries, blast furnaces, textile fiber mills, the glass container industry, and other processing plants.

The temperature sensor employs a fluidic thermistor - a control fluid passing through a capillary-tube arrangement, a technique analogous to a temperature sensitive resistor. Fluidic controls, HDL reported, have an advantage over electrical resistance sensors in that they can function in very severe environments, limited only by material endurance.

The HDL announcement of the fluidic thermistor listed among its advantages larger temperature measuring range; potential accuracy within 0.001 degree Centigrade; no moving parts, hence excellent reliability; fluid mediums can be used; and initial production as well as life cycle costs are low due to inherent simplicity of the sensor.




**Blast Furnace Temperature Monitoring Concept, Using Fluidic Resistance Thermometry.**

# USAISR Provides Assistance to Tanerife Crash Victims

When commercial aviation's worst tragedy occurred in March on Tanerife in the Canary Islands, killing 566 persons, 12 survivors were rushed to the U.S. Army's internationally known "Burn Center," the Institute of Surgical Research of the Medical Research and Development Command, headquartered in Washington, D.C.

Burn patients of many types of disasters, most notably the seriously wounded soldiers in the recent war in Southeast Asia, have been rushed to the USAISR at Fort Sam Houston, TX, in increasing numbers in recent years as its international renown has increased.

The *Army Research and Development Newsmagazine* carried a dramtic front cover picture and a center-spread feature article on the USAISR in the Sept.-Oct. 1975 edition. The article described the research program, the precision of the rapid aerial evacuation and care during flight, and the subsequent treatment of burn patients.

A 5-man highly trained rescue team was flown from the USAISR to McGuire Air Force Base, NJ, to accompany the 12 survivors of the Tanerife disaster aboard a huge specially equipped "Skylifter" C141 aircraft to Fort Sam Houston. The proud record of these teams of specialists is that they have never had a patient die during enroute treatment in the aerial evacuation procedure.

MAJ (Dr.) Richard Treat reported the day following arrival of the Tanerife victims at the USAISR that they were all "in stable condition (with) a very positive attitude toward recovery." They ranged from 34 to 73 years of age. The USAISR treatment record shows that a young healthy patient who sustains third-degree burns over 50 percent of the body has a 50-50 chance of survival, despite the ever-dangerous possibility of fatal infection.

COL Basil A. Pruitt Jr., past president of the American Burn Association, with a distinguished record of research for treatment of burn and trauma patients, is the current director of the USAISR. It was established initially in 1943 at Halloran General Hospital in New York City for treatment of World War II wounded.

# Army Announces Acceptance of Initial AH-1S Cobra

Acceptance of the initial production model of the AH-1S Cobra, described as the most modern U.S. antiarmor helicopter, has been announced by the Army.

Improvements in the aircraft, as compared to the Cobra used in the Vietnam war, include arming it with the TOW missile system, an upgraded engine and power train, a flat canopy and a redesigned cockpit.

The engine is a Lycoming T53-L-703 rated at 1,825 shaft horsepower. The drive train has a 1,308 horsepower intermediate power transmission and a 260 horsepower tail rotor drive.

Project Manager Charles Drenz said a new gun and turret will be added next year and that a new fire control system is scheduled for 1979.

COL Drenz said the goal is to "modernize this bird so the guy in the field can fly it against the threat, if that threat should materialize on the battlefield . . . do his lethal mission and get back."

The first 148 AH-1S models are on order and the remaining aircraft of a planned total procurement of 305 are scheduled to come off the line in a "more modernized version," COL Drenz said. The modernization program changes the Cobra from a low-intensity to a mid-intensity warfare aircraft.

# MERADCOM Provides Tech Guidance on LCU 1579

Strange, "off-beat" assignments are usually accepted almost casually by the Mobility Equipment Research and Development Command (MERADCOM), a major element of the U.S. Amry Materiel Development and Readiness Command (DARCOM).

How about, for example, a task of providing technical guidance on pilot modernization of a Landing Craft Utility (LCU), with a view to application on 60 other Army LCUs - all as part of planned modernization by 1985 of the U.S. Army's "Navy" of more than 1,300 vessels?

The pilot LCU 1579 is scheduled for completion of modernization by May for removal to Fort Eustis, VA, for user acceptibility testing.

Improvements will include new mechanical gear, pollution abatement equipment, modernized engine, advanced communication equipment, electrical system and navigational instruments, and a new gyrocompass and radar system.

Many of the Army's LCUs are equipped with engines procured during the 1950s. LCU 1579 has a diesel "clean air" replacement engine, since all commercial and military ships now must meet Federal Water Pollution Standards.

An oil bilge water separator prevents the film formerly left in an LCU's wake. Sewage from commodes and other facilities is ground up and pumped into a holding tank. Later, it is transferred ashore instead of into the water.

The new VHF/FM radio can send and receive up to several hundreds calls, as compared to old communication gear limited to a range of about 50 miles. Communication with Navy and commercial ships is possible, instead of limited to other U.S. Army craft.

# NBS, Battelle Labs Corrosion Study Nears Completion

Corrosion damage and bacterial deterioration of military materiel and equipment have been of concern to the U.S. Army ever since World War II studies showed costs totaling many millions of dollars annually - which directs attention to a comprehensive corrosion study nearing completion.

Under contract with the U.S. Bureau of Standards, scientists of the Battelle Columbus Laboratories are scheduled to complete a study in June that will separate total corrosion costs into reducible and presently irreducible categories. Congress directed the NBS to make the study.

Dr. Joe H. Payer, Battelle program manager, reports that the purpose is to determine the economic effect of corrosion in terms of capital, materials, energy and labor that would be available for alternate uses if losses due to corrosion could be minimized.

Irreducible costs are described as those unavoidable with present preventive technology, that is, requiring technology advances to achieve goals of minimizing costs. Data collected and analyzed jointly by NBS and Battelle scientists will be used to formulate national policy decisions for preventive action.

About 130 industrial sectors are involved in the study, along with Federal Government agencies and other economic sectors - each of which will be considered as a user and/or producer of capital. Included in the study are costs of maintenance and repair, prevention and control, and excess capacity maintained in considering scheduled and unscheduled down-time.

Consultants and other technical experts from throughout the United States are providing assistance. An advisory panel of experts, a peer group, also is contributing to the study.

# 60mm Lightweight Mortar Awaits Type Classification

Type classification of the 60mm Lightweight Company Mortar System (LWCMS) as standard, meaning that it has completed development and operational testing and is considered suitable for production, was awaiting approval by the Department of the Army at press time.

If approved, the system is expected to be made available for procurement in FY 1976, and is scheduled to replace the 81mm weapon currently used by nonmechanized infantry units. The LWCMS will offer increased firepower and mobility for combat effectiveness where man-portability is essential.

Watervliet (NY) Arsenal had management responsibility for the complete system, with John P. Purtell as program director, Donald E. Jones as deputy, and Robin L. Elder as test director following the recent assignment of MAJ John R. Adams III to Germany.

The mortar barrel, base plate and mount were developed by Watervliet. Other agencies involved in the project included Frankford Arsenal, fire control; Picatinny Arsenal, ammunition; Harry Diamond Laboratories, fuzing; Test and Evaluation Command, testing.

Standardization of the system has been recommended by representatives of the Army Materiel Development and Readiness Command, Army Training and Doctrine Command, Logistics Evaluation Agency, and Marine Corps.

**NEW 60mm lightweight company mortar, Program Director John P. Purtell, and MAJ Robin L. Elder who was in charge of testing.**

# Joint Conventional Ammunition Group Claims 3-Year Billion Savings

Savings of more than $1 billion during the past three fiscal years have been announced by the Joint Services Conventional Ammunition Program (JCAP) Coordinating Group.

Effectiveness of the group in achieving..."efficient, economic management and operation for all conventional ammunition logistics programs and activities," since it was organized in May 1972, was announced during the 22d *quarterly* meeting at the Army Armament Materiel Readiness Command (ARRCOM), Rock Island, IL.

Participants discussed the ammunition "industry," which includes 37 government-owned production facilities (operated by government or contractor personnel) worth more than $14 billion. Production and procurement of conventional ammunition involves over 21,000 items.

An Army estimate is that almost $13 billion will be spent on procurement of conventional ammunition for all three Services, spanning Fiscal Years 1976-1981, as follows: Army—$5.4 billion (43%); Navy/USMC—$4.4 billion (34%); Air Force—$2.9 billion (23%).

ARRCOM Commander MG Bennett L. Lewis, chairman of the JCAP Coordinating Group, headed the 42 intra-Service military and civilian officials and management and technical experts who discussed and took action on 15 conventional ammunition items on the agenda.

Other participants included MG William E. Eicher, ARRCOM deputy commander; RAdm Donald P. Hall, deputy commander for Fleet Support, Naval Sea Systems Command; BG John R. Paulk, vice commander, Ogden (UT) Air Logistics Center; BG John S. Egbert, U.S. Army project manager for Munitions Production Base Modernization and Expansion, Picatinny Arsenal, Dover, NJ; COL James R. Lindsay, deputy commander for Armament Systems, Armament Development and Test Center; and Edward J. Jordan, JCAP Coordinating Group executive secretary.

Considered at the JCAP-CG meeting were industrial management, base modernization, procurement, production, supply, maintenance, quality assurance, logistics engineering, security, management information systems, transportation and traffic management, manpower and personnel, budget and funding...and sensitive item coding for conventional ammunition.

In reviewing accomplishments over the past five years, the group reported development of "dynamic economic models" with supporting methodology and a management information system, and verification system that was acceptable by all of the Armed Services.

The group produced nine "managerial decision models" designed to provide ammunition managers with alternative solutions to problems such as item acquisition/production tradeoff, multiple bid evaluation, life-cycle cost subsystem, and storage space-allocation forecasts.

The item acquisition/production tradeoff model was demonstrated and evaluated for eight Army, Navy and Air Force ammunition items, with anticipated potential savings of one-half billion dollars.

The multiple bid evaluation model, now being used by the Army and under consideration by the Navy and Air Force, is another example of a managerial concept replacing planning practices that have changed very little in 40 years.

Two actions initiated by the JCAP Coordinating Group also crossed Service lines in meeting combat requirements for critical ammunition.

**JOINT SERVICES Conventional Ammunition Program Coordinating Group: Front row, l. to r., BG John R. Paulk, OALC vice commander; MG Bennett L. Lewis, ARRCOM commander; MG William E. Eicher, ARRCOM deputy commander; RAdm Donald P. Hall. Second row, COL James R. Lindsay, deputy commander for Armament Systems, Armament Development and Test Center; Edward J. Jordan, executive director, JCAP Coordinating Group; MG John S. Egbert, project manager for Munitions Production Base Modernization and Expansion.**

When the Navy needed 5-inch shell cases during the late stages of the Vietnam War, the Army (which had a plant producing 105mm shell cases) immediately made the "hot base" available to the Navy.

During the Middle East War, the reverse happened when the Navy made its "hot" base available to the Army for production of antitank shell cases.

These actions were accomplished in record time and accounted for savings of about $500,000 each by avoiding a need to reactivate a production line. In another action, the Ogden Air Logistics Center asked the JCAP to provide the least expensive means of procuring a pallet to use for repalletization of 68,000 M117 Air Force bombs in Guam.

After studying computer-aided analysis of data, the JCAP recommended that procurement of pressure-treated wood pallets, instead of metal boxes being considered, would be less expensive and still do the job. The Air Force ordered the wooden crates and saved $1.4 million ($3.3 instead of $4.7 million).

The JCAP-CG also is responsible for initiating a management information system which provides ammunition managers with unified data and information that enables them to communicate across Service lines. Managers receive complete information on what each Service has and is planning to procure or demilitarize. This results in less duplication, less waste, and better use of available resources throughout the Defense establishment.

# Video Instrumentation Credited With $800,000 Savings

Video instrumentation, a relatively new approach to reading materiel test data, is credited with saving about $800,000 and has greatly reduced manhours of test time during the past two years at Aberdeen Proving Ground, MD.

Advances in video and electro-optics technology are credited largely to APG's Instrument Development Branch, Materiel Testing Directorate. One of APG's new developments is the Automated Video Target Scoring System, consisting of a camera, video digitizer and programable calculator. AVTSS permits test fire scorings without requiring down-range access.

This system produces immediate data for on-the-spot corrections, is reportedly more accurate than "spotters," provides a permanent record of test results and requires less manpower.

Development of a Target Simulation Facility is credited with "really starting the ball rolling in video instrumentation." The TSF features target projection, digital computer control and video data acquisition, without dependence on weather conditions. Used as a prelude to actual range firing, it has cut range testing in many instances from several weeks to a couple of days.

New developments in video instrumentation have proved invaluable in testing the MICV (Mechanized Infantry Combat Vehicle), the XM-1 and M60 tanks and other major systems, ID Branch Chief James Fasig reports.

CPT C. David Brown, a 27-year-old electronics engineer with an MS degree, is credited by Fasig with achieving many of the video and electrooptics advances since he was assigned to APG about two years ago. John Wallace, also an electronics engineer, was the first APG researcher to make video instrumentation work in the field.

Brown is involved in development, design, construction, and field evaluation of new instrumentation and training field operators.

## MT Project Seeks Improved Batteries

One of 13 manufacturing technology projects at the U.S. Army Mobility Equipment Research and Development Command (MERADCOM) has the objective of producing better batteries for use in electric propulsion.

Prototypes from a production line are being evaluated to determine performance characteristics. Involved in the project are molten salt electrolyte, lithium tellurium tetrachloride batteries for use in 6,000-pound forklift trucks, particularly in ammunition handling.

Batteries of this type offer high energy density, high power density, rapid recharge and increased capability as compared to lead-acid batteries. MERADCOM reports that the improved batteries are expected to increase forklift trucks reliability and maneuverability; also, to reduce fuel consumption, pollution and logistics.

# HDL Fuze Selected for General Support Rocket System

Selection of the U.S. Army Harry Diamond Laboratories' fuzing system for the General Support Rocket System was announced early in April by GSRS Project Manager COL Kenneth S. Heitzke. The fuze will be supplied to the contractor as government-furnished equipment.

The GSRS is a large-caliber multiple rocket launch system intended to support conventional artillery by providing heavy firepower, especially in a battlefield surge operation. To achieve high survivability, a "shoot and scoot" concept is utilized.

Two 6-round expendable launch pods, which serve as both shipping container and launch platforms, are mounted on a self-propelled launcher on the new Mechanized Infantry Combat Vehicle (MICV).

The GSRS has an automatic fire control aiming system with a remote-set electronic time fuze. Inherent in this HDL design concept are the electronics from the XM587-724 fuzes and a fluidic power supply coupled to a and gearless safing and arming device developed for the XM444 remote-set rocket fuze.

An HDL spokesman said this approach was chosen to provide a low-risk development program while taking advantage of the larger quantity production of the XM724 electronic components in order to achieve a reasonable production cost.

# USCSC Study Traces Educational/Pay Level Parallel

Educational levels are compared with pay levels in a recent U.S. Civil Service Commission news release on results of the first such study ever made of the federal white-collar work force, involving 1.16 million GS employes.

The compilation of statistics showed 30 percent had bachelor's degrees or advanced study beyond that level; 25 percent had attended college without earning a bachelor's degree; 13 percent had technical training beyond high school but no college courses; and 32 percent had no education or training beyond H.S.

Further, the study revealed that 53 percent of General Schedule employes in the GS-9 through 10 salary grades had bachelor's degrees and 32 percent had engaged in graduate study.

Among male employes in grades GS-14 through 18, the study showed 79 percent were college graduates and 60 percent had pursued graduate courses. Among the women in these grades, 78 percent had graduated from universities or college and 67 percent had gone on to graduate-level studies.

The survey showed 60 percent of the employes were males and that 43 percent of them had achieved bachelor's degrees or advanced study, as compared to 11 percent of the women. Twenty-four percent of the men and 26 percent of the women had less than bachelor's degrees.

## HumRRO Publication Collects Data On Team Training Effectiveness

Literature relevant to instructional techniques is contained in *Team Training and Evaluation Strategies: State-of-the-Art*, a new publication of the Human Resources Research Organization (HumRRO).

Technical Report 77-1 is prepared as an information base that the Defense Advanced Research Projects Agency could use as a foundation to facilitate decisions relative to future research program support.

Sources of information used in this research include the Educational Resources Information Center, National Technical Information Service, Defense Documentation Center indices, DoD-sponsored reports and social psychological publications.

Conclusions of the study indicated that team training effectiveness depends upon development of objective team performance measurement instruments and procedures. Current problems include lack of standard test conditions and accepted test criteria.

## Armament Command Contract Orders Development of XM235 Prototype

Development of a prototype infantry squad automatic weapon (SAW), designated as the XM235, was ordered in a contract awarded in March by the U.S. Armament Materiel Readiness Command, Rock Island Arsenal, IL.

Intended to satisfy an Army requirement for a one-man lightweight weapon capable of sustained fire at long range, the SAW will replace the M16A1 in the automatic fire mission and may replace one or more M60 machineguns in an infantry rifle platoon.

Weight of the SAW, including 200 rounds of an improved 56mm ball and tracer type of ammunition (SM777 and MX778), will be less than 21 pounds, the contract news release said.

## 4 Van-Mounted Instrument TV Units Undergo Acceptance Tests at WSMR

Acceptance testing of four $150,000 van-mounted Instrumentation Television units, designed for live coverage of missile firings, target launchings, missile intercepts and other field work, is in progress at White Sands (NM) Missile Range.

Equipped with microwave transmitters and receivers, video tape recorders, production switchers and monitors, dual synchronization generators, time annotators and test equipment, the units will replace four Army vans placed in operation at the 4,000-square-mile range 12 years ago.

Each unit can operate up to eight monochrome TV cameras, including low-light-level types that will produce pictures on cloudy, moonless nights.

Cameras designed by the WSMR Data Systems Division and produced under contract will have lenses ranging from self-contained zoom to externally mounted 180-inch focal length types.

## WRAIR Reports 'Artificial Skin' Succeeds in Animal Wound Tests

Successful treatment of mouth wounds by replacing lost soft oral tissue with "artificial skin" has reportedly been achieved in animal tests at the U.S. Army Institute of Dental Research, Walter Reed Army Medical Center.

Calfskin treated with enzymes to prevent rejection by surrounding tissues was sewn into the gums and cheeks of injury sites on test animals. Composed of collagen, the artificial skin serves as a scaffold for new tissue growth during the repair process.

Use of such materials to aid in wound healing and reconstructive surgery may eliminate the need for grafting skin from one area to another in humans. Reductions in surgery time and postoperative problems also are envisioned.

USAIDR Drs. Marvin P. Levin and Peter J. Tsaknis have indicated that although the "artificial skin" is well tolerated by tissues in animals, additional tests are required to validate properly its use in humans.

## Joint Interface Test Force Established at Fort Monmouth

Establishment of a center at Forth Monmouth, NJ, to direct, monitor and control an Army, Navy, Air Force and Marine Corps test program has been announced.

The Department of the Army said the test activities are part of a Joint Chiefs of Staff program called Ground and Amphibious Military Operations (GAMO), and will be designated the Joint Interface Test Force (JITF).

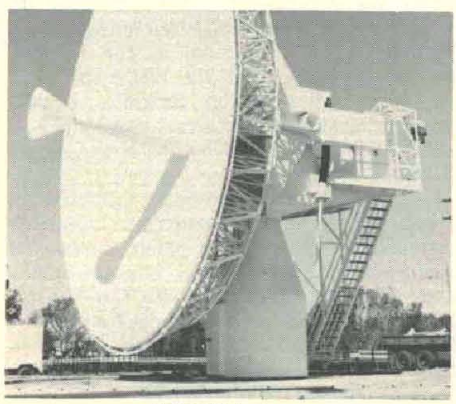
Selection of Fort Monmouth is based on existence of immediately available space and over-all facilities that best meet Army requirements for technical support to manage a joint service test program. Personnel of all the services will be selected to man the center.

Plans provide for a staff of about 51 military and 24 civil service employes, the beginning of operations in the third quarter of Calendar Year 1977, and operational costs of about $1 million annually. Contractual support will be procured.

The Army announcement said GAMO's mission is to insure compatibility, interoperanility and operational effectiveness of tactical command and control facilities/systems in support of ground and amphibious military activities through the 1980s. Use of the Fort Monmouth site is projected until the test program ends.

# CEEIA Field Tests OE-222 Prototype Antenna at Monmouth

Programed as a major component for the AN/MSC-61 medium satellite antenna terminal, a prototype OE-222 antenna was recently field tested by the Communications Electronics Engineering Installation Agency at Fort Monmouth, NJ.



OE-222 Antenna

A major subordinate element of the U.S. Army Communications Command headquartered at Fort Huachuca, AZ, the CEEIA conducted the tests to determine the antenna's reliability, maintainability, human factors engineering, safety and transportability.

Unlike larger fixed satellite terminal antennas, the OE-222 is designed for rapid disassembly, transport and reassembly at distant sites.

An 8-man team from CEEIA's Communications-Electronics Installation Battalion participated in recent OE-222 testing, which involved disassembly at the contractor's plant in Helbourne, FL, air transport to Fort Monmouth and reassembly in three days.

Plans call for operation of AN/MSC-61 terminals by the Army, Navy and Air Force, including distribution of 10 terminals to three ACC operations and maintenance units—the 5th, 6th and 7th Signal Commands.

# Getting Sun Power Down to Earth

## SOLAR POWER FOR REMOTE LABORATORY

By Donald D. Faehn

Archimedes is believed to have set fire to an attacking Roman fleet in 200 B.C. by directing the sun's rays off large mirrors. Solar-heated stills were used for lifecraft survival in World War II. The U.S. space program in the 1950s developed a solar cell to power satellites.

Although solar energy has been successfully used in warfare, however, until now there have been few military applications.

Now the U.S. Army Mobility Equipment Research and Development Command (MERADCOM), Fort Belvoir, VA, is engaged in an experimental program - putting the sun to work to power military equipment ordinarily operated by engine generators or batteries.

Results in Defense-wide benefits are also expected to contribute significantly to increasingly widespread civilian use of the sun's energy in homes and businesses.

Designated the lead R&D center of the Department of Defense for terrestrial applications of solar photovoltaic energy conversion systems, MERADCOM is engaged in a program with the Energy Research and Development Administration (ERDA) to demonstrate this technology in a variety of military uses.

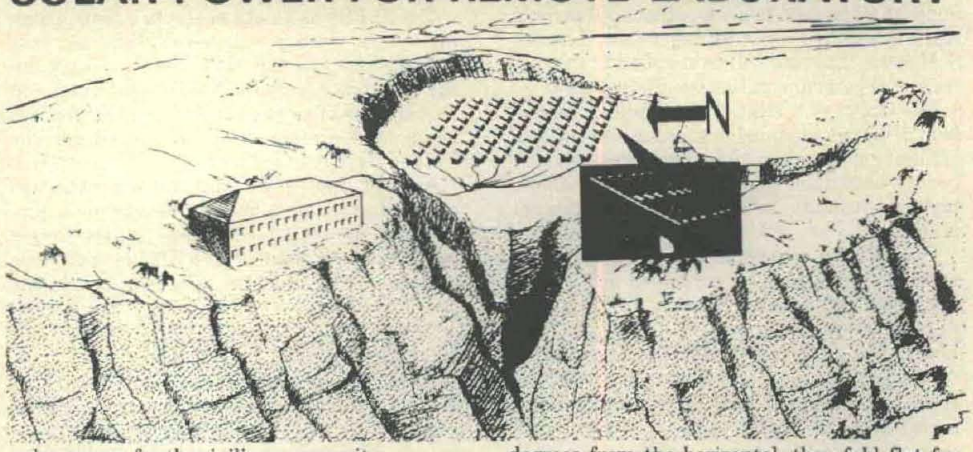
Photovoltaic cell systems convert solar energy into electricity without the intermediate heat process. Cells of this type have been used extensively in spacecraft. The terrestrial solar cell industry, however, is just emerging and the main problem to widespread usage—as a means of reducing dependence on short supply gas and oil—is cost.

Progress in providing Defense forces with an alternative source of electric power is the objective of the ERDA-funded program initiated by the Department of Defense in 1975.

Called MAPS (Military Applications of Photovoltaic Systems), the program was placed under the general management of MERADCOM on the basis of the command's long—standing work on electric power generation, including fuel cells and other energy conversion methods.

ERDA sponsorship of the program stems from its quest — in the interests of national energy self-sufficiency — for the development of low-cost, reliable solar cells that could be mass produced for widespread use in residential and commercial applications. Development of the substantial anticipated early market for solar cell equipment within the Department of Defense could be a major step toward low-cost solar energy for the civilian community.

**MOBILE communications center is powered by two van-mounted solar arrays, each consisting of 2,592 3-inch diameter cells that produce 56 volts and 22 amps at peak sun. This is enough power to operate the center and charge 32 deep-discharge electric vehicle-type batteries that provide power during periods of darkness and cloud cover.**




Potential military benefits from the use of solar cells are viewed as 5-fold: energy and cost savings in reduced use and storage of petroleum products; decrease in logistic burden of continual replenishment of fuel and batteries; energy self-sufficiency for a variety of remote or isolated military applications; improved reliability, availability, and maintainability of energy-consuming systems; and the option of a silent, alternative source of electric power.

To explore the DoD solar cell market, six military systems covering a broad range of power, voltage and duty requirements were selected for a demonstration of solar cell potential. In September 1976, three of these systems — a battery charger, a radio relay system, and a telephone communications station — were put into operation on solar power in an open area at MERADCOM.

A water purification plant will become operational in February. A remote radar station at the Naval Weapons Center, China Lake, CA, is scheduled for completion in March.

The sixth and largest system, designed to demonstrate energy self-sufficiency for DoD remote island facilities, is planned for Bermuda. It will interface with the electric utility grid system of the Navy's Tudor Hill Laboratory to provide power for lighting, air conditioning, ventilation and other personnel support.

Two projects, the telephone station and the radio relay, incorporate significant storage battery subsystems. The battery charger, water purification plant, and remote radar are essentially day-light-only systems. All the projects, with the exception of the battery charger (which was developed exclusively for solar power), are existing military systems.

The five operational demonstrations required a 30-KW allocation of solar cell modules from the 46-KW block procured by the Jet Propulsion Laboratory for the ERDA-sponsored test and demonstration program. System engineering support and array design and construction were supplied by the NASA Lewis Research Center.

Solar-array construction was common to all projects except the telephone communications system. Produced by three manufacturers, the modules were fastened to A-frame stands designed to be compatible with this variety. Frames were 4 x 4 feet each except for the 2 x 4 foot size for the radio relay. Array power varies from 35 watts at 12 volts to 11 KW at 240 volts. Adjustable in tilt angle from 15 to 62 degrees from the horizontal, they fold flat for transportation.

The solar array for the telephone system is located on the tops and sides of the truck-mounted shelters. Peak power is 2.4 KW (1,200 W per shelter), providing average net continuous electrical power of 300 W.

The array may be positioned at several discrete angles between 15 and 60 degrees from the horizontal by means of telescoping support struts. For transportation, the hinged arrays are folded flat against the tops and sides of the vehicles for transportation, requiring only a 3-inch extension of vertical and horizontal dimensions.

**Battery Charger.** This is the only new item in the demonstration program and it is intended to charge multiple nickel-cadium batteries with solar cell power. The objective is to reduce military dependence on primary batteries used in numerous military applications, such as night vision devices for which expendable batteries must be replaced.

The logistics and cost burdens of night operations could be diminished by recharging storage batteries with solar cells during the day, when the viewers are idle. Airport lighting is a similar application area.

The demonstration charger is designed to recharge completely simultaneously 84 D-Cell NiCd batteries during five hours of daylight. Current-limiting circuits in each of the six control sections of the charger prevent damage to

**Eighteen 3-inch diameter silicon solar cells are used in individual modules having a peak output of 8.6 watts. Four of these modules are used to power radio relay equipment designed to report intrusions to a remote monitor for an area security system.**

the batteries, even in the event of prolonged over-charge in full sun.

Indicators have been provided to show battery state of charge, 0 to 100 percent in 20 percent increments. Batteries are discharged to a low level prior to being placed in the charger.

The array contains 28 solar cell modules. Groups of four modules are wired in a 2-by-2 series/parallel arrangement to form seven independent circuits, connected to the charger sections by a multiple conductor cable. Blocking diodes in each charger section prevent discharge of batteries. Control power is obtained from one of the circuits and 10 additional batteries in series.

**Radio Relay.** The existing military item forming the basis of the radio relay system demonstration is a multiple point intrusion detector having radio links to a monitor console. Subsystems (sensors, relays and monitor) are each powered by primary batteries and sensors transmit data to the radio relay, which in turn transmits the data to the monitor.

Generally, up to eight sensors are assigned to one relay and transmission between sensors, relays, and the monitor is on one frequency. Each of the sensors, however, has a different identification code. The monitor interprets this code and displays information revealing the active sensor.

The IDS was modified for the demonstration program by replacing the expendable batteries in one relay and two monitors with photovoltaic power systems, each consisting of an array, voltage regulator and lead-acid batteries.

Repowering the sensors was not considered feasible at this time, since in tactical situations they are camouflaged and often buried. However, as a means of demonstrating nontactical applications in civilian security systems, five sensors also were solar cell powered.

Design criteria for the power system included Washington, DC, solar radiation (insolation) patterns, seven days battery storage without input from the arrays, and complete recharge of the batteries within two days after discharge. Batteries for the relay are of the gelled electrolyte lead-acid type, and for the monitor, are automotive lead-acid batteries.

**Telephone Station.** The demonstration AN/MTC-1 Telephone Central Office operates essentially as a local operator's switchboard, with 200 local lines and 20 trunk lines. Normally, operating power is obtained from an engine-driven generator set.

The 48 volt d.c. system can operate about 24 hours without power from the generator, using an internal lead-acid battery bank. Switchboard stations, relay equipment and power system are housed in two 8 x 12-foot communications shelters, each normally mounted on 2½-ton trucks.

Because the telephone system must operate 24 hours daily, good weather or bad, additional batteries were added. Capacity was limited to allow for operation only two days (three nights) without any input from the sun.

This capacity was determined to be the minimum storage required with an acceptable risk that the system would function properly, thus permitting a reasonably low battery weight addition to the vehicles. Because of the desire for minimum weight, and the relatively deep daily discharge of the batteries (due to the minimum amp-hour capacity), electric vehicle type batteries were employed.

Junction boxes on each vehicle contain blocking diodes for each 8-module series string,

**BATTERY CHARGER used in MAPS demonstration can energize 84 D-cell batteries at a time. Future editions may also be capable of charging storage batteries that would replace expendable types now used.**

manual test points and switches, fuses and bus bars. An instrumentation section records instantaneous current flow from the array and to the load. Digital displays show integrated amp-hours for measurements.

Although this system is designed for d.c. power, an inverter was incorporated for the initial demonstration phase. This 1.5 KW MERADCOM development device provided either 60 Hz or 400 Hz, 120/240 volt single phase a.c. power for demonstrating convenience items, such as the instrumentation section, and was used to provide some of the dummy load during portions of the demonstration program.

**Water Purification Plant.** This is a prototype of a representative item for producing potable water from ground sources such as lakes and streams. Consisting of large, prefabricated water storage and processing tanks, filters, purification modules, and electric motor-driven pumps, it operates on the reverse-osmosis principle.

The pumps force water through the purifier's membrane tubes. Electric power requirement is approximately 7 KW to operate the system at 360 gallons an hour rated capacity. Two a.c. motors employed in the standard configuration were replaced by d.c. motors for the solar demonstration and a small commercial inverter also was used to drive a.c.-powered chemical feeders.

This project was configured as a daylight-only system, with energy stored in the form of purified water in the tanks, rather than in storage batteries. However, a small 240-volt pack of automotive batteries is needed to provide surge capacity for motor starting, and to smooth power variations caused by passing clouds.

The 240-volt d.c. potential from the array is achieved by connecting sufficient modules in series. Each series string is paralleled at a control cabinet.

The cabinet contains switches for each series string, diodes, bus bars, recording instrumentation similar to that used in the telephone system, main power circuit breaker, and receptables to allow for individual monitoring of the performance of each solar cell string. Rated at 10.8 KW (peak), the solar array contains modules from three manufacturers, but only one module type is used in each string.

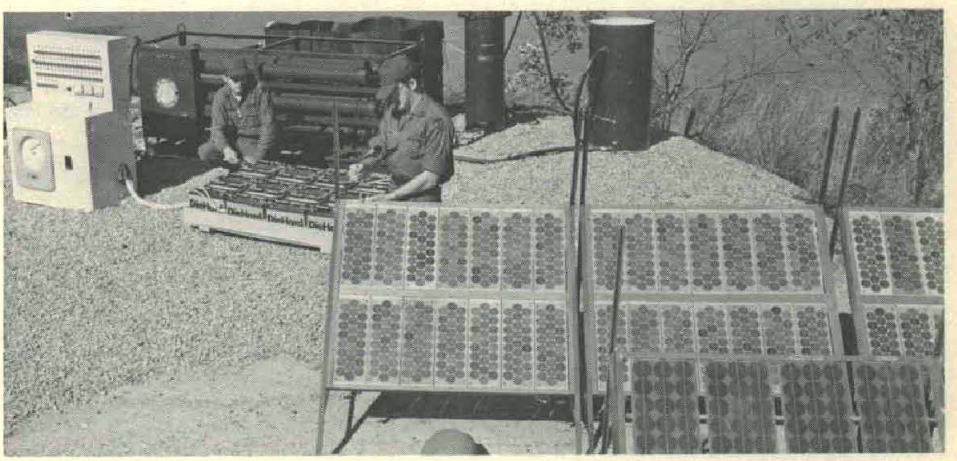
**Remote Radar.** This is the highest power project, also requires alternating current, and is representative of many types of instrumentation used at military sites in the southwest. Demonstration of this equipment will be conducted solely at the Naval Weapons Center, China Lake, CA.

Because the radar is used only during periods of good visibility (high insolation), battery requirements are minimal. The system is not operated more than one day without an inactive interval, allowing for some battery/array sizing trade-offs. The demonstration array was sized at 12 KW (peak) to power the nominal 15 KW load. A traction type (forklift truck) 240-volt, 300-amp-hour battery is employed. A custom-built motor-generator is used to supply the 120/208 volt 3-phase a.c. power for the radar.

The initial centralized solar energy demonstration was completed at MERADCOM in November 1976. Indications are that it was successful in promoting an awareness of solar photovoltaic systems as an attractive alternative source of electric power for military equipment.

Although the MERADCOM demonstrations were operated for only two months, the absence of failures of the photovoltaic systems proved encouraging.

Operating experience with the radio relay system was excellent. The only problem occurred in the failure of the primary batteries in some of the non-solar powered sensors. The telephone system operated round-the-clock without failure.



**REVERSE OSMOSIS water purifier is being powered by solar energy at Fort Belvoir, VA, where the U.S. Army Mobility Equipment R&D Command is demonstrating military potential.**

# Getting Sun Power Down to Earth

(Continued from page 11)

In addition, the hinged solar arrays on the telephone vans made it clear that although considerable illuminated area may be required for some photovoltaic applications, due to the diffuse nature of the sun energy source, size and weight of solar arrays need not be excessive. No failure or severe degradation of solar cell modules was experienced.

MERADCOM projects shown at Fort Belvoir are being dispersed to other military facilities for field demonstrations under a more representative military environment. The intent is to promote more widespread awareness on the part of the military of terrestrial photovoltaic technology.

Upon completion of modifications to reduce its size and weight, and eliminate some of its control and instrumentation hardware, the battery charger will be evaluated by the Marine Corps, Navy and Air Force.

The telephone communications system is being operated at Fort Hood, TX, and will later be driven to White Sands Missile Range, NM, and Fort Bragg, NC. The remote radar will be in operation at China Lake, and the water purification unit at MERADCOM. The radio relay is being refurbished for delivery to Eglin Air Force Base, FL, and Fort Huachuca, AZ.

The only one of the six planned solar energy systems not constructed is scheduled for demonstrations in 1977. Designed to interface with the electric utility system at the Navy's underwater research facility in Bermuda, it will be connected to a low-voltage service panel which powers a 100-KW laboratory load.

In this way, the 60-KW (peak) alternate energy source will closely match load requirements, thereby making a distinct contribution to system needs. Solar array power will be converted by a conditioner or inverter to be located in the laboratory basement from a variable d.c. voltage, normally 350 volts, to the required 120-208 volt 3-phase, a.c.

The array will require about 30,000 square feet of land area. Part of the array will be on an existing south-facing slope. Cables will conduct the direct current solar cell power to the inverter via an underground conduit. Storing electricity in batteries is not required.

This solar energy application is expected to be productively useful in its initial form for many years. However, it is anticipated that it will be augmented from time to time with wind power or improved photovoltaic components so that the Tudor Hill Laboratory could become energy self-sufficient.

The objective of the six demonstration projects, as stated earlier, is to prove ultimately the feasibility of solar energy systems for a large number of similar applications within the Defense Department and the private sector.

Initial results are encouraging. Much more R&D will be needed, however, before the small-size, lightweight solar arrays necessary for mobility in tactical situations are a reality. Vulnerability and survivability measures, including defeating the threat of detection, must be developed.

Feasibility includes not only technical but costs and logistics factors. Concurrently with the demonstration program, MERADCOM is making a market survey of the Defense Department potential as a user of solar photovoltaic systems, under an agreement with the Federal Energy Administration. As its third task in MAPS program management, the command has established a tri-service coordinating body. Members are: Army, Donald D. Faehn; Navy, Dr. G.W. Leonard; Naval Weapons Center, China Lake, CA; Air Force, Joseph F. Wise, Aero Propulsion Laboratory, Wright-Patterson AFB, Dayton, OH.

*DONALD D. FAEHN was awarded the 1975 Dr. L.M. Ames R&D Award by the Mount Vernon-Lee Chamber of Commerce for his work as program manager for military applications of photovoltaic systems at the U.S. Army Mobility Equipment Research and Development Command.*

*The MERADCOM program is a new effort involving coordination with the Department of Defense, the Federal Energy Administration, and the U.S. Energy Research and Development Administration. MERADCOM is responsible for five demonstration projects, identification of early markets within DoD for photovoltaic systems, at the request of the DoD establishing a tri-service coordinating body for photovoltaic application surveys, and R&D programs management.*

*Faehn has been at MERADCOM since 1961 and was senior project engineer in the Electromechanical Division, Electrical Power Laboratory prior to his selection as program manager. Electrical Power Laboratory is responsible for MERADCOM's power generation efforts.*

*A member of the Society of Automotive Engineers and a registered professional engineer with the District of Columbia, Faehn received his BS degree in mechanical engineering from Iowa State University in 1958 and an MS in mechanical engineering from Stanford University in 1969.*

*The Ames R&D Award citation states, in part, that Faehn "has demonstrated an ability to supervise and administer an activity which is a significant facet of the national energy program...(he) has demonstrated diligence, initiative and competence in this work, which frequently demanded actions for which no precedent was established."*

*Dr. Ames was a Mount Vernon Chamber of Commerce member and a MERADCOM scientist who worked in the old materials lab from 1944 through 1958. He was chief of the fungus control group, now the Biodeterioration Research Group, Lab 9000.*

# DARCOM Realignment Climaxes With ERADCOM, CORADCOM, CERCOM Decision

*(Continued from page 6)*

changes of the reorganization is based on the following breakout: of the $5.9 million for construction and facilities modification for ERADCOM, $4.7 million will be used at Fort Monmouth; $1.7 million for CORADCOM and CERCOM facilities; $7.1 million for personnel relocation, severance pay, terminal leave pay, home owners' assistance, equipment relocation and purchase of new equipment.

About $400,000 will be spent for modifications at Vint Hills Farms Station; $500,000 for development of laser test ranges at Fort Belvoir and at Fort A. P. Hill, VA; and roughly $175,000 for enlargement of photographic facilities of the Night Vision and Optical Devices Laboratory at Fort Belvoir.

Some of the functions transferred to ERADCOM will be accomplished by personnel who will remain in the Fort Monmouth area, but 112 civilian jobs and 3 military spaces will be transferred to Adelphi, MD, where a net loss of 29 jobs will take place. The Harry Diamond Labs will lose 162 civilian spaces, of which 150 will be reductions in force and 12 transfers.

Over-all, formation of ERADCOM, CORADCOM and CERCOM will result eventually in an environmental impact payroll loss estimated at $16.5 million annually in the Fort Monmouth business area (loss of 756 spaces, civilian and military jobs).

However, 7,404 civilian and 745 military spaces will remain in place. The loss breakout is 576 civilian jobs and 22 military transferred, and 433 civilian positions eliminated.

## ALMC Library Redesignated as 'The Army Logistics Library'

Redesignation of the U.S. Army Logistics Management Center's Logistics Library as "The Army Logistics Library" was announced Mar. 28.

Publications stored in the former ALMC, Army Quartermaster School and Army Management School libraries are consolidated in Bunker Hall, the principal academic building. More than 4,000 periodicals, 85,128 books and 1,674,571 government publications are available.

More than 500 current subscriptions to periodicals have been purchased by the library, many of which have been converted to microfilm or microfiche. Readers and printers are provided for use of these film documents. Microfilmed military and federal specifications and standards, audio cassettes, audio visual films and slides and a small legal library also are available.

The Logistics Reading Course, offered to active military, civilian DoD employes and Reserve officers, is administered by the AL Library. Supported also are the Florida Institute of Technology master's degree program and Chapman College Courses.

# BRL Achieves Improved Projectile Performance

**By Anders S. Platou**

Research and development efforts to maximize firepower of U.S. combat forces and thereby improve odds for victory against a numerically superior opponent are of primary concern as strength of the potential foe increases. Many modern weapons use projectiles having ballistic trajectories and improvement in performance can be achieved through one of these approaches:

- Increasing the projectile length so a greater payload can be carried without destabilizing the projectile motion. (The projectile length is limited by the gyroscopic stability factor, which must remain greater than one for all flight conditions.)
- Giving the projectile a trajectory with lower angles of attack so that the probability of hitting the target is increased.

These approaches apply to all projectiles — small-caliber, antipersonnel, antitank, antiaircraft, or large-caliber inidrect-fire projectiles. Improved performance will increase the usefulness and flexibility of many weapons.

Wind tunnel and aerodynamic range tests conducted by the U.S. Army Ballistic Research Laboratory (BRL), several years ago, showed that the conical boattail (Figure 1a) used on most projectiles to increase range has a very adverse effect on projectile flight stability.

As the conical boattail reduces the projectile drag and increases the maximum range, it reduces the projectile flight stability. Stability can be maintained only by shortening the projectile length. The shorter length, of course, reduces the available payload volume.

Due to the projectile spin, the conical boattail also develops large aerodynamic forces and moments—called the Magnus forces and moments—at transonic velocities. A large Magnus moment may lead to serious flight instabilities which, in turn, will cause the projectile to fall far short of its intended target by a significant distance.

Conventional projectiles are limited to 5 to 6 caliber lengths as a result of incorporating conical boattails. Longer lengths would require faster, impractical spin rates to maintain flight stability.

After determining the poor flight characteristics of the conical boattail, Ballistic Research Laboratories scientists found that projectile flight characteristics could be improved markedly by a new boattail shape.

This boattail is formed by cutting the main projectile cylindrical body at three skewed planes so that the shape shown in Figure 1b is formed. The base is triangular and the three skewed planes form aerodynamic lifting surfaces on the projectile's rear portion, providing added lift and increasing flight stability.

Skewing the surface maintains the spin and reduces the Magnus forces and moments generated on the projectile. Low Magnus forces and moments permit the use of projectiles in which the centers of gravity can be moved further forward, increasing flight stability.

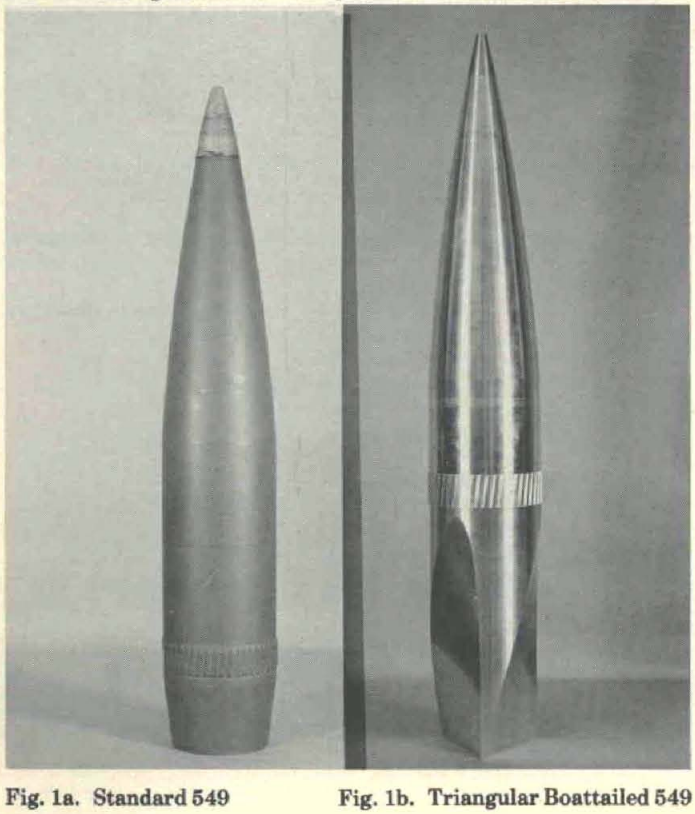


Fig. 1a. Standard 549 Fig. 1b. Triangular Boattailed 549

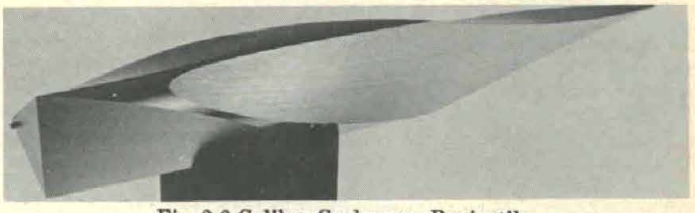


Fig. 2 6-Caliber Corkscrew Projectile

The new shape also permits the air to flow much more efficiently over the boattail, thereby reducing viscous or drag losses. This shape also has portions of the main body cylinder extending to the base, thereby increasing the projectile "wheel base" and reducing gun tube balloting.

Wind tunnel and aerodynamic range tests have shown that a projectile with the new boattail (Figure 1b) has a low or lower drag than a similar conical boattail configuration. It also can be made longer than a similar projectile with a conical boattail and still maintain good flight stability. For example, the M549 or M708 projectile (Figure 1a) is 5.7 calibers long. The new projectile can be 6.2 calibers long.

The configuration also can use a center of gravity further forward due to the smaller Magnus forces and moments generated on it. In turn, this adds to projectile flight stability. The projectile can have the same or less weight than one with a conical boattail. The forward center of gravity requires lightweight materials in the rear portion so that the longer projectile will not weigh more than one with the shorter conical boattail.

Another projectile shape which has very interesting and useful aerodynamic properties may be useful for certain military applications which require a long projectile. This shape meshes the skewed triangular boattail, as described, with a skewed triangular nose (Figure 2) — hence the nickname Corkscrew.

The streamlined corkscrew has very low drag and extremely good flight stability for long-length projectiles. So far 6-caliber long corkscrews have been flown under practical conditions in the BRL aerodynamics range. From these flights, it is estimated that corkscrew projectiles up to at least 11 calibers can be flown successfully. Flights during the past winter were designed to prove out these estimates. The pointed nose would have to be blunted for military field conditions, but this is not expected to increase appreciably the drag or lower the flight stability.

Conventional projectiles are limited to approximately 6-caliber lengths and have a maximum volume equal to approximately $3d^3$ where d is the projectile diameter. The corkscrew, if flyable in 11-caliber lengths, will have a volume of over $4d^3$, thereby making it possible to fly larger and heavier payloads to the target.

The difficulty limiting use of the corkscrew projectile is fabrication of the configuration. If made from one homogeneous piece, fabrication of the exterior shape poses special but not insurmountable problems. However, hollowing out the interior to accept a payload may be difficult.

Access to the interior is best accomplished through the base. However, this confines the payload to a cylindrical, or at best, a twisted triangular volume. For this reason, use of this configuration might be limited to a high-velocity, small-caliber penetrator round where the whole configuration becomes the penetrator, or to a large-caliber, high-velocity penetrator round where the cylindrical penetrator is enclosed in the corkscrew configuration.

The triangular form is expected to become the projectile boattail of the future since its aerodynamic properties are far superior to those of the conical boattail. Projectiles of all sizes will gain in flight performance, increased payload, and increased probability of hit. The corkscrew projectile has yet to be tried as a military projectile. Superior aerodynamics and long length make this configuration attractive, but fabrication difficulties may limit its use.

*ANDERS A. PLATOU is an aerospace engineer with the Launch and Flight Division, U.S. Army Ballistic Research Laboratory, Aberdeen Proving Ground, MD. Since 1944 he has worked with the BRL mainly in wind tunnel and range aerodynamic measurements. Graduated from Purdue University with a BSME degree, he served in the U.S. Army during WW II. He received a U.S. Army R&D Achievement Award in 1975 and is the inventor of a new projectile boattail.*

# NATO's Tactical and Logistical Concepts Panel: Guide to Long-Range RD&E

**By MAJ John D. Elliott**

Presidential approval of the Department of Defense 1977 Appropriation Act, Public Law 94-361, has provided a much needed "strategy for military standardization" for the research, development and engineering (RD&E) activities of the North Atlantic Treaty Organization.

PL 94-361 states clearly the intent of Congress that "weapons systems being developed for employment in the NATO theater shall conform to a common NATO requirement."

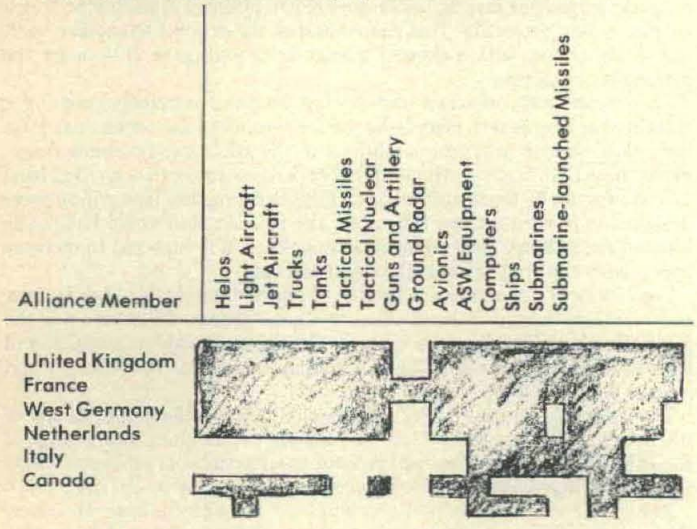
The Secretary of Defense is now authorized to buy other than U.S. military equipment to implement this important objective of fielding military equipment in conformance with NATO's standardization principles and long-range (10-20 years) operational concepts, such as those developed by NATO's Tactical and Logistical Concepts Panel XI.

Implementation of this policy, in the near and mid-range time frames, may result in more U.S. procurement of arms and equipment from NATO member nations. Greater reliance will be placed on licensing and coproduction agreements within the alliance. New initiatives will be required by Panel XI to develop operational concepts for the long-range time frame sufficiently broad to guide future NATO armies RD&E.

Materiel standardization has been a persistent concern of NATO because of the advantages it contributes to over-all military effectiveness and cost savings in RD&E. GEN Goodpaster, former Supreme Allied Commander, Europe (SACEUR), estimated that lack of standardization has taken a toll of at least 30 percent of NATO military effectiveness.

The extent of the problem is illustrated by the current costly duplication of equipment types among major NATO nations (see Table 1). Elimination of this problem is among primary new initiatives targets.

**TABLE 1. Duplication of Equipment Among NATO Allies**




This article attempts to describe standardization goals and organization with emphasis on NATO's Tactical and Logistical Concepts Panel XI, including its method of operation, current work program, and some suggested new initiatives for consideration.

The *NATO Glossary* defines standardization as the process by which member nations achieve the closest practicable cooperation among forces, the most efficient use of research, development and production resources, and agree to adopt on the broadest possible basis the use of:

- Common or compatible operational, administrative and logistic or technical procedures and criteria.
- Common, compatible or interchangeable supplies, components, weapons or equipment.
- Common or compatible tactical doctrine with corresponding organizational compatibility.

Stardardization of specific materiel or tactical items in NATO is sought at one of three levels, depending upon need and other factors. These are *interchangeability, interoperability, compatibility.* Interchangeability exists when two or more items can be exchanged for each other between NATO armed forces. Interoperability is the ability of systems, units or forces to provide services and to accept services from other NATO armed forces. Compatibility is the capability of two or more items or components of equipment to exist or function in the same system with other NATO armed forces.

Achievement of the appropriate level of standardization, in each case,


**Fig. 1. NATO Organization**

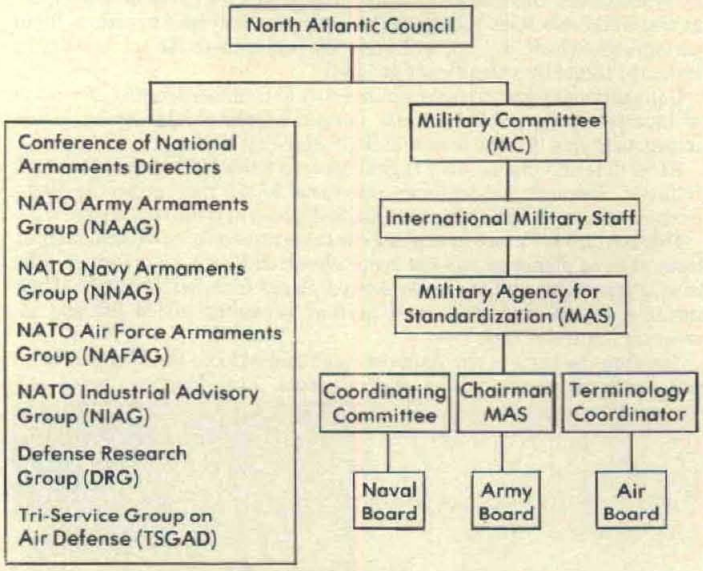



**Fig. 2. NATO Standardization Organization**

contributes to the broader aim of "rationalization," defined as "any action which makes more efficient or effective use of the resources devoted by the alliance to defense."

One of the key mechanisms specifically designed to achieve standardi-

| | |
|---|---|
| Panel II | – Combat Vehicles |
| Panel III | – Infantry Weapons |
| Panel IV | – Surface-to-Surface Artillery |
| Panel V | – Land Based Air Defense Weapons |
| Panel VI | – Combat Intelligence |
| Panel VII | – Nuclear/Chemical |
| Panel VIII | – Telecommunications |
| Panel IX | – Engineer Equipment |
| Panel X | – Air Vehicles for Tactical Air Mobility |
| Panel XI | – Tactical and Logistical Concepts |
| Panel XII | – Meterology |
| Panel XIII | – ADP for Command and Control |
| Group of Experts on Electronic Warfare | |
| Tri-Service Group on Navigation/Position Finding | |

**Fig. 3. NATO Army Armaments Group (NAGG) Panels**

zation of armaments and other equipment in NATO is the Conference of National Armaments Directors (CNAD). The Director of Defense Research and Engineering is the U.S. representative.

CNAD is on the civilian side of NATO's organizational structure, as

shown at Figure 1, but is, in fact, a hybrid civil-military organization; its supporting Armaments Group and subelements consist of national military officers. The CNAD proper has a major general representing the Military Committee and two or three of the National Armaments directors are general officers.

Reporting directly to the North Atlantic Council, CNAD thus has a speedy means of channeling forward the results of its forum activities in which it strives for "cooperation as easy and advantageous as possible."

The Service Armament Groups, composed of national military officers, are a major component of the CNAD forum (Figure 2). Each group supports the CNAD by exchanging information "to identify common concepts, doctrine, national equipment programs and policies, and the logistic aspects thereof." The NATO Army Armaments Group (NAAG) is of primary interest because it relies on Panel XI as one of its 11 equipment panels and one working group, as shown at Figure 3, to accomplish NATO Army materiel and nonmateriel military standardization.

Accomplishment of these objectives and adherence to operational principles are aided by the Military Agency for Standardization (MAS). The MAS (Figure 2) is the Military Committee's primary agency to implement formal standardization agreements in NATO.

While the CNAD is concerned primarily with future armaments, the MAS is concerned with the interoperability of existing equipment and with procedural and doctrinal standardization. Policy is formulated by the Military Committee, reporting to the North Atlantic Council.

Panel XI is charged with the development of long-range (10-20 years) operational concepts to provide guidance in research and development for the 11 NAAG equipment panels. Panel XI has a key role in the CNAD forum because these long-range operational concepts result in nonmateriel standardization policy that decisively impacts on NATO RD&E.

Ideally, this process begins at the long-range conceptual stage and continues through to the NATO adoption of standardized operational policies and procedures for fielding equipments and weapons systems. Panel XI seeks to establish commonality by developing and reviewing long-range concepts to identify capability requirements of future military materiel.

Military personnel are charged with developing and obtaining approval for Panel XI operational concepts, even though the panel works on the civilian side of NATO, as mentioned earlier. Currently, BG J. J. M. Antionetti of the Netherlands is the panel chairman. The secretary is a Belgian officer assigned to the international staff. Primary and alternate Panel XI members represent each of the participating NATO countries, along with an observer/liaison officer from Supreme Headquarters Allied Powers, Europe (SHAPE). This group represents national defense decision-making bodies at meetings. It also prepares and processes long-range concepts for final approval, usually at HQ NATO in Brussels, Belgium.

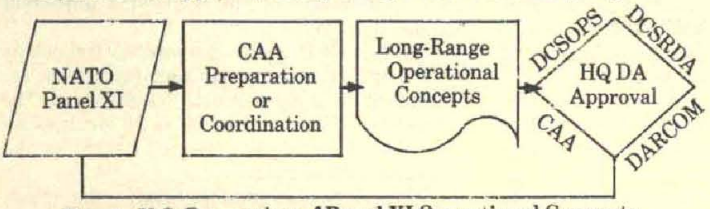



**Fig. 4. U.S. Processing of Panel XI Operational Concepts**

Operational concepts are prepared by designated national sponsors who generally have preeminent qualifications within specific subject matter areas. Some inputs are prepared jointly by groups of nations such as EUROGROUP (Belgium, Denmark, Germany, Greece, Italy, Luxembourg, Netherlands, Norway, Turkey and the United Kingdom.)

After a nationally or multinationally approved first draft is prepared, it is staffed with NATO member armies and revisions are discussed at panel meetings and by correspondence between meetings. Revisions are staffed until *consensus* is reached. When this occurs, an approved NATO operational concept is published and distributed to the NAAG equipment panels and other interested parties.

Preparation and staffing of operational concepts within the U.S. Army is accomplished by the Strategic Planning Group of the Army's Concepts Analysis Agency (CAA), Bethesda, MD, which provides the U.S. delegation to Panel XI. As the *Action Agency* for Panel XI, CAA responds to directives of the Deputy Chief of Staff for Research, Development and Acquisition (DCSRDA), the *Administrative Agent*.

The U.S. Army Deputy Chief of Staff for Operations (DCSOPS) provides the point of contact on the HQ DA staff for national coordination and approval. Accordingly, CAA supports the decision-making process by coordinating and staffing input with the Training and Doctrine Command (TRADOC), the Materiel Development and Readiness Command (DARCOM), and other interested Army agencies, as well as initial development of U.S.-sponsored operational concepts.

After HQ DA approval, CAA represents the United States in further coordination with Panel XI and ensures that required follow-up actions are taken. See Figure 4 for an overview of this process.

Panel XI has completed nine operational concepts to provide guidance to the NAAG equipment panels on R&D in the long-range time frame. These documents, sponsors, and dates of approval are shown below.

**Approved Panel XI Operational Concepts**

| *Subject* | *Sponsor* | *Approval* |
|---|---|---|
| Low and Very Low Ground Based Air Defense | UK | Sep 73 |
| Attack of Armor by Direct and Indirect Fire | US | Jan 74 |
| The Armored Vehicle Family | FRG | Jan 74 |
| Maintenance of Mobility | UK | Jan 74 |
| Requirements for Indirect Fire Support | Italy | Feb 74 |
| Battlefield Surveillance and Target Acquisition | France | May 75 |
| Urban Warfare | FRG | Apr 76 |
| Command and Control With an Emphasis on ADP | UK | Apr 76 |
| Long-Range Countermobility Concepts | US | Jan 77 |

The Panel XI work program currently contains three operational concepts in preparation, as shown here.

**Panel XI Operational Concepts in Preparation**

| *Subject* | *Sponsor* |
|---|---|
| Use of the Main Battle Tank in Future Warfare | BE |
| Concepts for Operations in A chemical Environment (1980-1990) | NL |
| The Implications of Sustained Day and Night Operations | US |

Three operational concepts now being processed are expected to be available for distribution to the NAAG equipment panels by late 1977. With their completion in sight, this is a good point in time to begin consideration of new initiatives for Panel XI.

New initiatives will be determined by the entire panel under guidance of its chairman. These will be affected by any restructuring of the NAAG in response to CNAD management. The NAAG is continuing its efforts to develop an organization with military standardization as its primary mission. Ultimately, this will produce an organization more fully capable of translating the long-range military commonality identified by Panel XI into hardware-oriented operational requirements.

My opinion is that as standardization efforts continue to make progress, Panel XI's new initiatives supporting the objectives of the NAAG should include, among others, the following "core" operational concepts.

A NATO *over-all operational concept*, similar in scope to the *ABCA* (American, British, Canadian, Australian) *86-95 Operational Concept*, to guide research and development of tactics, equipment, and logistics for the NATO armies during the long-range time frame. This would provide the general framework necessary for developing two additional operational concepts—a NATO *tactical-operational* concept to support armies executing NATO tactics and strategy in the long-range time frame.

Agreement on a tactical, logistical and an over-all operational concept will require extensive research and reasoned exchange of views over several years. Considering that Panel XI will soon complete its current work program, it is in an excellent position to accomplish "core" operational concepts such as those outlined above.

Public law 94-361 has given new impetus to NATO military standardization. This legislation will make it far easier to achieve two objectives for United States cooperative RD&E efforts announced earlier this year as:

- Reducing the shortfall, in real terms, between the United States RD&E program and that of the Soviets by making greater use of the RD&E of our allies.
- Increasing NATO military force effectiveness through increased common or interoperable hardware and the resultant efficiencies in procurement, training, logistics, manpower and operational flexibility.

Panel XI's new work program will benefit greatly, I believe, from this "strategy for military standardization" as it contributes to achieving these objectives by developing long-range RD&E operational concepts.

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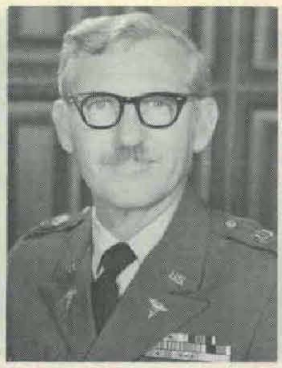
*MAJ Elliott's assignments have included duty with the Army Ordnance School, HQ U.S. Army Europe, Office of the Deputy Chief of Staff for Logistics, and Special Forces in Europe and Asia.*

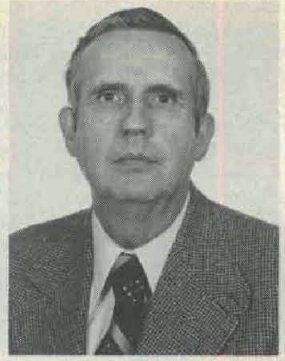
*A frequent writer on defense issues, MAJ Elliott has prepared a more in-depth analysis of this subject in his essay, "The Impact of Military Standardization on American National Security," to be published soon in a book on related subjects by the International Studies Association.*

**COL Garrison Rapmund**
*Director & Commandant*

**COL Philip K. Russell**
*Deputy Director/Commandant*



**COL Dale E. Wykoff**
*Associate Director, Operations*



**Dr. Howard E. Noyes**
*Assoc. Director, Research Management*

**LTC Gale E. Demaree**
*Executive Officer*

## *Walter Reed Army Institute of Research . . .*

# Activities in Many Lands Build Solid Base of World Renown

World renowned is a descriptive distinction term too often applied loosely by publicists of agencies and individuals contending for top recognition and honors awards. When applied to 84-year-old Walter Reed Army Institute of Research, it prompts an international chorus of concurrence.

WRAIR's history of exceptional scientific achievements—starting with those of the U.S. Army physician for whom the institute is named— has been acclaimed by a continuing expression of gratitude for "medical marvels" and humanitarian service in many nations.

Assistant Secretary of the Army for Research and Development Edward A. Miller gave the WRAIR staff members one of their proud moments in 1975 when he presented to them the "Army Laboratory of the Year" award.

Criteria for this selection include "the degree to which each Army laboratory realizes its full potential impact in enhancing operational force capabilities." An ad hoc panel of noted scientists makes the evaluation.

Accomplishments cited by the panel included: Characterization of virus antigens; establishing more firmly the military requirements (with civilian community "spinoff" benefits) for the hepatitis vaccine; demonstrating the feasibility of development an immunizing agent using microbial genetics—that is, studies of diarrhea-producing bacteria.

Another achievement considered by the judges was development of a vaccine from irradiated trypanosomes which protects cattle from naturally transmitted infections—also considered a major step toward development of a human vaccine for sleeping sickness.

Additionally, WRAIR was recognized for demonstrating the feasibility of stockpiling "donor" freeze-dried veins for vessel replacement in humans.

Multiply this impressive list of achievements for a single year by the historical factor of 84 years; results serve to instill a properly respectful appreciation of the worldwide impact of WRAIR activities.

**WRAIR Headquarters is located on the grounds of the Walter Reed Army Medical Center, Washington, DC, along with the Armed Forces Institute of Pathology, the Walter Reed Army Hospital, and other tenant activities, laboratories and animal-holding facilities.**

WRAIR R&D to advance medical technology and improve patient treatment procedures are managed by a director and commandant. The dual title is used because the responsibilities are those of a director of a research laboratory and commandant of a school.

With his headquarters staff, the director/commandant manages 14 WRAIR divisions, and the Special Foreign Activities (SFA) in Malaysia, Brazil, Thailand and Kenya. The divisions dealing with research are: Communicable Disease and Immunology, Surgery, Medicinal Chemistry, Neuropsychiatry, Veterinary Resources, Biochemistry, Medicine and Pathology.

Each of these divisions pursues independent research but they also serve each other. Interdisciplinary studies and resources provide enrichment across the broad lines of study encompassed by the WRAIR.

Additional service divisions support all of the WRAIR research, providing data processing (Division of Biometrics and Medical Information Processing); and the development and fabrication of special laboratory tools (Division of Instrumentation).

Other areas of effort are motion picture and still photography and medical illustration (Division of Medical Audio Visual Services); purchasing and contracting, supply and maintenance (Supply and Service Division).

Training, both the courses taught by WRAIR, and that provided for WRAIR, is the respon-

WRAMC Reports Rare Operation

## Severing Laryngeal Nerve Remedies Loss of Speech

Spastic dysphonia, a voicebox disorder that had worsened steadily since 1964 until a Washington, DC, woman was almost completely deprived of oral communication, was corrected, except for a lingering huskiness, by a recent operation at Walter Reed Army Medical Center.

Dr. (LTC) Robert Henderson, chief of the WRAMC Ear, Nose and Throat Service, commented that the resection of the laryngeal nerve operation may be the first of its kind in the U.S. outside the San Francisco area.

Louise Barkin had been virtually unable to talk to her husband, a retired officer, since 1975 because of her affliction and the loss of hearing he suffered from bombs during World War II.

When she was told by her doctor, Dr. James McFarland, that her condition was rare, and that the only U.S. doctor known to have performed corrective surgery was Dr. Herbert Dedo at the University of California, she remembered WRAMC's famed capabilities.

"I thought it was inconceivable," she said, "that at a teaching hospital like Walter Reed there would be nobody who was not familiar with the procedure. It turned out that Dr. Henderson had operated on a similar case with Dr. Dedo while he was stationed in California."

Dr. Henderson explained that the operation, involving cutting one of the nerves in the voicebox, is a comparatively simple procedure. This paralyzes the vocal chord on one side of the larynx. Normally the two chords come together and air passing between them causes them to vibrate and produce sound.

In her case, they came together with such force that no vibration was possible. Keeping the chord on one side in place by severing it enabled the other chord to come all the way across the laryngeal opening to produce vibration for the power of speech.

sibility of the Division of Academic Operations. Currently, courses at WRAIR range from individual student programs, under the Clinical Clerkship and Health Professional Scholarship Programs, to the Veterinary Animal Specialist Course (MOS-91T10), conducted by the Department of Instruction, Division of Veterinary Resources.

WRAIR is the parent laboratory for all OCONUS (outside continental U.S.) activities of the Army Medical Research and Development Command. Research is carried out in infectious and communicable diseases, combat injury, and psychophysiological disturbances related to military situations.

Staff is about evenly split between military and civilian, with the military staff divided about 50-50 between enlisted and officer personnel. The current WRAIR staff professional qualifications are attested by 84 MD (Doctor of Medicine) degrees, 119 PhDs, 28 DVM (Doctor of Veterinary Medicine), 152 master's and 381 bachelor's degrees.

Personnel are presently operating in five OCONUS locations, at the main headquarters located at the Walter Reed Army Medical Center, and several substations in CONUS. Recent field Army medical emergencies required WRAIR teams in Europe, Korea, Alaska and Fort Dix, NJ.

ROLE IN EDUCATION. The 1893 General Order establishing the Army Medical School stated its purpose was to instruct "approved candidates for admission to the Medical Corps of the Army in their duties as medical officers." The faculty of four taught: duties of medical officers in war and peace; military surgery; military hygiene; clinical and sanitary microscopy. Over the years, WRAIR has established courses ranging from one-day seminars to year-long studies.

Courses like "Global Medicine" provided for many years the "finest, most authoritative interdisciplinary study of preventive medicine techniques available to the uniformed medical services"—whose members might find themselves faced with medical problems anywhere in the world.

Course sizes range from one or two students, pursuing a narrow field of training, to more than 100 students. The number and sizes of classes, as well as the subjects taught, reflect the changing challenges of military medicine.

ROLE IN RESEARCH. WRAIR's annual reports reflect its enviable record of continuous contribution to medical knowledge and technology. The Jet Injection Gun for mass immunization programs is a product of WRAIR research familiar to many people all over the world. So are vaccines for Rubella (German measles) and Meningococcus type "O."

In recent years WRAIR laboratories have explored: characterization of virus antigens through studies of the composition and structure of the dengue virus; epidemiology of hepatitis, and the co-occurrence of hepatitis and drug abuse; potential of a vaccine for trypanosomiasis, developed from irradiated trypanosomes, and of possible value in preventing sleeping sickness in humans; feasibility of providing a stockpile of freeze-dried veins in a donor bank for use in blood vessel replacement (the latter two items as reported early in this article).

WRAIR (pronounced "rare") today represents and exemplifies the man who was soldier, scientist and teacher. Walter Reed was a member of the first faculty, a captain and assistant surgeon. His great work in Yellow Fever made his name synonymous with research in preventive medicine.

Evolution of the Army Medical School into the WRAIR was also the evolution of the science of preventive medicine, as exemplified by Walter Reed's own work. Now, under the command of COL Garrison Rapmund, MC, WRAIR's mission still is to research and teach those subjects that are significant in preserving America's fighting strength.

*Malaria Research.* Some concerns are of long standing at WRAIR. Malaria, for instance, has been termed the "most persistent enemy we have ever fought." It is still a threat to military and civilian populations.

As recently as the war in Vietnam, malaria was the number one cause of medical disability for the U.S. Army. In 1968 alone, almost 250,000 man-days were lost, at a cost of over $11 million in medical care.

Part of the problem in Vietnam was caused by the occurrence of a new, drug-resistant strain of malaria. Using a computer-based system developed at WRAIR, it has been possible to break down, screen and test for anti-malarial activity more than 225,000 chemical substances.

The computer system is able to print-out 2-dimensional representations of the chemical compounds. Once a substance has been put into the computerized system, it is instantly available to the other antiparasitic drug development programs at the institute.

Presently, one such drug, mefloquine, resulting from the $4.2 million annual program, has advanced to the point of clinical evaluation. Investigators report that, so far, it has proven reliable and safe.

*Adenoviral Acute Respiratory Disease.* In the past, basic training centers routinely figured on 50 percent hospitalization rates for mid-winter trainees due to this disease. WRAIR first isolated adenovirus Type 4 in the early 1950s and by 1965 a successful vaccine had been developed for testing.

In 1968, WRAIR began development and testing of a vaccine against Type 7. Since 1974, oral vaccines have been given routinely against both types with great success. For instance, adenovirus has been isolated in less than 5 percent of the trainees hospitalized since 1973 at Fort Dix, NJ.

The two vaccines were developed at a cost of $4.84 million. In the first two years of administering them, manpower savings to the Army alone were reported at $7.53 million.

More than 30 strains of adenovirus are known to affect humans, which explains why WRAIR maintains a continuous surveillance of long-term assessment program. One payoff has been in the vaccine developed for ADV 21.

First identified in 1966, ADV 21 did not appear as a problem until October 1975, when a vaccine was already under development at WRAIR. The surveillance program indicated that ADV 21 would have Department of Defense-wide impact, and plans were made to field test it among recruits in the Air Force and the Army.

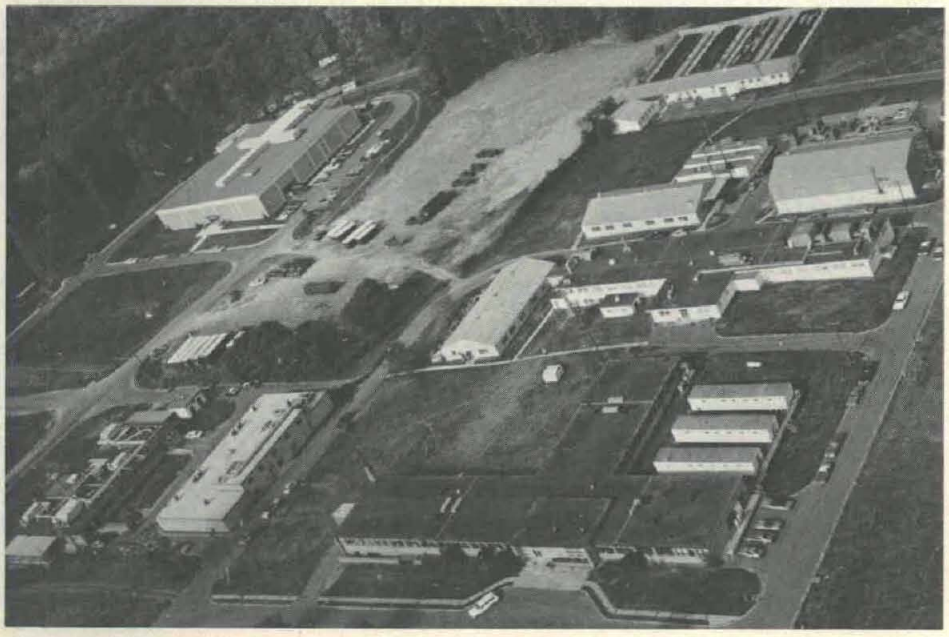
Results of the serologic testing conducted at WRAIR proved not only the efficacy of the vaccine, but also that it could be taken together with the type 4 and 7 oral vaccines without difficulty.

*Microwave Research.* New developments in battlefield technology bring new concerns in military medicine. Microwaves, usually associated with communications and cooking, are also a part of missile guidance and tracking systems, navigation and portable radar.

In modern warfare, the over-abundance of microwave propagation can create a hazard to the unprotected soldier fighting beneath what should be a protective shield. Research, leading to a better understanding of these high-frequency electromagnetic waves is essential to establish levels of exposure that can be absorbed safely by the human body.

Working through its resources in neuro-psychiatric research, WRAIR has developed a program that seeks, first, ways of measuring behavorial and morphological changes. The second task is to define safe levels of exposure to the wide variety of possible microwave sources. It is not unusual for WRAIR scientists to find themselves in a situation where progress

(Continued on page 18)



**KELSER SECTION, Forest Glen Annex, located in Montgomery County, MD, 4 miles from the Main Post, houses portions of the Veterinary Resources Division (right foreground and left background), and Microwave Research Department, Division of Neuropsychiatry.**

# WRAIR Activities Build Solid Base of World Renown

*(Continued from page 17)*

in research depends on tools not yet developed.

In microwave biohazards research, for example, computers have been adapted to provide constant analysis and monitoring of the minute amounts of microwave energy delivered to test animals and materials.

Tests are performed in specially constructed anechoic chambers at the institute's microwave research facility. One major barrier, when the microwave project was started, was the inability of existing instrumentation to measure directly the effects of exposure on living tissue.

Measuring devices would succumb to exposure effects before the tissue being tested. WRAIR has succeeded in developing devices capable of withstanding microwave radiation while the surrounding tissue responds in a measurable way.

OVERSEAS OPERATIONS. Since the days of the Yellow Fever Commission, when Walter Reed did his famous work in Cuba, the WRAIR has relied on overseas research stations to provide the core of its research. Field teams and overseas research laboratories have operated since 1945 in Japan, Puerto Rico, Korea, Germany, the Congo, Panama, Uganda, Vietnam and Alaska. Today, WRAIR researchers are at work in Malaysia and Thailand, Kenya and Brazil. This year, WRAIR researchers will return to Europe.

EUROPE. Modern concepts of sustained mobility and continuous combat operations have raised new questions as to the limit of man's capacity to function in extended operational demands. WRAIR team deployed to Europe will be testing medical hypotheses about relationships in units, maintaining individual and unit effectiveness, and examining the extent to which these factors contribute to the distribution and spread of medical problems among U.S. Army Europe personnel.

KENYA. Trypanosomiasis (African Sleeping Sickness) has been the major concern of this laboratory. Research performed in-country, with continental U.S. support, has demonstrated that certain trypanosomes causing this illness in man are serologically indistinguishable from parasites infecting domestic cattle.

This finding has yielded an important inter-epidemic reservoir of trypanosomes that may contribute to understanding periodic explosive epidemics in man. It has also shown Central Nervous System abnormalities in cattle infected with trypanosomes have, for the first time, proven very similar to changes observed in man.

Consequently, cattle might be an appropriate model for the development and testing of vaccines and other protective measures. In another test, gamma-irradiated trypanosomes used to inoculate cattle produced immunity against the same but nonirradiated strain, thereby demonstrating the feasibility of vaccine protection.

BRAZIL. Two separate projects are under way at Belem and at Brasilia. In the Amazon Basin, WRAIR researchers are studying the effects of disturbance of virgin tropical forrested terrain, as the Brazilian Government moves to open new settlements along the route of a new highway to the Peruvian border.

The first comprehensive investigation into the causes of febrile disease among Amazon Basin residents has been completed. Malaria and certain arbovirus infections have been identified as the major diseases.

In military terms, the investigation provides an insight into the health consequences of a large-scale disturbance of virgin terrain, such as may occur in wartime.

The second research effort is a joint venture with the University of Brasilia. WRAIR is working to identify new drugs effective in the prevention and/or treatment of Schistosomiasis. This is considered the number two parasitic disease in the world. It poses a severe threat to U.S. Forces which may be required to operate in endemic areas of the World

Presently, there are no effective drugs that will prevent this disease, also known as "snail fever," and none of the treatment drugs is without major shortcomings. Drawing on the nearly 300,000 compounds in WRAIR's November 1976 drug-screening inventory, 3026 compounds have been screened; 23 have been found to have anti-schistosomal characteristics.

THAILAND. The U.S. Army Medical Component, Southeast Asia Treaty Organization (SEATO), has been responsible for testing the new antimalarial drug, mefloquine, which to date has provided a 100 percent cure rate in the treatment of drug-resistant falciparum malaria.

Other ongoing research in the Bangkok lab, in conjunction with the Royal Thai Armed Forces Institute of Pathology, is in the pathophysiology of a life-threatening shock syndrome associated with second infections of dengue fever virus. Vaccines are under development against four serotypes of dengue.

These studies are expected to aid in establishing ways to avoid this syndrome when the vaccines are used. Hepatitis B is endemic to areas like Bangkok and this well-studied environment is ideal for evaluation of a Hepatitis B vaccine.

This research will continue as a bilateral effort with the Royal Thai Armed Forces. Thailand continues to offer the best environment for evaluation of new antimalarial drugs, hepatitis and dengue shock syndrome.

MALAYSIA. The U.S. Army Medical Research Unit-Malaysia conducts investigations of mite-borne typhus, otherwise known as scrub typhus. This disease has been a significant cause of hospitalization of military personnel in World War II, Korea and Vietnam conflicts. It occurs throughout Asia within a triangular area bounded by Australia in the south, Siberia in the north, and Pakistan in the west.

U.S. Army medical investigations began in Malaysia in 1948. WRAIR researchers had discovered that chloramphenicol halted the growth of rickettsiae, the class of microorganisms which cause various kinds of typhus fever.

The drug was carried to Kuala Lumpur to test it as treatment for scrub typhus. Investigations by WRAIR teams demonstrated that scrub typhus vaccines composed of killed rickettsiae did not protect man from the disease.

In 1953, advantage was taken of prior association with British and Malaysian investigators at the Institute for Medical Research (IMR) and Kuala Lumper to establish a small U.S. Army unit as part of the IMR.

Objectives of the unit were to determine the causes of febrile illnesses among British troops engaged in fighting an insurgency in the tropical forests of peninsular Malaya. Advances were made in knowledge of arthropod-borne virus infections and leptospirosis as they affected military personnel.

Subsequently, the unit focused again on scrub typhus because outbreaks of disease were encountered in Commonwealth (Australian, New Zealand, and British) troops, as well as in military units from the indigenous population.

Investigations developed new insight into the distribution of vector mites on the ground and of scrub typhus rickettsiae in the vector mites. A new vector of scrub typhus in Southeast Asia was recognized and colonies of vector mites were established.

The findings pointed to the highly focal nature of the disease (high efficiency of transovarial transmissions between generations of vector mites). Recent studies have characterized more precisely scrub typhus infection in man.

EXTRAMURAL RESEARCH. Another responsibility of the WRAIR is technical supervision of extramural contracts and grants sponsored by the USAMRDC in the fields of communicable disease and immunology. Specific subjects include entomology, global health data, infectious hepatitis and sanitary engineering.

The Office of the Associate Director for Research Management conducts continuous review and analysis to insure coordination of in-house research programs. WRAIR researchers and expert committees chosen from outside sources advise on the scientific merit of research proposals and monitor the use of human volunteers as research subjects.

Military medical research, as conducted by WRAIR, has become an established part of our nation's defense requirement. Results are not always likely to affect the civilian community in times of peace, but they do have significance when and where our forces must be deployed.

By going into the threat environment and seeking answers to questions of potential future importance, WRAIR (the laboratory and the school) carries on the tradition established by Walter Reed, the scientist and teacher.

## Call for Papers Issued for Nondestructive Test Conference

Summaries of papers proposed for presentation at the 26th Defense Conference on Nondestructive Testing (NDT), Nov. 15-17 in Seattle, WA, must be submitted no later than June 10 to the Steering Committee chairman.

The call for submission of proposals states in part: It is requested that you consider the presentation of an NDT problem or technical paper as your contribution to the conference .... The only restriction is that all presentations must be made by military or civilian personnel of the Department of Defense since attendance is restricted.

Hosted by Army, Navy, Air Force, and Defense Logistics Agency (DLA), on an annual rotational basis (Air Force this year), the conference brings together managers and other professional personnel who have responsibility for development or application of NDT methods in research, development and engineering, maintenance, and quality assurance.

Prime purpose of the conference is to provide a forum in which DoD agencies can disseminate information and develop potential solutions to NDT problems. Specific objectives include interchange of information pertaining to NDT methods and applications, ongoing programs, and critical problem areas; to encourage uniform practices in the application of NDT methods; and to provide establish personal contacts with NDT specialists of other agencies.

Summaries of papers whould be submitted by June 10 to: Chairman, Steering Committee, 26th Defense Conference on Nondestructive Testing, Supervisor of Shipbuilding, Conversion and Repair, USN, Seattle, WA 98115.

# Utilizing Reliability in Materiel Acquisition

**By Jim McCrory**

Applied to U.S. Army materiel requirements, reliability is used most often in the context of designing in, demonstrating or improving reliability. This is in keeping with the concept of having reliability as a major goal in the design stage and then providing for it to grow to maturity goals by the process of find-and-fix.

This find-and-fix process is accomplished by testing to define areas requiring improvement, initiating essential product improvement, and testing to verify its adequacy.

These steps of designing in, demonstrating, improving, and *again* demonstrating reliability constitute the bridge between concept formulation and the fielded system. They are thus characteristic of reliability growth.

Almost all major development programs in Army aviation today are based on the concept of reliability growth. Considerable methodology has been developed in this area by the Army Materiel Systems Analysis Activity (AMSAA). The Army can, by tracking reliability growth through the various stages of materiel development, insure that reliability gets proper attention to achieve maturity goals on schedule.

Another aspect of reliability relates to the test function, and it completes the reliability bridge of design, demonstration, and improvement mentioned earlier. This link in the bridge is *utilizing reliability,* which is the real payoff.

An example of how reliability can be and has been utilized to the benefit of the Army is evident in the T53-L-13B engine that powers the UH-1H and AH-1G/Q aircraft. When the T53-L-13 engine was introduced into Army testing, the time-between overhaul (TBO) was 300 hours. The time-between-inspection (TBI) (hot-end) was 150 hours.

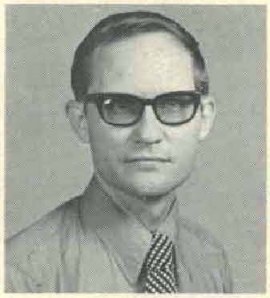
Early in the flight test program at the U.S. Army Aircraft Development Test Activity (USAADTA), Fort Rucker, AL, several problems were identified. The engine's hot-end inspection interval, for example, was limited due to a circumferential cracking problem in the first-stage gas producer nozzle.

The Powerplants Branch, Aviation Systems Command (AVSCOM), St. Louis, MO, initiated and managed development of several types of modified nozzles by Lycoming Division of AVCO Corp. Each type of nozzle that appeared to offer some tangible improvement was flight tested at USAADTA. A cast nozzle was found to be the solution to the circumferential cracking problem and it was adopted as standard.

A number of other problems were encountered during the USAADTA flight test program. Solutions were developed by the engine manufacturer through AVSCOM management. One of the most significant problems was a catastrophic failure associated with the aluminum axial compressor disc. Introduction of a titanium compressor spindle resulted in a solution to this problem. The original T53-L-13 engine, by this process of find-and-fix, evolved to the T53-L-13B configuration.

As problems were identified during the flight test program and solutions demonstrated to be acceptable, it became more evident that the hot-end inspection interval and the time-between overhaul could be extended.

The TBO, for example, was rapidly extended to 1,200 hours with a 300-hour TBI. This made the TBO and TBI of the T53-L-13 series engine comparable in those respects to other turbine engines operating in Army helicopters.



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The substantial investment in achieving solutions to problems, however, appeared to the testers at USAADTA and the personnel in the AVSCOM Powerplant Branch to have purchased a considerable improvement in reliability over and above that necessary to support the then established TBO and TBI.

Based on this evidence, USAADTA, with the concurrence of AVSCOM, initiated an effort to utilize the reliability of the improved T53-L-13B engine by investigating, through flight testing, the feasibility of extending the TBO and TBI.

Test engines were flown beyond the authorized TBO and TBI. Detailed documentation was developed of the condition of individual parts at selected inspection intervals. Performance of the engines was monitored by daily engine data acquisition and by the then newly developed engine health indication test (HIT) system.

Performance data were reviewed daily and all inspections were conducted by USAADTA aerospace engineers. Results were documented to AVSCOM in reports, and recommendations relative to the TBO and TBI with supporting rationale were forwarded to AVSCOM, as appropriate. Test flying was done by Army aviators and was designed to duplicate field flight conditions to which it was expected the engines would be exposed.

Test profiles were based on interviews with personnel returning from Southeast Asia and were coordinated with AVSCOM to insure validity of test conditions and the integrity of the test data. The U.S. Army Aircraft Development Test Activity thus became the spearhead used to break the barrier of the then existing TBO and TBI, which, as was noted previously, were comparable with other existing turbine engines used in Army helicopters.

Once USAADTA had demonstrated in a controlled test environment and documented by detailed inspections the feasibility of longer inspection intervals and higher TBOs, AVSCOM was able to broaden the sample from the two or three engines at USAADTA by directing selected units to operate helicopters to the higher TBO and TBI intervals.

The TBO of the T53-L-13B engine was increased by this method in an orderly manner to the current field level of 1,800 hours and the hot-end inspection interval was deleted. T53-L-13B engines at the Fort Rucker Aviation Center now operate with a 2,400 hour TBO and no scheduled hot-end inspections.

The engine HIT system, developed at USAADTA, is used to monitor engines during operation to indicate the need for a hot-end inspection. The deletion of the scheduled hot-end inspection is based in part on the use of the HIT system. The extended TBO, and to a considerable degree, the deleted scheduled hot-end inspection interval, however, were made possible by the significant improvement in reliability achieved through the product improvement programs initiated by AVSCOM's Powerplant Branch.

The increase in TBO and deletion of the scheduled hot-end inspection requirement should have salutary effects on the operational availability of aircraft powered by the T53-L-13B engine and on the maintenance manhour requirements. Improvements in operational availability and maintenance manhour requirements were made possible by completing the reliability bridge.

To the link of designing in reliability, and to the iterative reliability growth links of demonstrating and improving reliability, must be added the link of utilizing reliability. A major effort to design in reliability, when coupled with an active program of tracking and growing reliability, during development by the iterative process of demonstrating and improving reliability, can lead to a fielded system that achieves goals set during concept formulation.

Setting of maturity reliability goals and the improvement actions taken during the reliability growth period, however, do not represent a pure science. Concept formulation goals and any improvements realized during the development period are not likely to converge precisely to reach a previously envisaged design objective relative to inspection or removal policy. What constitutes the reliability limits relative to inspection and overhaul periods may not be known.

This twilight zone of reliability can best be investigated by a controlled flight test program during which the boundaries of safe, reliable operation can be surveyed. This can lead to the increased operational availability and reduced maintenance manhours that are characteristics of a cost-effective system. The T53-L-13B engine has, by utilizing reliability, established a benchmark of success for future helicopter turbine engines.

The advances achieved with the T53-L-13B engine may be transferred to other helicopter dynamic components by properly planned and executed test programs. To achieve early cost-effective operation of newly developed aircraft, maturity phase test programs should be designed to investigate the boundaries within which *reliability* can be safely *utilized.*

This policy will benefit the Army in the years ahead in both operational availability and the dollars required to support fleet operations.

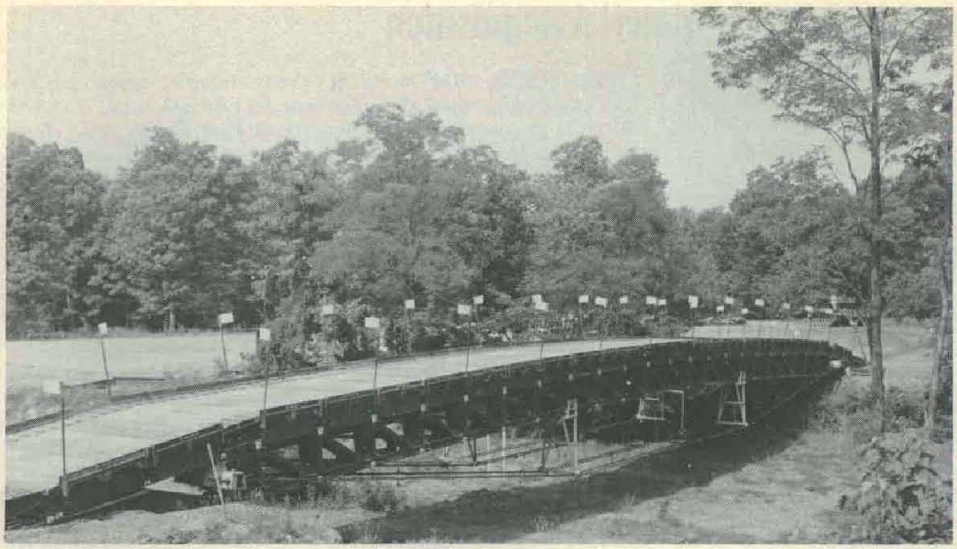


Figure 1

# Bridge Reinforcing Systems for the 1980s

**By William R. Abell**

U.S. Army Mobility Equipment Research and Development Command engineers have proved again that because something has been done a certain way for many years, it does not necessarily mean that it is the best way—that innovative thinking may lead to improvement.

This example involves the reinforcing systems used to reinforce the Bailey Bridge and the Medium Girder Bridge (MGB) to extend them from their basic design span to longer spans. To extend the MGB from its basic 30-meter design to 50 meters, a reinforcing kit (Figure 1) with 8 steel cables with queen post frames is used.

When the cables and frames are in place, each cable is tensioned to 22 tons with a hydraulic jack. When fully prestressed, the bridge has 176 tons of energy built into the cables, which results in a bridge camber of approximately 22 inches.

During recent tests on the MGB, it was observed that when a 60-ton tank crossed the bridge, it just about resulted in elimination of the camber. Obvious also was that the bridge's inherent strength was not being challenged in the least by the crossing load, due to the built-in prestress.

Since the bridge has sufficient strength to span 30 meters when subjected to class 60 loads, the first question was why not utilize this strength in extending to longer spans? It seems logical that at the longer spans, the top and bottom chords should be stressed to the same level as they are at the 30-meter span.

Similarly logical to assume was that, by utilizing this inherent bridge strength, the number of reinforcing members could be reduced, and also the mount of prestress required. We knew, if our assumptions were correct, we would not only effect a vast saving in material but also in time and manpower requirements.

We decided that the best approach to test our theory would be to construct a 50-meter bridge and prestress it to the 22-ton per cable level; then to subject it to a class 60 load and record the stress levels and deflections. Further, we would reduce the prestress loads in 1-ton increments, and load the bridge at each prestress level with a class 60 load—recording the data until we had attained the desired stress in the top chord of the bridge.

How did our theories prove out? I will give a few of the prestress levels with their results; however, this is sufficient to show the trend. Please keep in mind that the prestress introduces a camber in the bridge, and that deflections given are the changes in deck elevation from the unloaded prestressed condition to the class 60 loaded condition.

Remember also that the stress in the top chord when subjected to a class 60 load at an unreinforced condition and at a 30-meter span is approximately 31.5 Ksi (thousand pounds per square inch).

With each cable prestressed to 22 tons, the load in the cables increased to 42.5 tons when the bridge was subjected to the class 60 load. The maximum top chord stress was 9 Ksi; compression and the resultant deflection was approximately 22 inches.

The load in the cables increased to 33.5 tons at a cable prestress of 15 tons. The maximum top chord stress was 16 Ksi; compression and the resultant deflection was about 16.4 inches.

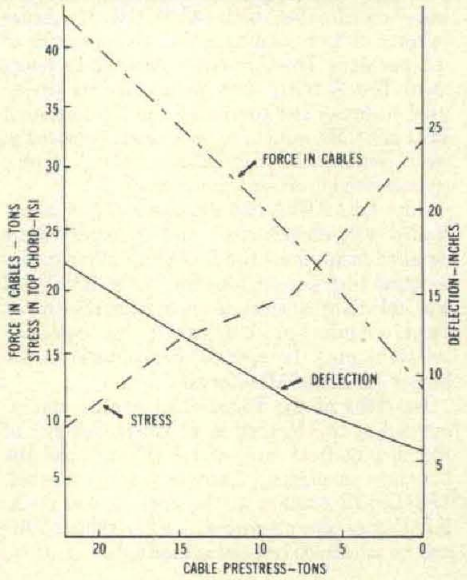



Figure 2

The load in the cables at a prestress level of eight tons increased to 24.5 tons, resulting in a top chord stress of about 19.7 Ksi and deflection of roughly 11 inches.

When the load in the cables was increased to 15.6 tons at a prestress level of two tons, the top chord stress was 23.6 Ksi and the deflection approximately 6.2 inches.

Unfortunately, our test setup did not permit us to reduce the cable prestress below two tons. Indications were that the stresses in the top chord at the 30-meter unreinforced condition could readily be balanced with the stress at the 50-meter reinforced span by proper adjustment of the reinforcing cables. Results at selected prestress levels are shown in Figure 2.

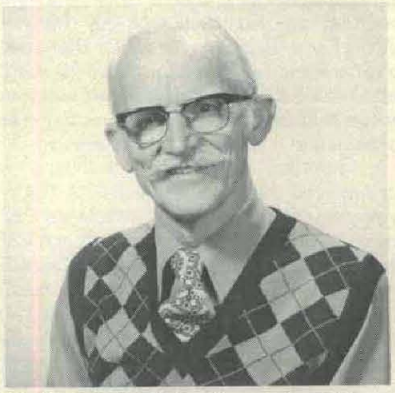
Every indication in research to date, it can be seen, is that the number of prestressing cables can be reduced by at least 50 percent. In all probability, no prestressing will be required. Thus, savings in time, money and manpower to be realized become very significant. Further savings and simplifications can be realized.

Because of the high prestress and the resultant high forces in the cables while under load, it was necessary to reinforce substantially the bridge members where the cables are terminated. Due to the vast reduction in prestress loads in the cable, these members in all probability can be changed back to their original designed condition without the necessity of adding weight and cost.

Before these reductions can be made, extensive traffic tests will be needed to assure there are no secondary stresses, bridge reactions, etc., which might be detrimental as a result of reducing the prestress. However, it appears almost a certainty that this approach will be the subject of subsequent product improvement projects on these items in the near future.

Investigations to date are having an influence on our Bridging in the 80s reinforcing system. Based on our calculations and test results, our design will incorporate only one reinforcing tension member per girder and a very small amount, if any, of pretensioning. This will permit us to attain the rapid bridge construction times required for highly mobile forces.

Our research results, we believe, point out that Army scientists, engineers, technicians and program planners should always be alert to possible ways of improving equipment to make it cost less and require less manpower to use.



*WILLIAM R. ABELL, chief of the Bridge and Structures Division of Lab 5000, U.S. Army Mobility Equipment R&D Command (MERADCOM), began his Civil Service career in 1957 and has worked at the Fort Belvoir, VA, activity since 1955. He received his BS degree in civil engineering from the University of Kentucky and is a registered professional engineer.*

## Speaking On . . . *(Continued from inside front cover)*

ness. In addition, the Soviet soldier has traditionally, and with justification, prided himself on his night-fighting capability. He trains constantly in snow and bad weather.

Our weaponry must not be limited by ambient light or fair weather or it will be of little use to us the majority of the time. Hence we give our attack helicopters a day-night adverse weather capability and our tanks and antitank missile systems an excellent passive night-vision capability. We fortunately have a leg up on the Soviets in thermal imaging, and need to continue pursuing that technology.

ARE THE SOVIETS ADDICTED TO ARMOR? A debate of moderate proportions has been continuing in this country over the survivability of the tank on the modern battlefield. An echo of it may be seen in the military journals of the Soviet Army. The future of the tank was questioned as early as 1964 by Nikita Krushchev after witnessing an antitank guided missile destroy one in a demonstration.

The doubts were magnified, of course, by the temporary but significant success of the Sagger (missile) against Israeli armor in 1973. The tankers have apparently prevailed, however, and the Soviets have concluded (correctly in our opinion) that the importance of the tank on the battlefield has not diminished, but that some alterations in tactics are required to accommodate the increasing antitank missile threat.

There is, however, a trace of stodginess to be noted in the Soviet dismissal of the increasing variety of threats to the tank. They may be sticking with the tank out of habit and the dusty World War II memories of the decision-makers rather than out of sound reasoning.

As recently as September of last year, Marshall of Tank Troops Babadzhanyan was quoted in *Pravda* as saying:

"It is true that in some capitalist countries' armies, the opinion has lately been voiced that, in connection with the appearance of... antitank guided missiles, helicopters and so forth, tanks are beginning to lose their former significance."

We do not think so. Soviet military art assigns to tank troops the role of the main strike and maneuver force of the ground forces. Soviet Tankmens Day, and many other like occasions, bring forth ringing and deserved tributes to Soviet armor in World War II, and its vital role today.

The Soviets are accomplished tankers and tank producers. We tend to think of armor expertise as a German forte, but often forget that the vast majority of German tanks that fought in Russia were greatly outclassed by the T-34, easily the outstanding ground weapon of World War II. The Russians, despite unbelievable wartime devastation, managed to produce over 95,000 tanks in four years, and about as many since then.

WHY SO MANY TANKS? Soviet ground forces, especially in Europe, are the most tank-heavy of any nation in the world, with a density of almost 16 tanks per thousand troops. The emphasis on armor stems primarily from two sources. The first is the ever-present Soviet eye to the past. The second, and more ominous, is the probable nature of a Soviet and Pact conception of a successful attack on Western Europe.

The Soviets regard the old saw about "General Winter" defeating the German invaders in 1941-42 as "fascist propaganda." They feel that the destruction of the German forces was effected not by the cold, nor the blundering of Hitler, but by the heroism of the Soviet soldier, specifically the tanker.

The Russians, one must remember, were the victors at Kursk. The largest tank battle ever fought saw such a density of armor on the battlefield that, in some cases, opposing tanks began ramming each other because they were so close that they could not bring their guns to bear.

BLITZKRIEG IS HIGHLY REGARDED. The Soviets also considered themselves, and not the Germans, as the originators of the blitzkrieg, and point with pride to the Manchurian campaign of August-September 1945 which they claim caused the surrender of Japan. (In Soviet mythology, the Atomic bombs were dropped by the United States to intimidate the Soviets, not the Japanese. The really telling blow to Japan they feel was the Manchurian blitzkrieg).

The blitzkrieg did make spectacular advances but against weak, often decimated Japanese forces which were under-equipped and demoralized. Still, one suspects that the Soviets are confident of a European repetition of the Manchurian campaign in the event of war.

This, in conjunction with the tank-heavy nature of their combined arms forces, reinforces our conviction that any conflict in Europe could be initiated by the Pact on a surprise basis, with a virtual absence of mobilization or warning.

**The Soviets consider the offensive** to be paramount in combat. Forced to be on the defensive through much of the war when their erstwhile Nazi friends surprised them, they suffered as many as 20 million dead and the ravishment of much of their homeland.

In some cases, they were reduced to training explosives-laden dogs to run under advancing German tanks and blow themselves up. They do not intend to let it happen again. Should the situation require, *they* will be the attackers, and to do so they have invested heavily in the preeminent instrument of ground offense—the tank.

The Soviets consider the tank to be strictly an offensive weapon that, according to their senior officers, represents "the main strike force of land based troops." Chief Marshall Rotmistrov, last September, saw evidence of "imperialism" and aggressive tendencies in the U.S.—FRG tank standardization efforts (saying): "Let us note that we are talking of *offensive* and not defensive weapons...."

REQUIREMENT: STOP HUGE TANK ATTACKS. Clearly, then, stopping Warsaw Pact armor is essential to winning any war which might break out in Europe. The Army has been criticized at times for its seeming preoccupation with antitank weaponry and the apparent redundancy of some of its systems. Hellfire, TOW, Dragon, Copperhead, Viper, mines, ICM's, the AAH, and the XM-1 *are* designed to accomplish precisely the same primary mission: the destruction of enemy armor.

Clearly, we are being defensive in our approach to stopping the Pact. But considering the fact that we have accepted a defensive rather than an offensive role for ourselves, and that the main weapon to be used against us will be the tank, complementary, flexible antitank weaponry is essentail to our success.

Other Soviet strong suits are also the result of sad experiences in the Great Patriotic War. The Luftwaffe devastated their troop and tank formations and supply columns in the early stages of the war, with several German pilots destroying or damaging hundreds of vehicles.

The Soviet concern for effective air defense was reinforced by the effectiveness of the U.S. Air Force in Korea and Vietnam. The Israeli destruction of virtually the entire Arab Air Force by surprise attack in 1967 drive the lesson further home.

AIR DEFENSE MAY BE OFFENSIVE. The result of the understandable Soviet determination to protect their assets from a sophisticated air threat may be seen in two other "heavy" areas of the Soviet force structure: An enormous fleet of fast, maneuverable interceptors, and a redundant, sophisticated, interlocking air-defense missile and gun system.

This system, or at least a significant part of it, can be interpreted as offensive in design, for the SA-6, SA-7, SA-8, SA-9, ZSU-23-4 gun and several other gun systems can keep up with blitzing armor and mechanized infantry. They will have to. Based on projected rates of Pact advance (exceeding 60 KM per day), the forward elements would run out from under the protection of the larger SA-2, 3, 4 and 5 systems within a matter of days from jump-off.

The Arabs, to their dismay, ran out from under their umbrella in 1973 and suffered tremendous losses from the Israeli Air Force. For the Soviets to do likewise in the face of a formidable NATO ground attack capability would be unthinkable.

**Requirement: Aircraft that Can Function and Survive in a High-Density Air Defense Environment.** Their redundancy in this case is a reaction to one of our strong points, and promises to pose problems for both Air Force and Army aviation. Our tactics and our weapons must accommodate the threat, or their use to our ground forces will be severely constrained.

A steady upgrading may also be noted in the ground attack capability of the Soviet Air Force. Increasing numbers of Soviet high-performance aircraft are now being built to fill a dual role: interception and ground attack. Some, such as the first-rate MIG-23 Flogger and SU-19 Fencer, are being introduced in exclusive ground attack versions.

**Protect Our Forces From Ground Attack Aircraft.** Standard Soviet fighters, in vast array, also have a ground attack capability, although they generally cannot perform as well in that role as our current aircraft.

While the debate continues on the strategic capability of the Backfire bomber, there is no question of its ability to deliver conventional or nuclear payloads on high value targets anywhere in Western Europe, the British Isles, or the Mediterranean. It would quite likely be used to attack a short while prior to or concurrent with a westward ground assault.

The Russians, it should be remembered, are no novices in the use of air power in the ground attack and interdiction role, and the Red Air Force delivered over 30 million bombs during the last war. Whether their Air Force is now dominated by the outmoded thinking of "old pilots," as is claimed by the MIG-25 defector, LT Belenko, remains to be seen.

If the Soviets were impressed by the performance of the U.S. and Israeli Air Forces, they also did not permit the role of the attack helicopter to go unnoticed, and it is now *we* who are behind in numbers of antitank capable attack helicopters. Their HIND, which they have been busily upgrading, is now the most heavily armed helicopter in the world, and will continue to be until the AAH joins the (U.S. Army) inventory.

The story, thus, in the Soviet air defense and ground attack area is the same as in virtually all their other departments: massive, redundant and increasingly sophisticated.

**Soviet Artillery: Formidable, Increasingly Mobile.** Soviet preoccupation with artillery may be traced to the lessons learned in that nation's disastrous participation in World War I, where she wasted the lives of millions of pitifully equipped, poorly led men before crumbling internally from revolution. Her divisions in World War I had less than half the number of guns as their German counterparts and, worse, only 850

(Continued on page 22)

## Speaking On . . . (Continued from page 21)

rounds were available for each gun in the inventory.

**Artillery: Biggest Killer on the Battlefield.** World War I was the last time the Russians were to be caught short in the fire support area. They claim that artillery inflicts over 50 percent of the casualties on the battlefield (which may even be a conservative estimate), and have worked incessantly at increasing and improving theirs.

During World War II, in several operations, the Soviets managed to provide one gun in support of every 4-5 attacking soldiers, and in April of 1945 massed an incredible 375 guns per kilometer in support of their crossing of the Tel'tov Canal.

Marshall of Artillery Kuleshov stated, a few months ago, that a salvo fired by the guns in a Soviet division has increased in aggregate weight over 30-fold from its 1939 figure, and the Commander in Chief of the Warsaw Pact has claimed an 8-fold increase in the firepower of Bulgarian and Polish divisions since the end of the War.

There is little question that a surprise attack on NATO would be preceded by an artillery preparation of devastating proportions, with 152,130,122, and 100mm weapons accompanied by 2-ton salvos from multiple rocket launchers and short-range missiles. Their artillery strength is currently three times ours, and the rocket launchers provide a saturation capability that we do not possess at all.

The Soviets and their allies do have one weakness in the artillery area, and that is they chose in the past to equip their forces with large quantities of towed tubes, and sacrificed the mobility that self-propelled pieces provide. A 60- or 70-kilometer a day armored advance would encounter almost insurmountable fire-support problems if forced to depend on truck-towed artillery of low cross-country mobility.

Needless to say, the Soviets are now rapidly fielding their own self-propelled pieces, a development which certainly does nothing to dispel the growing trend we see toward the blitzkrieg nature of their weaponry.

**Chemical or Nuclear Blitzkrieg? Both?** Will a Warsaw Pact assault on Western Europe employ nuclear and chemical weapons? We obviously do not know for sure, but the employment of these weapons is so eminently reasonable from a strictly military standpoint, and not totally unreasonable from a politico-strategic one. High-ranking Soviet officers and military theorists do stress the advantages of nuclear or chemical strikes against an unsuspecting enemy.

An important primary target, even ahead of depots, headquarters, units, etc., is the enemy's own nuclear weapons. A successful counterforce strike of this type would permit the achievement of the principal of mass on the part of the attacker; always a Soviet objective.

If the enemy's nuclear weapons remain in reserve, the attackers tank formations are extremely vulnerable, and the attacking formations must be spread over a wide area, decreasing their ability to support one another and exposing them to piecemeal destruction by conventional means.

"It is believed," a prominent Soviet military theorist recently wrote, "that the side which first employs nuclear weapons with surprise can predetermine the outcome of the battle in his favor." Hence, it is important to "maintain the secrecy of all measures for the preparation and launching of a nuclear strike."

Our tactical nuclear weaponry in Europe poses a tremendous problem for any Soviet plans for an assault on the West. Since we have wisely reserved the option of first use in the event of a Pact invasion, the Kremlin's options are reduced to three: 1) Launch a preemptive strike against our nuclear weapons sites in Europe. 2) Attack conventionally or with chemical munitions in penetrate-and-spread, mass armored formations. Take the chance that we will not employ nuclear weapons to avoid the possibility of strategic escalation. 3) Attack on a broad, dispersed front and present a minimum of attractive targets, thereby losing mass but lowering the risk of nuclear warfare.

**Requirement: Insure the Deterrent Value of Tactical Nuclear Weapons by Insuring Their Survivability.** Considering some of these possibilities, the importance of the U.S. Army's tactical nuclear weapons, Pershing, Lance and nuclear artillery projectiles, becomes clear. It is impossible to target all of them—especially the projectiles—because of their mobility and ease of concealment.

**Soviet Chemical Capability: Awesome.** Chemical warfare would almost certainly be employed by the Soviets in the event of a tactical nuclear war in Europe—because if a strategic exchange did not result from tactical use of nuclear weapons, it would obviously not be provoked by chemicals. The more important question is whether chemicals would be employed by the Soviets in a nonnuclear attack? The answer is quite probably yes.

The Soviets are so immersed in chemical weaponry, tactics, doctrine, equipment and personnel, and so much of their training centers around the use of lethal agents, that it would be odd, from a military standpoint, if they did not employ them.

Their offensive chemical capability dwarfs ours to the point that they would be throwing away a possible decisive advantage by not using chemical weapons. Our own offensive chemical weapon arsenal, while not puny, is, at this point probably not a sufficient deterrent, and it is unlikely that we would reply to the use of chemicals against us by initiating atomic warfare.

Chemical warfare, to the Soviet leadership, is just another means of winning. This form of warfare holds for them none of the disgust and fear with which it is justly regarded in the West.

Should a Pact advance bog down in front of a well-entrenched or massing NATO defense, the use of Soviet chemicals would probably be ordered almost routinely. It would be strange if it were not, for the imbalance in capabilities is so great. Scores of Soviet generals and some 70-100 thousand full-time chemical warfare officers and men are not employed in developing a capability which will be ignored should its need arise.

**Requirement: A Credible Deterrent to Chemical Warfare.** We often forget the pressure on our own government during World War II to use lethal chemicals on the Japanese-held islands in the Pacific. The argument most commonly advanced in favor of the idea was that we had the means to employ it on them while they could not retaliate in kind.

That situation does not prevail in Europe today, but it can be safely stated that chemical warfare will hurt us a lot more than it will the Pact, and that datum may, in fact, cause it to be initiated if it might prove decisive to the success of a Warsaw Pact attack.

With the possible exception of the atomic weaponry area, most broad characteristics that can be assigned to Soviet strategic thinking are either a result of experiences in the past war or are reactions to perceived American strong suits. Even the Soviet commitment to superior weaponry, strategic and tactical, is the result of a nagging technical inferiority complex.

Russian theorists ascribe their country's setbacks in the Russo Japanese War, World War I and the Crimean War to technological backwardness. The advances made under Communism, they claim, are largely responsible for later victories in World War II and coups such as Sputnik.

**The Soviet Military: Technology Minded and Amply Financed.** Whatever the shortcomings of the Senior Soviet military planners, they are not backward in their approach to technological advance. Almost everything is to be sacrificed for better arms and equipment. The wretched state of their housing, and the lack of comforts that are available in much poorer countries, is testimony of their monomaniacal pursuit of the very best in military hardware.

When a country has to pay its recruits only three dollars a month and need only house them like animals, it can afford to devote more of its resources to building machines for these troops to employ. Also helpful is what at times appears to be a virtual blank check from the Soviet treasury for equipment expenditures.

This free hand has its drawbacks, however, and there is evidence that seems to indicate that the highest military and scientific circles in the Soviet Union are inbred, cliquish, and somewhat staid. Certainly they do not benefit from the type of stimulating dialogue with the legislature that we enjoy.

In the industrial sector our competitive system and the profit motive seem to produce better products than the state-run bureaucracies of the Soviet Union.

One last characteristic of high-level Soviet leadership that must be kept in mind is its perfect willingness to expend tremendous quantities of human life and amounts of resources to achieve an objective. Indications are that the troops are often needlessly exposed to danger, such as artillery fire, mines, close-in bombing strikes, and even chemical munitions, to "toughen" them.

General of the Army Pavlovsky recently suggested this type of practice as a technique, and the callousness of it is evident in the recent report of a defector who told of an entire motorized regiment being sent into radiation-contaminated nuclear test site, where hundreds of the men sickened and needed prolonged hospitalization.

The lesson to be drawn from this is that we are not going to win a war with the Warsaw Pact by merely halting their advance. If the Soviets fix their eyes on the English Channel and move, we are going to have to inflict enormous casualties on them and destroy enough of their equipment to render their units inoperable.

The hardware implication of this fact is that our weapons must be capable of handling the "traffic"—human and mechanical—that may be hurled at us. Their fire must be voluminous as well as accurate.

**The Soviet Soldier: A Cog in a Machine.** Equally important as the strategy and character of Soviet leadership is the character and capability of the Soviet soldier—the man who may operate weapons used against us.

A composite Soviet soldier might be 18 or 19 years old, short in stature, literate and with a fair education, and perfectly prepared by years of all-pervasive indoctrination to be a cog in the Soviet military machine. He comes from a manpower pool so abundant that his leaders can afford to be somewhat choosey.

Soviet tanks can be built with a low silhouette because only men five feet six or shorter are assigned to tank units. The eyesight of the troops in Europe is generally excellent, because the Soviets send only those who don't require glasses.

Garrison life, even in the Soviet Union, is hardly pleasant for the 2-year

conscript. He is housed in barracks which are surrounded by barbed wire. His family, if he has one, must fend for themselves in nearby towns. He is not permitted to drive a car, and couldn't afford one if he were, on his three dollars a month salary. He is fed a carefully calculated ration of food, much like a farm animal, and undergoes rigorous physical training and hours of political indoctrination.

Suicide and alcoholism rates are quite high. Garrison life in Eastern Europe is even more dismal. The conscript, when not on maneuvers, is a virtual prisoner in camp, and is permitted no contact with the inhabitants of the host country.

Dissatisfaction with this miserable existence occasionally erupts into mutiny, as on the Soviet destroyer last year, or in defections or desertions, which are punishable by death. Mostly it is stolidly accepted as "the way things are." This blind and even brutish obedience permeates every activity of the Soviet soldier, and it will undoubtedly manifest itself in combat.

**Requirement: Break the Chain of Communication and Command.** The Soviet conscript or noncommissioned officer is taught not to think but to obey; not to improvise or make snap decisions, but to follow regulations to the letter and the chain of command to the link. Enlisted men are normally not permitted to talk on the field radios and are frequently denied access to maps, which are classified.

Twenty-nine percent of the troops are not fluent in Russian. Compartmentalization is so strict, for security purposes, that men working only a few feet from each other in, say, a radar van, cannot perform each other's functions, even in an emergency. They can, however, usually perform their own functions quite well.

Training often consists of endless hours of repetitious practice, sometimes on simulators, sometimes with crude facsimiles. A Sagger gunner, for instance, performs thousands of simulations before he is even allowed near the real thing.

One of the most profound shocks to Soviet defectors who are given the opportunity to see our armed forces in training is the relatively awesome responsibility that our NCOs are permitted. Functions performed routinely here by NCOs are entrusted to field-grade officers in the USSR.

LT Belenko visited an American aircraft carrier for a day and was astounded by the teamwork and professionalism of the enlisted men, and the effortless manner in which they performed their functions without being badgered or shouted at by officers.

The rigidity and robot-like performance of duty characteristics of the Soviet soldier is a 2-edged sword. In certain types of combat situations, particularly defensive, it can be advantageous as far as allocating (artillery) fire and executing limited precise movements.

In a blitzkrieg-type offensive, with a mobile FEBA (forward edge of the battle area), strange terrain, and the mass confusion associated with intense combat, it could work, perhaps decisively, against the Soviets, for unit commanders have a pronounced tendency to do nothing rather than make a mistake.

**Requirement: Surprise Them on the Battlefield. Expose Them to Weapons and Tactics Alien to Their Training.** A Warsaw Pact advance could rapidly degenerate into a disaster if we can A) keep them off balance and surprised, and B) destroy their communications and command and control structure.

If we disrupt their planned routes and rates of advance, we will be forcing hundreds of thousands of commanders, from squad to division level, to make snap decisions and use their own initiative—things they have been taught to avoid all of their military and civilian lives.

Since a sizable number of troops participating in any attack on the West would be drawn from other Pact nations, primarily Poland and East Germany, they form a part of the equation. Soviet planners must sometimes wonder if they can expect willing support from nations who have been virtual captives of the Soviet Union for almost three decades.

What are some of the phenomena we could expect in the event of a Pact attack on the West? It is almost certain that it would be preceded by an artillery and rocket barrage of tremendous proportions. The Soviets, as we have mentioned, are highly professional artillerymen and are armed with a variety of cannons which equal or exceed ours in quality.

The destructive power of massed modern artillery can be best comprehended by its effectiveness and volume in past wars. At the outset of World War I, planners on both sides projected ammunition expenditures of about seven rounds per day. One of the first great lessons of that war, and one that had to be relearned in the Middle East, was that large conflicts consume almost more of everything than planned. In the case of the artillery, the Russian planning figure of seven rounds per day was shortly superseded by expenditures of 500 rounds per day and more.

In 51 months of fighting both sides fired between 650 and 700 million artillery projectiles at each other and almost literally shot their way into bankruptcy. The 6-day artillery barrage at Malmaison consumed the equivalent of 266 30-car trainloads of artillery ammunition alone.

(In the battle of) Verdun, four million rounds were fired in seven days along a mere 17-kilometer front. The concentrations of high explosives were such that the terrain was actually altered in many areas, with hills and forest disappearing.

**Soviet Doctrine: Short Intense Artillery Preparation, then Attack.** The Soviets have no quarrel with such expenditures, but stress the necessity to reduce the duration of the barrage and increase its intensity. They point out that this magnifies its shock value, scatters and demoralizes the survivors, preventing preparation for defense against the ground attack which follows immediately.

The Soviets are admirably equipped for this type of preparation. Their artillery is accurate and fast-firing, and their multiple-rocket launchers produce a carpet pattern of high explosives which reminds one of a B-52 strike.

The initial preparation would coincide with mass air attacks against high-value targets, in order to disrupt attempts to organize the defense. A form of rolling barrage would then precede the armor-heavy spearhead of the assault. This technique, perfected during the first World War to the point where it was claimed that the troops had to stoop so as to allow the shells to clear their heads, has a new significance since the October War in the Middle East.

The Israelis, in the early Sinai counterattacks, neglected artillery cover and indulged in a series of disastrous armor attacks against unsuppressed Sagger and RPG armed infantry. It did not take them long to learn their lesson, and it is certain that the Soviets will employ this tactic whenever feasible when advancing against ATGM armed NATO positions.

What would this advance consist of? It is estimated that with a short, limited mobilization the Warsaw Pact could hit NATO forces in Central Europe with 58 divisions armed with 16,000 tanks, and supported by over 3,000 tactical aircraft. Another 7,000 or so tanks and 2,000 aircraft could be drawn from the Western USSR in a matter of weeks.

The objective of this colossal force would be to achieve by mass, shock and surprise a large enough hole, or holes, in the NATO defenses to achieve deep envelopments, split Allied Forces, disrupt supply lines and deny NATO the time to organize an effective defense. Tank battles would quickly develop that would exceed, in ferocity and numbers of vehicles committed, anything heretofore seen in warfare.

**Requirement: Get the Force to Where It's Needed—Fast.** That penetration will be achieved in the early stages of such a war is unquestionable. The Pact will have in its favor not only surprise and mass, but the option of picking the spot to hit (and there are too many possibilities for us to bank on any one in particular).

Our problem then will be to plug the initial holes, and concentrate our forces and fire on the enemy forces which have penetrated. Since we will have to use virtually every man, gun and vehicle we can muster, high mobility is critical. It will be a "come as you are" war, and dependence on anything except forces in being is an invitation to disaster.

The Soviets will be racing against time as they move toward the Rhine and then the Channel. The German debacle during World War II taught them what happens when a blitzkrieg bogs down and is stopped. If we can slow them up or stop them before they advance too far, the oft-maligned "tail" in our tooth-to-tail ratio will begin to show its worth; superior staying power of NATO will begin to grind them down and roll them up.

We must, of course, be prepared to fight a longer war, but dependence on anything except forces *in place*, or readily available, during the first critical days or weeks of the battle would be hazardous and perhaps fatal to our defense.

We obviously feel that the troops who will participate in such a violent type of war must be armed with nothing but the very best we can afford; that mere parity in quality in the face of such an imbalance in quantity is inadequate. The old formula which claims that the attacker requires a 3-1 superiority of force over the defender may be true in small-scale attacks, but surprise makes the entire equation meaningless.

Let us now consider the major types of Soviet equipment and how they match up against both our present equipment and the items that we are asking the committee to approve today.

**Assistant Secretary of the Army** (R&D) Miller and Deputy Chief of Staff for Research, Development, and Acquisition LTG Cooksey closed their FY 1978 budget proposal with a detailed discussion of comparative qualities of U.S. Army-NATO Pact weapons systems vis-a-vis those of the Soviets and the Warsaw Pact nations.

Included in their presentation were tanks, their firepower and other capabilities; aircraft systems, firepower, protective armament and ground support qualities; artillery mobility and firepower; armored personnel carriers; cannon-launched rocket projectiles; air defense capabilities; individual ground-launched missiles; sensor systems; tactical communications, radar and laser system target locators; electronic warfare; chemical, biological and radiological warfare aspects; and remotely piloted defense and attack vehicles.

# Conferences & Symposia . . .

National JSHS Marks 15th Anniversary...

## Scientist-Astronaut Heads Guest Speakers

Befitting the 15th anniversary of the National Junior Science and Humanities Symposium, scheduled May 4-7 at the United States Military Academy, West Point, NY, is an all-star group of five guest speakers, headed by NASA's celebrity scientist-astronaut, Dr. John Lind.

Dr. Lind will speak on "A Scientific View of Space - Skylab to Shuttle." His address will hark back to the keynote speech given at the NJSHS in 1972 in the Morehead Planetarium, in the Durham, NC, area by Astronaut Russell Schweikert. That unforgettable account of his Earth orbital observations included a Skylab Project description.

One of the most controversial issues in modern science will be the topic of Dr. David Young, Maryland (TN) College, when he speaks on "Genetic Engineering" — involving all the speculative human mutational risks of this developing new art.

Dr. Maynard Miller, who held his young audience spellbound when he addressed the 1971 NJSHS on the subject of "The Environmental Crisis," will return as a featured speaker on "The Coming Crisis in Vital Metals." Dr. Miller is dean of the University of Colorado School of Mines.

Dr. Ernst Herbert Soudek, professor in the School of Engineering and Applied Sciences, University of Virginia, is programed to present the featured "humanities" address. His subject has not been announced.

Numerous distinguished academic and military leaders will give presentations preceding the opening of 10 or more concurrent panel discussions of topics in various scientific disciplines.

Five outstanding science students from each of 41 regional Junior Science and Humanities Symposia will be selected to attend the 15th NJSHS, and one from each region will present technical papers on their basic research projects.

The papers will be judged by a select panel and five presenters will be selected to go to England for the "London International Youth Science Fortnight" in July and August.

Six long-time outstanding members of the recently abolished Advisory Committee of the Junior Science and Humanities Symposia Program (names not available at press time) will be honored. The committee will be succeeded by a U.S. Army Youth Science Activities Steering Group scheduled to convene for its first meeting May 5.

Including the regional symposia directors and high school science teachers accompanying their students at their own expense, total attendance at the NJSHS is expected to range from 300 to 325.

More than 50 percent of the expense of conducting the JSHS program is paid by academic institutions and industrial organizations sharing support of the program in cooperation with the U.S. Army.

The objective of Army support is to stimulate career goals and point out to the young participants in the JSHS Program the scientific and engineering career opportunities in Army research and development laboratories — thus facilitating recruitment of outstanding university and college graduates interested in Federal Civil Service employment.

## Watervliet Researchers Address Foreign Parleys

Four Watervliet (NY) Arsenal scientists are representing the U.S. Army by presenting technical papers at conferences in Germany, England, Canada and France within a 3-month period.

**Dr. Garry C. Corofano** led off with a paper titled "Laboratory Simulation of Recoilless Rifle Backblast," presented at the 3d International Symposium on Ballistics at Karlsruhe, Germany. The symposium was sponsored by the West Germany Federal Ministry of Defense in cooperation with the American Defense Preparedness Association.

The paper describes results of arsenal efforts to simulate, in the laboratory, blast phenomena when weapons are fired. Simulation equipment developed by Watervliet scientists permits study of such effects at greatly reduced cost.

**Dr. Michael H. Kamdar** gave the keynote lecture on liquid metal embrittlement at the International Conference on Mechanisms of Environment Sensitive Cracking of Materials, held early in April at the University of Surrey, Guilford, England. He also served on the organizing committee for the conference, sponsored by the Metals Society of Great Britain supported by the U.S. Army European Research Office. He has led a successful effort to determine the cause of embrittlement, a problem for materials scientists for nearly half a century.

During his investigation of fracture in gun steels, he determined that the embrittlement occurs in a ductile metal, such as steel, when it comes in contact with certain liquid metals. Among these are lead, mercury and gallion. His lecture described advances made during the past decade toward understanding this embrittlement and suggested possible directions for future research.

Dr. Kamdar will make keynote lectures on liquid metal embrittlement at the 4th International Conference on Fracture at Waterloo, Canada in June, and at the Conference on Environmental Degradation of Engineering Materials at Virginia Polytechnic Institute in October.

Two papers relating to research carried out at Watervliet Arsenal for the U.S. Army Air Mobility Research and Development Laboratories, Moffett Field, CA, will be presented in Canada and France.

**Joseph F. Throop** will discuss "A Fatigue Resistant Titanium-Aluminum Laminate," prepared in collaboration with his fellow mechanical engineer, Robert R. Fujczak, at a symposium on "Toughness and Fracture Behavior of Titanium." Sponsored by the American Society for Testing and Materials, the symposium is scheduled at Toronto, May 2-3. His conclusions derive from an exploratory program for development of damage-tolerant materials for aircraft and helicopter structures.

Arsenal mathematician **Dr. Julian Wu** will participate in the International Symposium on Innovative Numerical Analysis in Engineering Science, May 23-24, in Paris. His paper describes development of efficient numerical methods in solving the dynamics problem related to the Research in Structure Program of the Air Mobility Command. This symposium is sponsored by the U.S. Air Force in conjuction with various French scientific organizations.

## ASAP Meet Themed on Soldier's Armor Environment

More than 75 U.S. Army Scientific Advisory Panel members, associate members and invited dignitaries are expected to attend the ASAP spring meeting on "The Modern Soldier in the Armor Environment," May 9-10, Fort Knox, KY.

The theme parallels that of the fall meeting held at the Infantry Center, Fort Benning, GA, on "The Modern Soldier in the Infantry Environment."

Invitees will include research and development leaders of the Navy, Air Force and Marines, the Medical R&D Command, Corps of Engineers, Office of the Deputy Chief of Staff for Research, Development, and Acquisition, the Office of the Office of the Deputy Chief of Staff for Operations, the Army Materiel Development and Readiness Command, and other major agencies.

MG John W. McEnery will give the welcoming address as host, commander of the Armor Center and director of the Armor School. He also has accepted an invitation to make the banquet address.

Featured will be a presentation by MG Robert J. Baer, the recent winner of the Secretary of the Army's first annual Project Manager Award as PM for the XM-1 tank. COL Robert E. Butler will report as PM for the M-60 tank. The Fort Knox Tank Force Management Group is programed for a briefing on tank tactics in future warfare.

Other briefings on the Armor Center and the envisioned threat will be made by Fort Knox staff members, the Armor and Engineer Board, and a group on training doctrine and technology.

Highlighting the business meeting will be reports by five ad hoc groups, with comments by Assistant Secretary of the Army (R&D) Edward A. Miller and Deputy Chief of Staff for Research, Development, and Acquisition LTG Howard H. Cooksey.

Electronic Warfare Intelligence will be chaired by former ASAP vice chairman, Dr. Richard Montgomery; Systems Engineering Technology, headed by former ASAP chairman, Lawrence (Larry) O'Neill; Gun Tube Wear and Erosion, Dr. Joseph Sternberg; Command and Control, Robert M. Lockerd; and Optical Countermeasures, Dr. Paul Kruse.

## Navy Hosts Army 23d Design of Experiments Meet

Texas A&M University Prof. H. O. Hartley is programed for the keynote address, "Analysis of Unbalanced Experiments," at the 23d Conference on the Design of Experiments in Army Research, Development and Testing, Oct. 19-21, at the U.S. Naval Postgraduate School, Monterey, CA.

The conference theme is "The Design and Analysis of Field Experiments," with emphasis on the analysis of data subjected to uncontrolled variation.

Dr. George E.P. Box, University of Wisconsin at Madison, is scheduled to speak on "The Analysis of Time Series." He received the American Statistical Association's Samuel S. Wilks Award in 1972 and is the incumbent of the Ronald A. Fisher Chair of Statistics.

Presentation of the Wilks Award, given for contributions to the advancement of scientific or technical knowledge in statistics, is a special

feature of the annual meeting. Consisting of a medal, citation and a cash honorarium, the award was presented to Dr. Solomon Kullback, professor emeritus at George Washington University, in 1976.

Other invited speakers include Dr. Norman Breslow, University of Washington, whose topic is "Censored Data," and Dr. H.L. Lucas, North Carolina State University, who will discuss "The Analysis of Messy Data."

The Conference on the Design of Experiments (CDE) is one of three annual conferences sponsored by the Army Mathematics Steering Committee (AMSC) to promote exchange of mathematical and statistical expertise among Army scientists and engineers. The others are the Conference of Army Mathematicians and the Army Numerical Analysis and Computers Conference. (See January-February 1977 issue of this magazine, p. 26.)

BG Donald Packard, who heads the U.S. Army Combat Developments Experimentation Command, Fort Ord, CA, is host to the CDE, and his scientific adviser, Dr. Marion Bryson, is chairman of arrangements. Further information can be obtained by calling or writing Dr. Robert L. Launer, Mathematics Division, U.S. Army Research Office, Research Triangle Park, NC 27709, telephone: (919) 549-0641 or Autovon 935-3331.

## Wastewater Overland Flow Treatment Reviewed

Treatment of wastewater (contaminated effluents), currently one of the nation's broad problems, by improved overland flow systems was demonstrated and discussed at a "field day" at the Environmental Effects Laboratory (EEL) of the U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Attended by about 70 representatives of a wide diversity of interested organizations and agencies, the event was sponsored jointly by Office of the Chief of Army Engineers, Cold Regions Research and Engineering Laboratory, the Environmental Protection Agency, Cooperative Extension Service of Mississippi State University, and the Town of Utica.

Participants included city managers, officials from environmental and health regulatory agencies, agricultural extension specialists, farmers, soil and water conservationists, and others interested in the system.

Experimentation at the Overland Flow Research Facility, an element of WES at Utica, MS, is programed to determine the most effective system operation and the crop management practices relevant to wastewater use.

The field day program included a tour of the OFRF and the showing of a film, "Wastewater Bonanza." The program was planned to enable participants to evaluate overland flow treatment as an alternative for treatment in accord with Section 201 of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500).

A high level panel discussion group included Richard Thomas and Robert S. Kerr of the Environmental Protection Agency's EP Laboratory; Russ Wright, Water Division, EPA at Atlanta, GA; Barry Henson, Mississippi Air and Water Pollution Control Commission; Ronald Crites, Metcalfe and Eddy Consulting Engineers, Palo Alto, CA; Joseph Brown, Bureau of Environmental Health, Mississippi State Board of Health; Dr. Fred Beckett, consulting engineer, Bruce, MS; Dr. Paul Murrmann, Army Cold Regions Research and Engineering Laboratory, Hanover, NH; Dr. Richard Lee, panel moderator, Robert Peters and Andy Green of WES.

## WSMR Employes Present Papers at National Parleys

Research papers authored or coauthored by three White Sands Missile Range employes while working with New Mexico State University will be presented at national scientific conferences.

H.P. Huddleston Jr., an engineer with the Army Materiel Test and Evaluation Directorate (ARMTE), and Dr. G.P. Mulholland of NMSU, are coauthors of "Evaluation of Thermal Soak Times," which will be presented at the 23d annual Institute of Environmental Sciences in Los Angeles, Apr. 24-27.

The paper describes construction of a mathematical model for heat transfer within the electronic package of a Chaparral missile. The model is used to predict performance of the Chaparral system when exposed to excessively high and low temperatures in WSMR environmental tests.

"WSMR Fast Burst Reactor Irradiation Cavity Enlargement Thermal Stress Analysis" explains procedures and results of tests conducted by range employes Armando De La Paz and Don Welch and Dr. W.C. Hull and Mulholland of NMSU's Mechanical Engineering Department.

The paper, which describes shock stress tests designed to insure structural soundness of the fast-burst nuclear reactor after its modification to provide an enlarged irradiation cavity, will be presented at the annual meeting in June of the American Nuclear Society in New York City.

Huddleston is a mechanical engineer with the WSMR Climatics Branch of the Applied Sciences Division. De La Paz and Welch are nuclear engineers with the Nuclear Weapon Effects Branch, which De La Paz heads.

## Conferees Examine Snow Impact on Transportation

The Impact of Snow on Transportation was the theme of a recent 3-day technical conference sponsored by U.S. and Canadian sections of the International Society for Terrain Vehicle Systems and the Army Cold Regions Research and Engineering Laboratory.

Held at CRREL, Hanover, NH, the meeting drew more than 80 attendees representing government agencies, research laboratories, industry and academia. Dr. D.R. Freitag, CRREL technical director, was conference chairman.

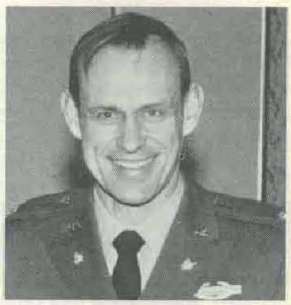
Topics of four major technical sessions, supported by individual presentations and panel discussions, were: evaluation and testing of winter tires; snow removal techniques and equipment research; snow mechanics; and over-snow vehicles.

The International Society for Terrain Vehicle Systems was established in 1961 to advance knowledge of the mechanics of terrain vehicle systems and soil working machinery capabilities in all types of environments. Dr. R.A. Liston of CRREL is U.S. national secretary.

## Conferees Examine Organizational Effectiveness

Ways of integrating effort to aid in preparation of a coordinated organizational effectiveness (OE) research, development, test and evaluation program for Fiscal Year 1978 were discussed at a recent conference sponsored by the Army Deputy Chief of Staff for Personnel.

BG Alfred B. Hale



COL William C. Maus

Conducted by the U.S. Army Research Institute for the Behavioral of Social Sciences, a DCSPER element, the 2-day meeting in Arlington, VA, attracted about 50 representatives of major Army agencies. The purpose was to identify research needed to improve organizational effectiveness and to ensure coordination of all ongoing OE efforts.

Principal speakers included BG Alfred B. Hale, director, Plans, Programs and Budget, ODCSPER; COL William C. Maus, commander, Army Research Institute; and Dr. Julius E. Uhlaner, ARI technical director and Army chief psychologist.

The program also offered presentations by LTC Anthony Nadal, chief, OE Task Force, Office of the Army Chief of Staff; COL Clarence A. Miller Jr., chief, Leadership and Motivation Division, Office of the Director of Human Resources Development, ODCSPER; and Dr. Ralph Canter, chief, ARI Personnel Accession and Ulitization Technical Area; and COL J. A. Neuberger, chief, Research Office, Directorate of Plans, Programs and Budget, ODCSPER.

COL Neuberger clarified the conference objective by stating it was directed to OE research and was not concerned with the question of organizational structure for implementing OE in the Army.

Featured also were presentations on the Training and Doctrine Command's Work Study Program, Administration Center, Fort Benjamin Harrison, IN, and the OE Training Center unit working on the Organizational Effectiveness Evaluation Plan, Fort Ord, CA.

Working group discussions centered on Military Problems Needing OE R&D; Tools for OE: R&D Efforts; R&D Interface with OE State-of-the-Art: New Requirements; and R&D Interface Policy, Doctrine and Instruction (management).

Dr. Paul Thayer, president of the Division of Industrial and Organizational Psychology, American Psychological Association, and senior vice president, Life Insurance Marketing and Research Association, Hartford, CT, gave the conference summary.

Dr. Canter, Dr. Paul Duffy and Dr. Ray Kirk of the Army Research Institute staff had lead roles in arrangements for the conference. Proceedings will be available soon for distribution.

# Awards...

## Achievements Recognized in R&E, Administration

**NARADCOM Commander COL Rufus E. Lester Jr., and Technical Director Dr. Dale H. Sieling flank Meritorious Civilian Service Medal winners Dr. Abdul R. Rahman and Henry Weisgold.**

Meritorious Civilian Service Medals and gold and silver pins recognizing achievements in research, engineering and administration were presented recently during annual awards ceremonies at the U.S. Army Natick (MA) Research and Development Command.

**Dr. Abdul R. Rahman,** head of the R&D Plant Products Branch, received the MCSM, the Army's second highest decoration for civilian employes, for contributions to development of compressed foods and dehydrated perishable vegetables.

**Henry Weisgold,** a facilities engineer, also received an MCSM in recognition of engineering and management of all phases of NARADCOM's maintenance and energy conservation programs.

**Thomas M. Keville** was awarded the Technical Director's Gold Pin for Research. He was cited for design and development of new body armor for combat personnel to achieve improved user protection and comfort.

**Arthur L. Murphy Jr.** gained the TD's Silver Pin for Research for developing a theory for the guidance and control of gliding parachute systems, designed to overcome current delivery systems inaccuracies.

**Peter J. Macek** was presented the TD's Gold Pin for Engineering for service as project engineer and sole Army airdrop representative on joint-service programs. The award justification states his work is expected to result in U.S. Government savings estimated at about $100,000.

**Leonard F. Flores Jr.,** a textile technologist, won the TD's Silver Pin for Engineering. His management of the TOW CAP project achieved completion of the RDT&E cycle for the gunner's protective cover in 142 days.

**Dr. Eugen Wierbicki, John J. Killoran, Dr. Fred Heiligman, Joseph S. Cohen, Gary W. Shults** and **John J. Howker** shared the TD's Silver Pin Group Award for Engineering, in recognition of joint development of irradiation preservation of beef, ham, pork and chicken as rations. They were cited for successful technology transfer of small pilot plant operations to industrial-scale production and packaging.

**CPT Joseph W. Kernodle** was presented the Commander's Annual Military Award for Research, Development, Test and Evaluation. He computerized technical data for the Uniform Quality Control Program, which received acclaim for NARADCOM from manufacturers.

**Eugene G. Beary** won the CO's Gold Pin for Leadership in Administration for improvements in services of the technical library. He managed installation of a remote terminal link and formulated plans for automating publications acquisition.

**Dr. Donald E. Westcott,** a food technologist, gained the CO's Silver Pin for Leadership in Administration. He was cited for outstanding service on projects and as head of NARADCOM's Plant Products Group.

**John V. DeSalvo** and **Lois M. Willard** received the CO's Gold Pin for Installation Support. DeSalvo was credited for craftsmanship as a machinist and Willard for administrative duties in visual aids.

## 4 Army Civilians Gain Meritorious Service Awards

Dr. Helmut Sommer, an associate technical director of the U.S. Army Harry Diamond Laboratories, Adelphi, MD, is one of four recent recipients of a Meritorious Civilian Service Award.

Federally employed for 28 years, Dr. Sommer was cited for "outstanding management of a large number of complex electronic R&D programs" and contributions to fuzing and nuclear radiation effects.

A radar officer in the Signal Corps during World War II (1943-46), he joined the Atomic Physics Section of the National Bureau of Standards in 1949. He was transferred with 152 other NBS employes to HDL (then the Diamond Ordnance Fuze Laboratory) in 1953.

After serving as a research professor at the University of Florida during 1957, he returned to HDL in 1958 and subsequently served as chief, Radio Systems Branch, and chief, Microwave Branch. Later he was chief of the Systems Research Laboratory.

Dr. Sommer has BS, MS and PhD degrees in electrical engineering from Texas A&M University, pursued graduate study at Massachusetts Institute of Technology, and conducted his thesis research at the National Bureau of Standards. He has authored numerous technical publications and is a member of the Philosophical Society of Washington, Washington Academy of Science, Institute of Electronic and Electrical Engineers and Tau Beta Pi and Sigma Xi fraternities.

**Other MCSA recipients** include Drs. Ingo W. May and Charles H. Murphy of the U.S. Army Ballistic Research Laboratories, Aberdeen Proving Ground, MD, and Dean C. Borgman, employed at HQ U.S. Army Aviation Systems Command, St. Louis, MO.

DR. MAY was cited for interior ballistics research expected to have far-reaching applications in the design of propelling charges and their igniters — specifically in ensuring safe development of large-caliber weapons.

Assigned to BRL's Propulsion Division, he has authored four technical papers and more than 20 government reports. He has a BS degree in chemistry from Gannon College, with MS and PhD degrees from Case Western University.

**Dr. Ingo W. May**

DR. MURPHY is chief of the Launch and Flight Division and received his MCSA for contributions to the theory of nonrigid payload behavior in projectiles, and verifying complex equations of motions of cargo-carrying projectiles.

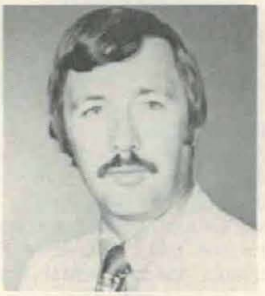
Employed at BRL since 1948, he received his BS (cum laude) in mathematics from Georgetown University. He has an MA in math, an MS in engineering aeronautics and a PhD in aeronautics from Johns Hopkins University.

**Dr. Charles H. Murphy**

DEAN BORGMAN, chief of the Army Air Mobility R&D Lab's Systems Research Integration Office at AVSCOM, received the MCSA for outstanding contributions leading to establishment of an effective air mobility R&D program.

A former deputy program manager for the XV-15 Tilt-Rotor Research Aircraft Program, he has a BS degree in aeronautical engineering from California State Polytechnical University and an MS degree from Stanford University.

President of the St. Louis Chapter of the American Helicopter Society, he is a member of the American Institute of Aeronautics and Astronautics, and the Tau Sigma engineering fraternity.



**Dean C. Borgman**

## Pine Bluff Man Patents Volumetric Filling System

**Harold D. McKinney**

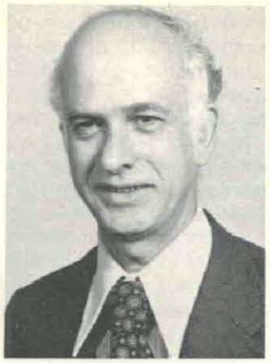
Development of an improved method for filling white phosphorus munitions, reported in the Sept.-Oct. edition of the *Army R&D Newsmagazine* as the "Volumetric Filling System," has earned an award of a U.S. patent for Harold D. McKinney of Pine Bluff Arsenal, AR.

A senior project engineer in the Directorate of Engineering and Technology, McKinney described his process before the American Defense Preparedness Association's 1977 meeting of the Loading Assembly and Packaging Section, Eglin AFB, FL.

Prior to development of the Volumetric Filling System, the only successful method for filling white phosphorus munitions was by a dip fill or wet fill process, in use at Pine Bluff since World War II.

Although basically simple in concept, dip filling required a large man-hour effort for production operations and line maintenance, generated large quantities of water and air pollution, and thus presented a potential safety hazard to operating personnel. McKinney began developmental work on volumetric filling in 1973, followed by installation of a prototype production line. The first successful filling was completed in 1975.

## NARADCOM Food Scientist Serving on Journal



Dr. John G. Kapsalis

Appointment of U.S. Army Natick (MA) Research and Development Command scientist Dr. John G. Kapsalis to the editorial board of the **Journal of Food Quality** was announced concurrently with issuance of the first edition of the quarterly periodical in April.

Dr. Kapsalis will be an adviser on journal policy and aid in soliciting manuscripts. All aspects of food quality, regulations, reviews of new substances, statistical interpretation of quality control, and original techniques for measuring food quality are covered in the journal.

Dr. Kapsalis received bachelor's and master's degrees in agriculture from Athens College of Agriculture in Greece, his native land. In 1955 he earned a master's in food science from the University of Florida and in 1959 received his doctorate from Texas A&M University.

Dr. Kapsalis began his Federal Civil Service career in 1960 as a food technologist at the Armed Forces Food and Container Institute in Chicago. He now heads Natick's Food Chemistry Group, Physical Sciences Division, Food Sciences Lab.

A former Fulbright Fellow and an Ohio State University post doctoral Fellow, he conducted research in 1965 in rheological properties of freeze-dried foods under an Army Research and Study Fellowship.

Author of more than 50 research papers, he is a member of Gamma Sigma Delta, Fi Tau Sigma, American Men of Science, the Research Society of America and is on the *Journal of Texture Studies* editorial board.

## ECOM Engineer Serving on NRC's 'Commission C'

Bernard Goldberg

Bernard Goldberg, a supervisory electronics engineer, was recently elected to the National Research Council's "Commission C" (Signals and Systems), following approval by the International Union of Radio Science.

Goldberg is chief of the Signal Processing Technical Area of the Center for Communications Sciences, Automatic Data Processing Laboratory, Army Electronics Command, Fort Monmouth, NJ.

He has a BSE degree from Monmouth College and an MSE from New York University. He has published 30 technical papers, holds four patents, and edited the 1976 issue of **Communication Channels: Characterization and Behavior.**

The National Research Council is the principal operating agency of the National Academy of Sciences and the National Academy of Engineering, serving the federal government and other organizations.

## Soil Scientist Chosen as Arctic Institute Fellow

Circumpolar scientific research has earned Army soil scientist Dr. Jerry Brown election as a Fellow and a member of the board of governors of the Arctic Institute of North America (AINA).

Founded in 1945, AINA assists in orderly development of the North American Arctic through research and educational programs linked to the social and natural sciences. AINA offices are located in the United States and Canada.

Dr. Brown is chief of Earth Sciences, U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, NH, and was cited for his 5-year service as director of the U.S. Tundra Biome of the International Biological Program. U.S. Government and university researchers joined to study in-depth the Alaskan Arctic tundra ecology.

Findings were correlated with studies conducted in other polar areas and Dr. Brown is continuing this research as coordinator of the National Science Foundation's program of Research in Arctic Tundra Environments.

Active also in environmental and permafrost research exchange programs between the United States and the Soviet Union, he graduated from Rutger's University with a bachelor's degree in agricultural research and a PhD in soils research.

## Dr. Eccleshall Elected Ballistic Laboratory Fellow

Dr. Donald Eccleshall

Dr. Donald Eccleshall, chief, Physical Sciences Branch, Ballistic Modeling Division, U.S. Army Ballistic Research Laboratory, Aberdeen (MD) Proving Ground, has been elected as a BRL Fellow in recognition of outstanding professional achievements.

Graduated in 1956 with a PhD in physics from the University of Liverpool, England, Dr. Eccleshall contributed to the design of one of the first tandem accelerometers. He also does research in nuclear physics and test diagnostics.

After working 10 years at the Atomic Weapons Research Establishment, Aldermaston, United Kingdom, he accepted a research appointment at the University of Pennsylvania in 1966. He has authored about 30 technical papers and seven U.S. Government reports.

In 1968 he was named to head Edgewood Arsenal's new Tandem Accelerometer Facility. Later he served as chief, BRL Radiation Laboratory and chief, Applied Mathematics and Science Laboratory.

## Suggestion Earns HDL Employe $1,200 Award

Armywide adoption of a suggestion expected to net first-year U.S. Government savings of $20,000 has earned a $1,200 award for Mary F. Manby, an intelligence research specialist at the U.S. Army Harry Diamond Laboratories.

HDL Commander COL Thomas McGregor made the presentation in recognition of a suggestion titled "Change in Format of R&D Master List." This is a compilation of R&D projects and tasks requiring intelligence support throughout the U.S. Army Materiel Development and Readiness Command.

Mrs. Manby streamlined the list format. Assigned to HDL's Foreign Intelligence Office, she served from 1973-76 at HQ DARCOM, Alexandria, VA. Earlier civil service assignments were with the U.S. Department of Health, Education and Welfare, and the Foreign Science and Technology Center at Charlottesville, VA.

## ARRCOM Honors Reynolds as Inventor of Year

ARRCOM Commander MG William Eicher presents Inventor of the Year Award to George Reynolds for gun patents.

Selection of George Reynolds as the first recipient of the U.S. Army Armament Materiel Readiness Command Inventor of the Year Award was announced in mid-March by HQ ARRCOM, Rock Island, IL.

Employed as an engineering technician in the Small Caliber Weapons Division of the Thomas J. Rodman Laboratory, Reynolds was cited for numerous outstanding innovative achievements during 1976. He was granted patents for a combination cartridge extractor-ejector and a manually operated firearm with forward-moving barrel, including an automatic breech lock.

Other inventions that helped him to win the award include a firing rate reducer for the M16 rifle and a soft-feed mechanism for a grenade launcher. The extractor-ejector requires only one part for both operations; normally, two or three parts are used for each function.

The extractor-ejector has limited application to grenade launchers and large cartridge shotguns but is expected to be less costly and more efficient than conventional mechanisms.

Reynolds is a gun enthusiast who constantly stores knowledge from which he frequently draws for his inventions. An example is a 10-shot grenade launcher developed with detailed knowledge about the U.S. Army M16 and M14 rifles, AK47 Russian rifle and German Luger.

Reynolds' interest in inventing started at age 18 when he was stimulated by his father who patented a fertilizer spreader, a corn planter and the first tractor-mounted post-hole digger.

"Unfortunately," he commented, "my father obtained the patent on the post-hole digger in the 1920s when it was cheapter to hire a man to dig all day than to use the machine."

Employed at Rock Island since 1969, Reynolds attended the University of Illinois and Black Hawk College. He served three years in the Army and taught a small arms repair course at Aberdeen (MD) Proving Ground.

Outstanding Achievements Cited. . .

## 4th Annual Awards for Materiel Acquisition Presented

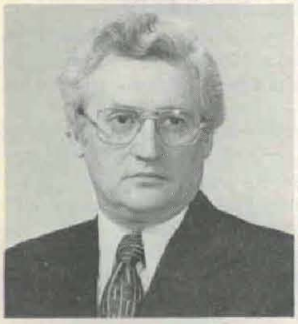
Four individuals and a 3-man team have been selected as winners of the fourth annual Secretary of the Army Awards for Outstanding Achievement in Materiel Acquisition.

When the award was initiated, the first presentations covered the 1970-72 period. The award is presented in recognition of high-level effort in project, materiel and special-item management activities; procurement and production achievements; and scientific research.

A maximum of 10 winners are selected annually from among nominees serving in a staff or operating function in support of the materiel acquisition process for at least 12 months.

Consideration is based on the complexity of the problem and degree of initiative and originality in solving it; relative significance of the accomplishment or adoption of the contribution by other activities; and improvement in program management.

Civilian or military individuals or teams receive a silver medallion and a miniaturized lapel pin depicting the first U.S. Secretary of War Henry Knox. Starting early in April, award ceremonies at installations where the winners are employed will honor:



William Kracov

**William Kracov,** Quality Assurance Directorate, HQ U.S. Army Materiel Development and Readiness Command, who will be cited for innovative contributions in procurement, quality assurance, tactical computer solftware and R&D acceptance test procedures.

"Under his leadership," the citation states, "a new approach termed Project Hand-Off was developed which improved the fielding of Army materiel and established a closer relationship between the developer and the user in the field."

Federally employed for more than 26 years, Kracov has a BS degree in chemistry from the College of the City of New York, is an honorary faculty member of the Army Logistics Management Center and member American Society for Quality Control.

Otto H. Schoenberger

**Otto H. Schoenberger,** Avionics Laboratory, U.S. Army Electronics Command, will receive recognition for outstanding technical management in the development and fielding of the Proximity Warning Device.

The device is credited with eliminating mid-air helicopter collisions in high-density training areas where it has been used. During a 2-year period, 2,000 helicopters have been equipped with the device.

Schoenberger is a native of Germany with BS and MS degrees in electrical engineering from the Institute of Technology in Munich. Employed by ECOM in 1958, he has served as project engineer and technical consultant.

Since 1959 he has represented the U.S. Army as a member of the Collision Prevention Advisory Group. He is a licensed pilot for fixed- and rotary- wing aircraft.

William A. Wondisford

**William A. Wondisford,** Bent Weapons Laboratory, U.S. Army Watervliet (NY) Arsenal, was credited for achievements in developing and implementing a "guided-boring system which improved cannon tube quality and reduced production costs."

The system eliminates rework associated with previous methods and assures quality components on a production operation that formerly was a major source of rejects. The citation terms the system "revolutionary."

Employed at Watervliet Arsenal since 1959, Wondisford has served as a project leader and consultant on numerous machining projects, including rapid threading, compression forming, and guided boring techniques.

**Fred N. Newcomb,** a supervisory engineer at the U.S. Army Human Engineering Laboratory, Aberdeen (MD) Proving Ground, was selected for "significantly improving the accuracy of the Dragon Anti-Tank Missile System" by incorporating a viscous-damped mount between the Dragon and the M113 Armored Personnel Carrier.

Integration was accomplished without modification to either of these systems, and is expected to provide infantry elements with a greater effectiveness in combat situations.

Newcomb joined APG as a mechanical engineer in 1952 and received a BS degree in industrial management (magna cum laude) from the University of Baltimore in 1971. He is a member of Beta Alpha Scholarship Society and author of several technical reports.

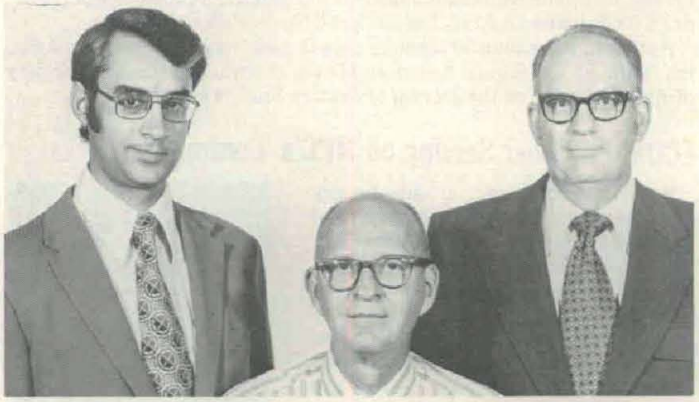
**James T. Flood, Robert L. Hutchison** and **Lawrence A. Runnels,** employes at the U.S. Army Aviation Systems Command, St. Louis, MO, will be cited for development of an economic price adjustment clause for use in government procurement contracts.

The clause provides for "equitable adjustment" between contract participants during periods when labor and material costs vary from indices published by the Bureau of Labor Statistics.

Flood has been a Department of the Army civilian employe since 1946, and is a recipient of two Outstanding Performance Ratings and a Sustained Superior Performance Rating. He attended the St. Louis University Evening Division.

Hutchison also attended St. Louis University (School of Commerce and Finance) and has served as a contract assistant and specialist since 1965.

Runnels is a dean's list honors graduate of St. Louis University, has a 1968 J.D. degree from New York University and an LLM in taxation from Washington University Law School. He is a member of the Missouri and Illinois Bar Associations.



Lawrence Runnels, Robert Hutchison, James Flood

## Meat Science Association Honors Army Expert

Dr. Eugen Wierbicki

Dr. Eugen Wierbicki, a food technologist at the U.S. Army Natick (MA) Research and Development Command, has been appointed chairman of the 1976-77 Research Award Selection Committee of the American Meat Science Association.

Recipient of AMSA's 1976 Distinguished Research Award, Dr. Wierbicki will oversee the 6-man committee which will review nominations for the 1977 award. It is presented annually in recognition of outstanding R&D contributions to meat science.

Head of Natick's Irradiated Food Products Group, he has responsibilities for planning and supervising biochemical and technological programs to establish Armed Forces food irradiation processing systems.

Special emphasis is placed on sterilization of meats, poultry and seafoods to permit prolonged storage without refrigeration. Irradiated meats developed by his branch were used on the Apollo 12 and 17 flights and the Apollo-Soyuz U.S. and Soviet space link-up mission.

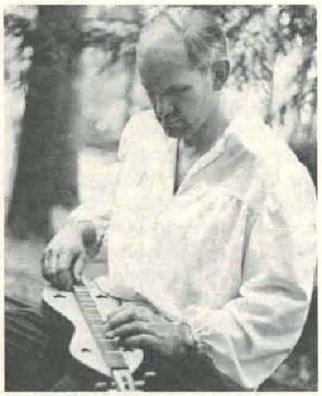
Dr. Wierbicki has authored numerous articles dealing with meat research and served as a member of the U.S. Food Processing Delegation to the USSR in 1960. In 1964 he was a U.S. Department of State official and escort for a Soviet delegation to the United States.

He is listed in the *American Men of Science, Marquis' Who's Who in the East, Who's Who in America, Dictionary of International Biography* and the *International Register of Profiles,* Cambridge, England.

# People in Perspective...

## Appalachian Music Man . . .

### Builds Dulcimers True to Colonial Specs



LTC (Dr.) George Orthey

Woodworking and a love of American culture dating back more than 200 years have provided a rather unusual hobby and a satisfying lucrative avocation for LTC (Dr.) George Orthey.

Deputy for Veterinary Activities at the U.S. Army Medical Department Activity, Carlisle Barracks, PA, LTC Orthey is termed by "those in the know" as one of the finest dulcimer makers in Pennsylvania's Appalachian Mountains. He estimates he sells annually about 100 of his handmade stringed instruments. All are made in his spare time and faithfully reproduced from those made by Appalachian residents more than 200 years ago.

"The colonists," he reports, "not only brought an old art to America but developed a variation of their own. The 'stringed bagpipe' or Appalachian dulcimer originated with Scotch-Irish settlers. They also produced a hammered dulcimer and psalteries—which date back to Biblical times."

Unlike the Appalachian dulcimer, the hammered version resembles the inside of a piano and is played by striking the strings with a mallet. The psaltery is much like the lyre in appearance and tone, and is played by plucking the strings.

LTC Orthey built his first dulcimer in 1964 while assigned to Walter Reed Army Medical Center in Washington, DC. He sold the first ones to a local music store manager and wishes he had them as momentos.

The sale, however, intensified his interest to continue the hobby. After reporting for duty at Fort Sam Houston, TX, he was asked to play and show his wares at San Antonio's 1968 HemisFair and to entertain at Lynda Bird Johnson's engagement party.

During a tour of duty in Pusan, Korea, he set up operations in a craft shop and later in an abandoned printing shop when he was assigned to Fort Devens, MA. He now quarters his hobby in a renovated carriage house near his home in Newport, PA.

Public demand for his dulcimers has grown to such an extent that the hobby has actually blossomed into a "family affair." His wife and two sons serve as salespersons. Mrs. Orthey also designs and makes authentic colonial costumes for public performances.

# Reader's Guide . . .

## ARI Reports on Questionnaires, Small Maps Use

Development of work environment questionnaires and use of reduced-detail maps for tactical operations are subjects of new documents issued by the Army Research Institute for the Behavioral and Social Sciences.

Technical Paper 275, *The Development of a Work Environment Questionnaire for the Identification of Organizational Problem Areas in Specific Army Work Settings,* is the result of a 3-year effort to improve organizational effectiveness at an Army field installation.

The questionnaire provides indexes of soldier perceptions, motivations, and satisfactions in specific terms to identify problem areas suitable for corrective action. A later survey has identified seven major problems.

Technical Paper 274, *A Comparison Between a Standard Map and a Reduced Detail Map Within a Simulated Tactical Operations System,* reports on whether reduced map detail lessens efficiency of human information processing and decision making.

Results indicate that no significant difference in performance during planning or combat was associated with the level of map detail factor. Further studies are suggested to determine the feasibility of using reduced maps in conjunction with computer graphic display capabilities.

## CGSC Publishes Master's Theses Reference

Summaries of 240 Master of Military Art and Science theses completed at the U.S. Army Command and General Staff College from 1964-76 are contained in a new single-volume reference.

*Abstracts of Master of Military Art and Science (MMAS) Theses and Special Studies 1964-76* was conceptualized and edited by Drs. L.L. Sims (MAJ, USAR) and MAJ A.D. Officer, Office of the Director, Graduate Degree Programs, CGSC. A copy of the document is available in the library at HQ U.S. Army Materiel Development and Readiness Command, 5001 Eisenhower Ave., Alexandria, VA 22333.

The introductory section lists subjects of general interest, followed by a yearly listing of theses titles beginning with *Leadership in the Chinese Communist Army.*

Selected samples of other abstracts and the year of submittion are:

*Project Managers: The Concept in Perspective* (1965); *An Analysis of the Psychological Necessity of Censorship in Combat Zones* (1970); *A Study of Personal Defense Weapons for U.S. Army Helicopters* (1972); and *Strategic Implications of Moscow's Initiative for Collective Security in Asia* (1976).

Copies of these written after 1975 may be obtained by submitting a DDC Form 1 to: Defense Documentation Center, ATTN: TSR, Cameron Station, Alexandria, VA 22314.

Copies of all theses are on file in the CGSC Library and may be obtained through interlibrary loan channels. Address requests to Interlibrary Loan, USACGSC Library-Bell Hall, Fort Leavenworth, KS 66027.

# Women in Army Science...

## Health Hazards Challenge Industrial Hygienist

Taking the worry out of whether working conditions are environmentally safe for employes at U.S. Army Materiel Development and Readiness Command installations is the job of Army Bialota of the Army Health Services Command.

Ms. Bialota is an industrial hygiene technician assigned to Rock Island Arsenal, IL. One of 29 HSC industrial hygienists, including four women, detailed to various DARCOM activities nationwide, she is concerned with monitoring and controlling potential health hazards ranging from poisonous gases to dangerous noises.

To located problem areas, Rock Island's industrial hygiene team relies on a combination of methods. One approach is talking with RI employes and examining their workshop areas.

Using instruments such as a sound level meter, she can determine when shop noises exceed 85 decibels—the level at which hearing loss due to exposure can occur. Employes in such areas might be required to wear earplugs.

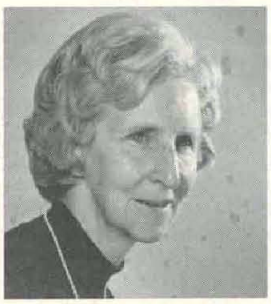
Air quality is also closely monitored to detect poisonous gases. One problem area is oil smoke produced by metals heat in the arsenal's forge shop. Carbon monixide poisoning can often result from imcomplete combustion.

Ms. Bialota recently forwarded forge shop air samples to the U.S. Army Environmental Hygiene Agency at Aberdeen (MD) Proving Ground. Similar data are also being sent to the EHA from the open surface tanks in the arsenal's plate shop.

"The tanks," she says, "are used to remove rust from gun barrels now under arsenal development." The derusting process may also be producing a poisonous alkaline vapor. Changes in the shop's ventilation system might be recommended."

Ms. Bialota says her work is discouraging sometimes because of the cynical attitude of people, and that resistence to changing the traditional way of doing things is the greatest problem she encounters.

## Grogan Appointed to ASNDT RPQ Committee



Catherine F. Grogan

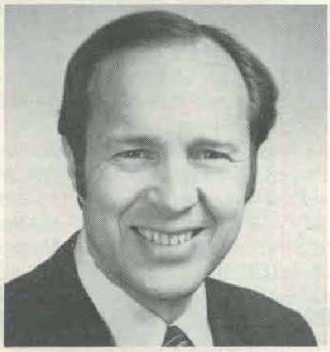
Catherine F. Grogan, a Watervliet Arsenal physical science technician, has been named to the Radiographic Personnel Qualification Committee of the American Society for Nondestructive Testing.

Mrs. Grogan is the only woman on the 24-member committee, composed of researchers who have made significant accomplishments to advancement of radiography techniques.

Chosen for development of a radiographic enhancement technique that has increased the amount of information extractable from an existing radiograph, she has applied for a U.S. patent for the procedure. It decreases the degree of original radiation exposure needed to open up possibilities for numerous applications of the technique not only in nondestructive testing but also in the medical field.

# Personnel Actions . .

## Perry Succeeds Currie as Director of Defense R&E



Dr. William J. Perry

Director of Defense Research and Engineering Dr. William J. Perry was sworn in to that office, following U.S. Senate confirmation of President Jimmy Carter's appointment of the industrial leader to succeed Dr. Malcolm R. Currie, who resigned Jan. 20.

When selected, Dr. Perry was president of ESL Inc. and director of ESL Laboratories in Sunnyvale, CA. He is one of the founders of ESL, incorporated in January 1964. For 10 years prior he was director of Electronic Defense Laboratories, Sylvania Electric Products Inc., Sunnyvale.

Concurrent with ESL management responsibility, Dr. Perry conducted analysis of missile systems and designed electronic reconnaissance systems. His technical expertise includes partial differential equations and propagation and statistical theory.

Awarded the Defense Intelligence Agency's Exceptional Civilian Service Medal for performance as a member of the DIA Scientific Advisory Comittee, Dr. Perry earned a U.S. Army Outstanding Civilian Service Medal for "development of systems for collection of vitally important intelligence through the use of advanced electronics." He served on the National Security Council, and was an adviser to the U.S. Government on a panel study of the "missile gap" issue in 1960; also, a study of verification problems in the Strategic Arms Limitation Talks (SALT).

Dr. Perry's academic credentials include bachelor's and master's degrees in mathematics from Stanford University and a doctor of philosophy in mathematics from Pennsylvania State University, where he was a mathematics instructor. Later he was a part-time lecturer at the University of Santa Clara, CA.

A member of the Scientific Research Society of America, American Mathematical Society, and the National Academy of Engineering, he has authored numerous reports on signal analysis, advanced systems design and mathematics analysis. He was born Oct. 11, 1927, in Vandergrift, PA.

## Griffith Heads Korea JMAG . . .
## Nord Directs DARCOM DE, Street PMs Patriot

BG (P) Alan Nord

BG (P) Alan Nord, deputy commander, U.S. Army Armament Materiel Readiness Command, will report for duty in June as director of Development and Engineering, HQ Army Materiel Development and Readiness Command, succeeding MG Harry A. Griffith.

MG Griffith will take over late in May as chief, Joint U.S. Military Advisory Group, Korea, succeeding MG Oliver Street, who is scheduled to report in July as new project manager for Patriot (formerly SAM-D), Redstone Arsenal.

*BG Nord* initially joined ARRCOM (formerly Army Armament Command) in 1975 as director of Procurement and Production, following an assignment as commander of Seneca Army Depot, Romulus, NY.

During 1974 he served as executive officer of the Science and Technology Team, Army Materiel Acquisition Review Committee (AMARC), and on the Army Materiel Command Committee—Armaments. Earlier he was PM for Safeguard Munitions at Picatinny Arsenal, including duty as lead project officer for the Sprint and Spartan missiles warheads.

Other career assignments have included duty in Germany as chief of Special Weapons Plans, Central Army Group, NATO; assistant secretary of the General Staff, Office of the Army Chief of Staff; and project officer, Nuclear, Chemical Biological Division, Office, Army Chief of R&D.

He also served as an instructor and assistant professor in chemistry at the U.S. Military Academy; participated in the 1962 test series at the Nevada Test Site while assigned to the Combat Development Command Chemical Agency; and served with the XVIII Airborne Corps, including duty as secretary of the General Staff during the Cuban missile crisis.

BG Nord was commissioned in the Army Chemical Corps in 1952, following completion of ROTC requirements and award of a BA degree in chemistry from South Dakota State University. He also holds BA and MA degrees from Oxford University, and completed the master's program in international relations at George Washington University. He has completed the Command and General Staff College requirements, the National War College, and the Chemical Officers' Career and the Nuclear Effects Engineer courses.

His military decorations include the Legion of Merit with Oak Leaf Cluster (OLC), Bronze Star Medal, Meritorious Service Medal, Air Medal with OLC, and the Army Commendation Medal with OLC.

MG Oliver Street

*MG Oliver Street* is backed by more than 20 years of active military service. He graduated from the U.S. Military Academy with a BS degree in military science and engineering and from George Washington University with an MS in personnel management.

During 1973-74, he served as commander, 1st Region, U.S. Army Air Defense Command, Stewart Field, NY, following a 2-year tour as assistant chief of staff, Land Operations, and commander, U.S. Army Element, Allied Forces, Central Europe.

Assigned during 1969-1971 to the Office of the Deputy Chief of Staff for Military Operations, Washington, DC, he served successively as assistant chief, and chief, Strategic Forces Division, and acting deputy director of Plans.

Other assignments have included commander, 101st (later 18th Artillery Group), Lockport, NY, and member, Gaming Branch, General War Division, Joint War Games Agency, Organization, Joint Chiefs of Staff.

MG Street is a graduate of the Army Command and General Staff College, Armed Forces Staff College, Army War College, and Artillery and Guided Missile School Advanced Course. He wears the Legion of Merit with Oak Leaf Cluster (OLC), Joint Service Commendation Medal, and Army Commendation Medal with three OLC.

## Eicher Heads Newly Established ARRCOM

MG William E. Eicher

Heading the newly established U.S. Army Armament Materiel Readiness Command, Rock Island Arsenal, IL, is MG William E. Eicher, who has served since January 1976 as deputy commander, U.S. Army Armament R&D Command at Rock Island.

MG Eicher was director of Maintenance at HQ U.S. Army Materiel Development and Readiness Command until he departed for duty at Rock Island. During 1972 he was chief, Installation Program Team, Office, Deputy Chief of Staff for Logistics, Department of the Army. He also has commanded the 26th General Support Group in Vietnam.

He is a veteran of 26 years military service and has a master's degree in business administration from Syracuse University. He received his commission after graduating from the State College of Washington.

Among his military awards are the Silver Star, Legion of Merit with Oak Leaf Cluster (OLC), Bronze Star Medal with three OLC and "V" device, Joint Service Commendation Medal, Army Commendation Medal with OLC, Purple Heart, and Combat Infantryman's Badge.

## Selection Board Announces PM Assignments

Colonels and promotable lieutenant colonels selected recently by the Project Manager Selection Board, U.S. Army Materiel Development and Readiness Command (DARCOM), will be assigned to new programs and to fill vacancies in the near future.

The *Army R&D Newsmagazine* featured U.S. Army Project Managers in the November-December 1976 issue, which included 55 programs and managers, and the first annual Project Management Award presentation made by Secretary of the Army Martin R. Hoffmann to MG Robert J. Baer for XM-1 tank development.

The 6 project managers selected for assignment to new programs, 3 product managers being changed to project managers and 16 designated

to fill a vacancy are listed by project as follows.

COL Eugene Fox, *Air Defense Command and Control System AN/TSQ-#73 (Missile Minder);* LTC Leonard S. Marrella, *Army Gun Air Defense System;* COL John F. Zugschwert, *Aircraft Survivability Equipment Program;* COL Robert P. St. Louis, *AH-1 Cobra Series Aircraft;* COL Sammy J. Cannon, *Corps and Echelons Above Corps Electronic Warfare and Intelligence;* LTC (P) Thomas Cameron, *Firefinder System (formerly MALOR - Mortar/Artillery Locating Radars);* COL Benjamin J. Pellegrini, *Ground Laser Designators;* COL Barrie P. Masters, *General Support Rocket Systems;* COL John D. O'Donohue to succeed COL Edwin Aguanno, *Iranian Aircraft Program;*

LTC (P) Ivar W. Rundgren Jr., *Interim Advanced Target Acquisition Designation System;* COL Alvin G. Rowe, *Mobile Electric Power;* COL Rodney W. Spotts, *Mechanized Infantry Combat Vehicle Armament Systems;* COL Joseph O. Lax Jr., *Multipurpose Missile System;* COL Anthony F. Albright, *Multiservice Communications Systems;*

COL Robert D. Morgan, *Position Locating and Ranging System;* COL Charles F. Lindberg, *Satellite Communications;* COL Lawrence F. Skibbie, *Selected Ammunition Program;* LTC (P) August M. Cianciolo, *Stand-off Target Acquisition System;* COL Frank Hungerford, *Tactical Fire Direction System;*

COL Clarence A. Patnode Jr., *Target Acquisition Designation System and the Pilot Night Vision System (TADS-PNVS) for the Advanced Attack Helicopter (AAH);* COL Edward D. Bjorn, *Tactical Operations System;* COL Joseph H. Leszczynski, *Training Devices.*

The three programs being upgraded from product management to project management are: FAMECE/UET (Family of Military Engineer Construction Equipment, Universal Engineer Tractor), COL Max Schreiber; SEMA (Special Electronic Mission Aircraft Materiel), COL John Top; SIGINT/EW (Signal Intelligence/Electronic Warfare Materiel), COL Willian Clingenpeel.

## Hardin Assumes Duties as TARCOM Commander

MG Harold F. Hardin Jr. has assumed command of the U.S. Army Tank-Automotive Materiel Readiness Command, Warren, MI, after service as director, Procurement and Production, HQ U.S. Army Materiel Development and Readiness Command.

MG Harold F. Hardin Jr.

MG Hardin has a bachelor's degree in history from Loyola University of Los Angeles and an MBA degree in industrial management from Babson Institute. He is a graduate from the Army Command and General Staff College, Naval War College and the Army War College.

He has also served with the Joint Chiefs of Staff, Department of the Army; Deputy Chief of Staff for Logistics, DA; commander, U.S. Army Safeguard Logistics Command; and U.S. Army Armament Command.

Other assignments have included duty with the 7th Infantry Division in Korea; 9th Ordnance Battalion (now 101st Battalion), Germany; I Corps, Vietnam; commander, Support Command, 2d Infantry Div., Korea.

MG Hardin wears the Bronze Star Medal with "V" Device (3d Oak Leaf Cluster), Meritorious Service Medal with two OLC, Army Commendation Medal with one OLC, and the Navy Unit Commendation Medal.

## Corps of Engineers Announces District Assignments

**COL William W. Brown,** a strategic research analyst with the Strategic Studies Institute, U.S. Army War College, Carlisle Barracks, PA, is one of four personnel recently selected for U.S. Army Corps of Engineers district engineer assignments.

COL Brown will assume new duties in July as Charleston (SC) District engineer. He is a 1955 graduate from the U.S. Military Academy (USMA) and has a master's degree in geodetic science from Ohio State University.

**COL John H. Moellering** has been selected as Vicksburg (MS) District engineer, following completion of the Army War College course. He graduated from the USMA in 1959 and has an MS degree in civil engineering from the University of California (Berkeley).

**COL Robert K. Tener** will take over in August as Nashville (TN) District engineer upon completion of the Naval War College course. He graduated from the USMA in 1957, holds MS and doctor of philosophy degrees in structural engineering from Iowa State University.

**COL Adolph A. Hight** will succeed COL Homer Johnstone Jr. as Wilmington (NC) District engineer. He has an MS degree in civil engineering from Hampton Institute and is a graduate of the Command and General Staff College and National War College.

## Bolte Assigned as TECOM Deputy Commander

BG Philip Bolte, former assistant project manager of the Main Tank Armament Development, XM1 Tank System, is the new deputy commander of the U.S. Army Test and Evaluation Command, Aberdeen Proving Ground, MD.

BG Philip Bolte

A 1950 graduate of the U.S. Military Academy, West Point, NY, BG Bolte completed the Canadian Army Staff College course in 1965 and has a master's degree in electrical engineering from Georgia Institute of Technology.

He has served tours in Germany, Japan, Vietnam and Korea. In Vietnam he commanded the 1st Squadron, 1st Cavalry, Americal Division, Vietnam. He also served as assistant for Combat Materiel, Office, Assistant Secretary of the Army for R&D, Department of the Army.

BG Bolte wears the Silver Star with Oak Leaf Cluster (OLC), Legion of Merit with three OLC, Meritorious Service Medal, Air Medal with three OLC, Purple Heart w/OLC, and Combat Infantryman's Badge w/star.

## Tate Heads Defense Nuclear Agency Field Command

BG Grayson D. Tate Jr., commander, U.S. Army Missile Research and Development Command since January, has been selected to take over in August as commander, Defense Nuclear Agency Field Command, Kirtland Air Force Base, NM.

BG Grayson D. Tate Jr.

Graduated from the U.S. Military Academy in 1950, he has BS and MS degrees in aeronautical engineering from Georgia Institute of Technology. He has competed career development courses at the Command and General Staff College, Armed Forces Staff College and Industrial College of the Armed Forces.

BG Tate served during 1975-76 as deputy commander of the Army Missile Command following assignments as project manager, Lance Weapon System and special assistant to the MICOM commander.

His career record shows assignments as commander, Fourth U.S. Army Missile Command, Korea; assistant for Missiles, Office, Assistant Secretary of the Army (R&D); chief, Nike-X Branch and, later, chief, Nike-X and Space Division, Office, Chief of Army R&D, Washington, DC.

BG Tate wears the Legion of Merit with Oak Leaf Cluster (OLC), Bronze Star Medal, Army Commendation Medal w/OLC, and Purple Heart.

## Wright Directs Army Materials, Mechanics Research

Director of the U.S. Army Materials and Mechanics Research Center, Watertown, MA, is the new title of Dr. Edward S. Wright, former AMMRC associate director of Operations, acting director for the past year and an AMMRC employe since 1970.

Dr. Wright has a BS degree in physical metallurgy from Washington State University and a PhD in metallurgy from the University of Newcastle upon Tyne, Newcastle, England. He has served on academic staffs of Carnegie Institute of Technology and the University of California.

Dr. Edward S. Wright

Engaged in materials R&D since 1949, he managed the Metallurgy Department of Stanford Research Institute until he transferred to the AMMRC. He also has been employed by Westinghouse Electric Corp., the Los Alamos (NM) Scientific Laboratory, and Lockheed Aircraft Corp.

The Army Materials and Mechanics Research Center is the U.S. Army Materiel Development and Readiness Command's lead laboratory for R&D in materials, solid mechanics, and materials testing technology.

## Burbules Appointed Joint Fuze Task Group Chairman

COL Peter G. Burbules is the initial chairman of the Joint Fuze Task Group, the action arm of the newly established Fuze Management Organization which is under cognizance of the Joint Logistics Commanders.

COL Peter G. Burbules

COL Burbules served in 1974-75 as the executive officer, Systems Review and Analysis, Office of the Deputy Chief of Staff for Research, Development, and Acquisition (ODCSRDA), HQ DA, with concurrent duty as the executive secretary, Army Systems Acquisition Review Council (ASARC). Prior to that duty, he was a weapon system analyst, Office of the Army Chief of Staff.

A graduate of the Infantry Officer Candidate School, he was commissioned a second lieutenant in the Ordnance Corps in May 1954. He has served in numerous ammunition assignments, including tours of duty in Korea (1957-58), Defense Atomic Support Agency (1958-61), Turkey (1962-65), Vietnam (1967-68), and commander, Cornhusker Army Ammunition Plant (1968-69). COL Burbules commanded the Support Battalion of the 172d Arctic Light Infantry Brigade in Alaska from 1971-73.

Under the Army's "Bootstrap" Program, COL Bulbules received a bachelor's degree in general engineering at the University of Omaha in 1962 and a master's degree from Babson College in 1970. He is a graduate of the Armed Forces Staff College (1971), Naval War College (1976).

COL Bulbules' awards include the Legion of Merit with Oak Leaf Cluster (OLC), Meritorious Service Medal, Joint Service Commendation Medal and the Army Commendation Medal with OLC.

## Eckert Directs ECOM Personnel, Training, FD

COL Edward N. Eckert, a 1952 graduate of the U.S. Military Academy and former commander of the third ROTC Region, recently took over as director of Personnel, Training and Force Development, U.S. Army Electronics Command.

COL Edward N. Eckert

COL Eckert served during 1973-74 with the U.S. Army Training and Doctrine Command, following completion of his second duty tour with the Military Assistance Command in Vietnam. He is a field artillery officer with 25 years of military service.

Other key assignments have included service in the Office of the Deputy Chief of Staff for Personnel, Washington, DC; commander, 8-inch Field Artillery Battalion, Dachau, Germany; and service in the Office of the Deputy Chief of Staff for Operation, Heidelberg.

COL Eckert has completed courses at the Army Command and General Staff College, Armed Forces Staff College, and flight training at Fort Rucker, AL. He is a senior Army aviator and holds a dual rating.

## ECOM Chooses Thornton as ETD Lab Director

Dr. C. G. Thornton

Dr. C. G. Thornton, a U.S. Army Electronics Command employe since 1972, was recently named director of ECOM's Electronics Technology and Devices Laboratory, filling a vacancy created by the retirement of Dr. Hans K. Ziegler.

Recipient of a 1976 Army Research and Development Achievement Award and an Army Science Conference Award for a technical paper on a research project, Dr. Thornton has bachelor's, master's and doctoral degrees from University of Michigan.

He was elected a Fellow of the Institute of Electrical and Electronics Engineers in 1970 and is a member of the American Crystallographic Association, Electrochemical Society and the American Association for the Advancement of Science.

Prior to joining ECOM, Dr. Thornton was employed for 17 years with Philco-Ford Corp., during which time he served as director of research and engineering. He holds six patents and has authored 38 technical papers and numerous reports on process innovations.

# Army R&D — 15 Years Ago

*The Army R&D Newsmagazine reported on...*

## 5 Generals Head Reorganization Implementation

Congress has approved a plan for broad reorganization of the U.S. Army. Designated by Secretary of the Army Elvis J. Stahr, Jr., five general officers assumed duties as chairmen of the formal groups to begin implementation of the plan. Comptroller of the Army LTG David W. Traub is project director for the reorganization which is scheduled for accomplishment within an 18-month period.

Other chairmen are: United States Continental Army Command, MG Richard D. Meyer; Materiel Development Command, MG Frank S. Besson Jr.; Combat Developments Command, LTG John P. Daley; Office of Personnel Operations, MG G.E. Martin.

The directive states that headquarters of the Combat Developments Command and the Materiel Development Command "should be located in the general vicinity of Washington, DC." Existing facilities will be used because new construction funds are not available through FY 1963.

## WRAIR Opens Institute for Dental Research

Coincident with the 51st anniversary of the founding of the U.S. Army Dental Corps, an Army Institute of Dental Research was dedicated Mar. 3 at Walter Reed Army Medical Center, Washington, DC.

Army Chief of R&D LTG Arthur G. Trudeau was guest speaker at the ceremonies. MG Joseph L. Bernier, chief of the Army Dental Corps, stated: "This Institute will enable us to meet the increasing need for more extensive research in the field of dentistry.

"Its main objective is to continue to find means of reducing the incidence of oral disease, with emphasis on prevention, and to devise simplified techniques which will permit rapid and effective dental treatment, including injuries to the jaw."

Future plans include establishment of five subordinate research activities in existing military facilities located at Walter Reed Army Medical Center, Washington, DC; Brooke Army Medical Center, Fort Sam Houston, TX; Fort McPherson, GA; St. Louis, MO; Alemeda, CA.

## ABC Standardization Program Unites 3 Armies

Differences in weapons, ammunition, field equipment, procedures and doctrine often hindered battlefield performance when the United States, British and Canadian Armies fought side by side in World War II. Through the American-British Canadian (ABC) Standardization Program, the three armies are resolving differences and enhancing ability to fight together more effectively in any future war.

Standardization of materiel and nonmateriel items has progressed notably through this program during the past 15 years. Effort is directed toward the greatest possible economy for armies of the governments concerned through use of combined technological and scientific resources.

Standardization effort is aimed to ensure that there will be no operational, materiel or technical obstacles to full cooperation and collaboration among the American, British and Canadian Armies to achieve the greatest benefits at lowest practicable cost.

## Army Gets OK to Create Limited War Laboratory

Changing emphasis in national military concepts, responsive to the increasing need of readiness for any type of confined combat in remote undeveloped areas, backs a decision to expedite establishment of a U.S. Army Limited War Laboratory.

The proposal was presented by Chief of R&D LTG Arthur G. Trudeau. When fully staffed, the USALWL will be manned by about 70 highly trained officers, civilian scientists, technicians and clerical personnel. Its primary mission will be to generate new concepts and develop Army materiel having particular application to limited war in remote regions.

## Role of In-House Laboratories Outlined to AMA

Assistant Secretary of the Army (R&D) Dr. Finn J. Larsen, in an address to the American Management Association in Chicago, discussed the various roles and responsibilities of Army in-house laboratories, saying:

"...One of the major responsibilities of the Federal Government is to insure that the vast sums it spends on R&D are spent as fruitfully as possible. This means that due consideration must be given to work which can be performed in laboratories owned and operated by industry, universities, other private groups or individuals, and government labs.

"...Industry and the rest of our nation profit through this portion of the Army program because most of the work is in basic research and, therefore, results in benefits to many segments of our economy. In my opinion, we must continue to suport research in our universities, but in the years ahead it is recognized that their capabilities will not increase significantly."

# White Sands Installs $9 Million Drone Formation Control System

Formations of jet drones, executing high-speed flight patterns over White Sands Missile Range (WSMR), NM, are being controlled and tracked at the Drone Formation Control System (DFCS), a new $9 million addition to the range's instrumentation facilities.

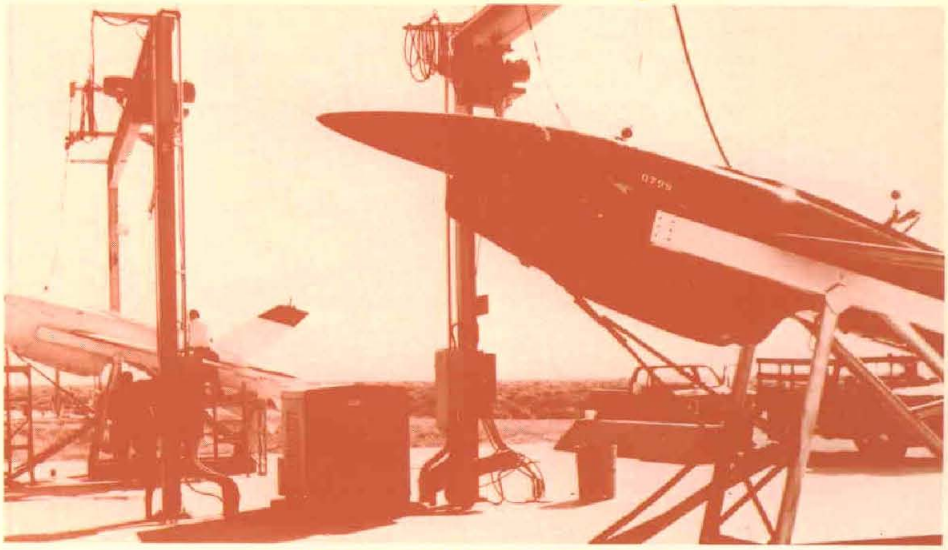
Self-contained with its own tracking and control equipment, telemetry link and display consoles, the DFCS is the largest project to date in the Army's improvement and modernization program for range instrumentation, and the only system of its kind in the Free World.

The DFCS was conceived in 1974 when it became apparent that a means of controlling multiple targets, flying in formation, would be required for missile testing. Design specifications were prepared and a contract was awarded in 1975 to IBM Federal Systems, Huntsville, AL.

During demonstration and acceptance tests conducted late last year, the DFCS showed its ability to control formations of two, three and four BQM-34 Firebee drones and a formation of two PQM-102 (F-102) drone aircraft.

In future tests, the DFCS will control formations of four Firebees and two F-102s, simultaneously. While tracking and controlling up to six of these targets, the system also has a capability to track up to four other drones.

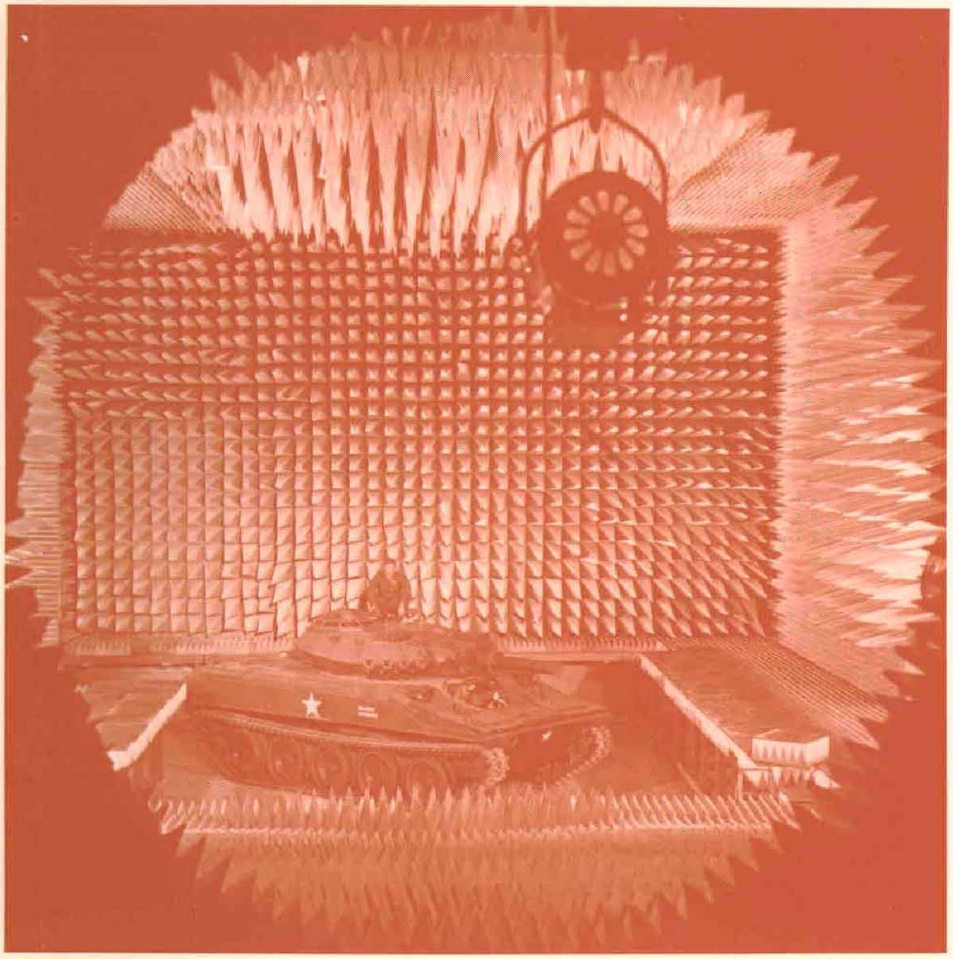
The DFCS combines telemetry, radar and distance measuring equipment with an IBM computer. Control consoles and the computer are located in the Drone Control Center, while a number of subsystems are located at various vantage points around the range.



BQM-34 "Firebee" Drones at WSMR, NM

Airborne drone units and interrogator stations located at the Drone Control Center and four other range sites form a data-link subsystem. The fixed interrogator stations, which are not manned during operation, are located at elevations ranging from 4,290 to 8,958 feet. A mobile interrogator station also is available for use wherever it is needed.

Flying at altitudes ranging from 600 feet above ground to 26,000 feet above sea level, drones can be controlled automatically by the computer or manually through the control consoles. Video screens allow operators to monitor flight paths of the drones at all times.



STEEL-POINTED "JAWS" appear to be closing in on this M-51 Sheridan Shillelagh undergoing testing of its electronic functions at White Sands Missile Range, NM. The spikes and pyramids of this anechoic chamber are made of foam rubber or soft carbon-based material which absorbs all radio frequencies and radiation, thereby producing an electronically sterile environment for testing. Chamber testing is under direction of the Office of Missile Electronic Warfare, a U.S. Army Electronics Command activity at the range. Army photographer SSG Klaus Degan climbed the chamber and found a hole near the top to focus his camera.

## Patriot Interception of Drone Satisfies All Test Objectives

Countermeasures in a maneuvering environment failed to protect a Firebee Drone when it became the recent target of the U.S. Army's PATRIOT air defense missile. It was intercepted in a firing that "satisfied all test objectives" at White Sands (NM) Missile Range.

Distinction of being the first soldier to fire the PATRIOT at a flying drone, and putting it within the warhead's lethal distance, gave a thrill to SGT John Pearce while on loan to Raytheon Corp. from the U.S. Army Materiel Test and Development Directorate.

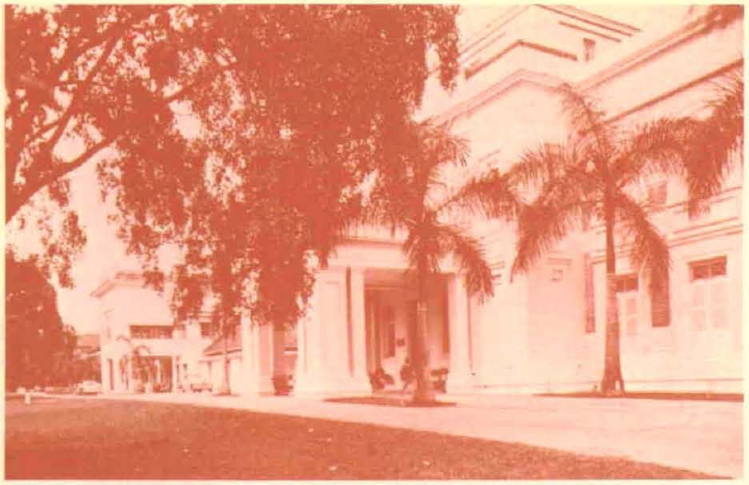
Countermeasures were generated by an Air Force jet flying directly in line with the drone but they gave no protection against PATRIOT's FP-1 (radar control station and launcher). The FP-1 was used for only the second time in PATRIOT's 16th fully guided flight in the test.

Project Manager MG Charles F. Means, assigned from the U.S. Army Materiel Materiel Development and Readiness Command to the Missile R&D Command facility at Huntsville, said the firing satisfied all test objectives.

Intended to be the U.S. Army's principal air defense against medium- to high-altitude targets in the highly sophisticated land warfare environment predicted for the 1980s and beyond, PATRIOT will replace Hawk and Nike Hercules.

PATRIOT is designed for a high kill probability and fast reaction time to handle saturation attacks against highly maneuverable targets in intense countermeasures environment.

Currently PATRIOT is in its final stage of full engineering development. The 49-month $425 million contract to complete the R&D phase was negotiated in August 1976.



**WRAIR MEDICAL TEAMS conduct activities in many lands on a continuing basis, seeking to find research solutions to prevention and treatment of numerous deadly diseases. Shown are a few of the facilities where they are stationed. *Above:* Malaysia, where scrub typhus, leptospirosis and arthropod-borne virus infections are studied; *right,* SEATO hospital in Bangkok, Thailand, where prime effort is antimalarial testing; *center,* use of WRAIR-developed jet injector for immunization in Vietnam; *center left and right,* Brasilia, capital of Brazil, research on schistomiasis; *lower left,* research in South America Amazon Basin; *right,* Kenya, where sleeping sickness is a major problem. Other WRAIR teams are at work in Africa, Puerto Rico, Panama, Korea and West Germany.**