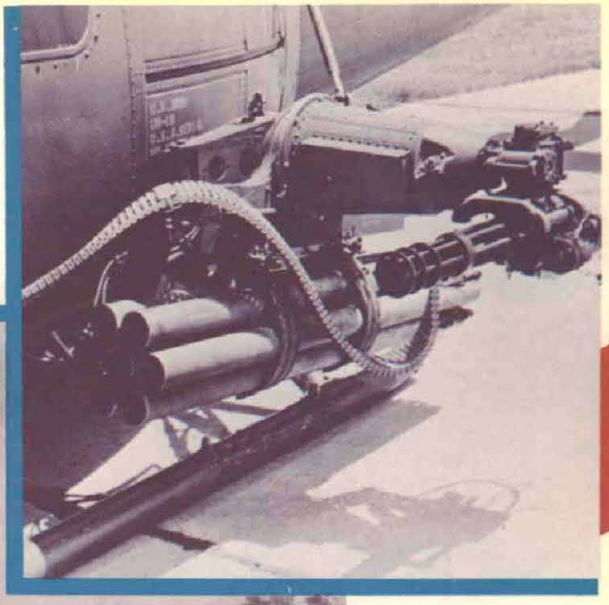
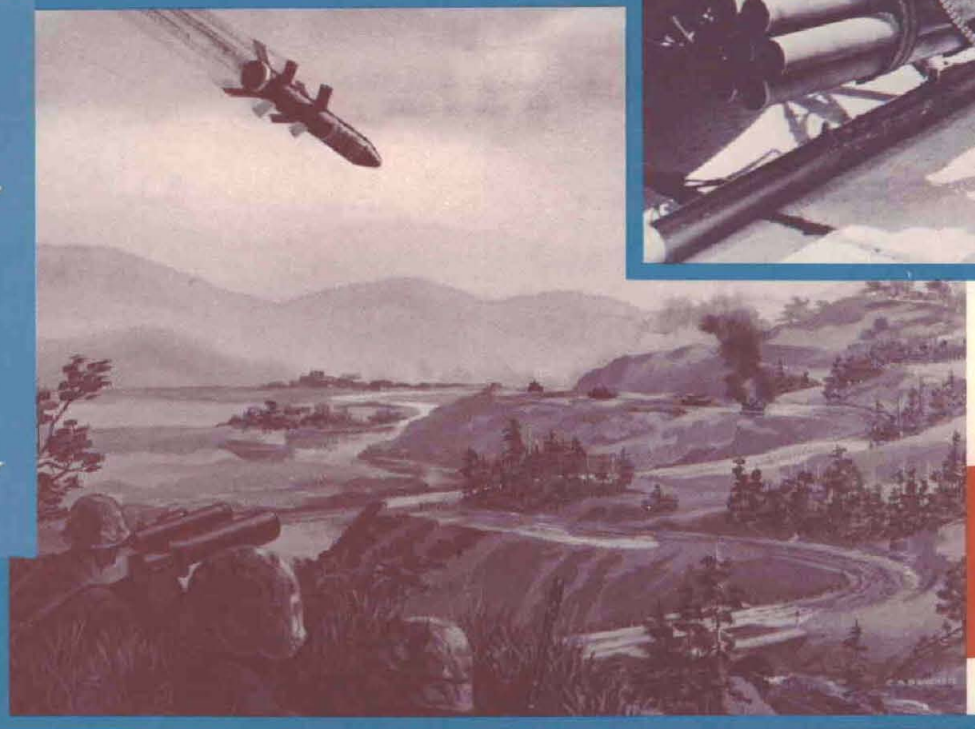
ARMY RESEARCH AND DEVELOPMENT

July—August 1976





ARMCOM Mission:
Superior Firepower
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U.S. ARMY ARMAMENT COMMAND

SPEAKING ON . . .

The Export of Technology: A 'Handle With Care' Commodity

Since the President and Congress joined in 1972 to implement a national program to stimulate transfer of technology advances from federal agency research and development programs, for application to economic and social problems, this complex problem has been receiving increasing attention.

Featured at the 1976 U.S. Army Science Conference, June 22-25, was a panel discussion on "Technology Transfer and the Army." Defense Advanced Research Projects Agency Director Dr. George H. Heilmeier, in a June 16 address to the International Association of Machinists and Aerospace Workers discussed "Export of Technology: A 'Handle With Care' Commodity," as follows.

I am delighted to be here today to discuss a topic vital to the interest of the nation, namely technology transfer. Technology transfer is a process which has gained attention on many international fronts; it is a process which must therefore be handled with care.

I shall be discussing various aspects of technology transfer; its importance to the nation, to our nation's defense, and how the U.S. controls the export of technology. I will offer some observations and suggestions for insuring that we don't sell too cheaply, or even unwittingly give away those advanced and evolving technologies which underpin our national security and economic well being.

My job, as Director of the Defense Advanced Research Projects Agency of the Department of Defense, is to do all in my power to keep the United States number one in those technologies vital to our national defense. We are dedicated to the concept that the best way to prevent a foreign power from coming up with a technological surprise that could endanger our national security is for the U.S. to be first in developing and applying new technologies.

This approach says, in effect, that the U.S. must be first with the most effective and advanced space systems, fighters, bombers, missiles, submarines, ships, tanks, communication systems, and so forth. Saying the same thing another way, if the U.S. has thoroughly investigated the applications of technology, we cannot be surprised by any foreign power producing a superior or totally new weapon.

Over the past few years the challenge to do this job well has been complicated by the severe competition within our own country for allocation of federal funds. Increasingly, it has become clear that we in the Defense Department must utilize our resources more efficiently, choose our targets of interest most carefully, and concentrate our efforts where they will have the best short-term payoff.

In the process, many promising areas are not explored. We tend to be more conservative - less tolerant of the risks inherent in basic research and less likely to achieve major breakthroughs. We are still number one in technology but other countries, some friendly and some hostile, are competing harder with us in this area so vital to our security and economic well-being.

THE PERSPECTIVE of my job and its relation to the complex issues facing our nation makes it clear that national security is the nation's number one priority. While I hasten to add that I recognize other national problems such as energy, environment, inflation and unemployment, I can't forget that Soviet military and political might is growing relentlessly and expanding its presence around the globe. Think of their presence and influence in Eastern Europe, Africa, the Middle East, in the Atlantic, Pacific and Indian Oceans, and in the Mediterranean.

What is the key to preserving our national security when we are faced with the fact of the tremendous numbers of personnel and weapons of the Soviet Union and its allies? We cannot match their sheer numbers. The key is technology. I can assure you that as of this moment our weapons are technologically superior. Employing the most advanced technologies (a number of which, I'M PROUD TO SAY, WERE DEVELOPED THROUGH DARPA initiatives), U.S. manufacturers produce an arsenal of weapons that has consistently improved with the years.

Our weapons reflect our utilization of advanced technology, and our qualitative superiority here maximizes the effectiveness of our men and minimizes combat losses. This same technology base contributes to our continued ability to compete successfully in the world market though our workers are among the world's most highly paid.

No other country can match our capabilities in such high techonolgy products as computers, semiconductors and, of course, aircraft mainframes and engines. These industries and many others draw upon a competence developed mainly since World War II.

Certainly we cannot attribute our ability to compete in foreign markets to our inexpensive fuel (prices have increased astronomically, as you all well know) or to our limitless and cheap natural resources (we are short many vital materials such as nickel, manganese, cobalt, copper - to list but a few). The reason is our productivity and our technology.

All of us here today know that our technology base has, indeed, provided us with much more than superior quality weapons and the ability to compete in world markets. U.S. military and civilian aircraft, drawing, for example, on our numerical control expertise, are purchased by many foreign customers.

We also know that our technology serves us in our daily lives by improving our standard of living - ample food in a food-short world; effective transportation and communications systems; superior medical, dental and surgical services; and opportunities to enjoy our increasing leisure time.

But, let's face it, our technological superiority just didn't happen. Nor do I claim it's only the result of good science. Rather, I submit that U.S. technological superiority stems from the combination of: Good science; innovative engineering and enterpreneurship; sound management and planning; effective use of available materials; aggressive and effective marketing; and close government and industry cooperation.

In short, as I perceive the situation, technology is all-pervasive; it is our national long suit, one which we have developed for over a century. Today, we enjoy technological superiority in many key areas, but we cannot be careless about maintaining and improving what we already have. Frankly, I see some disturbing trends.

SOME CONCERNS. Given the importance of our technological competence, let's consider our future position if we export advanced technologies without proper management of the process.

Let's ask, for example, how our national security would be affected if our advanced guidance and control systems were made available to all interested customers. How would our security be affected if we actively made available our airframe and jet engine design and production know-how, or if we sold our advanced developments in integrated circuitry, semi-conductors, microprocessors and computers to all who wanted them?

Clearly, the threat to our national security would be immense. In addition, we could lose our ability to compete in many world markets and thus lose those jobs currently involved in production for export.

To complicate matters, many technologies serve equally well for defense and nondefense needs. For instance, the basic technology used for hand-held calculators and digital watches - which I am sure many of you own - can be applied with major benefit to guiding a missile, managing a machine tool, or assisting a fighter pilot.

This presents the U.S. Government and our allies with a dilemma: How can we be sure that this nation does not contribute technology to enhance Soviet defense posture? The control and management of technology transfer has become a major issue for U.S. Government policy. It is perfectly clear that the export of U.S. advanced technology must be carefully managed in our national interest.

HOW IS TECHNOLOGY EXPORT DONE TODAY? The transfer occurs in many ways. One can transfer technology through a proposal; a visit to a laboratory, trade fair or plant; through literature; or the sale of products with associated instruction. Let me cite a few examples of some products embodying advanced

(Continued on page 24)

ABOUT THE COVER . . .

Formed by merging the Weapons Command, Munitions Command and Ammunition Procurement Supply Agency, the U.S. Army Armament Command is now the largest of six hardware-producing major subordinate commands, in terms of programs and commodities, of the U.S. Army Materiel Development and Readiness Command. Responsibilities extend to commodity management of the entire family of conventional gun-type weapons, fire control equipment and associated ammunition for each.

Dedicated to providing the American fighting man with the weapons and ammunition necessary to establish and maintain superior firepower under all combat conditions, ARMCOM has a professional workforce of more than 20,000 military and civil service personnel and a contractor civilian team of approximately 18,000 people with a broad variety of skills.

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FEATURES

DEPARTMENTS

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Selective Scanner . . .

Contract Orders Production Facility for M732 Fuze

Design and fabrication of an integrated production facility for the M732 artillery proximity fuze - accepted for production in January 1976 and developed by the Harry Diamond Laboratories of the U.S. Army Materiel Development and Readiness Command (DARCOM) - was ordered in a recent contract award.

The $5,386,705 2-year contract with Lockheed Electronics Inc. stipulates that the mechanized production line will reduce the number of persons required to assemble the fuze components from about 300 to 120; also, that the equipment will be transportable to another contractor, should the need arise. HDL will supervise production and capacity will be 5,000 fuzes in an 8-hour day.

The M732 fuze senses the setback and spin forces inside the artillery weapon to initiate operation. Flight or overhead safety is provided by an electronic instead of a mechanical or gear train timer. A miniaturized transceiver turns on about three seconds before the projectile arrives at its target and is detonated at the desired height.

Watervliet Fabricates Fiberglass Tank Roadwheel

Fabrication of a fiberglass tank roadwheel from filament wound composites was completed recently as part of a feasibility study in the Organic Materials Laboratory at Watervliet (NY) Arsenal.

Funded by the U.S. Army Tank-Automotive Command, the study was initiated to minimize or reduce conventional tank roadwheel weight by about 40 percent.

OM Laboratory Chief and Project Director Dr. Giuliano D'Andrea reported that the new composite approach is also believed capable of reducing roadwheel vulnerability to mines due to less weight and flexibility gains.

Dr. D'Andrea was assisted in the project by mathematician Royce Soanes, mechanical engineer Peter O'Hara and engineering technicians Paul Croteau and Harry Scheck. OM Lab personnel successfully tested in late 1975 a 106mm recoilless rifle made from composites.

NASA Launches 2d Black Brant Research Rocket

Research directed toward advanced technology for processing and testing metallic and nonmetallic materials in a zero-gravity environment moved ahead with the recent second firing of a Black Brant VC (5C) rocket at White Sands (NM) Missile Range.

Launched as a part of a 5-year National Aeronautics and Space Administration project, termed Space Processing Applications Rocket, the SPAR carried an 800-pound, 10-experiment paylond. it reached an altitude of 123 miles and collected data on about 5 minutes of processing.

SPAR will expand studies made during Apollo, Skylab and Apollo Soyuz test missions, and will provide space-processing data until reusable space shuttle flights begin in the early 1980s. Three Black Brant missions a year are planned through 1980. The first launching in December 1975 resulted in full success of 8 of 9 experiments.

The program is managed by NASA's Marshall Space Flight Center, Huntsville, AL. NASA's Goddard Space Flight Center in Greenbelt, MD, assists in providing rocket systems and directing launch and payload activities.

Navy Flys Tomahawk Turbo-Fan Cruise Missile

Using a turbo-fan instead of a turbo-jet engine for the first time, the Navy's Tomahawk cruise missile with a fully guided control system completed a 61-minute flight test recently at White Sands (NM) Missile Range.

Launched at 11,500 feet altitude from the wing of a Pacific Test Center A-6 Intruder aircraft, the missile traveled at high subsonic speed for 446 nautical miles. The cruise missile was also the first of its kind to be navigated by terrain contour matching (TERCOM) guidance.

The flight was described as the first in a series to test the missile's capability to perform navigation, guidance updates, and low terrain-following maneuvers.

TERCOM compares measured terrain heights with heights stored in an on-board computer, correcting the missile's course and altitude and guiding it to a designated geographical location.

Expected to have an ultimate range of nearly 2,000 nautical miles, the Tomahawk is scheduled for a test series to expand the flight envelope and refine terrain-following characteristics. Use of a parachute made the Tomahawk recoverable for further testing.

WSMR Shows Engineering Displays at SAVE Meet

Two White Sands (NM) Missile Range engineering displays, selected by the U.S. Army Test and Evaluation Command, Aberdeen (MD) Proving Ground, were shown at the national conference of the Society of American Value Engineers at Minneapolis, MN.

One display was a Telereadex modification for reading Contraves Model F film. Nine Telereadexes are programed for modifications that reportedly will save $107,000 as compared to cost of one F film reader.

A second display was a value engineering change proposal (VECP) submitted by Eleph, Inc., a WSMR contractor. Modifications to a WSMR transmitter permit frequency and amplitude controls on a printed circuit.

The change resulted in a reported saving of $54.28 per unit, reduced production time, and provided a more reliable system. Contractors share in the savings when their VECPs are accepted by the government.

WSMR is credited with estimated government savings of $1.6 million in 1975 and 1976 by adoption of 26 VECPs.

TACOM Establishing Metrication Office

Establishment of a Metrication Office at the U.S. Army Tank-Automotive Command, Warren, MI, in line with growing momentum for conversion to the metric system nationwide, is announced.

National interest in the metric system stems from Presidential approval of the 1975 Metric Conversion Act, establishing a U.S. Metrication Board.

Acting TACOM Metrication Officer Harold Sinclair-Smith noted that the new MO will serve both R&D and Readiness Commands resulting from TACOM's reorganization.
such as training machinists to operate metric-converted machinery. Training will be extended to field units.

TACOM's metrication officer and his deputy will maintain a liaison with industry's conversion efforts by serving on the American National Metric Council.

Army Approves SAM-D Redesignation to 'Patriot'

"Patriot" has been selected by the Department of the Army as the new name for SAM-D (Surface to Air Missile Development), its new air-defense system intended to replace the Hawk and Nike Hercules missile systems.

"Official Army approval of a proper name is evidence of the Army's commitment to develop and eventually deploy the Patriot system," said MG Charles F. Means, Patriot Project Manager.

The Army assigns popular names to major equipment and weapons when they are approved for engineering development or deployment. Patriot was authorized to resume full-scale development in February 1976.

Dod Announces Intelligence Operations Changes

Department of Defense changes in management and operation of intelligence activities, in line with Executive Order 11905, include:

- Establishment of a DoD Inspector General for Intelligence. He will report directly to the Deputy Secretary of Defense, ensure the legality and propriety of defense intelligence activities, and work closely with the President's new intelligence Oversight Board.
- Designation of the Assistant Secretary of Defense (Intelligence) as Director of Defense Intelligence (DDI). He will have staff and line authority for DoD intelligence activities on behalf of the Secretary of Defense.
- A Principal Deputy DDI and two operating deputies will be included on the ASD (I)/DDI staff. One deputy will be responsible for Programs and Resources and the Director of the Defense Intelligence Agency is responsible for Production, Plans and Operations.

Directors of the National Security Agency and DIA will report directly to the Secretary and Deputy Secretary through the ASD (I)/DDI. The DIA Director will report also to the Chairman, Joint Chiefs of Staff, and will have only two vice directors, one for Intelligence Production, and one for Plans, Operations and Support.

A Defense Intelligence Board consisting of senior military and civilian defense policy officials will be established on a trial basis to improve intelligence quality.

2 Infantry Divisions Scheduled for Mechanization

Designed to provide a more balanced force for future battlefields is a Department of the Army action announced recently to mechanize two existing infantry divisions within five years.

Believed the most likely candidates for conversion are the 24th Infantry Division, Fort Stewart/Hunter, GA, and the 9th Infantry Division, Fort Lewis, WA. These units are favored because of economical factors and availability of housing and training resources.

Scheduled for conversion in 1978 is the 256th Infantry Brigade of the Louisiana Army National Guard. The 256th will be assigned to the Active Army's 5th Division (Mechanized), Fort Polk, LA.

Natural Resources Advisory Unit Chosen

Selection of committee members to conduct on-the-scene inspections of four military installations nominated for the Secretary of Defense Natural Resources Conservation Award was announced in June.

Established in 1962, this award is the highest honor presented to a military installation for management of its natural resource program and enhancement of the environment. Competition is among the 235 installations which have formal conservation programs.

Finalists for the 1976 award are Fort Sill, OK; Vandenberg Air Force Base, CA; U.S. Naval Air Station, Meridian, MS; and the U.S. Marine Corps Base, Camp Lejeune, NC.

The Secretary of Defense Natural Resources Advisory Committee is chaired by E.A. Rogner, director, Installation Management and Planning, Office, Assistant Secretary of Defense (Installations and Logistics). Members are William R. Hilts, president, New York State Outdoor Writers Association; Dr. Laurence R. Jahn, vice president,Wildlife Management Institute; Richard D. Pardo, programs director, American Forestry Association; Dr. Lucille F. Stickel, director, Patuxent Wildlife Research Center, Department of Interior; John C. Stone, coordinator of Educational Services, National Wildlife Federation; and Edward E. Thomas, assistant administrator, Soil Conservation, Department of Agriculture.

Defense Department Revises EO Directive

Equal opportunity programs and policies for civilian and military personnel are strengthened by revised Department of Defense Directive 1100.15 signed recently by Secretary of Defense Donald Rumsfeld.

Military departments and DoD agencies must now submit an annual report to the Secretary of Defense demonstrating progress in achieving goals of Affirmative Action Plans. DoD component heads are responsible for EO within their jurisdictions.

The directive also reemphasized DoD policy to require DoD contractors to comply with EO policies.

- Ensure that all on-base and off-base activities are available to all DoD personnel.
- Impose, as required, the off-limits sanction in cases of discrimination involving public accomodations outside military installations.

"The chain of command shall be continuously emphasized as the primary channel for correcting discriminatory practices and for communication of race relations and equal opportunity matters."

DoD Consolidates Tri-Service Information

Consolidation of the Tri-Service Medical Information System (TRIMIS) program into a separate field activity under the Assistant Secretary of Defense for Health Affairs is announced by Secretary of Defense Donald Rumsfeld.

Established in 1974 under guidance of the Office of the Secretary of Defense and direction of the Surgeon Generals of the Services, TRIMIS is now the only DoD activity responsible for automatic data processing to improve military health care delivery. Acting Assistant Secretary of Defense for Health Affairs Vernon McKenzie is director and COL Burton Kaplan, USAF, his associate.

Included among TRIMIS listed achievements are development of system descriptions for nine major medical subsystems; obtained rights for use of an inpatient pharmacy system, an outpatient pharmacy system and a patient appointment system; standardized requirements, installed and tested a clinical laboratory.

R&D News...

TENTH ARMY SCIENCE CONFERENCE...

52 Researchers Earn Awards; Panel Views Technology Transfer

Notable at the Tenth U.S. Army Science Conference, June 22-25, was the "changing of the guard" atmosphere - the substantial emergence of new leaders to carry on traditions of excellence set by stalwarts who have made major contributions for 15 or more years.

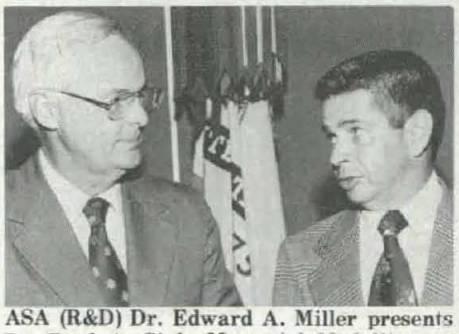
Sponsored by the Army Deputy Chief of Staff for Research, Development, and Acquisition, the conference was held at the United States Military Academy, West Point, NY, where all ASCs have been held, beginning in 1957.

Assistant Secretary of the Army (R&D) Edward A. Miller was the banquet speaker to about 400 attendees and he also presented awards for the 17 best of 96 technical papers given during four concurrent sessions continued over the 3-day conference.

Assistant Deputy Chief of Staff for Research, Development, and Acquisition MG Philip R. Feir gave the keynote address, "The Case for Strengthening Research and Development," and doubled as banquet master of ceremonies.

Audience participation in a questions and answers session following a panel presentation on "Technology Transfer and the Army," chaired by MG Charles D. Daniel Jr., special assistant to GEN John R. Deane Jr., commander of the U.S. Army Materiel Development and Readiness Command, indicated that this provided the highlight of the conference.

The panelists were Dr. John L. Allen, Deputy Director (Research and Advanced Technology), Office of the Director of Defense Research and Engineering, who spoke on "Technology Transfer as OSD Sees It"; COL Thomas W. Kelly, chief, Doctrine and Systems, Integration Division, Office of the Deputy Chief of Staff for Operations, HQ DA; Dr. John L. McDaniel, director, U.S. Army Missile Research and Engineering Laboratory, HQ MICOM; and Dr. Joseph Sternberg, director, Advanced Systems, Martin Marietta Space Division.



ASA (R&D) Dr. Edward A. Miller presents Dr. Paul A. Siple Memorial Medallion to Dr. Thomas E. Davidson, principal author of 5-man team from the Benet Weapons Laboratory, Watervliet (NY) Arsenal, that shared the ASC top honor and $1,000.

ASC $500 AWARD winners CPT Richard G. Allen, principal author of 2-man team from Walter Reed Army Institute of Research, and Dr. Robert J. Zeto, representing 4-man team from U.S. Army Electronics Technology Lab, Electronics Command.

COL Kelly discussed "An Army User's Approach to Technology Transfer." Dr. McDaniel's topic was "Technology Transfer from the Developer's Point of View," and Dr. Sternberg gave his views on "An Industry Approach to Technology Transfer."

(Attention of readers is invited to Speaking On... "The Export of Technology: A Handle

(Continued on page 5)

Explosives Technology Studied to Protect Hilo

Daring the fury of "Madame Pele," the mythical guardian of the world's largest active volcano, Mauna Loa on the Island of Hawaii, is not a venture to be undertaken lightly in the minds of those prone to superstition - but two intrepid U.S. Army researchers recently challeneged the hazards.

Using explosive excavation techniques developed by experts in the Weapon Effects Laboratory of the U.S. Army Engineer Waterways Experiment Station (WES), Vicksburg, MS, John E. Shaler and Sherman Price recently devised and directed a series of tests on the flanks of Mauna Loa.

The purpose was to obtain information on cratering behavior in several types of basalt, and to apply results to lava flow structures - lava tubes, levees and spatter cones. Basically, the technology was that developed by WES investigators to make railroad cuts through mountains, deepen and enlarge harbors of "dig" channels, and to demolish unsafe bridges.

All of these applications of WES explosives technology have been reported in the **Army Research and Development Newsmagazine** in numerous articles in recent years. On Mauna Loa, however, the investigation was to try to devise ways of protecting Hilo, a beautiful major port city, if a serious eruption occurs.

Mauna Loa had a summit eruption in July 1975 and U.S. Geological Survey records show that a flank eruption usually follows within three years. Hilo thus might be jeopardized by a large magnitude flow of lava in mid-1978.

Engineers estimate that the gentle slopes of the mountain and the thick vegetation at the lower elevations might allow up to 14 days to use the most effective control methods without delay once the eruption occurs.

Three lines of defense action have been proposed: (1) explosive disruption of the lava flow high on the slopes of Mauna Loa, (2) barriers to divert lava flow away from Hilo to an undeveloped area near the shoreline, and (3) cooling the lava by application of large volumes of water.

The latter would indeed be a last line of defense as there is a lack of water in the saddle area and it would not be practical to pump huge amounts of water 30 miles up the slope, although the availability of huge pumps is being discussed with the U.S. Air Force and Navy.

Past eruptions have resulted in the formation of lava tubes for undetermined distances through Mauna Loa. Should the lava form new tubes as an escape route, it would remain in a molten state longer and could flow unimpeded and undirected with no knowledge of where it would eventually surface.

Collapsing the lava tubes can have the effects of rubble stopping the flow or changing the force of the flow to other directions and also allowing the lava to flow into the air to disperse and solidify.

However, problems can be encountered in getting the explosives experts to the top of the lava tube in an active lava bed and these too are being analyzed. Use of helicopters is one of the key ways being considered.

During the pre-emergency tests, approximately 47 charges were exploded at depths from three to eight feet in pahoehoe, against 10-foot spatter cones and levee walls, and against 10-foot lava tube ceilings.

The explosives weighed from 40 to 240 pounds. Breaching spatter cone walls and lava levees may change the flow of lava to a desired direction, and charges in or ahead of lava flows may be useful in creating new channels, lava dikes, or lava lakes.

A 15-member team of Army combat engineers from the 65th "First In, Last Out" Engineer Battalion (Combat) of the 25th "Tropic Lightning" Infantry Division at Schofield Barracks, Hawaii, emplaced and detonated the charges.

Participating in the tests were Dr. Benjamin Cummings of the Ballistic Research Laboratories at Aberdeen Proving Ground, MD, who also represented the tri-service Joint Technical Coordinating Group/Munitions Effectiveness; and SFC Carlos W. Lanier and SSG Dennis Veal of the 7th Special Forces Group, Fort Bragg, NC.

Dr. John P. Lockwood of the Department of Interior's U.S. Geological Survey, and on the staff of the Hawaiian Volcano Observatory, emphasizes that Hawaii Island is fortunate in being able to plan for a future eruption.

PRE-EMERGENCY plans for protection of Hilo, Hawaii Island, include detonation of explosives on Mauna Loa volcano where a flank eruption is predicted to occur by mid-1978. Shown is a 40-pound charge fired on the north-northeast flank of the island.

With Care' Commodity," beginning on the inside front cover. The ASC panel presentations will be featured in Speaking On... in our next edition.)

General Chairman Dr. Ivan R. Hershner, assistant director, Research Programs, Office of the Deputy Chief of Staff for Research, Development, and Acquisition, called the conference to order. Welcoming remarks were made on behalf of Academy Superintendent LTG Sidney B. Berry by Dean of the Academic Board BG Frederick Smith.

U.S. Army Chief Scientist and Director of Army Research Dr. Marvin E. Lasser served as presiding chairman. He also headed the panel of judges which selected the 17 best papers that were presented. Members included Dr. Robert E. Beaudet, Department of Chemistry, University of Southern California; Dr. David L. Fried, Optics Science Consultants; Howard Gates Jr., consultant; Dr. Richard O'Neil Hundley, R&D Associates; and Dr. Herbert L. Ley Jr., former head of the U.S. Food and Drug Administration, now a medical consultant.

SIPLE MEDALLION. $3,250 in Honorariums. The most prestigious award at the conference, the Dr. Paul Allman Siple Memorial Medallion, included a $1,000 honorarium shared by a 5-man team from Benet Weapons Laboratory, Watervliet Arsenal, NY, for a paper titled "Unique Materials and Properties in the New High-Pressure Temperature Regime Above 20 Kbars." Recipients, each of whom was awarded a large silver medallion, were Dr. T. E. Davidson, D. P. Kendall, C. G. Homan, J. Frankel and Frederick J. Rich.

Included in the total of $3,250 in honorariums for the best papers, made possible through the Army Incentive Awards Program, were two $500 awards, each accompanied by individual bronze medallions. One went to CPT Richard G. Allen and MAJ G. R. Irwin, Walter Reed Army Institute of Research, Washington, DC, for "Antibody to Hepatitis B. Core Antigen."

A 4-man team from the HQ Electronics Command's Electronics Technology and Devices Laboratory coauthored the second $500 paper, "Low Temperature Pressure Oxidization of Silicon for Integrated Circuit Technology." Coauthors are Dr. Robert J. Zeto, Dr. Clarence G. Thornton, Eugene Hryckowian and Charles D. Bosco.

Five awards of $250 each and individual bronze medallions for coauthors were presented to: Donald A. Boxwell and Frederic H. Schmitz, Ames Directorate, U.S. Army Air Mobility R&D Laboratory, Moffett Field, CA, for "Inflight Far-Field Measurement of Helicopter Impulsive Noise."

•John F. Mescall, Paul V. Riffin and Charles J. Polley, Army Materials and Mechanics Research Center, Watertown, MA, for "New Wave-Shaping Concepts in Fragmentation Munitions."

•Erich Hafner, Stanley S. Schodowski, John R. Vig and Henry Mazurczyk, ECOM Electronics Technology and Devices Laboratory, for "Gun-hardened Crystal Oscillators for Remotely Monitored Battlefield Sensor System (REMBASS)."

•F.C. Petito and Dr. Thomas Cox, ECOM Night Vision Laboratory, Fort Belvoir, VA, for "High Performance Pyroelectric Vidicon."

•A. Schwartz, M. J. Wade, T. R. AuCoin and J. G. Caultieri, ECOM Electronics Technology and Devices Laboratory, Fort Monmouth, NJ, for "High Efficiency Pentaphosphates for Miniaturized Laser Application."

The nine meritorious paper awards were made to:

•Dr. Forrest J. Agee and Dr. Huey A. Roberts, Harry Diamond Laboratories, Adelphi, MD. "The Invention and Development of PLACER."

•Dr. Orval E. Ayers, Dr. James A. Murfree, Dr. Pasquale Martignoni and Dr. William M. Chew, HQ U.S. Army Missile Command, Redstone Arsenal, AL, "Solid Propellants for Hydrogen Gas Generators."

•Robert S. Bernard, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS, "A Projectile Penetration Theory for Layered Targets."

•COL Duane E. Cutright, COL J. M. Brady, COL Lee Getter and Robert A. Miller, U.S. Army Institute of Dental Research, Washington, DC, "Lactic Acid Derived Biodegradable Implant Materials."

•Frank DeVenuto, Angelo I. Zegna, William Y. Moores and Thomas F. Zuck, Letterman Army Institute of Research, Presidio of San Francisco, CA, "Transfusions with Hemoglobin Prepared by Crystallization."

•David C. Heberlein, U.S. Army Mobility Equipment Research and Development Command, Fort Belvoir, VA, "Chemical Neutralization of Trinitrotoluene."

•Martin J. Houle, Ned Hill, Roy LeGrand and Sandra Janroga, Dugway Proving Ground, UT, "The Fate of Isopropyl Methylphosphono Fluoridate in Growing Plants."

•Dr. P. M. Howe, Dr. R. B. Frey, V. Boyle and B. Taylor, Ballistic Research Laboratories, Aberdeen Proving Ground, MD, "Physics of the Response of Explosives to Shock Loading."

•Dr. Iskandar K. Iskandar (correct) and Daniel C. Leggett, U.S. Army Cold Regions Research and Engineering Laboratory, Hanover,

ASC $250 AWARD winners Donald A. Boxwell, principal author of 2-man team from U.S. Army Air Mobility R&D Lab, Moffett Field, CA; Erich Hafner, representing 4-man team from U.S. Army Electronics Technology and Devices Lab, ECOM; John F. Mescall, representing 3-man team from U.S. Army Materials and Mechanics Research Center, Watertown, MA; F. C. Petito, representing 2-man team from the Night Vision Laboratory, Fort Belvoir, VA; A. Schwartz, representing 4-man team from Electronics Technology and Devices Lab, ECOM.

MERITORIOUS AWARD winners: Top row—Dr. Forrest J. Agee, representing 2-man team from Harry Diamond Labs, Adelphi, MD; Dr. James A. Murfree, 4-man team from U.S. Army Missile Command, Redstone Arsenal, AL; Robert S. Bernard, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS; COL Duane E. Cutright, 4-man team from U.S. Army Institute of Dental Research, Washington, DC. Bottom row—Frank DeVenuto, representing 4-man team from Letterman Army Institute of Research, Presidio of San Francisco; David C. Heberlein, U.S. Army Mobility Equipment R&D Command, Fort Belvoir, VA; Martin J. Houle, 4-man team from Dugway Proving Ground, UT; Dr. P. M. Howe, 4-man team from Ballistic Research Labs, APG, MD. Not shown is Dr. Iskandar K. Iskandar, representing 2-man team from the U.S. Army Cold Regions Research and Enginnering Laboratory, Hanover, NH.

Tenth Army Science Conference

(Continued from page 5)

NH, "Reclamation of Wastewater by Application on Land."

(Abstracts of the prize-winning papers are presented at the end of this article.)

KEYNOTE SPEAKER MG FEIR devoted most of his address to the essentiality of adequate funding and astute programing to strengthen the United States advanced technology base through increased research and development to meet the potential threat of the Soviet Union as a future agressor. He stressed the numerical superiority of the Soviets in "massed armor, massed artillery and massed manpower" as well as massive effort to achieve technological superiority.

To illustrate this point, MG Feir quoted from a presentation to Congress by Director of Defense Research and Engineering Dr. Malcolm R. Currie on the U.S. defense budget proposals. He said that the Soviets now lead the U.S. in such areas as "high-pressure physics, welding, titanium fabrication, magneto-hydrodynamic power generation, high-frequency radio wave propagation, certain types of missiles, chemical warfare and artillery."

MG Feir also cited numerous examples of the increasing sophistication of many Soviet weapon systems, although the major thrust of R&D programing has been on product improvement activities as opposed to major new developments.

"...Clearly," he said, "Soviet equipment has begun to show technological sophistication across the board. Redundancy is coming into their systems; items are appearing which even we might call 'gold platting....'"

Referring again to Dr. Currie's presentation to Congress, MG Feir quoted him as expressing the opinion that "the Soviets are "...investing increasing resources in a search for revolutionary technologies...(and are) challenging our technological leadership across almost the entire spectrum of conventional warfare. They see very explicitly that science and technology is the battleground of the future...."

Complicating the U.S. problem of strengthening the national defense technological base is the prime consideration of affordability in view of continuing inflation of R&D costs and acquisition of new weapons systems.

MG Feir described at considerable length a new Science and Technology Objectives Guide (STOG) distributed recently to Army in-house R&D centers, universities and to industry. The STOG, he said, constitutes a new direction in the manner in which the Army is guiding its R&D activities. It is intended to help bring the user and the developer closer together to achieve critical materiel acquisition goals.

BANQUET SPEAKER ASA (R&D) Edwin A. Miller opened his address with a tribute to British, Canadian and Australian embassy and defense officials participating in the conference as guests.

In stressing the critical need for expansion of the U.S. effort to strengthen its technological base, he said that Russia is spending almost double the amount the U.S. is budgeting for research, development, test, evaluation and materiel acquisition - roughly 11 percent as compared to 6 percent.

Most of Mr. Miller's address was directed to problems of dealing with Congress and the requirement to justify intensively the budgetary proposals for research, development, test, evaluation and materiel acquisition. He expressed confidence that the increased FY 1977 defense budget and proposed increases into the 1980s will enable military departments to act adequately to build a greatly strengthened base of deterrence against the potential Soviet threat.

Foreign Science and Technology Center Display. Most of the conference participants

(Continued on page 22)

ASC SOCIAL HOUR GROUP: (L-R) CPT Michael Simonich, assistant executive, Directorate of Development and Engineering, HQ U.S. Army Materiel Development and Readiness Command, (DARCOM); Joseph Lindwarm, acting chief, Laboratory and Development Command Management, HQ DARCOM, and Mrs. Lindwarm; Terrence G. Kirtland, technical director, Mobility Equipment R&D Command, and Mrs. Kirtland; COL John W. Brennan, director, Plans and Analysis, HQ DARCOM.

DARCOM Creates Office of PM for Smoke

Increased emphasis on the U.S. Army Smoke/Obscurants Program is reflected by establishment of an Office of Project Manager for Smoke at HQ U.S. Army Materiel Development and Readiness Command, June 21.

Heading the office as acting PM is COL Henry R. Shelton, PM designee, who has served during the past year as executive, Office of the Deputy Chief of Staff for Research, Development, and Acquisition, HQ Department of the Army.

COL Shelton is the focal point for all smoke development and readiness activities for the Army Smoke/Obscurants Program. Until about mid-August his office will be in Room 8S-12, HQ DARCOM, 5001 Eisenhower Ave., Alexandria, VA, telephone AUTOVON 284-8496/7/8.

Contingent on Secretary of the Army approval of the PM charter, HQ DARCOM will formally establish the OPM SMOKE at Aberdeen Proving Ground, MD, and the PM will report directly to the DARCOM commander.

Interim staffing, including six engineers in grades GS-13 through GS-15 who are experts in smoke and obscurants, will come from the SMOKE Program Office, Edgewood Arsenal.

COL Shelton will participate with the HQ Training and Doctrine Command (TRADOC) in determination of qualitative and quantitative needs for the Smoke/Obscurants Program.

Responsibilities of the PMO include life cycle management of all classes of Army smoke/obscurants munitions, materials and dissemination devices used for countering observatin of friendly personnel, air and ground vehicles, units and installations, and for signaling, marking and deception.

COL Shelton is also responsible for collection, coordination, evaluation and dissemination of all smoke/obscurants information and technology, both foreigh and national. When the PMO is activated at Aberdeen PG, Smoke Management responsibilities will be transferred from the Army Armament Command to his office but ARMCOM will retain responsibility for support operations.

COL HENRY R. SHELTON'S qualitications for his new assignment as DARCOM project manager for the Army Smoke/Obscurants Program include continuous assignments since May 1967 in research and development or related activities.

Following an R&D tour of duty as a combat developments staff officer with HQ U.S. Army Combat Developments Command, Fort Belvoir, VA, he served from July 1969 to October 1972 with the Combat Materiel Division, Office of the Chief of R&D HQ DA. Initially a staff officer, he served as deputy and later as chief of the Combat Materiel Division.

After a tour as commander, 4th Training Brigade, Fort Knox, KY, COL Shelton became director, TRADOC Bushmaster Task Force, Fort Monroe, VA (March-July 74). He then returned to the Office of the Deputy Chief of Staff for Research, Development, and Acquisition, HQ DA, as chief of the Support Systems Division. He became executive June 1975.

His experience includes assignments as an instructor in basic tactics and later in nuclear weapons employment at the Infantry School, Fort Benning, GA, and associate professor of military science, ROTC, Ohio University, Athens, OH.

Graduated from Virginia Polytechnic Institute, Blacksburg, VA, with a BS degree in 1951, he obtained a master of military arts and science degree from the Command and General Staff College, Fort Leavenworth, KS, in 1964. He is also a graduate of the Army War College, Carlisle Barracks, PA, and the Senior Officers Legal Orientation, Judge Advocate General School, Charlottesville, VA.

COL Shelton is the author of numerous publications in military journals. He has amassed a long list of military decorations, including the Silver Star, Legion of Merit with OLC, Meritorious Service Medal, and Republic of Vietnam Gallantry Cross with Gold and Silver Stars.

54 PMDP Majors Selected for Promotion

Exceptional qualifications specified for officers in the U.S. Army Project Manager Development Program (PMDP) were evidenced, as they have been recognized repeatedly by promotion boards during the past year, in a July 26 announcement of majors selected for the lieutenant colonel list.

PMDP membership in grade of major when the promotion board convened was 273 and 54 were selected for LTC rank. Forty-four were selected from 48 as first-time eligibles, 1 of 2 from second-time consideration, and 9 from the secondary zone. The first-time rate was 91.66 percent as compared to the Armywide selection rate of about 63 percent.

Designed to prepare qualified officers in management of the acquisition of major defense systems, the Army PMDP accepted the first members in March 1975. Goals included about 200 colonels to serve in PM positions or other high-level jobs within the Department of Defense.

The Army is planning to expand the program to include 280 captains, 459 majors, 342 lieutenant colonels and 202 colonesl - for a total of 1,283 officers. According to the U.S. Army Personnel Center, more than 600 officers have been integrated into the PMDP since 1975.

Opportunities for development of officers in the PMDP are found in Project Manager Offices; HQ U.S. Army Materiel Development and Readiness Command and its subordinate commands; on the Department of the Army staff; and with other activities involved in materiel acquisition management.

Officers in the PMDP are selected by screening boards and they serve in positions related directly to the operation and maintenance of equipment at the unit level, in order to gain first-hand knowledge of any problems materiel users might encounter. Details concerning program application are available from officer career managers at the U.S. Army Military Personnel Center (USAMPC), Alexandria, VA 22332.

The USAMPC announced earlier this year "major adjustments with the implementation of the new Officer Personnel Management System (OPMS)."

The PMDP is built upon the framework of OPMS but expanded to provide training and experience in a wider variety of disciplines and skills than are normally a part of the 2-track OPMS system. Officers selected for the program can expect duty assignments in R&D, Testing, Financial Management, and a variety of Logistics position. They also can expect multiple assignments to positions of increasing responsibility within PM offices and early selection for appropriate civil and military schools.

Majors in the Project Manager Development Program selected for promotion are:

Terry L. Alexander, John W. Andrews, Douglas H. Barclay, Dennis B. Bulger, Roy F. Busdiecker, Donald V. Celata, John C. Christopher, Robert D. Clement, James K. Cooksey, John D. Cours, Clarence M. DeYoung, Eugene J. Dobrzelecki, James M. Dorrance, Francis M. Durel, Vernon L. Eppley, and

Burl O. Geisler, Richard C. Gervasini, Robert D. Girard, Richard J. Girouard, Carl T. Hansen, Karl M. Henn, Charles L. Herring, John W. Hocking, Edward R. Janusz, Donald H. Jones, William M. Kearney, William M. Knauer, Richard D. Koon, Edward M. Lee, Andrew C. Lewis, Donald L. McBee, Hugh H. Miller, and

James S. Millet, Frederick T. Mullens, Robert W. Muschek, Maynard A. Nagelhout, Clarke L. Neal, Malcolm R. O'Neill, William J. Owen, Norbert I. Patla, Richard F. Pell, Joseph Raffiani Jr., Thomas C. Rankin, Lawrence Residori, Regis J. Reynolds, Hezekia M. Richardson, William H. Schwend, Peter F. Scott, James T. Shannon, Ray L. Tilghman, Walter A. Vaughan Jr., John D. Veatch, John J. Walker, Phillip W. Williams.

DARCOM Deputy Commanding General for Materel Development LTG George Sammet Jr. commented on the high percentage of PMDP majors selected for promotion, saying:

"In my judgement, this is a well-merited testimonial to the high caliber of officers being trained for project manager or similar challenging key staff assignments. All of those selected for promotion are to be congratulated upon demonstrated potential for continued success in military careers."

40 PMDP Members Take Course In Defense Systems Management

Potential for achievement of career goals in the Amry Project Management Development Program is being enhanced for 34 officers and six civilian employes who started, on July 26, a 20-week course (76-2) at the Defense Systems Management School, Fort Belvoir, VA.

Eleven selectees are lieutenant colonels - Robert L. Catron, Daniel J. Delany, Victor J. Gongola, Robert A. Kaiser, Frank A. Klein Jr., Robert Letchworth, Robert M. Novogratz, Gerald W. Orr, James C. Schaaf, Carl A. Weaver Jr. and Jerry W. Weatherspoon.

Twenty are majors - Terry L. Alexander, William A. Allen, Theodore M. Brostrom, James K. Cooksey, Arnold H. Gaylor, John R. Kettering, Edward M. Lee Jr., David W. Logan, James A. Logan, Francis C. Marr, Donald L. McBee, James E. Milliner, Charles T. Morris, William B. Peyton, Joseph Raffiani Jr., William H. Schwend, Gilbert Stieglitz, Jackie W. Woods, John J. Xenakis and Guy G. Zimmerman.

Captains are Billie J. Price, Paul M. Root and Hugh N. Williams. Civilians are Martin P. Carroll, David N. Hubble, James R. Pritchard, Silvio B. Puglielli, Robert J. Ruth and Douglas C. Seay.

Fort Bragg to Test 160-Foot-Long Girder Bridge

Erection of a 160-foot-long Medium Girder Bridge scheduled for operational testing at Fort Bragg, NC, requires about half the time and one-sixth the personnel normally used for a similar conventional U.S. Army bridge.

Fourteen constructions and retrievals established these time and cost-saving facts during recently completed performance and endurance tests at Aberdeen (MD) Proving Ground, where a similar 100-foot span was tested in 1972. The recent endurance cycle tests included 2,576 crossings by 60-ton vehicles such as the M-60 battle tank and the M88 tank retriever.

Developed originally by the Military Vehicle and Engineering Establishment of Great Britain's Ministry of Defence, the new bridge is improved by a cable reinforcing kit. It can be erected by 28 soldiers in 12 hours without cranes or support equipment except trucks.

Peter H. Kamenik, test director from the Support Equipment Section, Automotive and General Equipment Division, Materiel Testing Directorate at APG, said the bridge is constructed on a roller assembly. A launch nose sticks out from 90 to 100 feet and as each section is completed it is pushed out to a balance point until the nose reaches the far bank.

A crew member then crosses to the far bank and emplaces a launch nose roller. The final section is then constructed and pushed across.

Six men can carry the largest bridge component and the average component requires four men. Attachable handles are provided to carry components mounted on standard 4 x 7-foot pallets transportable in 5-ton dump trucks. A 160-foot bridge requires 24 pallets.

APG testing was conducted under the Army's new SOMTE (Soldier-Operator-Maintainer-Tester-Evaluator) Program. Participating soldiers are assigned to the Military Support Division of the Materiel Testing Directorate.

Operational testing of the bridge is programed to begin in September at Fort Bragg, NC. Units of the U.S. Armed Forces Command will be under the direction of the Armor Engineer Board.

M-60 Tank Crosses Medium Girder Bridge

Yuma PG Unveils 'Recoil' Device For Tube, Munitions Testing

Development of an "alternate recoil device" - termed a major innovation for destructive testing of munitions and artillery gun tubes which may save the government more than $100,000 - has been announced by the U.S. Army's Yuma Proving Ground, AZ.

Lloyd Staley, project engineer with YPG's Munitions and Weapons Engineering Branch, designed the inclined plane gun tube mount, which is capable of repeated use even if the gun tube is destroyed by explosives.

Staley conceived the idea during malfunction tests of the 175/105 mm gun system. However, this involved 21 in-bore premature explosions needed in each full test. This was considered too expensive since a number of howitzer systems, costing $21,000 each, would be destroyed.

Staley designed a simple arrangement for counteracting the gun tube recoiling forces without using standard weapon carriage and recoil systems. Project customer, Picatinny Arsenal, concurred with his idea. Required components were reduced, in the design concept, to the gun tube, breech ring, breech block assembly and forward yoke, fitted into a mount to survive an in-bore premature explosion.

Staley's final design sketch called for an inclined ramp made of heavy steel I-beams, a heavy steel plate that would slide up and down the ramp, and a brace mount welded to the plate holding the tube assembly.

When a round is fired, the steel plate and gun tube recoil up the ramp so that gravity, mass and friction overcome recoil forces. The recoil assembly slides back down the ramp in position for the next firing.

Heavy construction of the mounting components greatly reduces potential damage when a tube explodes. Only the gun tube has to be replaced, and that is easily accomplished.

Staley was assisted in the project by Calvin Consley, a project engineer in the M&W Engineering Branch, Thor Ellison of the Aircraft Armament Engineering Branch and welder Robert C. Prickett from YPG's Metal Working Section.

13 DARCOM Employes Complete CAD-E Course

Thirteen civilian employes of the U.S. Army Materiel Development and Readiness Command (DARCOM) received MS degrees during recent graduation ceremonies for the 1975-76 Computer-Aided Design and Engineering (CAD-E) course at the University of Michigan.

Initiated in 1972 to meet the needs of DARCOM civilians working in design and engineering functions, the year-long course provides instruction in computer operation, programing and hands-on practical experience in computer interactive graphics. Satisfactory completion of a thesis project is a requirement for an MS degree, and students explained their projects during graduation ceremonies.

The course is structured to prepare the graduate to serve as an adviser/consultant on computer-aided technology within his command or laboratory.

Nominees for the course are required to have at least three years intensive design and/or engineering experience; they must hold a baccalaureate degree in an engineering or science discipline; have an undergraduate average of "B" or above, unless other significant qualifications exist; and they must have Federal Civil Service career status.

Graduates of the fourth CAD-E class, the activity at which they are employed, and their thesis projects are:

Gary A. Blunck, Rodman Laboratory, Rock Island Arsenal (RIA), IL, "Tektronix Graphic Manual"; *James A. Meehan,* Artillery and Armored Weapons Systems Directorate, RIA, "Optimization of Drag Force in Fixed Ammunition Feed Chuting With Equality and Inequality Constraints"; *Ronald J. Geiss,* U.S. Army Production Equipment Agency, RIA, (no thesis project); and

Richard L. Jayne, Rodman Laboratory, RIA, "Effectiveness of Reflex Collimator Sight, Muzzle Brake Compensator and Burst Control Device for M16A1 Rifle"; *Michael R. Kane,* Rodman Laboratory, RIA, "A Mathematical Model of the 30mm Advanced Medium Caliber Weapon System (AMCAWS-30)"; and

William R. Ealy, Night Vision Laboratory (NVL), Fort Belvoir, VA, "Interactive Performance Model for Thermal Imaging Systems"; *Daniel Schnal,* NVL, "Building a 'Smart' Graphics Terminal With the Use of a Microprocessor"; *David E. Thacker,* U.S. Army Mobility Equipment R&D Command, Fort Belvoir, VA, "Optimal Placement Aided by Interactive Graphics"; and

Hal Harrelson, Harry Diamond Laboratories (HDL), Adelphi, MD, "A 3-Dimensional Graphics Program With Real-Time Rotation"; *Albert C. Hynes,* Office of Missile Elctronic Warfare, White Sands Missile Range (WSMR), NM, "Software for a Flight Instrumentation System"; and

Kent D. Kimsey, U.S. Army Ballistics Research Laboratories, Aberdeen Proving Ground (APG), MD, "A Basic 3-Dimensional Graphics Software Library"; *Stephen A. McGlone,* Frankford Arsenal, PA, "Diagnostic Sensing in a Machining Operation"; and *Albert P. Puzzuoli,* U.S. Army Tank-Automotive Command, Warren, MI, "Computer-Aided Finite Element Mesh Generation."

AVSCOM Contract Calls for Extended CH-47 Life Span

Extension of the life span of the CH-47 Chinook helicopter, the "workhorse" cargo aircraft in the U.S. Army for almost two decades, is the objective of a $74.9 million modernization contract awarded in June by the U.S. Army Aviation Systems Command, St. Louis, MO.

Efforts to give the Chinook a new lease on life for another 20 years are the responsibility of the Boeing Vertol Co., which will modernize three of the aircraft.

Planned improvements include installation of fiberglass rotor blades, an integrally cooled transmission, a new hydraulic system, airframe rehabilitation and other changes. Delivery of the prototypes is scheduled by January 1980.

Provided the prototypes satisfy improvement goals set by the Army, the entire fleet of CH-47s operated by the Army could be similarly modernized.

Importance of the effort in the view of the U.S. Army Aviation Systems Command is indicated by the fact that the $74.9 million contract is about one-sixth of the total contracts that will be awarded by the command in 1976.

Technology developed during the Army's contract with Boeing Co. on development of the Heavy Lift Helicopter and the UTTAS (Utility Tactical Transport Aircraft System) is expected to enter into consideration of work on the Chinook. COL James M. Hesson is the project manager.

Ballistic Nylon Adds Protection for TOW Operators

Multilayered panels of ballistic nylon, the same type of fabric used in the infantryman's armored vest, give added protection to operators of the Tube-launched Optically tracked Wire-Guided (TOW) missiles in a new shield against heavy artillery fragments.

Announced in June by the Natick Research and Development Command (NARADCOM), the TOW CAP (Cover, Artillery Protection) was developed in 20 weeks of intensive effort involving numerous cooperating Army agencies. The cover will be procured and fielded in Europe during January 1977.

The fabric is sewn into blankets which are bolted together to form the panels, four of which are hooked together and raised on metal rings over a curved tubular frame to form the CAP. A front panel provides protection below the TOW launcher and the over-all outer layer is treated for oil and water repellency, and painted in camouflage design.

Mounted aboard the M113A1 personnel carriers, the CAP can be removed easily and set up in two minutes by two men to provide protection for ground operation of a TOW missile launcher. When not in use, the CAP is folded into two low storage sections on either sides of the M113A1 roof hatch.

Dr. Gregory DeSantis, chief of the Armor and Special Projects Branch at Natick and project officer for the TOW CAP, credited laboratories and offices at NARADCOM, as well as the many other Army agencies involved in setting the requirements and testing the materials to complete development in 20 weeks.

Close coordination was maintained with the TOW program manager, COL Robert W. Huntzinger, U.S. Army Missile Command, and the operational user, the U.S. Army Training and Doctrine Command.

Weight limitations and other requirements were set by the Human Factors Engineering Laboratory, Aberdeen Proving Ground (APG), MD. Ballistic data was gathered by Edgewood Arsenal, an element of the APG, analyzed by Natick, and provided to the Army Materials Systems Analysis Agency, APG, for a quantitative protection analysis. Final operational tests were conducted by the U.S. Army Infantry Center, Fort Benning, GA.

Explosive Safety Board Approves 5 Ammo Plant Suppressive Shields

Department of Defense Explosive Safety Board approval of five types of suppressive shields developed in the Edgewood (MD) Arsenal Manufacturing Technology Directorate, for use in Army ammunition plants, has been announced.

The steel composite structures are designed to contain all fragments from an accidental explosion, and to suppress any hazardous blast of flame effect to a safe level, as pointed out by MG Robert J. Malley, program manager for the Army Munition Production Base Modernization and Expansion.

The safety approved shields range in size from 24-inch shells to 10-foot diameter cylinders, and are designed for protection against high explosives detonation equivalent to 37 pounds of TNT.

A spherical shield is designed to replace costly car-trac conveyors on a detonator backline modernization project, and is expected to save almost $4 million as a Value Engineering effort. Applications for this shield at two other Army ammunition plants reportedly could save an estimated $12 million.

Rectangular frame and panel design shields are under consideration for use at the Lake City, MO, ammunition plant and on an 81mm mortar projectile production assembly line in Milan, TN; also, at various other AAPs during load, assembly and packing operations.

ASA (R&D) Presents 'Lab of the Year' Award to WRAIR

Walter Reed Army Institute of Research, internationally renowned for scientific achievements dating back more than 80 years, received Assistant Secretary of the Army (R&D) Edward A. Miller's accolade May 26 as the 1975 "Army Laboratory of the Year."

Numerous dignitaries present for the ceremony included Commander of the U.S. Army Medical R&D Command BG Kenneth R. Dirks, Deputy for Science and Technology Dr. K. C. Emerson, a member of Secretary Miller's staff, and WRAIR Director COL Robert J. T. Joy. BG Dirks presented COL Joy with the Army Medical R&D 1975 Award for Excellence, preliminary to the ASA (R&D) Award.

WRAIR's selection for this prestigious recognition was announced in the November-December 15th anniversary edition of the *Army Research and Development Newsmagazine*. The award was initiated in 1974 by Norman R. Augustine, then ASA (R&D) and now Under Secretary of the Army, with the honor going to the Night Vision Lab., Fort Belvoir, VA.

ASA (R&D) Miller acclaimed WRAIR staff members for "numerous significant achievements." Particularly notable in the judgment of the award selection committee, he said, was the introduction of Meningococcal Vaccine Type C, which has been authorized for military use by the Army Surgeon General.

A commercial firm has received U.S. Food and Drug Administration approval for manufacture and sale of the vaccine, using methodology and microorganism strains developed by WRAIR scientists.

Miller also cited WRAIR's staff for development of two new antimalarial drugs considered superior to existing drugs and considered a "major achievement for rapid definitive treatment of military personnel in the field."

The Laboratory of the Year selection committee, as noted by the ASA (R&D), also cited WRAIR researchers for:

• *Characterization of Virus Antigens* by studies of the composition and structure of the dengue virus, leading to data for vaccine development.

• *Hepatitis Viruses* epidemiologic studies that demonstrated the co-occurrence of drug abuse and hepatitis in military personnel. WRAIR was credited with establishing more firmly the requirement for a hepatitis vaccine.

• *Microbial Genetics* studies of diarrhea-producing bacteria which demonstrated the feasibility of developing an immunizing agent. One such organism, a hybrid of *E. coli* and *Shigella*, is now a candidate vaccine agent.

• *Trypanosomiasis*. A vaccine was developed from irradiated trypanosomes which protects cattle for naturally transmitted infections in East Africa. This is considered a major step toward development of a human vaccine for sleeping sickness.

• *Surgery*. The feasibility of stockpiling "donor" freeze-dried veins for vessel replacement was established.

A more recent project conducted by WRAIR researchers was the epidemiological studies of the outbreak of "A-Swine" influenza at Fort Dix, NJ, last February. A team of WRAIR researchers went to Fort Dix and conducted serum tests on a random sample of the post's population to find the presence of antibodies against the swine virus and to determine the spread of the disease.

The team's research findings were part of the data used by the U.S. Government in deciding on a $135 million nationwide flu immunization program. Later, 73 military personnel at WRAIR volunteered to test the vaccines the Army plans to use this fall against A-Swine flu, A-Victoria flu and Influenza-B.

Secretary Miller said the purpose of the Laboratory of the Year Awards Program is threefold: To create a means of routinely critiquing and ranking each Army in-house laboratory; to provide annual assessments which serve as a basis for improving and upgrading the Army's scientific and technical capability; to recognize quality performance.

Criteria for evaluation of the "best" laboratory include the degree to which each laboratory realized its full potential impact in enhancing operational forces capabilities.

Assistant Secretary of the Army (R&D) Edward A. Miller presents "Army Laboratory of the Year" award to COL Robert J.T. Joy.

Dr. Richard Montgomery, vice chairman of the Army Scientific Advisory Panel, was chairman of this year's committee which included Donald Looft, deputy director, Defense Advanced Research Projects Agency; COL Donald Carter, military assistant to the Deputy Director, Defense Research and Engineering (Research and Advanced Technology); Deputy Assistant Secretary of the Air Force (R&D) Dr. John Martin; Dr. Herbert Ley, Army Scientific Advisory Panel consultant; and James Probus, director of Navy laboratories.

$28.2 Million Contract Orders AN/TPQ Limited Production

Further development and limited production of the Artillery Locating Radar (ALR) AN/TPQ-37 are ordered in a 2-phase contract for $28.2 million awarded recently by HQ U.S. Army Electronics Command, Fort Monmouth, NJ.

The AN/TPQ-37 is designed to provide the U.S. Army's first effective capability to locate hostile artillery and rocket launchers at their normal firing ranges. It is engineered to locate weapons firing simultaneously from multiple positions with sufficient accuracy for destructive counterfire.

Initial contracts were placed in June 1972 with Hughes Aircraft Co. and Sperry Gyroscope Division, Sperry Rand Corp. for the development of advanced development competitive prototype models under a Department of Defense policy of reducing the cost and technical risk of developing weapon systems.

Artillery Locating Radar AN/TPQ-37

The competing radars were delivered to the Army's artillery range at Fort Sill, OK, late in 1974 for development and operational testing. Completed in December 1975, these tests involved the firing of more than 20,000 live artillery rounds and free-flight rockets.

Complexity of the ALR indicates an expensive system, but development has been conducted under one of the Army's first efforts to design a system to minimize unit production cost. Both contractors performed numerous trade-offs to limit the final production cost to the government, leading to selection of Hughes Aircraft Co. for the $28.2 million contract.

Research, development and procurement of the Artillery Locating Radar and that of its companion Mortar Locating Radar (AN/TPQ-36) are under the direction of COL William J. Harrison, Army project manager for Mortar and Artillery Locating Radars (MALOR), located at Fort Monmouth.

JSEP Director Prof. Zimmerman Retires After 15 years Service

Director of the Joint Services Electronics Program since its inception in 1961, as well as director of the Research Laboratory of Electronics at the Massachusetts Institute of Technology, Prof. Henry J. Zimmerman has announced his retirement effective June 30.

The Technical Advisory Committee of the JSEP, representing the three military departments, honored Prof. Zimmerman at a recent ceremony, recognizing him with a scroll for professional and administrative leadership.

Graduated from Washington University in 1938, he remained as an instructor until he joined the MIT staff in 1940 as a research assistant in the Electical Engineering Department. He received an SM degree from MIT in 1942 and 13 years later became a professor.

Prof. Zimmerman helped to organize and teach radar training courses for Army and Navy officers through the MIT Radar School, and was a coauthor of the first two editions of Principles of Radar, published by the MIT staff.

Dr. Hans K. Ziegler, head of the ECOM Electronics Technology and Devices Laboratory, and Army member of the Technical Advisory Committee of the Joint Services Electronics Program, presents scroll for professional and administrative leadership to Prof. Henry J. Zimmerman.

Recognize 78 Army In-House Scientists, Engineers

U.S. Army Research and Development Achievement Awards, one of the Army's most prestigious forms of recognition accorded annually to in-house laboratory personnel for scientific advancements of military importance, will honor 78 scientists and engineers.

Indicative of a growing trend toward team efforts in recent years, the 1976 awards recognize 18 groups totaling 70 persons and 8 individuals.

Established in 1961, the awards are presented for accomplishments that provide for subsequent technical improvements of military importance; materially improve the Army's technical capability; and/or contribute materially to the national welfare.

The prestigious award consists of a wall plaque and a cast-bronze desk decoration. Presentations will be made at home installations of winners over a period of several months by top civilian officials of the Department of the Army, and by senior general officers or their representatives from the Office of the Deputy Chief of Staff for Research, Development and Acquisition (ODCSRDA), and the U.S. Army Materiel Development and Readiness Command (DARCOM).

Army Chief Scientist and Director of Army Research Dr. Marvin E. Lasser was chairman of the panel of judges that selected the winners from nominations submitted by laboratories throughout the U.S. Army Materiel Development and Readiness Command, the Office of the Chief of Engineers and the Office of the Surgeon General.

Other ODCSRDA judges were COL John E. Wagner, deputy director of Army Research; Dr. Ivan R. Hershner, assistant director for Research Programs; Dr. Robert J. Heaston, scientific adviser to the Director of Weapons Systems; and Dr. Henry J. Smith, scientific adviser to the Director of Combat Support Systems.

Listed within the major command, subcommand and/or installation at which they are employed, the award winners and brief excerpts from their nomination justifications follow:

Army R&D Achievement Award Winners

Picatinny Arsenal, Dover, NJ. (1) From left, standing: Leon H. Glass, Jerome J. Abondolo, Albert J. Tenk, Stanley J. Witanek. Seated: Robert F. Drummond and Melvin Morgen, (2) Standing: Isidore G. Nadel and R. Scott Westley. Seated: SP4 R. J. Baker and Daniel Katz, (3) D. J. Ramer.

U.S. ARMY MATERIEL DEVELOPMENT AND READINESS COMMAND (DARCOM). Picatinny Arsenal, Dover, NJ. A 6-man team will receive awards for development efforts on the nuclear warhead sections for the Sprint and Spartan missiles as part of the Safeguard antiballistic missile system. The citation credits them with contributions which "materially improve the Army's technical capability" to provide a defense for a portion of U.S. retaliatory forces.

Team members are *Robert F. Drummond, Stanley J. Witanek, Albert J. Tenk, Leon H. Glass, Jerome J. Abondolo,* all from the Nuclear Development and Engineering Directorate, and *Melvin Morgan,* Office of the Project Manager for Safeguard Munitions.

A 4-man team of Picatinny engineers will receive recognition for development of an energetic propellant container for mortar ammunition. This container is fabricated by a molded fiber process, using fibrous nitrocellulose as the principal ingredient.

The container reportedly obsoletes cloth bags and "provides superior handling properties, moisture resistance and ballistic performance." The team conceived, developed and tested the approach in three new mortar systems. Production feasibility has been established, and the "development establishes a new baseline for future generations of mortar ammunition."

Team members, all with the arsenal Ammunition Development and Engineering Directorate, are *Daniel Katz, Isidore G. Nadel, R. Scott Westley* and *SP4 Robert Baker.*

An individual award will go to *Daniel J. Ramer* for an advancement in field portable data instrumentation. The citation states: "He has significantly improved the Army's technical ability to design discriminating, signature-responding munitions through his development of unique equipment necessary to define the signatures of potential threat vehicles.

"His contribution, while employed with the Technical Support Directorate at Picatinny Arsenal, permits the acquisition of data in locations worldwide with an accuracy and speed not previously possible."

Army Materials and Mechanics Research Center (AMMRC), Watertown, MA. A 6-man team was selected for demonstrating a new concept that "dramatically improves both the effectiveness and reliability of fragmentation devices."

The concept evolved from computer studies made by the team, and is based on a double-wall fragmentation casing, in contrast to the conventional single wall.

The concept is credited with fragmentation characteristics in ductile materials even better than those for brittle materials using conventional approaches; hence, a designer will be able to provide the needed measure of safety for gun crews.

Working with engineers from Picatinny Arsenal to scale the concept up to a 155mm projectile, the team is led by mathematician *John F. Mescall.* Other members are metallurgist *Paul V. Riffin,* mathematician *Anna M. Hansen,* engineering technician *Charles J. Polley,* and two Northeastern University cooperative students in electrical engineering who are gaining professional experience at AMMRC, *Joseph Casazza* and *Daniel Ryan.*

A 4-man AMMRC team was cited for "outstanding achievements in developing and establishing Electroslag Remelting (ESR) steels as prime candidates for numerous Army applications including armor plate. They are: *Francis C. Quigley, Arthur W. Ayvazian, Robert H. Frost, Dino J. Papetti.*

"Their R&D efforts," the award justification states, "have resulted in significant contributions which clearly define the potential and performance capabilities of these materials in armor plate with 40 percent superiority over air-melted material and 15 percent improvement over vacuum-melted steels at the 270 KSI strength level.

"Their investigations have further indicated that the ESR steels, with very low impurity levels (i.e., sulfur and oxygen), produce material with high toughness and ductility at high-strength levels that are desirable for many ordnance components."

Harry Diamond Laboratories (HDL), Adelphi, MD. In response to a need for a new lightweight company mortar of high lethality and lower cost, a 7-man HDL team developed the XM734 multi-option mortar fuze.

Credited with the development are *Raymond J. Baker, David C. Briggman, Dr. Carl J. Campagnuolo, Edward A. Cooke, Philip F. Ingersoll, Louis Richmond* and *Orrin K. Stimmerman.*

Developed on schedule with the rest of the new mortar system, the XM734 is described as a safe, low-cost, multi-option fuze which ex-

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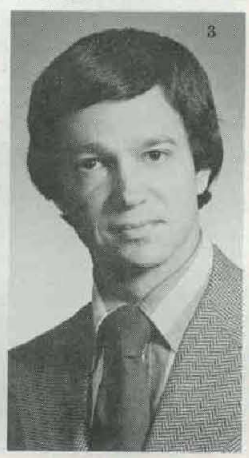
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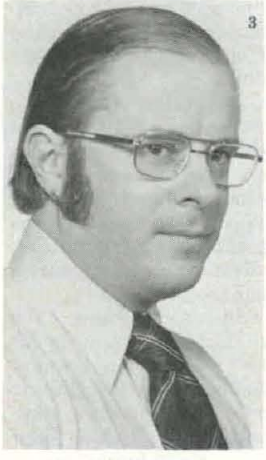
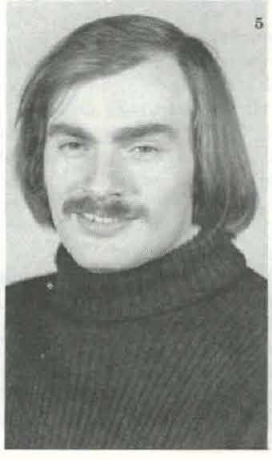
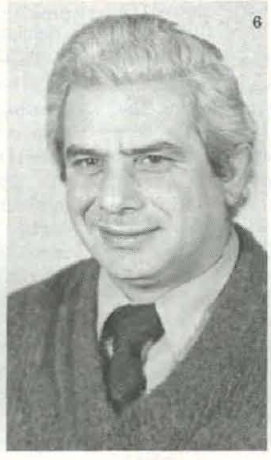
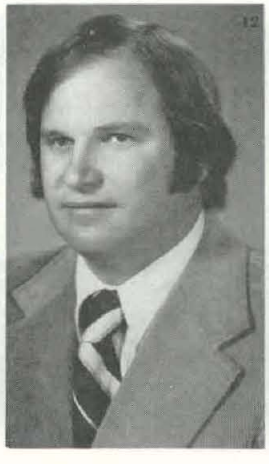


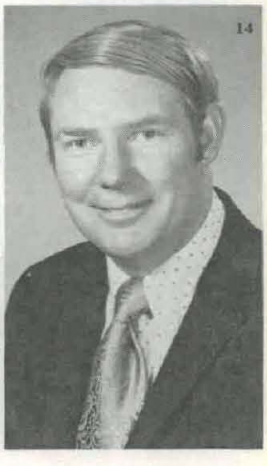




Army R&D Achievement Award Winners

Army Materials and Mechanics Research Center (AMMRC), Watertown, MA. (1) Standing (l. to r.): Charles J. Polley, Daniel Ryan, Joseph Casazza. Seated: Paul V. Riffin, John F. Mescall, Anna M. Hansen, (2) Arthur W. Ayvazian, Dino J. Papetti, Robert H. Frost. Francis C. Quigley. Harry Diamond Laboratories (HDL), Adelphi, MD. (3) James C. Blackburn, (4) Raymond J. Baker, (5) David C. Briggman, (6) Dr. Carl J. Campagnuolo, (7) Louis Richmond, (8) Edward A. Cooke, (9) Orrin K. Stimmerman, (not shown) Philip Ingersoll. Waterways Experiment Station (WES), Vicksburg, MI. (10) Dr. Yu T. Chou, (11) Dr. Walter R. Barker, (12) Harry R. Austin, (13) Gary G. Harvey, (14) William N. Brabston.





Army R&D Achievement Awards Recognize 78

(Continued from page 10)

ceeds all stated requirements for safety and reliability. Features include a low-cost detector, all hybridized electronics, commercial CMOS integrated circuits used in amplifiers, and a zig-zag setback.

It will be fielded as an integral part of the Lightweight Company Mortar System, and "will give the infantry a vastly reduced inventory of type fuzes, a reduction in logistic problems, maximum lethality for any round at the twist of a dial, and very high reliability." Preliminary tests indictate it will perform equally well on 81mm mortars.

James C. Blackburn will receive an award for "pioneering development and leadership" in the application of fiber-optic analog data transmission links in the measurement of radiation-induced transient electromagnetic pulses in military systems.

The summary of achievements states: "After a review of possible alternatives in developing an instrumentation system for measuring the response of satellites to a transient electromagnetic environment, Blackburn developed miniaturized, hardened fiber-optic analog data transmission systems that extended the frequency capability by a factor of seven, and reduced the size approximately an order of magnitude over previous alternate systems.

"In so doing, he made possible, for the first time, an extensive measurement program of system-generated electromagnetic pulse effects in military systems, particularly satellites. The technique is generally applicable to electromagnetic pulse (EMP) and system-generated electromagnetic pulse (SGEMP) investigations."

Ballistic Research Laboratories (BRL), Aberdeen Proving Ground, MD. *Dr. Bruce P. Burns, George Samos, William F. Donovan, Chester A. Grabarek* and *Fred Brandon* were selected for their efforts in developing a new 60mm kinetic energy projectile, as part of the Army's Medium-Caliber Anti-Armor Automatic Cannon Program.

"The new projectile has been demonstrated to defeat the medium and heavy NATO threats. Furthermore, the round accomplishes this task while using approximately half the energy required by contemporary 105mm tank cannon. The scientific approach used by the team resulted in a projectile that performed satisfactorily in its first series of tests."

Dr. Coy M. Glass, chief of the Materials Application Group, was cited for development of the concept and supporting technology relating to an electro-optical fuze. Terminal effectiveness of a wide variety of shaped-charge warheads reportedly will be increased, cost and weight reduced, and fuze reliability upgraded.

Dr. Raymond Sedney, a research physicist with the Office of the Chief, Exterior Ballistics Laboratory, will be honored for his "able leadership and scientific competence in providing new and effective analytical approaches to solving problems dealing with 3-dimensional and unsteady boundary layers.

"These contributions make available new computational techniques and safeguards for treating the hitherto formidable problems associated with the non-linear viscous interactions of moving fluids. As a consequence, the disciplines of aerodynamics and fluid mechanics have been materially strengthened, particularly in those specialized areas applicable to national defense."

Frankford Arsenal, Philadelphia, PA. A team of four scientists and engineers from the arsenal's Pitman-Dunn Laboratory, two from the **National Bureau of Standards (NBS), Gaithersburg, MD,** and one from the **Army Research Office (ARO), Research Triangle Park, NC,** collaborated on innovative accomplishments in the design, fabrication and testing of piezopolymer materials for fuze applications.

Dr. Robert J. Esposito, Eugene L. Church, Howard A. Jenkinson and *Carl W. Fleischer Jr.,* all with the arsenal, *Dr. Philip E. Bloomfield* and *Seymour Edelman* of NBS, and *Dr. Issai Lefkowitz* of ARO will be honored for developing PVF_2 (polyvinylidene fluoride) devices with demonstrated high electrical outputs comparable to commercial ceramic piezoid elements.

The citation states that they "demonstrated, for the first time, the concept feasibility of utilizing plastic piezoelectric devices in a ballistic environment for ordnance systems.... This technology can be immediately applied to current fuze problems/prototype designs for automatic cannon, large caliber, and guided projectiles requiring graze impact sensitivity."

Bruce W. Brodman and *Michael P. Devine,* Propellant Development Branch, Munitions Development and Engineering Directorate, Frankford Arsenal, will receive an R&D Achievement Award for their work on small arms propellants. This work has resulted in potential benefits to the Army in the area of manufacturing, storage characteristics, and improved weapon performance.

Missile Command (MICOM), Redstone Arsenal, AL. U.S. Army Missile Research, Development and Engineering Laboratory aerospace engineers *Harold L. Pastrick, Charles M. Will Jr.* and *Larmon S. Isom* will receive a team award for advancing missile system analysis through "hardware-in-the-loop simulation."

Their efforts have produced "comprehensive real-time simulations" of the Cannon Launched Guided Projectile (CLGP) and Hellfire weapons. Flight hardware can be used to perform guidance and control system design verification and autopilot and seeker optimization in a closed guidance loop situation.

"These simulations have proven invaluable to the development programs of CLGP and Hellfire and have greatly enhanced the Army's in-house analysis support of terminal homing weapon systems," the award nomination states.

A. R. Maykut, Missile RD&E Laboratory, was selected for planning and conducting R&D effort that resulted in advancement of propulsion technology for free-flight rockets.

His summary of achievement states: "The assessment of design factors to provide acceptable performance and impulse reproducibility while maintaining producibility is now available. A new concept for providing minimum thrust misalignment has been developed and a novel test stand for measuring very small thrust misalignments has been fabricated and put into use."

Raymond V. Ginocchio, Office of the Project Manager for 2.75-inch Rocket System, MICOM, will receive an R&D award for conceiving a better method of generating and dispensing smoke from artillery, mortar and rocket warheads, by utilizing a simple and inexpensive catalyst with already available smoke agents. This concept is now referred to as "wick technology."

A sample quantity of the prototype design, utilizing the 2.75-inch rocket as the vehicle, was produced for the singular purpose of proving or disproving the concept. Based upon successful prototype tests, followed by formal development tests, action had been initiated to spur adaptation of this "technological breakthrough

(Continued on page 14)

Award Winners

Frankford Arsenal, Philadelphia, PA. (1) From left, Howard A. Jenkinson, Dr. Robert J. Esposito, Carl W. Fleischer Jr., and Eugene L. Church, (2) Michael P. Devine, (3) Bruce W. Brodman. Not shown are Dr. Philip E. Bloomfield and Seymour Edelman of NBS, and Dr. Issai Lefkowitz of ARO.

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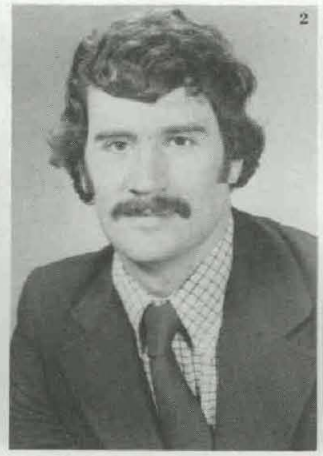

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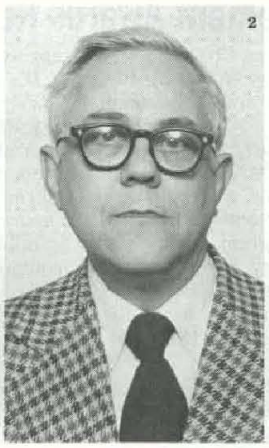
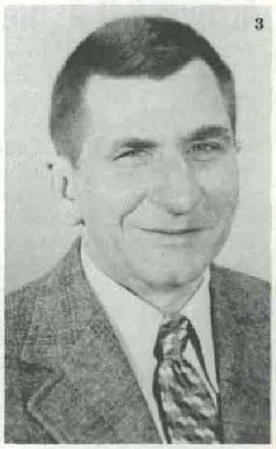
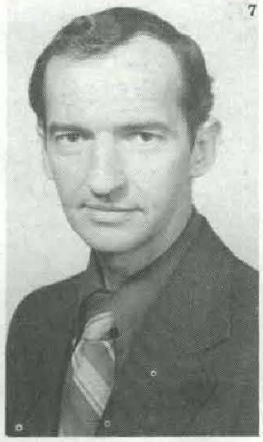
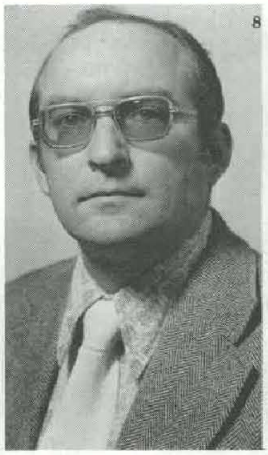


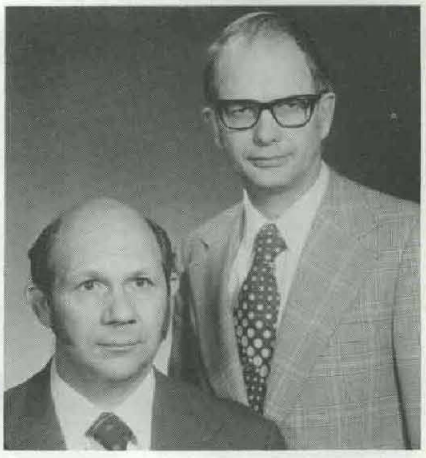


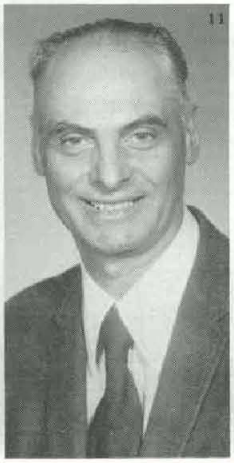
Army R&D Achievement Award Winners

Ballistic Research Laboratories (BRL), Aberdeen Proving Ground, MD. (1) From left: Dr. Bruce P. Burns, George Samos, Chester A. Grabarek, William F. Donovan, Fred J. Brandon, (2) Dr. Coy M. Glass, (3) Dr. Raymond Sedney. Mobility Equipment R&D Command (MERADCOM), Fort Belvoir, VA. (4) Johann A. Joebstl, (5) James A. Dennis. Missile Command (MICOM), Redstone Arsenal, AL. (6) Top left, Harold L. Pastrick; lower left, Charles M. Will Jr.; right, Larmon S. Isom, (7) A. R. Maykut, (8) Raymond V. Ginocchio. Electronics Command, Fort Monmouth, NJ. (9) Robert J. Zeto and Clarence G. Thornton, (10) Dr. Stanley Kronenberg, Dr. Robert A. Lux, (11) Kurt Ikrath. Letterman Army Institute of Research (LAIR), Presidio of San Francisco, CA (12) Dr. Frank DeVenuto and Angelo Zegna, (13) Dr. James R. Neville.









Army R&D Achievement Awards Recognize 78

(Continued from page 12)

to artillery and mortar, thereby enhancing the capability of the Army in an area previously recognized as deficient."

Air Mobility R&D Laboratory (AMRDL), Fort Eustis, VA. *Leonard M. Bartone, John W. Sobczak, E. Rouzee Givens* and *J. Nelson Daniel* were recognized for planning and directing a "comprehensive research program leading to the development of technology for laminated pad elastomeric bearings for use in helicopters."

Elastomeric bearings are currently being applied to Army UH-1 and AH-1 and to Navy CH-53 helicopters. The UTTAS (Utility Tactical Transport Aircraft System) and AAH (Advanced Assault Helicopter) are under consideration for elastomeric bearings, "since life cycle cost savings for...a fleet of 1,000 aircraft are estimated at $12 to $20 million."

Electronics Command (ECOM), Fort Monmouth, NJ. *Robert J. Zeto* and *Dr. Clarence G. Thornton,* research scientists with the Electronics Technology and Devices Laboratory, are credited with developing a novel silicon processing method in which oxidation temperatures are lowered by as much as 400°C., by application of commercial oxygen pressures.

The summary of achievements states: "In accord with thermochemical prediction, the resultant oxide material is lower in defect concentration and shows improved electrical properties relative to conventionally oxidized silicon. The method is well suited to commercial production and will impact upon a wide variety of military communications and data processing equipment employing advanced integrated circuits."

Research physicist *Kurt Ikrath,* Communications and ADP Laboratory, ECOM, was selected for "conceiving and promoting important innovations utilizing electromagnetic-excited trees and the bodies of vehicles as effective communications antennas."

His research resulted in a "demonstrated capability to effectively communicate by high frequency signals through dense jungles, even during heavy downpours, and development of tactical vehicular antennas that are almost invisible, less vulnerable than whips of comparable efficiency, and which can be operated in either the omnidirectional or directional mode."

The tree-EM excitation concept is being considered to overcome tactical communication problems in urban areas by using EM excitation of available man-made structures. The concept also is being studied by the Mobility Equipment R&D Command (MERADCOM) for development of inconspicuous antennas for the M-60A1 tank, and by the U.S. Drug Enforcement Agency for invisible surveillance antennas on cars and boats.

Dr. Stanley Kronenberg, a supervisory research physical scientist, and Dr. Robert A. Lux, research physicist, both with the ECOM Electronics Technology and Devices Laboratory, will receive an R&D Achievement Award for their part in designing and constructing a tactical nuclear dosimeter. The award justification states:

"The charge transport dosimeter, intended as a second-generation replacement for the Army's IM-185 tactical dosimeter (now in advanced development), has significant advantages in considerably lower production costs, technological simplicity, and freedom from maintenance. It also has the same advantages for replacing existing civil preparedness dosimeters."

Mobility Equipment R&D Command (MERADCOM), Fort Belvoir, VA. Physical scientist *James A. Dennis* was selected for his contribution to development of Fuel Air Explosive Mine Neutralization Systems.

The systems "permit U.S. combat forces to rapidly breach tactical enemy minefields, and the significant breakthrough is expected to pace worldwide countermine capabilities well into the future."

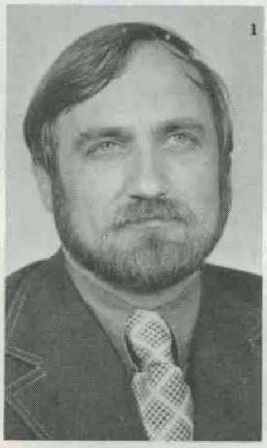
Johann A. Joebstl, research chemist, was cited for his contributions to the Army's fuel cell R&D effort in determining the behavior of oxygen and its catalytic reaction with carbon monoxide on platinum surfaces.

"Through his understanding and attention to experimental detail," the citation states, "resolution of critical catalytic problems was accomplished. This advance in the knowledge and application of surface research techniques to catalysis will contribute significantly to the Army and national fuel cell programs as well as related national energy independence efforts."

U.S. ARMY CORPS OF ENGINEERS (CE).

Award Winners

Air Mobility R&D Laboratory (AMRDL), Fort Eustis, VA. (1) John W. Sobczak, (2) E. Rouzee Givens, (3) J. Nelson Daniel, (4) Leonard M. Bartone. Cold Regions Research and Engineering Laboratory (CRREL), Hanover, NH. (5) Steven A. Arcone, (6) Allan J. Delaney, (7) Paul V. Sellmann, (8) Dr. Pieter Hoekstra. Walla Walla Engineer District, WA. (9) R.A. Kaden, (10) E.K. Schrader.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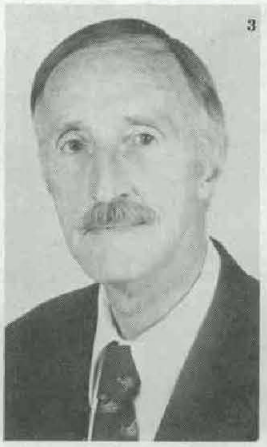
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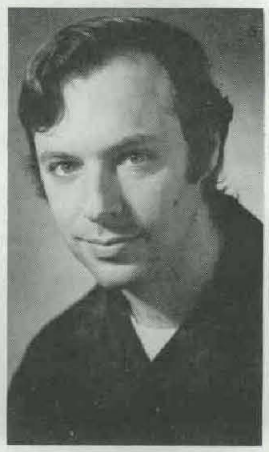
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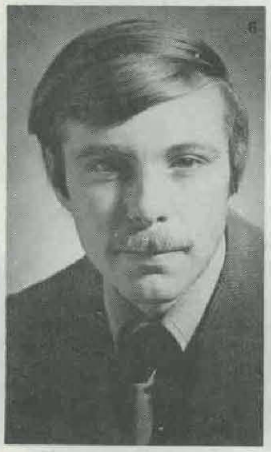
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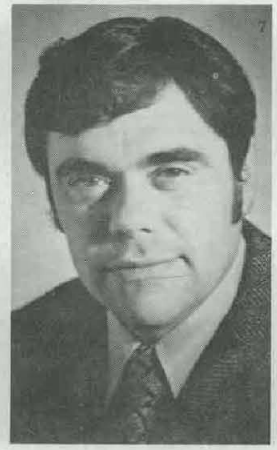
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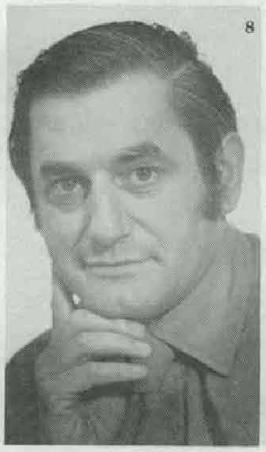
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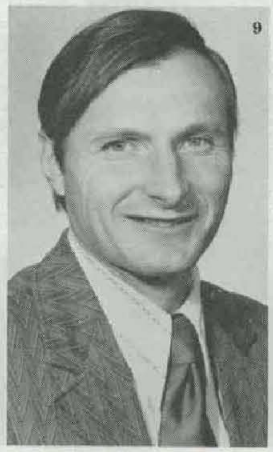
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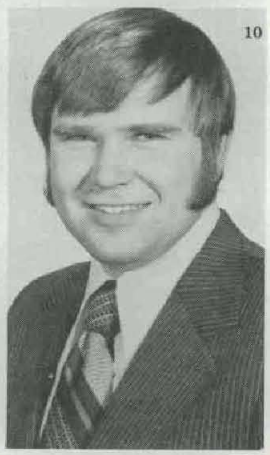
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Waterways Experiment Station (WES), Vicksburg, MI. *Dr. Walter R. Barker, Dr. Yu T. Chou, William N. Brabston, Gary G. Harvey* and *Harry R. Austin,* employed in the Soils and Pavements Laboratory, will receive a group award. Their research contributed to development and partial validation of a theoretically based flexible pavement design system for military roads and civil and military airfields.

"This new procedure," their award justification states, "has promise of replacing the current empirical criteria that have been in general use for many years. The procedure will permit the proper assessment and utilization of all possible pavement construction materials.... Being predictive in nature, it will lead to development of design and evaluation alternatives that will produce the most economical pavement system."

Cold Regions Research and Engineering Laboratory (CRREL), Hanover, NH. Development efforts and engineering applications of remote sensing electromagnetic techniques for exploring subsurface physical and geologic properties of organic, soil and rock deposits earned a team award for *Dr. Pieter Hoekstra, Steven A. Arcone, Paul V. Sellmann* and *Allan J. Delaney.* (Dr. Hoekstra has transferred to the staff of R. M. Hardy and Associates, Calgary, Alberta, Canada.)

The technique offers a "rapid means of determining the likely composition of the geologic and physical subsurface, such as gravel deposits, water wells and bedrock." The team has used the method to locate suitable areas for electrical grounding and cathodic protection installations for pump stations along the Trans-Alaska pipeline, resulting in estimated savings of $1.5 million in construction costs.

Construction Engineering Research Laboratory (CERL), Champaign, IL. *Drs. Ravinder K. Jain, Edward W. Novak* and *Harold E. Balbach* were selected for outstanding performance and leadership in the development of a system and procedure for environmental impact assessment.

The system reportedly "provides the Army with the means to effectively comply with the provisions of the National Environmental Policy Act (NEPA) and to incorporate environmental considerations into all levels of decision making."

ARMY R&D ACHIEVEMENT award winners, Construction Engineering Research Laboratory, Champaign, IL. From left, Drs. Harold E. Balbach, Ravinder J. Jain, Edward W. Novak.

Their award justification states: "As a team effort, they conceived an innovative program for research, organized and directed the activities of a diverse multidisciplinary group of recognized scientists and consultants from across the country, and developed a sophisticated but simple to use system and procedure for detailed analysis and prediction of impacts on the physical and socioeconomic environments. These procedures will permit the Army to comply with provisions of the NEPA at a minimum cost and effort."

Walla Walla Engineer District, WA. Civil engineers *Richard A. Kaden* and *Ernest K. Schrader* were nominated to receive an R&D award for their efforts in advancing the use of fiber-reinforced concrete and polymer-impregnated concrete.

This innovative process was used on the Dworshak Dam in major repairs on the stilling basin and outlet works. The in-place work with polymer impregnated concrete on vertical surfaces had never been done before, either in the laboratory or in the field.

Walla Walla District Engineer COL Nelson P. Conover commented: "This pioneering effort will advance use of fibrous concrete and polymer impregnation on structures subjected to high-velocity waterflows. We feel it is a great contribution to concrete technology. The process will probably find extensive application throughout the world."

OFFICE OF THE SURGEON GENERAL (OTSG). Letterman Army Institute of Research (LAIR), Presidio of San Francisco, CA. *Dr. Frank DeVenuto* and *Angelo Zegna* were selected for developing a method of preparing a hemoglobin solution of exceptional purity from outdated human red cells by crystallization.

The summary of achievement states: "This accomplishment will set the stage to make a cell-free resuscitation solution available to soldiers who otherwise might die of hemorrhage because of lack of available whole blood or packed cells for transfusions."

Dr. James R. Neville of LAIR also will be recognized for development of techniques for analyzing blood which have "greatly simplified and improved the analysis of oxygen transport to tissues."

Used in the Army's experimental programs to improve blood preservation and the treatment of hemorrhagic shock in battle casualties, the techniques permit routine clinical measurements to be performed on blood "that were not feasible previously, thus promoting a better understanding of many diseases, particularly of the cardiovascular and pulmonary systems."

Army Deactivates 'Super Dog' Cross-Breeding Program

Konrad's picture on the wall was a thing of beauty in the recent desolation of deactivation of the Division of Biological Sensor Research - organized in December 1968 when "super sniffer" dogs were needed for the war in Southeast Asia to find the enemy, avoid ambushes, ferret out mines and booby traps.

Konrad, a German Shepherd, was the granddaddy of the cross-breeding program to develop "super dogs," the ultimate in a breed of military working dogs. It was envisioned that this objective might require as long as 10 years. The program terminated in 8½ years, after five generations and 1,996 pups.

Walter Reed Army Institute of Research established the Division of Biological Research in the Edgewood Arsenal area of Aberdeen (MD) Proving Ground.

Under an Army R&D contract, the University of Maryland studied seven types of dogs. The German Shepherd was selected, based on learning abilities, over-all physical qualities, and a record of outstanding performance in serving armies and police departments in many lands.

COL M. W. Castleberry, a veterinarian who has been chief of the division almost from its inception, commented:

"During the past year, with the introduction of the late third and fourth-generation breeders, the production of a line of consistently successful military working dogs was established.

"The dysplasia (a crippling hip disease) rate radiographically demonstrated by these dogs was only 18.7 percent, as compared to the national average which is generally accepted as being well in excess of 50 percent," he said. "Trainers of these dogs attest to their increased reliability, trainability, and sensual acuity."

The selective breeding program was launched with 4 males and 21 females. The dogs were hand-picked from more than 200 dogs examined in the eastern and midwestern U.S.

All the dogs whelped in the program underwent extensive conditioning and evaluation from birth until 11 months, when they were either shipped to other military units, transferred to civilian agencies, or kept for breeding.

With deactivation of the unit, Castleberry said the breeding stock was recently transferred to the U.S. Customs Service at Front Royal, VA, The Seeing Eye, Inc., of Morristown, NJ, and the U.S. Air Force Dog Procurement Center, Lackland Air Force Base, TX.

The Army does not maintain a dog training center, Castleberry explained. All dogs the Army needs are procured through the Air Force.

Konrad

ARMAMENT COMMAND MISSION:

Providing Superior Firepower for All Combat Conditions

When the U.S. Army Armament Command was created in 1973 as a merger, they called it the "marriage of guns and bullets," joining the splintered responsibilities of the U.S. Army Weapons Command and the U.S. Army Munitions Command along with its Ammunition Procurement Supply Agency.

ARMCOM is now the largest of the six hardware-producing major subordinate commands, in terms of programs and commodities, of the U.S. Army Materiel Development and Readiness Command (DARCOM). Responsibility of ARMCOM extends to the integrated commodity management of the entire family of conventional gun-type weapons, their fire control equipment and their associated ammunition.

Weapons and ammunition for which ARMCOM is responsible range in size from the lightweight rapid-fire M16 rifle, with its 5.56mm 3-ounce payload, to the 175mm self-propelled gun that can hurl a 148-pound projectile nearly 20 miles.

The total ARMCOM mission is to provide the American fighting man with the weapons and ammunition necessary to establish and maintain superior firepower under all combat conditions. To accomplish this task, science, technology and manufacturing know-how are combined with management skills to produce weapons systems that function effectively the first time-and, objectively, every time.

Every ARMCOM worker is motivated by continuing awareness that when the mission is successfully performed, the American fighting man will have the weapons and ammunition necessary to establish and maintain a base of superior firepower, wherever and whenever the bounds of a future battlefield are drawn.

The Armament Command is viewed as "a dynamic military complex" with a headquarters staff of 25 major directorates and offices at its Rock Island Arsenal, IL, location. Thirty-three installations, seven arsenals and 26 Army ammunition plants, form its nationwide network.

The arsenals are engaged in research, development, engineering and test of gun-type weapons and their conventional, nuclear and chemical-biological munitions. The ammunition plants produce propellants and explosives, including loading assembly and packing of finished items.

ARMCOM's professional workforce consists of more than 20,000 military and civil service personnel who provide scientific and management skills and administrative services. ARMCOM manning includes a contractor-civilian workforce of approximately 18,000 people with a broad variety of production skills.

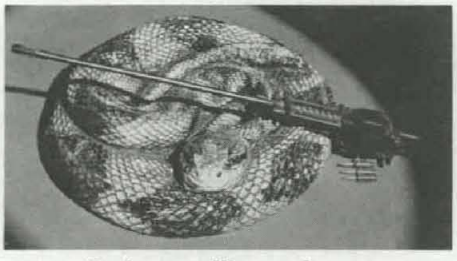
MG Bennett L. Lewis
ARMCOM Commander

MG William E. Eicher
ARMCOM Deputy Commander

Leonard Ambrosini
Chief Systems Engineer

The ARMCOM complex includes real estate, fixed property and equipment having a replacement value of more than $11 billion, used in the management and conduct of mission accomplishment. While the headquarters furnishes over-all direction for its far-reaching operations, subordinate field operations actually execute the armament program.

ARMCOM currently supports the activities of three project managers and two product managers operating at its Rock Island HQ.



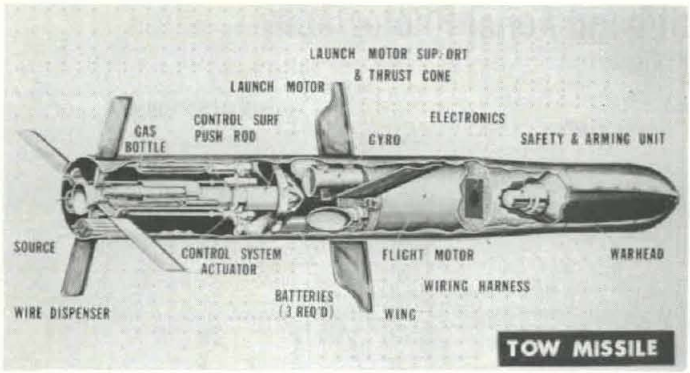
Bushmaster Weapon System

The Department of the Army announced in December 1975 that two new organizations, the Army Development Center and the Armament Logistics Command, would be formed by disestablishing the Armament Command. Since that announcement new names have been chosen for these new organizations. Effective Oct. 1 they will be redesignated as the U.S. Army Armament Research and Development Command (ARRADCOM) and the U.S. Army Armament Materiel Readiness Command (ARRCOM).

This reorganization, as has been widely publicized, resulted from a study by the Army Materiel Acquisition Review Committee appointed by the Secretary of the Army in December 1973. That study and a follow-on study by the Army showed that while creation of ARMCOM had "brought guns and bullets together at the headquarters level," this did not carry through to bench level. Interface between separated development components was still s source of problems. Therefore, the next step should be to consolidate at bench level to permit a systems approach that would replace the components approach.

The second finding was that research and development were at a disadvantage in competing for management attention with the more urgent day-to-day materiel readiness requirements—that the two should be separated organizationally. Third, the dispersed armament R&D functions should be consolidated geographically as fully as possible.

Consequently, AMARC recommended that the Army create a new Armament Development Center by consolidating research, development and engineering elements of Frankford, Picatin-



ny, Rock Island, Watervliet and Edgewood - all ARMCOM installations - along with the Ballistic Research Laboratories at Aberdeen Proving Ground.

Creation of an Armament Logistics Command from existing ARMCOM resources and facilities at Rock Island Arsenal also was recommended. Primary objective of the realignment is the improvement of Army armament functions, but significant economies also will result.

A total of 122 military and 5,775 civilian jobs will be affected. Forty-three military and 2,612 civilian jobs will be eliminated; 79 military and 3,163 civilian jobs will be transferred. Frankford Arsenal and Rodman Lab will close.

The estimated reduction in annual operating costs upon completion of the realignment, including the FY 77 portion of the Frankford Arsenal closure, is approximately $42 million. The one-time cost of the realignment will be about $86 million. Resources freed by this realignment are planned for reallocation to improve Army combat forces, and it is planned to finish the realignment by 1980.

In addition to the Army mission, ARRCOM will be assigned the single manager responsibility of procurement, production, supply and maintenance for conventional ammunition in support of all the military services. This additional assignment is in the implementation planning stage and will be phased over the period FY76 through FY79.

Before looking at future probabilities and requirements, a glance at ARMCOM today is in order. The ARMCOM materiel assignments list some 130 federal supply classes, 57,000 separate line items and a wholesale inventory valued at over $6 billion. ARMCOM management responsibility extends to hundreds of items not necessarily related to weapons and ammunition. Maintenance equipment common to end items assigned to two or more commodity commands is an example.

ARMCOM weapons systems include towed and self-propelled artillery, mortars and recoilless rifles, rocket launchers, individual and crew-served weapons, and aircraft armament. ARMCOM also manages fire control systems, weapon mounts and controls, feed mechanisms, conventional ammunition, defense munitions and pyrotechnics, chemical weapons and equipment, propellant-actuated devices, common tools, special tools, industrial plant equipment, ammunition and industrial gauges, nuclear and special weapons.

ARMCOM personnel take pride in some notable successes since 1973. After several years of system development and testing, the Army has classified the M110A1, 8-inch self-propelled howitzer as a standard item of equipment in its artillery inventory. The M110A1 is a major improvement of the Army's M110 howitzer and is planned to replace the M110 and the M107 175mm self-propelled guns.

Cost of the new howitzers estimated at less than $80,000 per vehicle. Product manager for the M110E2 LTC Benjamin A. Huggin said recently that the Army has saved several million dollars by improving the M110 rather than designing and developing a completely new weapon system.

"After development of a new system," he added, "production costs alone could have been as high as $700,000 for each vehicle. That is a spell-binding figure when one contemplates a fleet of 1,000 vehicles."

Conversion of the M110 to the M110A1 is scheduled to begin this year and will be made by replacing the current cannon and gun assemblies with the new 8-inch cannon assembly. ARMCOM also is making important strides in the development of the XM204, an experimental 105mm towed howitzer fired as it is moving forward into battery.

ARMCOM manages many kinds of ammunition for the artillery pieces it manages - for example, illuminating rounds, smoke rounds, high explosive rounds and those rounds called "improved conventional munitions." The latter class includes many submunitions which separate from the large projectile at an appropriate altitude and are then scattered. ARMCOM carries both antipersonnel and antimateriel submunitions.

Under the guidance of the project manager for Cannon Artillery Weapons Systems, the cannon launched guided projectile (CLGP) is being developed. Using a laser designator to illuminate the target, the CLGP homes in and can strike a point target - either moving or standing still. Field tests within the last 12 months have proved extremely successful.

Another achievement for developers at ARMCOM was the November 1975 success of a Gun Low Altitude Air Defense (GLAAD) test bed at Fort Bliss, TX. The GLAAD test bed proved its capability of engaging and hitting a high-speed aerial target.

ARMCOM maintains a strong interface with many other DARCOM commands. For example, it supports the Aviation Systems Command with airborne guns and munitions, the Tank-Automotive Command with "everything above the turret ring," and the Missile Command with warheads for rockets and missiles.

Currently ARMCOM stands at the "crossroads of the weapon systems," and its situation is unique among DARCOM commodity commands. Industry does not possess an extensive capability to produce a major part of the ARMCOM product line. Accordingly, such a capability is built into the organization.

ARMCOM's FY75 program for all customer sources totaled $3.42 billion and procurement accounted for $2.789 billion. Other program figures reveal $243 million for operations and maintenance; $196 million for research, development, test and evaluation; $186 million for its Army Stock Fund, and $6 million for miscellaneous expenditures.

The U.S. Army was, of course, ARMCOM's biggest customer, claiming 57 percent of the total FY75 program, and orders from foreign customers amounted to 37 percent. The accompanying chart illustrates the important position of ammunition in the overall ARMCOM mission.

Approximately 76 percent of ARMCOM civilian personnel are assigned to the five commodity arsenals and 18 percent to headquarters staff positions, mainly in five directorates.

Effective Oct. 1, ARMCOM will phase out and its components and resources will phase into the newly created U.S. Army Armament Research and Development Command, and the U.S. Army Armament Materiel Readiness Command. Meanwhile it stands at the crossroads of the weapons systems, "providing the best in weaponry for the modern U.S. Army."

Phase II Extends CE Authority To Protect U.S. Waterways

Phase II of a 3-year program to extend authority of the U.S. Army Corps of Engineers to protect the quality of the waters of the United States against harmful discharges of dredged or fill materials was effected July 1.

Jurisdiction of the Corps now extends to regulation of disposal of dredged or fill materials to lakes with more than five surface acres, primary tributaries of inland navigable waters, and nearby wetlands. The announced policy will be to "continue to use moderation and a reasonable approach in the administration and enforcement program."

Insofar as possible, general permits will be issued to provide for blanket authorization for activities with no significant adverse environmental impact in designated areas. The idea is to make the program "more manageable and practical by reducing the number of permits required."

Phase III, scheduled to take effect July 1, 1977, will expand control of the Corps to regulate discharges of dredged or fill material into other waters generally up to headwaters.

The Corps' permit program is being conducted as directed by the Congress under Section 404 of the Federal Water Pollution Control Act Amendments of 1972 and in accordance with the Mar. 27, 1975, decision of the U.S. District Court for the District of Columbia.

Geographic Applications of Multiband Aerial Photography

By T. C. Vogel & R. K. Brooke Jr.*

A single-lens, 4-channel multiband aerial camera, fully compatible with Army OV-1D Mohawk aircraft for providing detailed terrain data and military geographic information, has been designed and fabricated by the U.S. Army Engineer Topographic Laboratories, Fort Belvoir, VA.

The camera (Fig. 1) incorporates a single-lens, beam-dispenser design (Fig. 2) that eliminates a number of difficulties encountered with conventional multilens or multicamera designs—including shutter synchronization, boresighting, lens matching and parallax.

The experimental system is basically a 70mm aerial camera that records four individual, spectrally separated images of a ground scene. Adapted for standard T-11 or KC-type camera mounts, it requires a 23-inch vertical clearance, weighs 135 pounds with a full-film load, and operates from a 28-volt direct current power supply.

The optical system can be divided into two major sections, the lens and beam disperser. The 4- and 6-inch focal-length lenses can be mounted interchangeably. The field stop for each lens is at the exit side of the lens. The shutter and iris are positioned at this point, half an inch beyond the exit side of the lens, between the lens and beam disperser.

The disperser utilizes a series of thin-film, dichroic filters and total internally reflecting interfaces to separate spectrally and direct incident illumination to four individual focal planes that record blue, green, red and infrared (IR) energy reflected from a scene.

Spectral transmittance curves for the lens disperser combinations are shown in Fig. 3. Transmittance in each channel is balanced for equivalent exposure with Kodak film Type 3400 in the visible channels and Type 2424 in the IR channel. In its present configuration, the camera makes no provision for adjusting channel-to-channel exposures.

When using the additive-color-formation method, the four black and white negatives obtained with the camera can be used to simulate the spectral response of a number of conventional film and film/filter types. These simulations include color, color IR, black and white IR, and panchromatic photography (Fig. 4).

In practice, this 4-step method requires use of a 4-channel, optical additive-color viewer which enables the operator to project single-channel images or to superimpose two or more images in registration upon a rear projection screen.

The viewer image is projected at a fixed 3X magnification in either a white light or a color mode by insertion of appropriate color filters into any three of the four optical paths in the viewer.

For example, an image with a spectral response similar to Kodak Aerochrome MS, Type 2448 (a color positive film) can be simulated by reproducing a black and white film positive from each of the blue, green, and red multiband negatives. The blue, green, and red positives are then projected on the viewing screen through an appropriate filter, i.e., the blue image through the blue filter, etc.

In a tactical situation, the image interpreter would use the viewer display as his source for either terrain data or target detection. However, if a color reproduction is required, it can be reproduced either by projecting directly onto film or by photographing the viewer screen. A Polaroid-type color camera could be used.

The four channels of multiband imagery also provide input to another Engineer Topographic

Fig. 1. Single-lens Multiband Camera

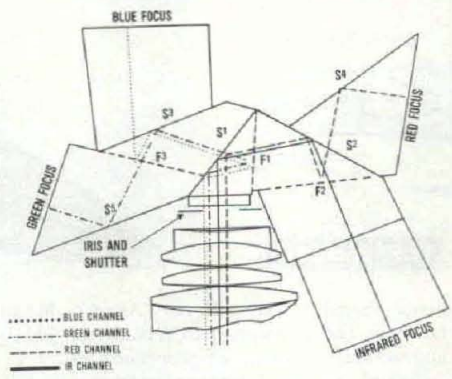


Fig. 2. Beam Splitter Schematic Single-lens Multiband Camera

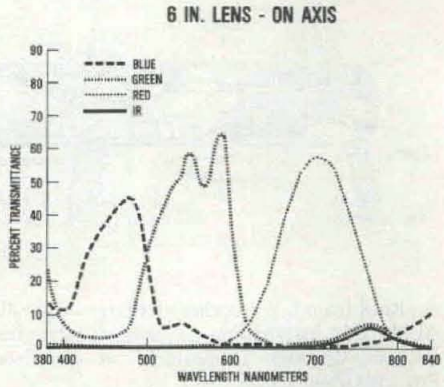


Fig. 3. Multiband Spectral Transmittance For 6-inch Focal Length Lens

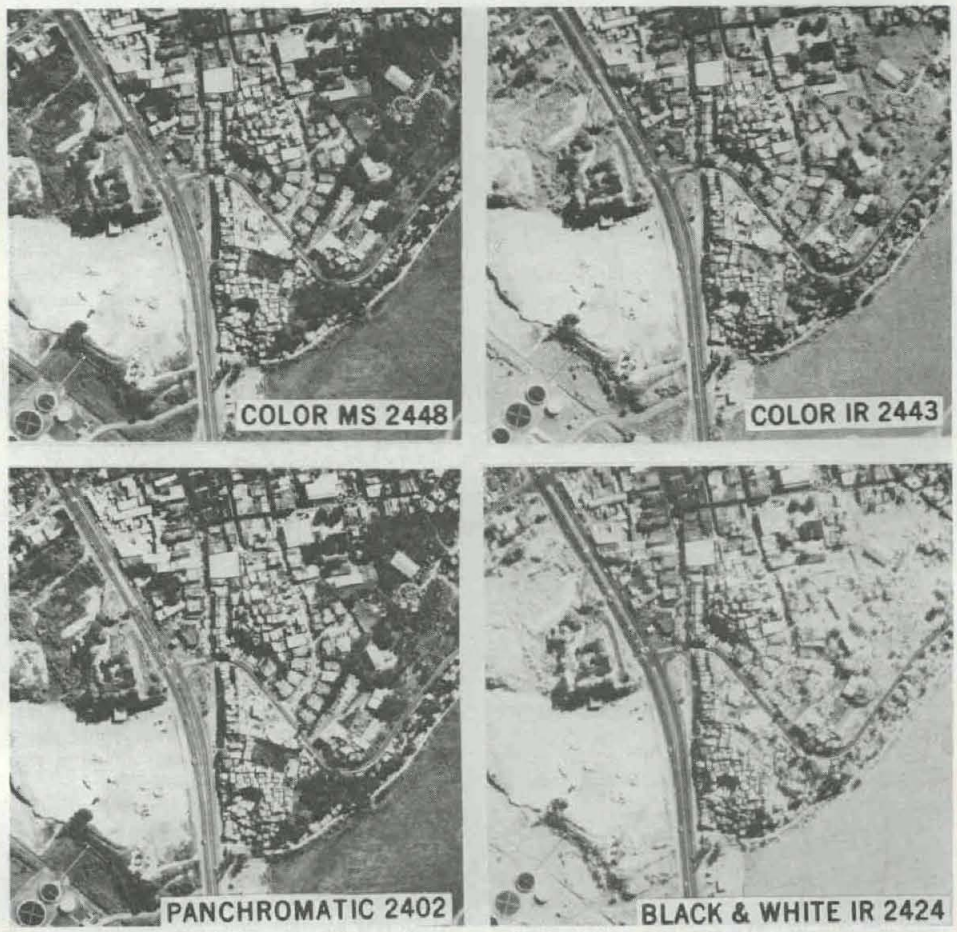


Fig. 4. Multiband Simulations of Standard Aerial Film/Filter Combinations

*Theodore C. Vogel is employed at the Geographic Information Systems Division, Geographic Sciences Laboratory, U.S. Army Engineer Topographic Laboratories (USAETL), Fort Belvoir, VA. Robert K. Brooke Jr, is now employed with the Naval Electronics Systems Command, U.S. Navy.

Laboratories research effort, the Automated Image Data Extraction System. AIDES employs principles of multispectral input to automate, interactively, image data extraction in support of geographic information.

Since delivery of the camera in 1972, experimental multiband aerial photography has been acquired over the USAETL Remote Sensor Test Areas, and a variety of military research and development programs to evaluate versatility and capabilities believed unique to this type of remote sensor imagery.

This photography has been applied to camouflage detection and evaluation, target detection, and collection of specific elements of terrain data. Missions have been flown for TRADOC Combined Arms Test Activity (formerly MASSTER), the Mobility Equipment R&D Command Camouflage Laboratory, and the NATO Camouflage Joint Field Test.

The USAETL multiband system provides the Army with the following:

- Color imagery capability without changing or augmenting present Army-in-the-field requirements for film processing equipment or personnel training and skill levels.
- A capability to obtain aerial photography during a single overflight that is equal in information content to at least three existing standard commercial film types; also, spectral enhancement of certain targets and terrain features.
- A continuous sensitivity to reflected energy from 380 to 840 nanometers.
- A fail-safe system for recording imagery in that if any one channel, or even three, fails to function properly, imagery is still acquired for evaluation.

In-House Peer Review: An Effective Mechanism for Research Management

By William C. Patrick III and William R. Beisel, M.D.

Peer Review is an approach to determination of how well U.S. Army laboratories are performing that has demonstrated its value in measurement of productivity or nonproductivity at the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) at Fort Detrick, MD.

Peer Review was selected for the scientific management needs of USAMRIID six years ago, after a study of other managerial techniques, to accomplish the following needs and objectives:

- Provide a continuing review process to assist the commander and his staff in judging large numbers of research tasks for merit, progress, cost effectiveness, and success in meeting applied mission requirements.
- Enable management to foster maximum in-house scientific communication among researchers with different professions and experience.
- Serve as a management technique to improve the quality of ongoing research with timely, repetitive and systematic evaluation by in-house peer scientists during USAMRIID's rapid expansion at that time.

HOW PEER REVIEW FUNCTIONS. A principal investigator heads a research team for each USAMRIID work unit. Seventy-eight work units are currently distributed among seven research divisions for administrative and technical management. Principal investigators report directly to division chiefs who, in turn, report to the commander.

The peer review system functions as follows. After appropriate preliminary explorations and discussions, a principal investigator prepares a detailed research plan which is submitted through his division chief to the commander. The plan is critically reviewed by the commander and a special committee.

If approved, the work unit is assigned to one of 11 internal peer review committees. The scientific adviser assigns 5 senior staff scientists to each committee, including at least one physician, PhD, and veterinarian. Each committee reviews from 6 to 8 work units semiannually.

The Plans and Programs Officer (PPO) administers and monitors the peer review program and maintains the peer review files to provide a complete set of work unit information documents for committee members.

Each information set contains the research plan, quarterly and annual progress reports, copies of recent publications or presentations, and related documents. Two weeks before review, data in work unit files are sent to appropriate committee members for study.

All members of a committee attend the formal review. Individual members may interview an investigator in advance of the formal meeting and the investigator may also appear personally to discuss his research with the entire committee. However, the investigator is not present during the subsequent discussion and appraisal.

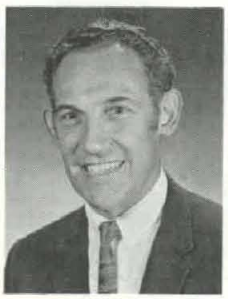
Each committee completes a standard form designed to guide deliberations, to assure completeness of evaluation, and to provide a standardized format for summarizing assessments. This form requires a committee to assess numerically each work unit for its relative importance in fulfilling institute mission; experimental approaches; technical methodology; influence on other institute studies; resource utilization; creativity; scientific comprehensiveness; technical complexity; research quality; and research progress.

A numerical rating of 0 to 4, assigned to each element, reflects types of performance: 0 = unsatisfactory; 1 = marginal; 2 = average; 3 = above average; 4 = outstanding. Although the standard form also proves many other aspects of the work unit, these 10 elements of appraisal provide the basic information to make the system work.

WHAT ACTIONS FOLLOW REVIEW? During committee deliberations, a standard form is completed for each work unit. Completed forms are considered confidential and are analyzed by the PPO for preparation of a consolidated report within 48 hours.

Work units with outstanding or poor performance appraisals are singled out. Significant shifts are identified in work unit performance and a USAMRIID profile of performance is established for each category of the appraisal rating as compared to past performance.

WILLIAM C. PATRICK, III is the Plans and Programs officer at U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), Fort Detrick, Frederick, MD. He has a BS degree in chemistry, an MS degree in microbiology and has been active in these fields in both industrial and government laboratories for the past 25 years.



WILLIAM R. BEISEL, M.D., serves as the scientific adviser to USAMRIID. HE received his doctorate from the University of Indiana School of Medicine. Since his graduation in 1948, Dr. Beisel has published approximately 140 scientific articles, many additional abstracts, and textbook chapters.

This consolidated report is also considered confidential. Management uses this information to prepare for a series of meetings with each division chief within two weeks following completion of the peer review.

Concurrently, each division chief uses the peer review forms to prepare for his meeting with management. Division work units then are appraised, using peer review evaluations as a point of reference, and major policy decisions regarding all aspects of a division's research are made.

WHO MONITORS THE SYSTEM? The quality of each review is monitored by the PPO. Questions are rephrased or eliminated if institute-wide responses become skewed or reflect ambiquity. Inherent bias, due either to a question or to a committee, is identified and evaluated. Work units that receive consecutive "outstanding" or "unsatisfactory" appraisals are transferred to new committees for evaluation.

Although committee continuity is considered important, a work unit is reassigned after four consecutive reviews to provide new challenges, to eliminate staleness among the reviewing peers, and to open new lines of communication among staff members.

WORK UNIT SCORES are obtained by adding the numerical ratings assigned to the 10 appraisal elements, with research quality and progress receiving double weight. Additional points are added for manuscripts published during the review period. Work unit scores for each appraisal element for their total are plotted to determine if they maintain a Gaussian distribution.

Performance by category is a reflection of this distribution. Institute performance, as evaluated in the past 5 reviews, is summarized in Table I. Institute performance, while not always pleasing to management, provides a realistic evaluation of the status of all research programs.

INVESTIGATOR'S RESPONSE. Experience has shown peer review to have flaws as well as advantages. The review process can generate hostility among investigators, and exaggerate differences of opinion. A committee may wrongly criticize an investigator about some aspect of his

(Continued on page 20)

Fuzing Concept May Increase Projectile Firing Rate

Fuzing specialists at the Army's Picatinny Arsenal, Dover, NJ, are developing a technique for increasing the accuracy and speed of firing airburst projectiles from a tank - by setting the fuze automatically after firing.

Faster firing results from transmitting ranging data after the round is in flight, and the technique is in advanced development.

Henry Hagedorn, project engineer at Picatinny's Ammunition Development and Engineering Directorate, explains: "Up to now, the tank commander would see a target, then determine the range. The crew would then have to set the range on the fuze manually before loading the round."

The new fuze system will be linked to the tank's laser rangefinder and onboard ballistic computer. Hagedorn says a tank commander can ride around with the round already in the gun. He can aim and fire as soon as the target is spotted.

The fuzing mechanism in the projectile includes an antenna, radio receiver, and low-power complementary metal-oxide-semiconductor timing circuits. Power is supplied, not by batteries, but by a simple generator, a coil within a cylindrical magnet.

Inside the coil is a movable core. When the projectile is fired, inertial forces move the core about one eighth of an inch with respect to the coil, breaking magnetic lines of flux and inducing a voltage in the coil. This voltage is used to charge a tantalum capacitor.

Hagedorn says the best time for transmission is when the projectile is less than 12 feet away from the tank. Signal attenuation from the hot propelling gases is not then excessive.

General Electric's Electronics Laboratory in Syracuse, NY, and GE's Armament Systems Department in Burlington, VT, have worked with Picatinny Arsenal researchers on the project. Hagedorn says most of GE's contribution has been in the radio-frequency area, and that a study is under way to determine optimum frequency.

The concept has been demonstrated successfully, he reports, in firings of artillery and rocket fuzes.

ECOM Deprived of 2 Space Program Pioneers

Numerous renowned scientists, engineers and technicians who have contributed to the U.S. Army Electronics Command's long list of notable achievements over the span of the past 25 to 30 years are adding to the recent high attrition rate among employes.

Dr. Hans K. Ziegler, who was among the German scientists added to the staff in 1947 as part of "Operation Paperclip," and has served since 1971 as director, Electronics Technology and Devices Laboratory, is among the retirees.

Dr. Ziegler was one of the pioneers in the U.S. Army space exploration efforts, including development of Vanguard I, the solar-powered "grapefruit" satellite launched on St. Patrick's Day, Mar. 17, 1958. He also contributed to SCORE, the world's first communications satellite, as well as to Tiros I and II, predecessors to modern meteorological satellites, and Courier, the first high-capacity active communications satellite.

ANOTHER ECOM SPACE PIONEER, Dr. Kurt Ikrath, died June 11 at the age of 51. In 1963 he received one of the Army's annual Research and Development Achievement Awards for his work in microwave antennas.

Born and educated in Vienna, Austria, he was the leader of ECOM's Unconventional Techniques Team at the time of his death. He held 17 patents and had six pending in the U.S. as well as two Canadian patents.

ACC Completed 5-Month Testing Of Communications Monitor

Completion of five months of operational testing of the AN/TSQ-118 Satellite Communications Monitor was announced late in June by the U.S. Army Communications Command, Fort Huachuca, AZ.

Described as a "one-of-a-kind center," the AN/TSQ-118 is designed to control and monitor tactical earth satellite communications terminals, including measurement of power, bandwidths and operational noise. When necessary it can serve as an earth terminal for either digital or voice communications.

Measurements are controlled by a minicomputer capable of maintaining and storing information for up to 100 terminals.

The system is housed in a standard shelter that fits on the back of a standard 2½-ton truck. It can be set up by a 4-man team to be operable in 27 minutes (average time), including time to acquire a satellite 24,000 miles away.

The terminal was developed under contract by Radio Corp. of America. Results of the test program are being evaluated with a view to entering the system in the Army's communications-electronic gear inventory.

A Mechanism for Research Management

(Cont'd from page 19)

work. A few investigators heartily endorse the system but the majority look upon peer review as a necessary evil. Most friction originates from work units in the unsatisfactory or marginal categories.

Despite these potential deficiencies, the system can be tested for possibly erroneous assessments. Work units twice evaluated as unsatisfactory or outstanding are transferred to a new committee.

Without exception, the new committee, meeting 6 months later, has confirmed the evaluation of the previous committee. The nature and frequency of peer reviews nag at an investigator. Although investigators do not accept critical analysis by peers lightly, they generally respond quickly, albeit grudgingly in some instances, to implement committee suggestions and recommendations.

MANAGEMENT'S ROLE. Management must be fully committed to the review process if it is to function in a useful manner, must respond to well-conceived recommendations if committee initiative is to be maintained. The fact that management carefully reviews each recommendation, independent of acceptance or rejection, conveys the importance it places on the review process.

Peer reviews are especially important to a division chief as they reflect on his management capabilities. Committee findings place him in the awkward position of denying or confirming program progress evaluation to the institute commander as well as to his individual investigators. Division chiefs generally considered peer review as a petty annoyance during its early years but the process has become an essential fact of life.

Initially, management sent peer review results through the responsible division chief directly to the investigator; however, this practice created many controversies. The division chief now has the responsibility for determining how much information, if any, is to be given to the investigator and the manner in which it is communicated. This enables division chiefs to use peer results as an aid in improving management.

ARE COSTS WORTH THE EFFORT? Almost any system of review and analysis recognizes completed research of outstanding merit. Management, however, critically needs an early diagnosis and identification of poorly functioning research efforts in order to reallocate resources. *This is the real strength of peer review.*

During committee deliberations early symptoms of nonproductivity or high productivity are spotted for corrective measures or recognition. The interaction of scientists can generate subtle yardsticks for measuring productivity in areas where other forms of review cannot.

Moreover, in the review process, equal attention is focused on quiet as well as noisy areas of research. Crisis-laden work units frequently consume much of management's time while quiet, nondemanding tasks can become lost in the busy schedule of daily activities. These latter work units may lose mission orientation and develop into "hobby research," a trend which plagues every R&D organization.

Peer review at USAMRIID is dynamic and viable and should remain healthy as long as management and review committees are responsive to the needs and requirements of each other.

TABLE I. Institute Performance Over Five Peer Reviews (%)

Review	Unsatisfactory	Marginal	Average	Above Average	Outstanding
1	8	4	32	48	8
2	7	5	38	41	9
3	5	7	59	19	10
4	4	8	53	27	8
5	0	8	37	49	6

Glitman Named DASD for Europe and NATO Affairs

Appointment of Maynard W. Glitman, formerly with the United States Foreign Service, as Deputy Assistant Secretary of Defense (Europe and NATO Affairs), Office, Assistant Secretary of Defense (International Security Affairs) was announced in June.

Graduated Phi Beta Kappa with highest honors in international affairs from the University of Illinois in 1955, Glitman has a master's degree from the Fletcher School of Law and Diplomacy, Medford, MA.

He entered the U.S. Foreign Service in 1956, serving initially in the State Department's Office of International Finance. Later, while serving in the U.S. Army, he was trained as a combat intelligence specialist.

Glitman was appointed director, Office of International Trade in the State Department's Bureau of Economic and Business Affairs in 1973, and in 1974 became Deputy Assistant Secretary of State for IT Policy.

Interactive Graphics Techniques for Structural Analysis

By James J. Pascale and William E. Lorensen*

Interactive graphics technology developed under its Computer Assisted Design and Engineering (CAD-E) Program is enabling Watervliet (NY) Arsenal's Benet Weapons Laboratory to reduce the task-time span of analyzing the stresses in weapons components.

Interactive graphics software packages are acting as pre- and post-processors to a large finite element analysis code (NASTRAN). Comparison analysis studies show that this technology has reduced the engineering time required for an analysis by an order of magnitude over that required by the "now old-fashioned batch mode of operation."

Benet Weapons Laboratory had long used one form or another of finite element techniques, usually developing a distinct and separate program for each structure analyzed - sometimes taking as much as six months or more to analyze one component. While far superior to the classical techniques with their simplifying assumptions, relying heavily on the creativity of the engineer/mathematician, this left much to be desired.

All finite element codes employ the same basic mechanics, but the translation to a computer program varies enormously with the author - so much that communications between users is seriously impaired. Then, in 1969, NASTRAN was released for general use by the National Aeronautics and Space Administration.

NASTRAN provided the user with a code sufficiently broad in scope and ease in use to be of benefit to all types of structural analysts. However, the rapid development of the finite element method, together with its widespread acceptance and increasing application in structural mechanics, has brought with it a series of problems in addition to its many obvious advantages. Problems such as programing errors, machine accuracy and element shortcomings have been fairly commonplace. The major problems have been concentrated in three areas.

First is the difficulty of ensuring input to the computer of the correct mathematical models. Second is the questionable ability to assess the validity of results. Finally, there are the problems associated with assimilating, compressing and organizing the voluminous amount of output data, inherent in a finite element analysis, into a usable format.

In all these areas, it became clearly evident to the computer science people at Benet Weapons Laboratory that the development of an extensive graphics capability, simultaneously with the implementation of a finite element code such as NASTRAN, would minimize and, in most cases, eliminate such problems.

Extensive graphics packages rapidly change from desirable aids to mandatory requirements as the complexity of programs and analysis increases, and as higher order elements are developed and utilized. The computer output data generated by large finite element codes range from the ample to the awe-inspiring. This variation requires that extensive graphics packages be present to enable the engineer to perform his studies with reassuring semblance of confidence and rationality of scheduling.

Consequently, the true value of these graphics packages lies in their ability to reduce errors, task time-spans and valuable computer costs. An example is a recent redesign of a mortar baseplate that was fracturing under dynamic loading. It is estimated that at least two months and many hours of computer time were saved by using the graphics system.

The technique of using IGFES (Interactive Graphics Finite Element System) as a finite element structural analysis tool compresses the time frame for each analysis, from concept to final results, by a factor of 8 to 10. This is accomplished principally by automating the tedious but necessary preparation of input data for NASTRAN.

Contributing to this time and cost saving is providing a means of reducing the voluminous amount of output to a single graphical picture. The "mental momentum" of the engineer is thus maintained, resulting in better designs, with more confidence in ability to do the job required.

The hardware consists of a 21-inch graphics tube with 12,000-word refresh memory and a 3-dimensional capability. Controlling the graphics is a 32,000-word mini-computer with paper tape reader and punch, a teletype and two disk drives each having 1.25 million word storage.

The entire system is connected to an IMB 360 model 44 computer via a direct-channel interface, providing the system with a high-speed communications link for data transfer to the NASTRAN.

In operation, an engineer submits to the mini-computer an outline of the structure to be analyzed. This can be done either by entering data points through the teletype or by interacting with the tube, roughly sketching his structure with a light pen. The engineer can then interact with the computer, via the graphics tube and light pen, dynamically determining the grid density, types of elements, as well as their placement.

When he is satisfied that the grid generated represents his model, he pushes a button and his picture is automatically put into a format understandable by NASTRAN. A file is established that can be run by the large finite element code at anytime thereafter.

This operation usually can be accomplished by someone familiar with NASTRAN and the graphics system in less than two hours. This represents at least two orders of magnitude in time savings over the error-prone and tedious hand drawing and element-placement method.

After the analysis has been completed by the main frame computer, many types of data manipulation techniques are available to the user. He can elect to view the deformed structure superimposed over the undeformed one, view the isostress contours within his structure, or even view the stresses as a surface.

The most recent addition to the graphics software development is the automatic generation of a finite element grid on a 3-dimensional surface. Much like the generation of a grid on a 2-dimensional surface, the user enters the outline of his structure and develops the grid on the screen.

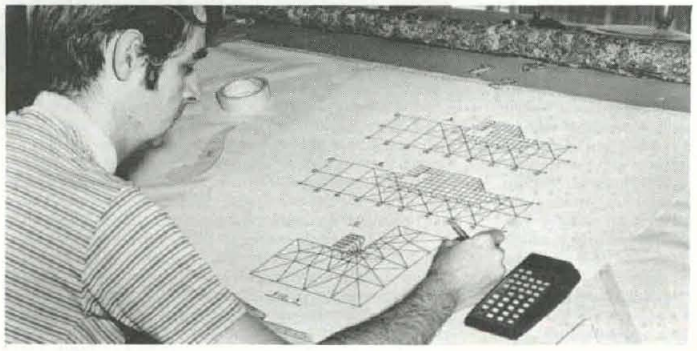
Four views are drawn on the screen-top, side and end views as well as one that can be interactively rotated - to visualize more effectively the structure. When the elements are generated on one view they are automatically generated on the other three. Thus, they can be checked.

This addition to IGFES is perhaps the most impressive segment of the software developed for the system to date. First, to be able to generate automatically a grid over an irregular surface has opened up a totally new area of analysis for NASTRAN. While the large finite element code always had the capability to analyze 3-dimensional surfaces, engineers considered it impractical because of the exorbitant amount of desk checking and data transcription necessary before it could be run.

Graphic interaction now makes it as easy to do as a 2-dimensional generation. The engineer also can get a better insight into his design by rotating the object interactively, to view it at any angle he wishes not only for analysis but for human engineering and aesthetic reasons as well.

For an engineer who has a good knowledge of the finite element method, and in particular NASTRAN, the system has proved easy to learn. After a 2-hour learning session, an engineer is ready to use the system with a practical problem. IGFES is available through the NASA-sponsored Computer Software Management and Information Center (COSMIC) at the University of Georgia, Athens, GA.

*James J. Pascale is chief of Computer Service Office and William E. Lorensen is a mathematician at Watervliet Arsenal, NY.



ERROR-PRONE and tedious hand drawing element-placement method (left) and new graphic system that automatically generates input data.

Tenth Army Science Conference

(Continued from page 6)

took time to visit an impressive display of foreign weapons systems (many of them miniature models) on exhibit in the Thayer Hotel, where concurrent sessions for presentation of technical papers were held.

Some of the systems shown were the Soviet TMM Truck-mounted "scissors" bridge and the Soviet "ribbon" bridge; propellants used by the People's Republic of China, the United Kingdom and Sweden; consumable and combustible ammunition cartridge cases from Belgium, France and Japan; solid fuel ramjets from Russia and Poland; and Soviet munitions and rocket-assist systems.

The display was planned and arranged by Dr. L. A. Mounter, Francis H. Breen, John M. Bollendorf, Howard Sheinfield and Miss Betty Jand Prufer of the U.S. Army Foreign Science and Technology Center, Charlottesville, VA.

CONFERENCE ARRANGEMENTS. Dr. I. R. Hershner headed the conference advisory group including Dr. Gordon Bushey, Dr. Hermann R. Robl, William B. Taylor and COL Philip E. Winter. Donald Rollins was the project officer and Anne G. Taylor was executive secretary.

Assistance in arrangements and handling registration and many details was provided by Mrs. Ronda F. Rice, Army Research Office, and Mrs. Bernice Miller, HQ U.S. Army Materiel Development and Readiness Command. The Military Academy assistants were LTC Donald H. Cline, MSG Michael Biskup and SFC Robert H. Pollack.

ABSTRACTS

Siple Medallion and $1,000

TITLE: Unique Materials and Properties in the New High Pressure-Temperature Regime Above 250 Kbars

AUTHORS: DAVIDSON, KENDALL, HOMAN, FRANKEL and RICH

ABSTRACT: This paper describes the equipment and techniques needed to enter the new pressure regime above 250 kbars and also to incorporate a cryogenic capability. A new design concept for pressure generation has been developed based on the principle of variable lateral support to a Bridgeman anvil device. This system, which has achieved pressures in excess of 400 kbars and with modifications is expected to reach 1000 kbars, will be described.

A unique full containment dewar and refrigeration system which permits cooling of the pressure cell to 10°K, and various measurement techniques used with this system will be discussed. These include resistometric and dielectric methods and ultrasonic interferometry. These permit detection of various types of phase transitions and equation of state measurements.

Important new results obtained will be presented. These include the P-T phase diagram of Bi up to 140 kbars with the discovery of two new phases at cryogenic temperatures; new phase transitions in GaP at 216 kbars, in NaCl at 292 kbars and in Bi at 300 kbars at room temperature.

Some of the implications of this new pressure-temperature regime will be discussed in terms of potential practical applications.

EXECUTIVE SECRETARY to the U.S. Army Science Conference Group, Mrs. Anne G. Taylor (left) and Mrs. Willie Mae Fennell, executive secretary to the Army Incentive Awards Group, shared in arrangements for presentation of awards to 52 authors and coauthors of the best of 96 technical papers.

$500 Award

TITLE: Low Temperature Pressure-Oxidation of Silicon for Integrated Circuit Technology

AUTHORS: ZETO, THORNTON, HRYCKOWIAN and BOSCO

ABSTRACT: A research study of the effect of dry oxygen pressure on the thermal oxidation of silicon has resulted in a new passivation technique that is expected to improve the performance, cost and reliability of large scale integrated circuit devices. Based on existing theory of the oxidation mechanism, it was reasoned that dry oxygen pressures above 1 atm would appreciably accelerate the oxidation of silicon, thereby leading to lower oxidation temperatures, reduced defect concentrations, and improved electrical properties. Special apparatus has been developed, and careful experimentation has demonstrated that oxidation temperatures can be lowered as much as 400°C by using only 140 atm dry oxygen pressure, i.e., a pressure lower than that contained in commercial bottled gas cylinders. Measurements have shown that the resultant oxidized material has a stable flat-band voltage, consistently low fixed surface-state-charge density, high dielectric strength, and a generally lower defect concentration relative to conventionally processed silicon. The use of pressure-oxidation (P-OX) to obtain oxide-isolated integrated circuits on sapphire to meet military requirements for low power and radiation hardening was demonstrated. The research technique is being applied by ECOM microelectronics engineers, and several industrial concerns have indicated plans for using this process. Suitable P-OX equipment on a production scale is being designed under ARPA sponsorship.

$500 Award

TITLE: Antibody to Hepatitis B Core Antigen

AUTHORS: ALLEN and IRWIN

ABSTRACT: Antibody to hepatitus B core antigen (anti-HBc) is an important immunological marker of hepatitis B virus (HBV) infection. In studies by others, anti-HBc was present in serum early after onset of hepatitis B and frequently present in patients in which hepatitis B surface antigen (HBsAg) could not be detected. Routine serologic tests for anti-HBc have been impeded by difficulty in obtaining core antigen (HBcAg).

In these studies, chimpanzees were treated with the immunosuppressive drug, cyclophosphamide, prior to and after infection with plasma containing HBV. HBcAg derived from infected chimpanzee livers served as the antigen for development of a radioimmune assay (RIA) test for anti-HBc, based upon inhibiting ^{125}I tagged anti-HBc derived from the plasma of an asymptomatic carrier of HBsAg. In preliminary studies, the RIA test has increased the efficiency of serologic diagnosis of hepatitis B by 30% and helped to distinguish subclinical primary HBV infections from reinfection in military populations. This test should prove essential as an independent marker of HBV infection in projected field tests of hepatitis B vaccine efficacy.

$250 Award

TITLE: High Performance Pyroelectric Vidicon

AUTHORS: PETITO and COX

ABSTRACT: The pyroelectric vidicon is an uncooled infrared television system which operates primarily in the 8 to 14 micrometer wavelength region and at present offers the lowest cost approach to thermal imaging. The vidicon camera tube is essentially a conventional vidicon with the window made from an infrared transmitting material and the usual photoconductive retina replaced with an infrared sensitive pyroelectric retina such as TGS (triglycine sulfate). This modification, however, creates several problems: nonuniformities in the image due to spatial variations in secondary electron emission, outgassing during operation and erosion of the retina by the electron beam. Since the problems were associated with the retina surfaces, an internal program was initiated to find a way of coating the surfaces, an internal program was initiated to find a way of coating the surfaces as a means of solving them. The characteristics required of a coating to be used on the beam landing side of the retina were: secondary electron emission coefficient significantly greater than one, good adhesion, low stress, stability during electron bombardment and good surface sealing properties. The coating materials tried and the conditions under which they were deposited will be described. The uniformity of the image has been increased by a factor of 10 so the nonuniformities are now almost imperceptible to the eye. Sensitivity has been improved by 90% and tube life has been increased from less than 50 operating hours to more than 1000. Details of operation, test and evaluation will be given.

$250 Award

TITLE: In-Flight Far-Field Measurement of Helicopter Impulsive Noise

AUTHORS: BOXWELL and SCHMITZ

ABSTRACT: A new and highly successful method of collecting far-field acoustic data radiated by helicopters in forward flight has been developed, utilizing a quiet aircraft flying in formation ahead of the subject helicopter. The lead aircraft, flown as an acoustic probe, was equipped with taperecording equipment and an external microphone. Spatial orientation of the helicopter with respect to the monitoring aircraft was achieved through visual flight reference. To date, quantitative far-field acoustic data defining the impulsive noise radiation characteristics of the UH-1H helicopter during high-speed flight and partial-power descents have been gathered with this technique. Three distinct types of impulsive waveforms have been identified and correlated with helicopter steady operating conditions.

$250 Award

TITLE: New Wave-Shaping Concepts in Fragmentation Munitions

AUTHORS: MESCALL, RIFFIN and POLLEY

ABSTRACT: A new technique has been developed to control the form of shock waves induced in fragmenting munitions. The result is a substantial increase (up to a factor of five) in the number of fragments produced in a given exploding shell. The concept offers interesting new options in the always difficult tradeoffs which must be made in meeting the conflicting requirements of needing a tough material to withstand launch stresses and needing a brittle material for good fragmentation characteristics at burst time.

The rationale for the wave-shaping concept is based upon theoretical analyses using one-and two-dimensional elastic-plastic wave propagation codes which provide details of both the detonation wave in the explosive and the subsequent shock loading of the metallic cylinders.

Results of the experiments confirm the theoretical predictions extremely well in terms of (a) the production of a new fracture mode, (b) a substantial increase in number of fragments, (c) optimum design configurations and (d) velocity of fragments produced.

$250 Award

TITLE: High Efficiency Pentaphosphates for Miniaturized Laser Applications

AUTHORS: SCHWARTZ, WADE, AUCOIN and GUALTIERI

ABSTRACT: Neodymium pentaphosphate (NdPP) has recently emerged as a new laser compound offering a considerable improvement in operating efficiency over existing materials. Up to thirty times more Nd can be incorporated than in Nd:YAG, without substantial fluorescence quenching, linewidth broadening, lifetime reduction and optical degradation of the crystal. The evaluation and testing of NdPP lasers in prototype components availability and quality of the single crystals. Unique modifications of conventional solution growth techniques have been devised which have yielded the largest crystals (1 cm) of NdPP currently available. Ambient control, growth temperature, rare earth oxide to phosphoric acid ratio, and seeding were found to greatly influence nucleation, growth rate and crystal quality. An as-grown crystal of Nd-PP containing 10% yttrium, 2.5 x 3.5 x 2.2 mm thick, produced 0.24 watts of output power for 1.0 watt of absorbed power using longitudinal pumping with a repetitively pulsed argon laser; the conversion efficiency is 24%.

$250 Award

TITLE: Gunhardened Crystal Oscillators for Remotely Monitored Battlefield Sensor System

AUTHORS: HAFNER, SCHODOWSKI, VIG and MAZURCZYK

ABSTRACT: The genesis of a temperature compensated voltage controlled (for FSK modulation) crystal oscillator capable of maintaining a 5 ppm accuracy in either FSK state (mark and space) under conditions of 15,000 g shock, −40 C to +75 C ambient temperature and aging for one year is described. The thick film microcircuit oscillator occupies less than 0.5 cubic inches and consumes less than 50 mW of power.

The development of the requisite crystal unit required a large number of design and processing innovations whose significance, aside from the shock resistance, transcends their immediate application to the REMBASS oscillator. Among them is a new family of microcircuit compatible ceramic flatpack crystal enclosures; a laser assisted X-ray goniometer for precision angle measurements; novel surface preparation and cleaning procedures definitized with the aid of high energy electron diffraction, scanning electron microscopy and Auger spectroscopy; and the concept of a novel in-line, ultrahigh vacuum processing facility to assure long term stability. Finite element computer studies aided in the shockproofing of the resonators, and 20 MHz crystal units that survived 36,000 g shock and remained within the assigned frequency tolerance at 15,000 h have been fabricated.

Social Hour Scenes from U.S. Army Science Conference

Dr. Richard L. Haley, deputy director, Development and Engineering, HQ DARCOM; Dr. Edward A. Miller, Assistant Secretary of the Army (R&D); LTG Sidney B. Berry, U.S. Military Academy Superintendent.

Dr. Gerth A. Morgan, Assistant Defence R&D Attache, Australia; LTC Kevin Cole, Assistant Army Attache, Embassy of Australia, and Mrs. Cole; BG Kenneth R. Dirks, commander, U.S. Army Medical R&D Command; Archie Gold, assistant director, U.S. Army Ballistic Missile Defense Program Office.

William B. Taylor, technical director and assistant for R&D to the Chief of Engineers, U.S. Army; Dr. Walter S. McAfee, scientific adviser to the director, Research, Development and Engineering, HQ U.S. Army Electronics Command (ECOM); Dr. William N. Carter, technical director, U.S. Army Harry Diamond Labs; LTG Sidney B. Berry, superintendent, U.S. Military Academy; Dr. John J. Burke, associate director, U.S. Army Materials and Mechanics Research Center.

COL John E. Wagner, deputy director, Army Research, Office of the Deputy Chief of Staff for Research, Development, and Acquisition, HQ DA; Mrs. Edwin D. Patterson; Dr. Ivan R. Hershner Jr., assistant director, Research Programs, ODCSRDA, and chairman, Advisory Group, U.S. Army Science Conference; Mrs. Rhonda Rice, U.S. Army Research Office, Research Triangle Park, NC; Norman L. Klein, assistant deputy for Science and Technology, HQ DARCOM; COL Edwin D. Patterson, associate dean, U.S. Military Academy.

Dr. Stanley Kronenberg, research scientist and author of the prestigious U.S. Army R&D monograph, High Intensity Radiation Dosimetry With SEMIRAD, HQ ECOM; Jack S. Shayler, head of Defence R&D, British Embassy, Washington, DC, and Mrs. Shayler; David Cardwell, chief scientist, British Army; Dr. H. L. Wain, counsellor for Defence Science, Australian Embassy, Washington, DC, and Mrs. Wain; Ben Baker, scientific advisor, Mobile Command, Canadian Forces.

Dr. Abdul R. Rahman, head of the R&D Plant Products Group, Food Engineering Laboratory, U.S. Army Natick R&D Command (NARADCOM); Mrs. Lester and COL Rufus E. Lester, commander NARADCOM; Dr. Abner S. Salant, new director of the NARADCOM Food Engineering Laboratory (succeeded Dr. Fred Mehrlich, retired); and Dr. David E. Bailey, director, Food Sciences Laboratory, NARADCOM.

Alexander Levin, U.S. Army Concepts Analysis Agency; Dr. Julius E. Uhlaner, U.S. Army chief psychologist and technical director, Army Research Institute (ARI) for the Behavioral and Social Sciences; Dr. John W. Weisz, director, U.S. Army Human Engineering Laboratory, Aberdeen Proving Ground, MD; Dr. Marvin E. Lasser, director, Army Research and chief scientist, U.S. Army; Dr. E. Ralph Dusek, associate director, Army Research Institute.

COL Phillip E. Winter, chief, Research Planning, U.S. Army Medical R&D Command; COL Frank W. Kiel, pathology consultant, U.S. Army Health Services Command, Fort Sam Houston, TX; COL Thomas McGregor, commander and director, U.S. Army Harry Diamond Laboratories; COL W.C. Petty, commander, U.S. Army Atmospheric Sciences Laboratory; Dr. L.A. Mounter, U.S. Army Foreign Science and Technology Center, Charlottsville, VA.

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

technology which have been transferred to the Eastern Bloc:

•The U.S. is providing computer-controlled foundry equipment for the Kama River facility where the Soviets will make trucks.

•Some numerical control equipment is available to Communist-Bloc countries, whereas the more advanced versions are embargoed.

•Some large computers have been made available to the Soviets, as, for example, the recent purchase of a large Sperry/UNIVAC system to help manage their airline reservation system.

•The French have sold an integrated circuit factory to Poland.

Our current government-wide export control management practices seem to give equal weight to active and passive ways of transferring technology. That is, product sales, a passive way, seems to have the same status as active technology transfer such as the delivery of processing equipment and training the purchaser in manufacturing know-how.

We in the DoD recognize that the present emphasis is not properly balanced and that proper export control management should focus more on active than on passive methods of technology transfer. In the long run, we can be hurt more through active than passive technology transfers. Trends in the machine tool industry offer an excellent case in point.

Case-by-case analysis of the implications of technology transfer, while important, is often cumbersome and costly, resulting in long delays and ambiguities, and it does not provide guidance for future decisions. These shortcomings arouse suspicion and frustration between us and our allies and between the U.S. Government and our own companies. This situation leads to decreased international cooperation in the effective control of critical technology export.

The Defense Science Board has recently studied the problem of technology export. They have reiterated some key questions to be addressed as we seek to improve our management of technology export. Some of these key questions are:

•Does the product or material have a significant military end use in itself? If the product is a weapon (fighter aircraft or tank) or the material plutonium, the answers are easy to come by. But when the product is a wide-body jet or the material a cobalt-based turbine blade alloy, the answers are more elusive.

•Another key question to consider is: Does the technology provide a critical manufacturing capability supportive of strategic products?

Examples of this type of consideration could be a request to export ultra-precision bearing manufacturing know-how, or the export of know-how and equipment that could be used in the manufacture of a guidance system or integrated circuits.

A different type of key question, but nevertheless critical, is: Is the technology transfer active or passive? Are we exporting only products (passive) or are we potentially exporting the know-how to build the products too? Can any useful technology regarding the manufacture of the product be extracted from possessing the product itself?

We must also ask whether the technology being exported is rapidly changing. If we export a technology that is improving rapidly, are we as likely to find ourselves threatened militarily or economically? In some cases, such as integrated circuit manufacture, the technology is moving rapidly, but even outmoded technology in this area can yield tremendous payoff to those who do not have it.

I think you will agree that these are complex questions which require that we have a great deal of knowledge about the U.S. state-of-the-art in any particular critical technology. But there is something more. We must know the environment into which the technology is to be exported and used. We must understand the capability of the recipient to use the technology, how long it will take and whether long-term damage to U.S. interests can result.

Consider the very difficult but critical case of assessing technology utilization in the USSR. The often-accepted American view of Soviet technology suggest that it is laggard, imitative, hobbled by bureacratic obstacles inherent in the system of Soviet government, and handicapped by the awkward necessity of deferring to official Communist dogma that may be at odds with scientific fact.

Since the late 1950s, it has been apparent that in critical military areas Soviet R&D progress has been remarkably rapid. In more recent years, the impact of their technical achievements on their military systems has become obvious. Nevertheless, both Soviet and U.S. analysts recognize major shortcomings in Soviet nondefense technology. Why is their performance so uneven? What remedies are being applied and with what success? Why do the Soviets value certain technologies as they do? Why do their values differ from ours?

These are questions which we must answer if we are to know where and how rapidly their technology will impact upon our defense and international competitive capabilities. These are factors that must be considered when assessing exports to the Communist-Bloc, as well as to friendly countries.

I stress the latter aspect since many of our allies, who depend much more greatly upon foreign trade than we do, view this situation differently. They seem to be much more permissive in their dealings with Communist-Bloc countries and often are willing to trade products and know-how when, in the interest of national security, we would not.

Such differences have imposed strains on our alliances, yet we feel strongly that all free-world countries should present a unified position relative to their dealings with Communist-Bloc countries.

SOME MODEST PROPOSALS. I have discussed the impact that technology has on our national security, our economy, and our very standard of living and the importance of proper management of the export of technology. I have also briefly considered how export control is managed today and have raised some key questions. It is appropriate now to conclude by offering some observations and proposals for ways to insure that we do not weaken our defense posture or our economy when exporting technology.

First, I suggest we will create more jobs for our people, and new markets, if we emphasize the sale of products rather than the technologies behind these products. It doesn't make sense to me to sell know-how to potential competitors or the tools that they could use to capture our markets.

Next, when we can agree there will be no danger to our defense or economy by selling some technology, we should insist on a fair price, one that includes all the R&D costs, even the blind alley costs.

Further, since it is expensive to develop a market, these costs must also be recovered in the price of transferring a technology. Too often, U.S. companies have been willing to sell technology very cheaply since the costs have already been recovered in the U.S.

In my opinion, this is particularly true of companies who, while possessing the technology, are not competing successfully for product sales. The days of such generosity are over; the time for hard-nosed dealings, even with our allies, is upon us.

To aid in arriving at proper management decisions, we need to focus on: Providing information to decision-makers on the relationships of various technologies to military missions; determining the key elements of these technologies and predicting their rate of advancement; describing the critical infrastructure and the equipment necessary to translate technologies into products.

We should, for selected exportable technologies, establish quid pro quo exchanges. That is, we must be ready to say which technologies we want to import for those we are willing to export.

Various U.S. laws and treaties provide a means to protect our strategic technological edge. To strengthen these tools, we need to focus on the control and enforcement issues relating to: Design and manufacturing know-how; rapidly changing technologies (where "how fast" becomes a key factor); intent (the most difficult of all export control issues to resolve with certainty).

Presently, there are those who rely too heavily on "End-Use Statements" as safeguards to prevent the diversion of products to military applications. These are simply not an effective control mechanism; they are both unenforceable and forgettable.

I believe that neutral countries should not be provided with key elements of high-velocity technologies that have military application unless we are certain that such technology cannot fall into the "wrong" hands. An interesting question - Can this be done?

But after all is said and done, we realize that even a perfect job of regulating the export of technology is but a partial and interim solution to maintaining U.S. technological superiority. To keep the U.S. technologically superior, we must renew our commitment to the policies actions that created the superiority in the first place, namely

Creative and innovative engineering; entrepreneurship; effective utilization of resources; sound management and planning; quality production and aggressive marketing; a national policy of solid commitment to R&D. I favor tax incentives to industry for this purpose rather than government selection of R&D programs.

These actions and policies, coupled with effective export control, will help maintain the U.S. technological superiority we must have to preserve our freedoms and to improve our quality of life.

27th Power Sources Symposium...

(Continued from outside back cover)

may eliminate the need for batteries designed for low temperatures.

SECONDARY BATTERY SESSION. Problems of thermal runaway in vented nickel-cadmium batteries, in applications such as aircraft, were addressed by Dr. J.J. Lander, Wright-Patterson AFB, in a session chaired by James Dunlop of Communications Satellite Laboratories. Presentations of technical papers reported work on two possible solutions.

J. Lee of RAI Research Corp. described progress on use of improved separator materials which have better temperature stability than the normally used cellophane. K. Feldman, Defence Research Establishment, Ottawa, Canada, told of a gas measuring technique used to detect vented nickel-cadmium cells with degraded cellophane separators.

Another approach to solution of thermal runaway was discussed by Martin J. Sulkes, HQ Electronics Command, who reported on use of monitor/warning devices capable of sensing temperature or current to control charging of the battery. Dr. H. Seiger, Yardney Electric Corp., and Dr. P.F. Pickett, U.S. Air Force, described methods of fabricating electrochemically impregnated nickel oxide electrodes with high stability.

Performance and charge characteristics of sealed lead-acid batteries were described by R. Hammel, Gates Rubber Co., J. Lear of Martin Marietta Corp. and W.S. Bishop of the Air Force. Failure modes such as plate growth and separator dryout under certain conditions were delineated.

Several speakers reported on progress in nickel-hydrogen battery development, including G. Van Ommering of COMSAT Laboratories, H.H. Rogers of Hughes Aircraft Co. (HAC) and P. Mikol of TRW Inc.

Albert Himy, Naval Ship Engineering Center, HQ Department of the Navy, described investigation of substitutes for mercury in the alkaline-zinc electrode. Results showed that compounds of lead, thallium and cadmium, along with combinations of these compounds, show promise for replacing mercury in zinc-silver oxide batteries.

ELECTRIC VEHICLE BATTERIES. Leonard Rogers of the Energy Research and Development Administration (ERDA) and Dr. Paul Nelson of the Argonne National Laboratory (ANL) were chairmen of a session on Molten/Solid Electrolyte and Electric Vehicle Batteries.

Using either molten electrolytes such as a lithium-chloride-potassium chloride eutectic or a beta-alumina solid electrolyte, these high-temperature batteries have the potential of extremely high-energy and power densities required for electric vehicles or load leveling service.

James Schaefer authored a paper on lithium-chlorine rechargeable battery presented by J.H. Thomson of ESB Inc. A.A. Chilenskas of the ANL discussed progress on design and performance of lithium aluminum/iron sulfide cells. Dr. S. Weiner, Ford Motor Co. project manager, reported on development of a sodium-sulfur battery.

Electric vehicle battery requirements and research efforts were discussed by L.E. Miller, Eagle-Picher Industries, Inc., and H.J. Schwartz of the NASA-Lewis Research Center, Dr. Albert R. Landgrebe of ERDA reported on the federal battery program for electric vehicles.

FUEL CELL SYSTEMS. Edward A. Gillis of the U.S. Army Mobility Equipment R&D Command chaired this session and joined with Dr. A.A. Adams of American University, Washington, DC, in describing an improved electrolyte (trifluoro methane sulfonic acid) for the hydrocarbon-air fuel cell. About twice the current density was achieved as compared to cells using a phosphoric acid electrolyte; however, wetting of the electrodes occurred.

L.B. Welsh of Universal Oil Products Inc. described characteristics of a carbonized alumina substrate for low-catalyst loaded oxygen electrodes for use in phosphoric acid fuel cells. A problem is to achieve high surface area coverage with the catalyst.

John Perry, HQ ECOM, told about research results on direct operating methanol-air batteries that are refillable by replacing the spent fuel-electrolyte mixture. Presently a problem is the evaporation of the methanol, but the batteries produced about 52 watt hours per pound and the service time of comparable Leclanche lantern batteries.

Three papers were devoted to R&D efforts on the 1.5 killowatt Indirect Fuel Cell Power Plant development for MERADCOM. They were presented by M. Callahan, MERADCOM, and S. Abens and M. Onischak, both with the Energy Research Corp. Callahan described a newly designed reactor which could result in increased catalyst life. Abens explained an economical stack manufacturing process for electrodes, matrix, bipolar electrode plates, Onischak reported on an integrated design for reformer/stack and DC to AC voltage regulation.

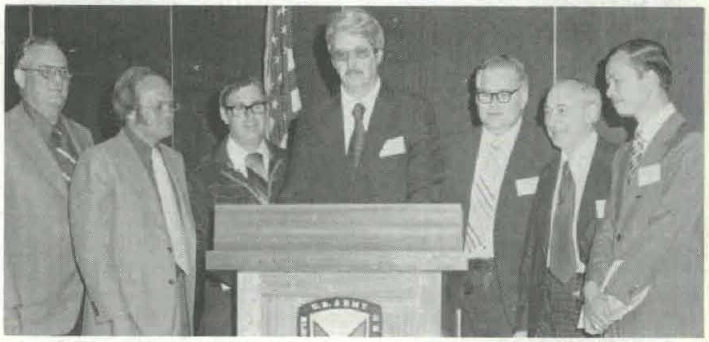
ALTERNATE POWER SOURCES. John M. Horstkamp, who recently departed from the research and engineering staff of HQ U.S. Army Materiel Development and Readiness Command, chaired a session devoted to alternate power sources.

Presentations and discussion covered conventional and nonconventional type energy conversion systems for generation of useful power output ranging from 50 millowatts to 2 kilowatts. J.E. Fine of Harry Diamond Laboratories and V.J. Galgano of Picatinny Arsenal described cost-effective and optimized design of electromagnetic generators that have entered advanced development for Army fuzing applications.

Computers have served to achieve a high degree of optimization of the magnetic "setback generators" and test results were described in detail. Emphasis was placed on radioisotope-fuel devices using material such as plutonium 238 and strontium 90 as substitutes for electrochemical power sources for long-duration mission (3 months to a year).

Dr. Guido Guazzoni, HQ ECOM, and T.J. Holleman of ERDA said the major thrust for development of these new devices, which they termed highly reliable, safe and relatively efficient, is the requirement for lightweight, long-term and in some cases unattended power sources. A consideration is reduced cost availability of radioactive material. ERDA is using advanced space technology for terrestrial and marine applications.

June 19 is the opening date for the 1978 Power Sources Symposium.



SECONDARY BATTERIES Session speakers included (l. to r.) J.J. Landre, Wright-Patterson Air Force Base; Ron Hammel, Gates Rubber Co.; J.W. Lear, Martin-Marietta Corp.; James D. Dunlap (chairman), Communications Satellite Laboratories; W.S. Bishop, Wright-Patterson AFB; K. Feldman, Canadian Defence Research Establishment; H.S. Lim, HAC.

SOCIAL HOUR GROUP (l. to r.) Dr. Ernest Littauer, manager of chemical research, Lockheed Corp., Palo Alto, CA; Ake Lownertz, National Defense Research Institute, Sweden; Bjorne Grenager, manager of electropower resources, Oslo, Norway; Dr. Frank Ludwig, research scientist on sodium-sulfur batter project, Ford Motor Co.; Russel McRae, ILC Co. program manager for batteries.

(L. to r.) Martin Klein, vice president, Energy Research Corp.; Peter Voyentzie, battery research scientist with Energy Research Corp., and wife; Guy Rampel, manager of aerospace engineering, General Electric Corp.; Robert C. Shair, manager, battery operations, Motorola Co.; Willard R. Scott, research scientist, space group, TRW Systems, E.C. Duncan, engineering technical superviser, Hughes Aircraft.

AOR Symposium to Focus on 'Complexity Crisis'

Attention at the 15th annual U.S. Army Operations Research Symposium, expected to attract more than 300 military, academic and industrial OR specialists to the Army Logistics Management Center, Fort Lee, VA, Oct. 27-29, will focus on "The Complexity Crisis and How to Avoid It."

Involved in this theme is the increasing sophistication of the modern analytical process used in operations research. Under Secretary of the Army for Operations Research David Hardison will be the keynote speaker. GEN W.E. DePuy, commander, U.S. Army Training and Doctrine Command (TRADOC), is programed for the welcoming address.

Cohosts of the symposium for the third consecutive year are MG Erwin M. Graham Jr., commander of the ALMC, and MG Dean Van Lydegraf, commander of the U.S. Army Quartermaster Center.

Over-all symposium planning is the responsibility of the TRADOC Systems Analysis Activity (TRANSANA), directed by Dr. Wilbur Payne, with David H. Meier, assistant deputy director for technical operations, in charge of arrangements.

Attendance will be limited to invited observers and participants. papers will be solicited to cover the full spectrum and value of ORSA techniques in supporting the Army's requirements in such areas as resource analysis, training, logistics, weapons systems assessment, and combat operations.

Inquiries pertaining to the symposium should be submitted to: Director, U.S. Army TRADOC Systems Analysis Activity, ATTN: ATAA-DT, White Sands Missile Range, NM 88002. Phone inquiries should be made to David Meier, AUTOVON 258-1810 or Diana Massengale, 258-1431.

WES Convenes Ground Sensor Technology Meeting

Design, Testing and Deployment of Unattended Ground Sensors was the subject of a recent U.S. Army, Air Force, Navy and defense industry symposium which drew about 50 participants to the U.S. Army Engineer Waterways Experiment Station (WES) at Vicksburg, MS.

Joint sponsors of the meeting were the Office of the Project Manager for the Remotely Monitored Battlefield Sensor System (REMBASS), Fort Monmouth, NJ, and the Program Office for Base Installation Security Systems, Hanscom AFB, MA.

Involvement of the United States in the last three major wars has served to emphasize requirements for low-cost, highly reliable intruder detection for perimeter and internal security at defense facilities. Line sensor and point sensor intrusion detection devices are recognized as potentially capable of providing highly localized intrusion alarms - even where the security link is several hundred meters long.

Military efforts to develop sensors over the past several years showed that state-of-the-art technology must be incorporated into the design early in the development phase; further, the designers of the systems must be aware of how they will be tested and eventually deployed.

WES hosted the first symposium on unattended ground sensors in 1973. Participants requested that a second symposium be held to review and discuss ways that sensor research could impact on development programs in the Department of Defense.

Technical papers and discussions were presented on sensor performance requirements, specification of material performance, Corps of Engineers support to materiel development, empirical design of sensor logics, deterministic design of sensor logics, target dynamics (personnel and vehicles), background moise measurements, signature measurements (analog and digital), test site documentation, long-term environmental effects, meterological considerations, and other topics relative to development of intrusion detection systems.

FSTC Hosts Penetrator Materials Parley

AMMRC Conference Chairman Dr. Frank R. Larson (left), and Jerome Persh, Office of the Director of Defense RD and E.

Interest in a 4-day High Density Alloy Penetrator Materials Conference held recently at the U.S. Army Foreign Science and Technology Center, Charlottesville, VA, was evidenced by about 140 civilian and military engineers, scientists and research managers from the United States and foreign nations.

Sponsored by the Defense Advanced Research Projects Agency/U.S. Army Armament Command Kinetic Energy Ammunition Materials Panel, and the Army Materials and Mechanics Research Center (AMMRC), the conference featured 45 technical papers by 66 authors and coauthors.

Dr. Frank Larson, AMMRC, conference chairman, discussed "Theme and Objectives" in opening the meeting. He introduced Executive Board Member Jerome Persh, staff specialist, Materials and Structures, Office of the Director of Defense Research and Engineering (ODDR&E), who spoke on "DoD Materials Coordination."

Keynote speaker Dr. Louis Rubin presented "An Overview of Department of Defense Activities in Kinetic Energy Technology," coauthored by Steward Frederick and Dr. E. G. Kendall. All are with Aerospace Corp.

ODDR&E Staff Specialist for Ordnance Technology Ray Thorkildsen, the dinner speaker, presented "A Department of Defense Perspective of Kinetic Energy Materials."

Subjects of technical sessions and chairmen included: Improved Properties of Tungsten Alloys by Processing, John D. Corrie, Frankford Arsenal; Tungsten Alloy Development, Processing and Testing, A. Joseph DeLai, AMMRC; Manufacturing Technology for Production of Depleted Uranium Alloy Penetrators, Dr. William Rostoker, University of Illinois; Melting and Casting of Homogeneous Uranium Alloys, Dr. Ernest Bloore, U.S. Army Ballistic Research Laboratories; Environmental Deterioration of Depleted Uranium Alloys, Dr. Steven G. Fishman, Naval Surface Weapons Center; Properties and Alloy Development of Depleted Uranium, Shin Inouye, Air Force Materials Laboratory; and Ballistic Evaluation of Tungsten and Depleted Uranium Penetrators, Harold Markus, formerly of Frankford Arsenal.

Army Materials and Mechanics Research Center Commander/Deputy Director LTC Edward E. Chick moderated a classified discussion session featured by presentation of eight papers.

Conference coordinators were Stephen J. Doherty, Josephine Ayoub, Aram Tarpinian, A. Joseph DeLai and Joseph A. Bernier, all with the AMMRC, and FSTC staff members William Marley and John Bollendorf.

ARI Document Reports on Organizational Effectiveness

Identification and analysis of significant human performance factors relative to organizational effectiveness are reported in an Army Research Institute for the Behavioral and Social Sciences publication.

Technical Paper 272, *Results of an Organizational Diagnostic Survey of an Army Facility Work Environment,* was compiled from a diagnostic Work Environment Questionnaire (WEQ) developed and validated over a 3-year period by an Army field unit.

Seven identified problems areas are: peer group norms failed to encourage good performance; lack of feedback information; need for supervisory training; ambiguity and conflict; inadequate intergroup communication; lack of performance rewards; ambiguous rating standards.

Dr. Siu Addresses High Pressure Phenomena Meet

Watervliet (NY) Arsenal and the U.S. Army Research Office, Research Triangle Park, NC, cosponsored a U.S. Army Symposium on Ultra-High Pressure Phenomena, June 1-4, at the world-renowned Institute on Man and Science at Rensselaerville, NY.

About 65 authorities on high pressure research representing industry, the academic sector and U.S. Government R&D agencies participated. Thirty-two papers were presented during 11 sessions.

Dr. Thomas E. Davidson, chief of the Materials Engineering Division at Watervliet Arsenal, presided as general chairman. He heads the group of Watervliet researchers which recently attained pressures of 400 Kbars, believed the highest ever reported in the United States.

Dr. Ralph G. H. Siu, formerly one of the Department of the Army's leading scientists for about 25 years, was the banquet speaker. He is now a corporate consultant and the author of numerous books. *Army Research and Development Newsmagazine* readers in the 1960s remember him as the author of its most popular regular column, "T-Thoughts," and the Army Science Conference banquet speaker for many years.

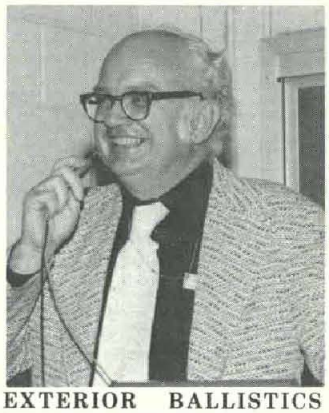
Ultra-High Pressure Phenomena Symposium participants included (from left) Billy Horton, Case-Western Reserve University, formerly of Harry Diamond Laboratories; Dr. Ralph G. H. Siu, principal speaker; Dr. Thomas E. Davidson, general chairman, and Dr. F.W. Schmiedeshoff, research director, both of Watervliet Arsenal, Watervliet, NY.

Spring Technical Conference...

Participants Review BRL Response to Army Needs

More than 60 scientists, engineers and research and development managers attended the annual Spring Technical Conference of the U.S. Army Ballistic Research Laboratories at Aberdeen (MD) Proving Ground.

Participants represented HQ U.S. Army Materiel Development and Readiness Command; Office, Deputy Chief of Staff for Research, Development, and Acquisition, HQ DA; Army Research Office at Research Triangle Park, NC; Defense Advanced Research Projects Agency; various Naval Research Centers; and the industrial and academic scientific community.



EXTERIOR BALLISTICS Laboratory Chief Dr. Charles H. Murphy discusses work of his staff at the annual Ballistic Research Laboratories (BRL) Spring Technical Review Conference at Aberdeen PG, MD.

Conducted as part of BRL's review and analysis cycle, the conference provided a forum for the exchange of technical information. Constructive criticism was welcomed to determine BRL responsiveness to U.S. Army changing needs.

MG Bennett Lewis, commander of the new Armament Research and Development Command scheduled for official activation Oct. 1 when the Armament Command phases out and branches into ARRADCOM and an Army Materiel Readiness Command (ARRCOM), spoke on its mission and BRL's role as one of its major components.

Synopses of about 40 papers presented and 54 additional papers prepared by BRL authors are available in published proceeding of the meeting. These synopses represent only a small cross-section of the complete BRL program.

AVSCOM Holds Indian Businessmen's Conference

American Indian businessmen seeking to initiate or expand activities with the U.S. Government met with representatives of federal agencies at a recent conference hosted by the U.S. Army Aviation Systems Command, St. Louis, MO.

Sponsored by the Bureau of Indian Affairs, the conference included Indian representatives of the Navajo, Oneida, Blackfeet, Uitwok and Apache tribes. Federal agencies were represented by personnel from the Small Business Administration, General Services Administration, AVSCOM, and the U.S. Army Troop Support Command, St. Louis, MO.

Discussion topics included "Department of Defense Agencies," "Selling to DoD/Preparing a Bid," "Selling to GSA and Civilian Agencies," and the "Small Business Administration."

The St. Louis SBA Procurement Center representative described assistance programs for disadvantaged firms.

22d CONFERENCE OF U.S. ARMY MATHEMATICIANS principal participants included (l. to r.) Dr. M. A. Hussain, Watervliet (NY) Arsenal's Benet Weapons Laboratory; Dr. Jagdish Chandra, director, Mathematics Division, Army Research Office, Research Triangle Park, NC; Prof. R.D. DiPrima, chairman, Mathematical Science Division, Rensselaer Polytechnic Institute, Troy, NY; and Dr. Hans Bueckner, Turbine Department, General Electric Co. Invited speakers also included Prof. A. Cermal Eringen, Princeton University; Prof. John Buckmaster, University of Illinois; Prof. Thomas Kailath, Stanford; and Prof. James Rice, Brown.

HDL Hosting Design of Experiments Conference

Princeton University Prof. J. S. Hunter will give the keynote address at the 22d Conference on the Design of Experiements in Army Research, Development and Testing, Oct. 20-22, at the U.S. Army Harry Diamond Laboratories, Adelphi, MD. The conference will feature 40 to 50 contributed papers, and four other invited speakers.

Prof. B. S. Blanchard, Virginia Polytechnic Institute and State University, is programed to speak on Management of Reliability and Dr. Carl Morris, Rand Corp., on Stein's Estimator: Its Generalization and Applications. Prof. R. V. Hogg, University of Iowa, will discuss Robust Statistical Procedures and Prof. N. D. Singpurwalla, George Washington University, has selected as his topic Accelerated Life Testing.

The conference is one of three annual meetings sponsored by the U.S. Army Mathematics Steering Committee (AMSC) to promote the exchange of mathematical and statistical expertise among Army scientists and engineers. The others are: Conference of Army Mathematicians, and the Army Numerical Analysis and Computers Conference.

Proceedings are published by the Mathematics Division, U.S. Army Research Office (ARO), Research Triangle Park, NC 27709. Information can be obtained by calling or writing to Dr. Jagdish Chandra.

Women in Army Science...

Awards Evidence Metallographer's Achievements

Professional achievements of women in Army research and development activities rarely result in rewards as numerous as those amassed by Theresa Brassard, director of the U.S. Army Watervliet (NY) Arsenal's Metallographic Laboratory.

Theresa Brassard

She was credited most recently for her direction of investigations of "White Layer" erosion phenomenon in gun tubes research (see feature article, page 9, *Army R&D Newsmagazine* Mar.-Apr. 1976 edition). Watervliet research scientist Dr. Michael Kamdar cited her efforts in identifying and characterizing this phenomenon and for metallographic analysis.

Competition in national and international metallographic exhibitions has earned her 42 awards as an author or coauthor of papers and exhibits, including the 1975 Metallurgical Engineering Assistant's Award from the Eastern New York Chapter of the American Society of Metals.

Director of Watervliet's Metallographic Laboratory, Mrs. Brassard is assigned responsibility for preparing, photographing, analyzing and evaluating materials structures in support of the research program. Employed at Watervliet since 1967, she was a runner-up for the Federal Woman's Award in 1975 and one of the Department of the Army nominees selected among the six nationwide finalists.

Mrs. Brassard's prize awards for R&D in photographic technology include 18 in international and national competition since 1972—five first prize exhibitions, two of which were deemed "best in their class," one second prize, one third place and "honorable mentions."

Recipient of a Quality Step Increase for Outstanding Performance, Mrs. Brassard has taken numerous technical courses from the American Society for Metals, including "elements of metallurgy," "modern ceramics," and "nuclear metallurgy," as well as several college courses.

Listed among her professional memberships are the International Metallographic Society, Society of American Military Engineers, American Society of Testing Metals and the American Society for Metals.

DoD Selects Randall as FWP Coordinator

Jeanne Ellen Randall, former chief, Personnel Operations Branch, National Park Service, U.S. Department of Interior, has been selected as U.S. Department of Defense Federal Women's Program Coordinator.

Federally employed for 17 years, Ms. Randall is assigned to the Office, Deputy Assistant Secretary of Defense (Civilian Personnel Policy), Assistant Secretary of Defense (Manpower and Reserve Affairs).

A former Baltimore (MD) policewoman, she has served also with the U.S. Department of Housing and Urban Development and as an appeals examiner with the U.S. Civil Service Commission.

Ms. Randall graduated from Morgan University in Baltimore, served as a delegate to the United Nations International Women's Year Conference in 1975, and is a recipient of the National Park Service's Equal Employment Opportunity Award.

Career Programs . . .

94 Selected for MARED Program Participation

Selection of 94 personnel for participation in the newly established Army Materiel Development and Readiness Command Materiel Acquisition and Readiness Executive Development (MARED) Program was announced in June.

Screened from among 525 nominees submitted by DARCOM commands, the selectees are representative of five career fields - Engineering and Scientist, Procurement, Quality Assurance, Supply Management, and Materiel Maintenance Management - program director Gordon N. Kellett stated. Program participants were chosen competitively by an Executive Development Board composed of management officials representing materiel acquisition and readiness-related fields.

Directed by DARCOM Commander GEN John R. Deane Jr., the MARED Program is designed to identify and provide development opportunities for civilian employes whose career records indicate high potential for executive responsibilities, and to provide appropriate training to maximize use of this potential.

Selectees will be briefed by top government and management experts at a 4-day seminar in September. Scheduled topics include technology growth; government ethics; life cycle of materiel; communication; and DoD, Army and DARCOM doctrinal concepts.

An Individual Development Plan (IDP) outlining short- and long-range training and duty assignments has been provided for each selectee. Adherence to the plan is mandatory for retention in the program

DARCOM installations/activities and the number of MARED Program selectees for each are as follows: HQ DARCOM (11); Army Armament Command (24); Army Aviation Systems Command (3); Army Electronics Command (11); Army Missile Command (2); Army Tank-Automotive Command (4); Army Test and Evaluation Command (5); Army Troop Support Command (5); Mobility Equipment R&D Command (7); Army Maintenance Management Center (2); and Army Management Engineering Training Agency (1); Army Logistics Management Center (5); Major Item Data Agency (2); Training Device Agency (2); Savannah (GA) Army Depot (1); Corpus Christi (TX) Army Depot (1); Tobyhanna (PA) Army Depot (2); Army Research Office, NC (1): DARCOM Installations and Support Agency (1); Army Procurement Activity (HI) (1); Rodman Laboratory (1); Logistic Assistance Office (Fort Monroe, VA) (1); and Project Manager, Mechanized Infantry Combat Vehicle (1).

DARCOM personnel in grades GS-13, GS-14 and GS-15 who did not apply or were not selected for the initial MARED Program may apply during the MARED entrance period which will be announced in December. It is estimated that about 9,000 DARCOM employes were eligible in the initial call for applicants.

8 Edgewood Employes Receive NCMA Certification

Certification as professional contract managers (CPCM) was granted recently to eight U.S. Army Edgewood (MD) Arsenal procurement personnel by the National Contract Management Association (NCMA).

Certified were James E. Shadwell, deputy director of Procurement; Charles D. Soloway, chief, Policy and Compliance Office; contract officers Radford A. Baker, Dale A. Zeigler and Melvin Silverman; and contract specialists Patricia S. Silsby, Diana J. Spear and Norman R. Wirts.

NCMA Certification Director James B. Scanlon commented that only a small percentage of the 15,000 DoD contract specialists have met the stringent education, training and work experience requirements for NCMA certification. Dedicated to changing the procurement function from a speciality to a profession, the NCMA is a private organization comprised of government and industry personnel fostering professionalism in negotiation and management of contracts.

AERB Reviews 1976 Army Schooling Requirements

Recommendations of the 1976 Army Educational Requirement Board (AERB) include a reduction from 5,556 to 4,976 in the number of officer positions requiring specific advanced degrees.

AERB suggestions also cite 382 positions to be filled by enlisted personnel holding baccalaureate degrees and 33 with associate degrees. This is believed the first formal review of enlisted civil schooling needs.

Additionally, the Department of the Army has requested Congress for FY 77 reinstatement of the enlisted undergraduate program termed Bootstrap. This action is still pending.

First CSC Employe Attends Comptrollership Course

Nancye F. Parker

When classes convened in June for the 1976-77 Department of the Army Comptrollership Program at Syracuse University, one of the students was the first U.S. Army Computer Systems Command employe ever selected for the course.

Nancye (correct) F. Parker, a senior management analyst and acting chief of USACSC's Resource Division, will earn a master's degree in business administration upon successful completion of the 14-month course, academically equivalent to four college semesters.

Federally employed for more than 13 years, including the last six with USACSC in the Comptroller Civilian Career Program, Ms. Parker has a BA degree and graduate course credits earned through off-duty study.

Merchant Named PMCC 'Distinguished Graduate'

George K. Merchant of the U.S. Army Air Mobility R&D Laboratory, Moffett Field, CA, has been named a "distinguished graduate" of the Professional Military Comptroller Course, Air University, Maxwell Air Force Base, Montgomery, AL.

George K. Merchant

Taught at the Air University's Institute for Professional Development, the PMCC has been termed the senior service course for the comptroller field It is designed to broaden capabilities of senior DoD financial managers.

Army Comptroller LTG J.A. Kjellstrom presented Merchant a letter of congratulations and Commander of the Army Materiel Development and Readiness Command GEN John R. Deane Jr. presented an official commendation.

Commendations were forwarded also by Commander of the Army Aviation Systems Command MG Eivind H. Johansen and AMRDL Director Dr. Richard M. Carlson.

2-Week Housing Management Course Established

Day-to-day management aspects of family, bachelor and guest housing will be reviewed in a new 2-week Housing Management Course to be offered six times a year at the U.S. Army Logistics Management Center.

Available to Department of the Army (GS-7 - GS-11) civilians and commissioned and noncommissioned officers, the course will emphasize functional management areas such as budgeting, provisioning, maintenance and improvements and administration.

The course is recommended and may soon be required for members of Army Civilian Career Program 27. Selection for attendance will be made at command level. Additional information may be obtained from: Commandant, U.S. Army Logistics Management Center, ATTN: DRXMC-LS, Fort Lee, VA 23801.

ALMC Expands T&E Management Course

Increasing importance of materiel testing in the acquisition process has prompted expansion in the length and curriculum of the Test and Evaluation Management Course, U.S. Army Logistics Management Center.

Planned for early development of junior and mid-management careerists, the course has been extended from 9 to 10 days. It includes practical exercises in probability statistics, hypothesis testing, and reliability-availability and maintainability (RAM).

Other additions include operational mode summaries and mission profiles; failure definition and scoring criteria; test integration working groups; evaluation planning and reporting; analysis of variance; and experimental design.

Offered by ALMC's School of Acquisition Management, the T&EM Course is scheduled Nov. 24-Dec. 10, 1976, Jan. 10-21, Mar. 28-Apr. 8, May 16-27 and Aug. 22-Sept. 2.

Additional information may be obtained from: U.S. Army Logistics Management Center, ATTN: DRXMC-ACM, Fort Lee, VA 23801.

People in Perspective . . .

Poisonous Snakes Bring Fame...

LTC Vick's Studies Lead to OTSG NATO Post

LTC James A. Vick

Pathways to fame were far from the mind of LTC James A. Vick, recognized as the U.S. Army's leading authority on snake venoms, toxins, the "Killer Bee," and related research, when he left his home in Crookston, MN, to join the 136th Infantry Division as a rifleman in Korea in 1951.

Commissioned in 1963, LTC Vick attended the University of North Dakota and the University of Minnesota medical schools, specializing in physiology and pharmacology. Earlier he completed the Army's surgical technical school and was assigned as chief aidman, Brooke Army Hospital, Fort Sam Houston, TX.

Featured as a speaker at the 1975 and 1976 U.S. Army sponsored National Junior Science and Humanities Symposiums, he was assigned recently as the NATO representative for medical operations in the Office of the Army Surgeon General.

"Whenever LTC Vick starts looking for another career after he retires from the Army," a friend said recently, "he's a natural as a pitch man for the world's most poisonous snakes in a circus or carnival." In the meantime he is increasingly in demand as an Army speaker at scientific gatherings.

Author or coauthor of more than 130 papers and five books on his research in shock, venoms and toxins, his work has provided techniques applicable to a variety of medical problems, including new approaches to treatment of septic shock, hemorrhage and nerve poisoning.

One of his experiments with bee venom, for example, has indicated that apimin, one of the three active components of the honey bee's venom, increases the beat and force of the heart pumping blood into the body.

One of the keys to his success as an after-dinner speaker at various public gatherings is his enthusiasm for his field of research and a fascinating collection of slides on the world's poisonous snakes.

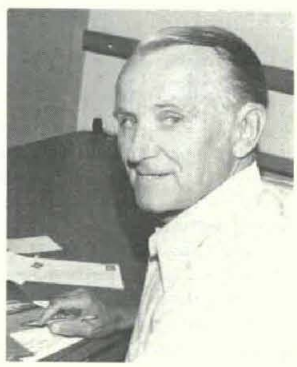
His work has taken him to many parts of the world on research assignments, including three tours of duty with the Navy Underseas R&D Command aboard ships in the South Pacific and the China seas, studying the numerous exceptionally deadly sea snakes.

LTC Vick's new NATO assignment came at the conclusion of his third tour of duty with Edgewood Arsenal, a part of Aberdeen Proving Ground, MD, an element of the U.S. Army Materiel Development and Readiness Command (DARCOM). He also has served with Walter Reed Army Hospital as chief of neurophysiology in the Biomedical Laboratory.

Logistician Bids for Renown . . .

Winner of Contests Claims Armywide Honor

Distinction comes in many forms to satisfy the ego of those seeking to prove they are better than anyone else in a special field and Frank Zebal, a logistics specialist with the Army Ballistic Missile Defense Systems Command, has entered his small bid for fame.



Frank Zebal

Zebal believes he is the U.S. Army champion with respect to the number of merchandise promotional contests he has entered during 18 years. Since he became "hooked on his hobby" in 1957, he has entered more than 500 contests and has won numerous prizes.

His wife, quite innocently, made him a "contest addict." All she really did was reject his suggestion to enter a contest by writing 25 words or less on the merits of using a soap product. Thus rebuffed, Frank did and won a collection of merchandise valued at more than $1,000 - laundry equipment including a washer, dryer, sink and hot water heater.

That first success "hooked" him and he has never tired of striving to win a "really big prize." His rewards include a console TV, numerous miniature and clock radios, golf equipment, deep sea fishing gear, season tickets to professional football games, small cash and other prizes.

Lots of changes have occurred in contests. "In the old days," he says, "you could use originality and make your entry something special. Not as many people entered contests and there was a better chance of winning."

Zebal has adjusted his tactics to match the times and now he usually submits from 25 to 50 entries in each contest. He reports that his biggest expense is for envelopes and postage, but he still enjoys it and there is always the hope of winning $100,000, a "dream home, a luxurious yacht, a new car, or something like that."

Reader's Guide . . .

DARCOM Publishing Metric Conversion Handbook

Engineering Design Handbook Metric Conversion Guide is the title of a new U.S. Army Materiel Development and Readiness Command publication scheduled for general distribution in August.

Identified as DARCOM-P 706-470, the document is designed to prepare DARCOM and other Department of the Army personnel for increased use of the International System of Units (metric system).

Unlike many previous metric system publications, this handbook features more than just listings of definitions and conversion factors. Its format permits reading and understanding of each chapter as a unit within itself.

Subjects include rules for and proper use of prefixes, formation of derived units, numerical value format, conversion units, methods for converting units, dimensional analysis, basic concepts in conversion of mechanical and electromagnetic quantities, measurements and estimates related to converted units, use of SI units in engineering drawings, and methods for toleranced dimensions conversion.

Department of the Army requests for the handbook should be submitted on DA Form 17, Jan. 70, to: Commander, Letterkenny Army Depot, ATTN: DRXLE-AJD, Chambersburg, PA 17201.

ARI Publishes Guidelines for Performance Tests

Guidelines for the development, use and interpretation of mastery-based performance tests are contained in a document published by the U.S. Army Research Institute for Behavioral and Social Sciences.

Titled *Guidebook for Developing Criterion-Referenced Tests,* it is part of a large CRT program conducted by ARI's Unit Training and Educational Technology Systems Technical Area.

A major goal is to develop procedures for applying CRT theory and to evaluate the adequacy of the CRT approach in a variety of training situations. A related effort is scoring procedures for tank gunnery training.

Mastery-based performance testing is motivated by the need to differentiate students who can successfully demonstrate required proficiency of a task from those who cannot. Progress in CRT applications has been impeded by lack of adequate guidelines.

Correspondence relative to distribution of this report may be addressed to: U.S. Army Research Institute for the Behavioral and Social Sciences, ATTN: PERI-P, 1300 Wilson Boulevard, Arlington, VA 22209.

EPA/CE Plan Wastewater Application Design Manual

Land application of municipal and industrial wastewater is the subject of a design manual planned for joint publication by the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers.

Designed for use by professional engineers and federal and state agencies involved with land treatment of wastewaters, the manual will be produced under a recently signed inter-agency agreement.

Under a $175,000 contract, a first-draft document will be produced within 15 months by Metcalf and Eddy of Palo Alto, CA, selected by EPA's Architects and Engineering Selection Board following public announcement of the project.

A joint working group will establish the scope of information for the manual, select consultants, provide contractor guidance, and review manual sections as they develop.

Production responsibilities are assigned to EPA's Offices of Water Programs Operations and Research and Development, and the Corps of Engineers' Urban Studies and Management Section, Civil Works Engineering Division.

Awards...

22 ISEF Winners Selected for Trips, Summer Jobs

Twenty-two winners of Department of the Army Superior and Meritorious Achievement Awards were selected from more than 400 finalists at the 27th International Science and Engineering Fair (ISEF).

Among the winners were one chosen for the annual "Operation Cherry Blossom" trip to the Japan Student Science Awards Exhibit in Tokyo next January and one as U.S. Army representative to the Nobel Prize Ceremony at Stockholm, Sweden, in December.

Sponsored by Science Service, a nonprofit institution whose objective is to stimulate interest in scientific research, the annual ISEF culminates competition among high school students in more than 200 affiliated local, state and regional fairs, including some in foreign lands, i.e., Canada, Japan, Puerto Rico and Sweden.

Exhibits of their research projects encompassed behavioral and social sciences, biochemistry, botany, chemistry, earth and space sciences, engineering, mathematics and computers, medicine and health, microbiology, physics and zoology.

Army winners were selected by a panel of judges comprised of 12 Army Reserve officers, and 14 representatives of Army in-house R&D labs.

MG Harry A. Griffith, director, Development and Engineering Directorate, U.S. Army Materiel Development and Readiness Command (DARCOM), presented awards to the Army's Meritorious and Superior Award winners. Each received a Certificate of Outstanding Achievement from the Secretary of the Army, and a U.S. Army silver or gold medallion. Superior Award winners also received an offer of a one-week all-expense-paid visit or summer employment in an in-house lab.

Operation Cherry Blossom was initiated in 1963 by the Army, Navy and Air Force, under sponsorship of the Japanese newspaper *Yomiuri Shimbun*. In 1972, the Air Force temporarily discontinued sponsorship of a student for the Japan trip, but joined with the Army and Navy in a new program in which each service selects a winner to attend Nobel Prize ceremonies in Stockholm.

This year, the Air Force again selected a student for the Japan trip. Army selectees for the trips to Tokyo and Stockholm also received checks for $100 from the Association of the U.S. Army.

Operation Cherry Blossom winners are: (Army) *Karen Sue Mikkelson*, 18, Will C. Crawford H.S., San Diego, CA, for her exhibit "Visually Evoked Response Detection of Ophthalmological and Neurological Dysfunctions"; (Navy) *Robert J. Partyka*, 18, Upper Arlington H.S., Columbus, OH, for "Linear Particle Accelerators in Biomedical Research"; (Air Force) *John H. Runnels*, 15, Episcopal H.S., Baton Route, LA, for "Combinatorial Problem: Paving With Integral Squares."

Cherry Blossom alternates are: (Army) *Sarah Elizabeth Dennis*, 15, John Marshall H.S., San Antonio, TX, for "Mordants"; (Navy) *Kreg A. Martin*, 17, Peterson H.S., Sunnyvale, CA, for "Computer for Cellular Simulations"; (Air Force) *Lori Ellen Rhodes*, 17, East Noble H.S., Kendallville, IN, for "Characterization of Antibiotics Isolated From Soil Microorganisms."

Nobel Prize Ceremonies. Army winner *Richard H. Ebright*, 16, Muhlenberg Township H.S., South Temple, PA, displayed "Endrocrinological Aspects of Lequidopterous PPM." The Navy selected *Diane Holland Wooden*, 17, T.S. Wooton H.S., Rockville, MD, for "Extinction in the Dark Nebula Lynds 1295."

The Air Force chose *David T. Leighton*, 17, Washington-Lee H.S., Arlington, VA, for "Development of a Radiocarbon Dating Process Suitable for Field Use."

Alternates for the Nobel Visit Award are: (Army) *Mikel S. Crook*, 18, Lander (WY) H.S., for "Using Solar Energy to Extract Fuel From Organic Materials." (Navy) *Lise Anne Desquenne*, 18, Burrillville H.S., Harrisville, RI, for "Discovering New Methods of Typing Blood Using Seed Extracts." (Air Force) *Michael D. Kanfer*, 17, South Shore H.S., Brooklyn, NY, for "Microsurgical Techniques for Transferring and Tracing RNA in the Neuroglis of Planarians."

Army Superior Award winners include *Mark Anthony Pecchinino*, 18, Proctor R. Hug H.S., Reno, NV, for "Wildfires and Trol-100 as Opposing Revegetation and Range Land Management"; *Michael A. Montgomery*, 17, Elizabethton (TN) H.S., for "Experimenting With High-Speed Data Transmission."

John W. Belliveau, 17, Woodside Priory School, Portola Valley, CA, for "Respiration-Induced Glutamate Transport in Halobacterium Halobium Envelope Vesicles"; *Timothy J. Piper*, 17, Marquette H.S., Michigan City IN, for "Anti-Viral, Anti-Cancer Activity of a Double Stranded Polynucleotide and Anti-Lymphocytic Sera by Intramolecular Bonding"; *Gregory W. Hammett*, 17, Baldwin H.S. Milledgeville, GA, for "Energy Levels and Transitions in the Nucleus of Promethium 149."

OPERATION CHERRY BLOSSOM Army winner (right) Karen Sue Mikkelson and alternate Sarah E. Dennis are congratulated by MG H.A. Griffith, DARCOM Director of Development and Engineering.

Army Meritorious Award winners are *Elizabeth Ann Hamblin*, 17, Athens (WV) H.S., for "Physical and Social Factors Influencing Nonconformity"; *Brenda I. Troche*, 16, Immaculate Conception Academy, Mayaguez, PR, for "Histological, Histochemical and Chromatographic Study of the Eyes of Insects";

Maggie Pearl Murray, 17, Melbourne (FL) H.S., for "Pollen Physiology: Tube Growth, Protein and RNA Synthesis"; *Christopher M. Lohse*, 17, Cocoa (FL) H.S., for "Steroidal Bioengineering: The ene Reaction of PhTD and Selected Monoterpenes"; *Dale F. Waldo*, 18, Lindbergh H.S., St. Louis, MO, "Survival of Man-Made Polymers in Earth Environment";

Peter A. Sandborn, 16, Fort Collins (CO) H.S., for "Torque of Rubber"; *Linda Jeanne Colby*, 17, Colonial Beach (VA) H.S., for "Les Spectacles du Triangle de Pascal"; *Robert A. Donato*, 17, Plymouth-Whitemarsh H.S., Plymouth Meeting, PA, for "Fetal Antigen and Antibody: Roles in Cancer Prophylaxis and Immunotherapy of Hepatoma and Virus-Induced Luekemia";

Mario Emmanuelli-Jove, 16, Colegio San Antonio Abad, Humacao, PR, for "Identification of Aquatic Bacteria and Their Effects on Living Organisms"; *Linda Ann McDonald*, 17, Mounds View H.S., St. Paul, MN, for "Effect of *Diplostomulum scheuringi* on the Coefficient of Condition of Lepomis macrochirus"; and *Michael Dinnerstein*, Stuyvesant H.S., New York, NY, for "Computer Simulation of Galactic Evolution."

U.S. Army participation in supporting ISEF is arranged by the U.S. Army Research Office (ARO), Research Triangle Park, NC, commanded by COL Lothrop Mittenthal. Anne G. Taylor was ARO action officer.

Dr. Gordon L. Bushey, U.S. Army Materiel Development and Readiness Command (DARCOM), was chairman of the Army judges panel. LTC Aubrey F. Messing, Office of the Deputy Chief of Staff for Research, Development, and Acquisition, was Reserve officers' coordinator.

Honored as First Physician Member . . .

Army Aviation Hall of Fame Inducts MG Neel

Commander of the U.S. Army Health Services Command MG Spurgeon Neel is the first physician and nonaviator inducted into the U.S. Army Aviation Association's Hall of Fame at Fort Rucker, AL.

MG Spurgeon H. Neel Jr.

Considered a pioneer in high-precision, high-speed medical evacuation techniques to save lives of badly wounded or severely injured persons, MG Neel received the honor in June. He was cited for "efforts leading to development of the Dustoff evacuation program in Vietnam and the Military Assistance to Safety and Traffic (MAST)," a civilian spinoff Army-Air Force program first tested in 1970.

Each of the programs was credited with saving many lives by expeditious helicopter evacuation to hospitals. MG Neel conceived the idea of using helicopters as air ambulances during the late 1940s and in 1949 was selected to chair a special board to test and evaluate the concept.

Korean war provided the first real test of the plan.

Three of four helicopter ambulance detachments became operational, leading to an inventory of 15 bubbledomed H-13s. Although only one or two patients could be transported per sortie, 24,121 were evacuated.

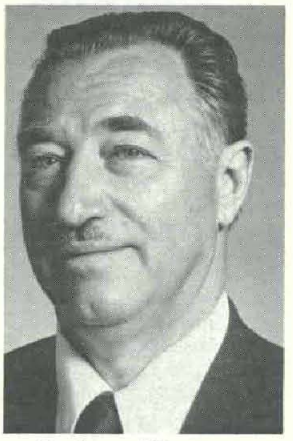
MG Neel established policies and procedures for the operating detachments and later became the Army's first aviation medical officer. His achievements included:

- Service as a key member of the Army board that conducted a design competition to select an improved helicopter for ambulance missions.
- Established flying status for aviation medical officers and became the Army's first medical officer to receive official flying status as well as the first chief of the Aviation Branch he set up in the OTSG.
- Designed and became the first recipient of the Aviation Medical Officer Badge, and established the Army's program for formal training of board certification of physicians in the new field of aerospace medicine.

MG Neel was honored as the Army's first board-certified physician in aviation medicine in 1960 and later worked closely with the air ambulance system in Vietnam. He served as chief surgeon of the Military Assistance Command and commanded the 44th Medical Brigade.

Dr. Wierbicki Wins 1976 AMSA Research Award

Contributions to progress in irradiation preservation of food for the U.S. Armed Forces at the U.S. Army Natick Research and Development Command have made Dr. Eugen Wierbicki the recipient of the American Meat Sciences Association 1976 Distinguished Research Award.



Dr. Eugen Wierbicki

Presented at AMSA's 23d annual awards banquet June 23, in conjunction with the AMSA Reciprocal Meat Conference at Brigham Young University, UT, the award recognizes Dr. Wierbicki for "creative ability and adherence to sound scientific philosophy and scholarly principles." He heads Natick's Irradiation Food Products Group.

Special emphasis is placed on radiation sterilization of meats, poultry and seafoods to permit prolonged storage without refrigeration.

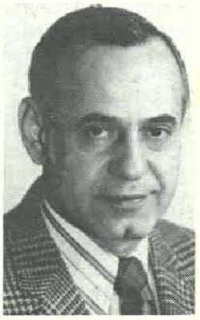
Born in Byelorussia (White Russia), Dr. Wierbicki has a "Diplom Engineer" (MS degree) in agriculture and agronomy from Technical University, Munich, Germany, a PhD in agricultural chemistry and soil mechanics from the University of Munich and a PhD in agricultural biochemistry from Ohio State University.

He served in 1960 as a member of the U.S. Food Processing Delegation to the USSR and in 1964 as a Department of State official and technical escort for a Soviet Food Processing Delegation to the United States.

Dr. Wierbicki has authored numerous professional journal articles and technical reports. He is a member of the American Chemical Society, Institute of Food Technologists, American Association for the Advancement of Science AMSA and New York Academy of Sciences.

Dr. Rahman Receives R&D Associates Isker Award

A U.S. Army scientist appointed recently to the President's World Food and Nutrition Study Group of the National Academy of Sciences is the 1976 winner of the COL Rohland A. Isker Award of the R&D Associates for Military Food and Packaging Systems, Inc.



Dr. Abdul Rahman

Dr. Abdul Rahman, chief of the U.S. Army Natick (MA) R&D Command's Plant Products Research Group, was selected for achievements in developing dehydrated, compressed vegetables and fruits that range from a 4-fold space saving for freeze-dried peas to 16-fold reduction for freeze-dried green beans.

Rahman is also involved in advanced R&D projects on new or improved fresh or frozen plant products. Considered promising is a glycerin treatment process to preserve the "crunch" of salad vegetables during extended storage.

A graduate of Cairo (Egypt) University, Rahman received a Utah State University master's degree in horticulture in 1954 and PhD in food techology from Oregon State U. in 1956. Employed at Natick since 1964, he is a recipient of a Department of Army R&D Achievement Award, has authored more than 50 technical papers and holds 12 patents.

Personnel Actions . .

Morris Takes Over as Army Chief of Engineers

MG John W. Morris became chief of the U.S. Army Corps of Engineers July 1, coincident with promotion to lieutenant general, following the retirement of LTG William C. Gribble Jr. June 30.

MG John W. Morris

Graduated from the U.S. Military Academy in 1943, LTG Morris has a master's degree in civil engineering from the University of Iowa and has completed the Command and General Staff College and the Army War College.

Formerly assigned as deputy chief of engineers, he has served more than 33 years of active military service, including assignments as director of Civil Works, Office, Chief of Engineers, and Missouri River Division engineer.

Other duty tours have included: deputy chief of Legislative Liaison for the Secretary of the Army; deputy commandant, U.S. Military Academy; resident engineer, Goose Bay Air Base, Labrador; and district engineer, Tulsa, OK.

LTG Morris is a recipient of the Distinguished Service Medal, Legion of Merit with three Oak Leaf Clusters (OLC), Bronze Star Medal, Army Commendation Medal with two OLC and the Air Medal.

Cannon Succeeds Hilt as Waterways Director

COL John L. Cannon is the new director of the U.S. Army Engineer Waterways Experiment Station (WES), Vicksburg, MS, following reassignment of COL G.H. Hilt as director, Facilities Management Division, U.S. Army Element, Office, Secretary of Defense.

COL John L. Cannon

COL Cannon has served since 1974 as deputy division engineer of the Corps of Engineers' Lower Mississippi Valley Division and as secretary of the Mississippi River Commission. Prior to this duty he was chief, Management and Test Division, Office, Army Chief of Research and Development, now the Deputy Chief of Staff for Research, Development and Acquisition, HQ DA.

He has commanded engineer companies in the 840th Engineer Aviation Battalion in Korea and the 325th Engineer Aviation Group. During 1968-69 he was battalion commander, 17th Engineer Battalion, 2d Armored Division.

He also has served as executive to the Director of Military Construction, Office, Chief of Engineers; engineer adviser to the 2d Field Army of the Republic of China; and assistant professor, Department of Mathematics, U.S. Military Academy.

COL Cannon has a BS degree from the USMA and an MS degree in civil engineering from the California Institute of Technology at Pasadena. He is a graduate of residence courses at the Army Command and General Staff College and Army War College.

Chase Appointed to Reserve Forces Policy Board

Appointment of MG Harold Chase, U.S. Marine Corps Reserve, to a 3-year term as a member of the Reserve Forces Policy Board, succeeding MG John R. Blandford (USMCR), has been announced by Secretary of Defense Donald Rumsfeld.

A political science professor and acting vice president for Academic Affairs at the University of Minnesota, MG Chase is a 1943 graduate of Princeton University where he also earned a PhD in 1954.

He received his Marine Corps commission in 1943 following eight months of enlisted service and was twice wounded during combat service with the 5th Marine Division at Iwo Jima, Volcano Islands. His present assignment is assistant director of the USMCR.

The Reserve Forces Policy Board serves as the principal policy adviser to the Secretary of Defense on matters related to Reserve components.

Most of its 21 members are general or flag rank Reserve officers.

Delbridge Assigned as European Division Engineer

BG Norman G. Delbridge, division engineer, U.S. Army Engineer Division, Europe, assumed this title following the recent reassignment of BG Louis W. Prentiss Jr. to HQ U.S. Army Europe and the Seventh Army.

BG Delbridge graduated from the U.S. Military Academy in 1953. He has an MS degree in civil engineering from Iowa State College and has completed residence courses at the Army Infantry School, Engineer School, Command and General Staff College, and Army War College.

Assigned until recently as commander, Division Support Command, 3d Armored Division, Germany, he has served as Pittsburgh (PA) District engineer and staff officer, Office, Chief of Research and Development, Department of the Army.

BG Delbridge is a registered professional engineer in Iowa. His honors include the Legion of Merit with Oak Leaf Cluster (OLC), Bronze Star Medal with OLC, Meritorious Service Medal, Army Commendation Medal with three OLC and Air Medal with two OLC.

Chandler Named New England Division Engineer

COL John P. Chandler, deputy commandant for Combat and Training Development, Army Engineer School, Fort Belvoir, VA, has been selected to succeed COL John H. Mason in August as New England Division engineer, Army Corps of Engineers.

Graduated from the U.S. Military Academy in 1949 after entering the Army as an enlisted man, COL Chandler has master's degrees in civil engineering from Harvard University, in mathematics from Rensselaer Polytechnic Institute and in business administration from George Washington University.

A registered professional engineer in New York, he is also a graduate of the Army Command and General Staff College, Armed Forces Staff College, and the Industrial College of the Armed Forces.

His assignments have included commander, 138th Engineer Group, Fort Riley, KS; staff officer, Office, Assistant Vice Chief of Staff, Department of the Army; and senior engineer adviser and chief, U.S. Army Mission, Bolivia, South America.

COL Chandler is a recipient of the Legion of Merit with two Oak Leaf Clusters (OLC), Meritorious Service Medal, Joint Service Commendation Medal and Army Commendation Medal with one OLC.

Allaire Selected as Walla Walla District Engineer

COL Christopher J. Allaire is the new Walla Walla (WA) District engineer, Army Corps of Engineers, following reassignment of COL Nelson P. Conover as commander, 4th Advanced Individual Training Brigade, Fort Leonard Wood, MO.

COL Allaire graduated from the U.S. Military Academy in 1956, has an MS degree in civil engineering from Texas A&M, and has completed the Army Command and General Staff College course. He served until recently as chief of Construction, Office of the Engineer, Army Forces Command.

Other assignments have included 11th Airborne and 24th Infantry Divisions, Europe; 101st Airborne Division, Vietnam; assistant area engineer, Omaha (NB) Engineer District; and commander, 82d Engineer Battalion, Germany.

COL Allaire is a recipient of the Legion of Merit, Bronze Star Medal with Oak Leaf Cluster (OLC), Meritorious Service Medal, Air Medal with three OLC and the Army Commendation Medal with OLC.

Ray Succeeds Glenn as Omaha District Engineer

COL James W. Ray, a graduate of the U.S. Military Academy, West Point, NY, has been named to succeed COL Russell A. Glenn as Omaha (NB) District engineer, U.S. Army Corps of Engineers.

COL Ray is now serving as deputy chief, Programing Division, Office of the Assistant Chief of Engineers, Washington, D.C. His new assignment includes responsibility for the water resource program in the upper Missouri River Basin, including six large multi-purpose dams on the river and embracing a 400,000 square mile area in Montana and parts of Wyoming, Colorado, North and South Dakota, Iowa, Nebraska and Minnesota.

Listed among his previous tours of duty are commander, 35th Engineer Battalion, Vietnam; Civil Works Directorate, Office, Chief of Engineers; and U.S. Army European Command, Germany.

A graduate of the U.S. Marine Corps Command and General Staff College, COL Ray holds a master's degree in civil engineering from Ohio State University and is a registered professional engineer in Ohio.

Army R&D — 15 Years Ago

The Army R&D Newsmagazine reported on...

First R&D Achievement Award Winners Announced

Twenty-two Army R&D Achievement Awards, involving 27 of the more than 8,000 scientists and engineers employed in Army in-house laboratories' activities, were announced as this annual program was inaugurated under Chief of Research and Development sponsorship.

Basic to the selection of winners was the criteria stipulation that "an achievement will be regarded as significant when it establishes a scientific basis for subsequent technical improvement of military importance, and/or (2) materially improves the Army's technical capability, and/or (3) contributes materially to national welfare." Winners are:

Billy M. Horton, Dr. R.E. Bowles and *Raymond W. Warren*, cited as a team for developing fluidics controls technology, Diamond Ordnance Fuze Laboratory, Washington, DC; *Pierce W. Siglin, Amory H. Waite, Jr., Dr. Walter S. McAfee*, U.S. Army Signal R&D Laboratories, Fort Monmouth, NJ; *John C. White*, HQ XVIII Airborne Corps, Continental Army Command, Fort Bragg, NC;

Dr. David McK. Rioch, Dr. Stanley M. Levenson, Walter Reed Army Institute of Research, Washington, DC; *Dr. Robert J. Eichelberger, Warren W. Berning*, Ordnance Ballistic Research Laboratories, Aberdeen Proving Ground, MD; *Paul Rodriguez, Dr. Georg A. Hass*, U.S. Army Engineer R&D Laboratories, Fort Belvoir, VA;

Frank J. Rizzo, Quartermaster Research and Engineering Center, Natick, MA; *Dr. John S. Clements*, Chemical R&D Laboratories, Army Chemical Center, MD; *Albert P. Levitt*, Watertown (MA) Arsenal Laboratories; *Dr. Arthur C. Damask*, Frankford Arsenal, Philadelphia;

Niles C. White and *H.S. Williams* (team); *L.N. McClusky, W.B. McKnight* and *G. H. Widenhofer* (team), Army Rocket and Guided Missile Agency, Redstone Arsenal, AL; *Jess B. Huff, John L. McDaniel*, Army Ballistic Missile Agency, Redstone Arsenal, AL; *George K. Roberts and William A. McCool*, White Sands Missile Range, NM; and *James G. Drake*, Picatinny Arsenal, Dover, NJ.

CRD Terms Management of 'Supreme Concern'

"Management is a subject of supreme concern in military R&D," Chief of Research and Development LTG Arthur G. Trudeau stated when he spoke to a Personnel Management for Executive Conference. He has reemphasized this theme in several recent keynote speeches.

"So fast is current scientific progress - today's wonder is tomorrow's relic - that the success we obtain in Army R&D depends as never before upon how well hour many diverse efforts are planned and controlled . . . .

"The battleline is shifting more and more to the Army Science-Industry team and what it is able to develop. I can assure you," he said, "that we, on that team, have but one sense of mission - the realization that national security depends as never before upon the imagination and boldness with which we acquire and utilize new scientific discoveries and industrial techniques for our national defense. . . ."

"The problem confronting the military R&D manager in this area is the establishment of an equitable balance between in-house and contract work. Although in-house capability pays high dividends in the form of creating and maintaining the Army's technical and administrative competence in the design, evaluation and direction of projects, we appreciate the necessity for maintaining a balance between our own competence and cost and the competence and cost in private industry.

"Within the Army, I am convinced that little or no expansion should be authorized (although coordination must be further improved) in our in-house R&D facilities and activities, and that we must make maximum use of the competence and experience of qualified industries and ...."

Army Presents New Materials Program to MAB

Geared to many urgent requirements of the Army, objectives of a programed substantial expansion of R&D activities in the field of materials were outlined to the Materials Advisory Board (MAB), National Academy of Sciences-National Research Council.

Chief of R&D LTG Arthur G. Trudeau said he expects "each Technical Service to recognize a fundamental relationship between materials R&D objectives and military operational requirements."

Among a "variety of approaches" to be taken by the Army in the materials field are to find lightweight materials of high strength, and to cut weight in weapons and equipment; to improve process metallurgy and to find new ways of shaping metals; to further study of solid-state physics; and to find cheap substitutes for potentially critical metals.

Near Real-Time Generation of 3-D Terrain Displays and Profiles

By Lawrence P. Murphy and Edward G. Trelinskie
U.S. Army Engineer Topographic Laboratories

When information and displays relating terrain conditions to line-of-sight problems or nap-of-the-earth flight plans are needed by the Army in the field, they are usually wanted in a hurry.

The U.S. Army Engineer Topographic Laboratories have devised, as a by-product of terrain data extraction research using aerial photographs as input, hardware and techniques for generating oblique perspective views and terrain profiles at TV processing rates.

Although analog in nature, the technique relies on computer processing to reformat digital elevation data on magnetic tape into a gray-level-encoded film. Digital Topographic (elevation) Data (DTD) on magnetic tape are available from the Defense Mapping Agency and from new automated map compilation systems.

Using the technique devised at ETL, the XY-array formatted elevation data are assigned (quantized) to gray-level values of 0 to 63 and rewritten on a second magnetic tape used as input to a digitally controlled printer (e.g., DICOMED) for writing the gray-level-encoded information on film.

Figure 1 shows a map graphic of the selected ETL test area (Cache, OK) and the computer-generated elevation encoded film for the same area.

An ETL brassboard analog (TV) processing system of off-the-shelf components was used to process and display the gray-level film. It consisted of a TV camera, a light table, analog processing circuits, a standard TV display, and a special XYZ TV display. The video cursor circuits in a commercial video hardcopy printer were used to extract terrain profiles.

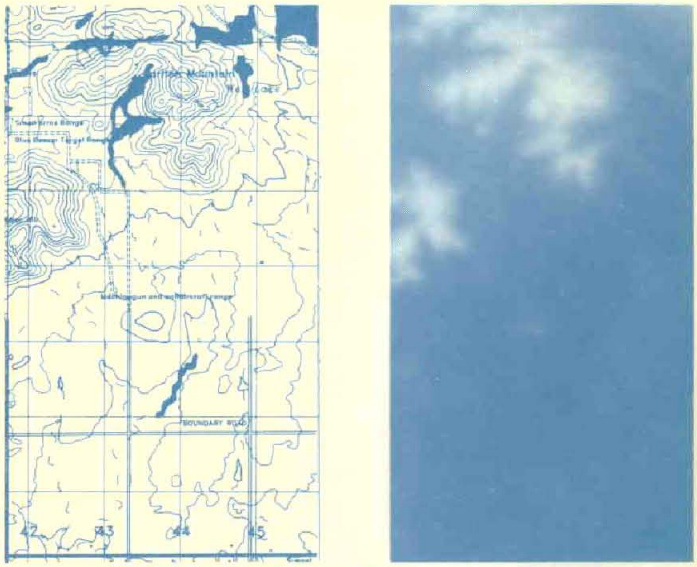


Fig. 1. Map Graphic and Gray-Level-Encoded Film

Terrain perspective views displayed on the XYZ TV display treats each video scan line like a densitometer trace. The entire image area appears as a closely stacked series of densitometer traces. The vertical deflection of the XYZ display can be changed quickly so that the resulting perspective views appear to be viewed from high to low observation points in space. It is possible to generate perspective views from any angle by rotating film at the light table.

Numerous perspective views were generated from the gray-level-encoded test film. Figure 2 shows a Polaroid recording from one of these perspective displays. The vertical exaggeration in this perspective view could have been increased or decreased simply by adjusting the signal gain (amplitude) control.

Figure 2 also shows the location of the profile cursor (selector) line. Along this vertical line, the signal is electronically sampled and a terrain profile plot is generated and displayed at TV rates on a standard TV monitor. The profile cursor can be placed quickly anywhere in the scene by adjustment of a single control knob.

The output of the video profiler and the manually plotted profile for the same terrain cross section is shown in Figure 3. A slight difference exists in vertical exaggeration between the two profiles. A means of plotting profiles of a specific exaggeration could be designed into a fully engineered model of the system.

Although a rather coarse brassboard system has been used, the resulting terrain profile is quite similar to the manually plotted profile. The electronic profile was obtained in $\frac{1}{30}$th of a second as compared to about one hour to plot the handdrawn profile.

The electronic profile could have been extracted anywhere in the scene in near real-time by manually or electronically rotating and translating the input film.

Other processes have been demonstrated at ETL, including extraction of equal-elevation layer tints and the generation of stereo oblique perspective image pairs. Using the extracted elevation layer tints, a manual analysis technique was devised for making quick assessments of the suitability of sites for deployment of line-of-sight devices.

Other gray-level transformations from elevation or other array formatted data on film could be of use at the field Army level. For example, the digital elevation data tape could be computer processed into a slope value array, gray-level-encoded and printed on film. Using signal thresholding circuits, the film could be processed at analog rates to allow the display of slope maps or to find quickly all areas in the image scene where the slope exceeds climbing capability of a specific military vehicle.

Similarly, this process may be of value in early route selection for balancing cuts and fills and for grade selection.

The basic premise for performing the analog graphic processing described in this article is that a cost-effective method can be made available for converting array formatted digital data (elevation or other data) into gray-level-encoded films, a file of which would be compiled at baseplant level with a large digital system.

The film file would be transferred to a field level unit for interactive analog graphic processing and display. A small terrain analyst console would be used in the field for performing the required analog graphic processing. Depending on processing and output requirements, this console may or may not contain a small (micro or mini) computer.

This conceptualized system could be suitable for use in the preparation of reports, studies, special graphics, and displays by current Army topographic units or for incorporation into systems proposed for development (e.g., Topographic Support System). The technology exists and a final production model would represent only minor development effort.

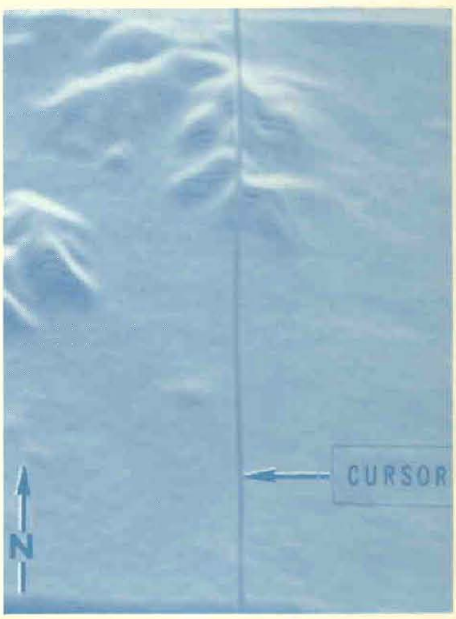


Fig. 2. Perspective Display
Profile Cursor Line Location

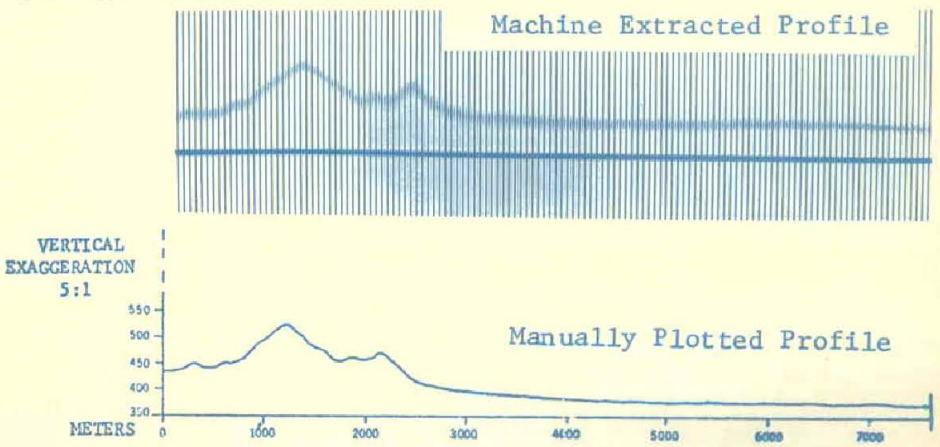


Fig. 3. Machine-Extracted Profile Versus Manually Plotted Profile

27th Power Sources Symposium Draws Over 600 Participants

More than 600 registrants in the 27th Power Sources Symposium at Atlantic City, NJ, June 21-24, heard reports on progress and problem areas in development of electrochemical power sources.

Sessions during the 4-day meeting were devoted to each of six major categories of developmental effort involving U.S. Government agencies, industries, not-for-profit research and academic organizations.

Sponsored by the U.S. Army Electronics Command - with the U.S. Air Force, Navy, National Aeronautics and Space Administration, U.S. Energy Research and Development Administration, and Communications Satellite Laboratories, as cosponsors - the meeting was chaired by David Linden, chief of ECOM's Power Sources Technical Area, Technology and Devices Laboratory.

Since 1947 the symposium has provided an opportunity for U.S. Army and other sponsoring agencies to meet with their counterparts in industry and universities to discuss with their counterparts in industry and universities results of R&D activities in the battery and fuel cell field.

Technical reports on government sponsored work (internally and under contract) and industry/university programs are presented and considered in terms of U.S. Army and other government agencies' requirements. Representatives of all major organizations in the U.S. and in friendly foreign countries engaged in R&D in this area are invited to participate.

Dr. Eugene G. Fubini

Former Deputy Director of Defense Research and Engineering Dr. Eugene G. Fubini, now director of Gould, Inc., was the guest speaker at an evening session on the opening day. Dr. Fubini served in the Office of the DDR&E from 1961 to 1965, the last two years as deputy. He is known as an expert in development of microwave components, magnetic detectors, electronic test equipment, boundary value problems, anti-jamming devices, direction finders, ferret reconnaissance systems, and countermeasure gear.

Dr. Fubini's address was a challenge to develop greatly advanced efficiency in energy-producing systems in view of the world's mounting energy problems. He referred to an article in the August 1975 edition of *Physics Today*, titled "Efficient Use of Energy," as a source of much of his thinking on this topic, particularly in the field of thermodynamics.

Citing numerous examples of nature's energy conversion processes as much more efficient than any that Man has been able to devise, he said: "But the basic fact remains; we have not made enough basic progress in the study of the interactions of molecules and ions with the other molecules that make our environment. Even after 80 years of study, fuel cells have not achieved practicality; they are far from theoretical efficiency."

LITHIUM BATTERIES. Chaired jointly by Dr. Judith Ambrus and Donald Warburton, U.S. Naval Surface Weapons Center, White Oak, MD, this session consisted of key papers on the developmental status of the new high-energy lithium batteries.

Capable of delivering two to four times the energy of conventional batteries of like size and weight, lithium cells perform in temperatures as low as 65 below zero Centigrade.

The lithium-electrolyte SO_2 battery was described as the high-rate system most advanced for use in military communications, surveillance, and weapons systems, and in similar communication applications.

Dr. Harry Taylor of P.R. Mallory and Co., Inc., discussed the new lithium cell structures which can safely withstand electrical, mechanical and environmental abuse. Extensive deployment of the lithium battery has been dependent on the demonstration of safe operation.

Several technical papers were presented on progress in developing a more energetic lithium battery, the lithium-thionyl chloride system. Dr. A.N. Dey of P.R. Mallory and Co. reported this system can deliver 50 percent more capacity than the SO_2 battery. Effort currently is concentrated on developing designs to prevent thermal runaway and assure reliable safe operation.

Dr. D.L. Chua, Honeywell Power Sources Center, discussed the investigation directed toward eliminating passivation of the lithium anode which causes voltage delays, particularly if the battery is subjected to long-term temperature storage. J.F. McCartney, Department of the Navy, reported on tests the Navy is conducting to evaluate the thionyl chloride battery for Navy needs.

PRIMARY BATTERIES. Several significant advances were reported in the growing field of high-energy density, long life and high reliability for microamp applications of this type of battery. Nathan Kaplan, chairman of the Manufacturing Technology Branch, U.S. Army Harry Diamond Laboratories, chaired this session.

Dr. H. Catoldi, General Electric Co., described new package design and structural changes of primary batteries. Dr. F.E. Kraus, Catalyst Research Corp., reported on life test studies of the solid electrolyte lithium-iodine cell.

Described as "opening the door" to further exploitation of the solid electrolyte lithium battery systems for expanding applications was a presentation by Dr. C.C. Liang of P.R. Mallory and Co., Inc. He reported on a new series of metal salt depolarizers for these systems.

Investigation into thermal batteries has branched into several new directions, according to papers presented on this type. B.W. Mulligan, Harry Diamond Laboratories, told of the use of low-temperature fused electrolytes in conjunction with fusable heat sinks. This development is viewed as clearing the way for designs capable of withstanding high-spin forces - a capability needed for ammunition fuzing.

An entirely new area of application for the thermal battery, that of emergency starting power for vehicles, may be served by a 20.4 kg, 12-volt, 500-amp cell described by F. Smith, Eagle-Picher Industries.

Tackling a problem faced by military field units, that of accumulation of hydrogen released from some batteries into the cases of electronic equipment, Dr. S. Gilman, HQ ECOM, reported on use of catalysts within the battery compartment to oxidize the hydrogen as it is released.

Another continuining military problem, that of low-temperature operation of battery packs, was discussed by Dr. T.A. Oftedal, Defence Research Establishment, Ottawa, Canada. He described the charcoal-fueled battery heater developed by the Norweigian Defense Establishment that

(Continued on page 25)

LITHIUM BATTERIES Session speakers (total of 18) included (front row, l. to r.) A.N. Dey, P.R. Mallory & Co., Inc.; J.R. Driscoll, EIC Corp.; D.L. Chua and C.R. Walk, Honeywell Power Sources Center. Back row, l. to r., J.F. McCartney, Naval Underseas Center; A. Lombard, GTE Laboratories; Dr. Judith Ambrose, chairman, Naval Weapons Surface Weapons Center, White Oak, MD; W.K. Bell, HQ Electronics Command; S.C. Levi, Sandia (NM) Laboratories; M. Eisenberg, Electrochemica Labs.

MOLTEN/SOLID ELECTROLYTE and Electric Vehicle Batteries Session speakers included (front row, l. to r.) A.R. Landgrebe, Energy Research and Development Administration (ERDA), Washington, DC; Dr. Paul Nelson, Argonne National Laboratories (ANL); Doris Yanetta (not a speaker, assistant to Conference Chairman David Linden at her right); L.J. Rogers, session chairman, ERDA. Back row, l. to r., J.C. Hall, Atomic International; J.S. Thompson, ESB Inc.; L.E. Miller, Eagle-Picher Industries Inc.; A.A. Chileskas, ANL; H.J. Schwartz, NASA Lewis Research Center; S.A. Wiener, Ford Motor Co.

The Power Sources Symposium, *one of the largest meetings of its kind in the world, and David Linden have been sort of "keeping company" continuously since 1947. That was his first year as cochairman of arrangements and he has been chairman since 1970, working out the multitudinous details with the joint sponsors.*

Sponsored primarily by the U.S. Army Electronics Command, the symposium is cosponsored by the Air Force, Navy, U.S. Army Mobility Equipment Research and Development Command, the Army Harry Diamond Laboratories, National Aeronautics and Space Administration, U.S. Energy Research and Development Administration, and the Communications Satellite Laboratories.

Linden has a bachelor of science degree from City University of New York, an MS degree from Polytechnic Institute of Brooklyn, and also attended Rutgers University. He is a Fellow of the American Institute of Chemists, and a member of the American Chemical Society, and Electrochemical Society.

In addition to serving as U.S. representative to the NATO Group of Experts on Electrical Power Sources, and as chairman of the Electrochemical Working Group of the Interagency Power Group, Linden has worked on the power sources committee of the Institute of Electrical and Electronics Engineers, and the American Institute of Astronautics and Aeronautics.

Author of the battery and fuel cell chapters for the Handbook for Electrical Engineers, and the Handbook for Electronic Engineers, Linden has written articles on batteries and power sources for professional journals, as well as for the **Army Research and Developmental Newsmagazine.**