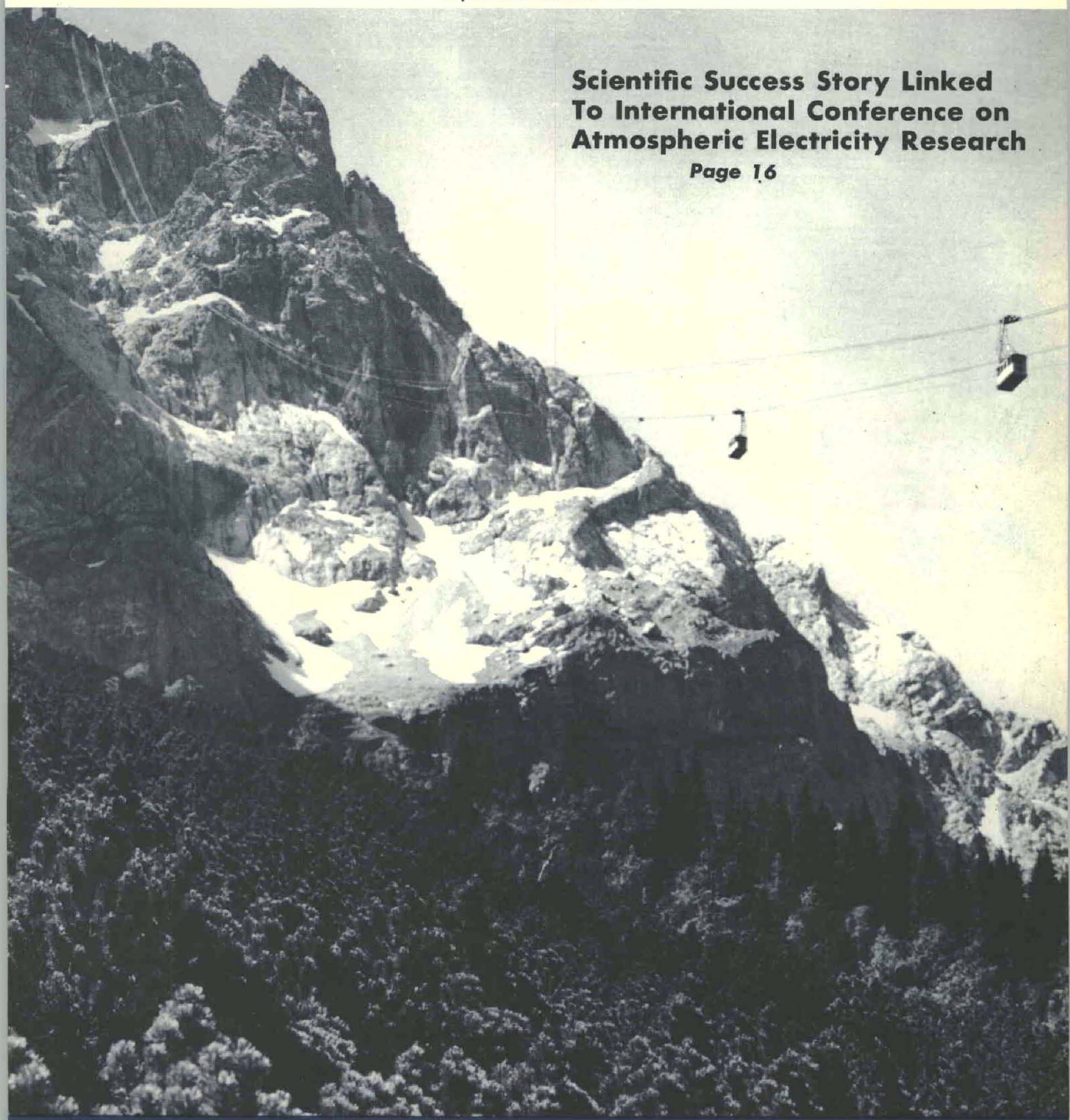
ARMY
RESEARCH AND DEVELOPMENT

September–October 1974



Scientific Success Story Linked To International Conference on Atmospheric Electricity Research

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SPEAKING ON . . .

Management Principles for Defense Research and Development

Director of Defense Research and Engineering Dr. Malcolm R. Currie, in a letter of transmittal for a document titled "Statement of Principles for Department of Defense Research and Development"—believed without precedent as a joint service declaration of R&D management philosophy—explains its purpose. The letter states, in part:

"Defense Research and Development is fundamentally important to all Americans. It does represent a large sum of money, some $9 billion annually, but it also is a key to our future security in the highly technical and competitive world we face.

"It is desirable, therefore, that the broad public, and particularly national leaders, have a deeper understanding of our efforts to bring a business-like approach to our Defense Research and Development.

"To help with this understanding, I am sending interested persons a copy of a set of general principles that are being followed in the evolution of a more effective Defense Research and Development establishment.

"The first purpose of the Principles is to help Department of Defense and industry people work more closely together, using a common base of reference. I believe that the Statement can also help persons outside the Defense Research and Development community understand, in particular, that our objective is to insure a full return from the national investment in Defense Research and Development. . . ."

The full Statement of Principles follows.

Dr. Malcolm R. Currie
DDR&E

ROI CONSCIOUSNESS. We must develop and use a deeper and more explicit consciousness of Return on Investment in management of Defense Research and Development.

This return lies in demonstrated deployable capabilities that can be acquired and owned at minimum and affordable cost, and which can be sufficient in performance and numbers to accomplish necessary military and deterrence missions.

TECHNOLOGY BASE. Our greatest long-range asset is our Technology Base. It must be nurtured and managed so that it:

- Gives us great leverage in terms of Return on Investment;
- Constitutes a fully integrated Department of Defense tri-Service activity;
- Searches out substantial increases in military capability and consciously uses technology to reduce costs.

PROGRAM PLANNING. The success of a program is often established or destroyed in its initial stage—by its concept, its request for proposal, the program plan and its funding. We must give this part of the process more explicit attention.

VIABLE OPTIONS. It is essential to create viable options which will allow timely low risk development of new systems when the need arises. This can be accomplished by:

- Forcing, as appropriate, the development and consideration of alternative paths to the same goal;
- Developing and testing "brass board" or experimental configurations, prototypes, advanced development models and advanced components in response to anticipated need but well in advance of the establishment of firm operational requirements.

COMPETITION. Controlled competition wherever possible—between technical approaches and developers—is a powerful management tool for maximizing Return on Investment.

SELECTIVITY. We must be vigorously selective among competing solutions. In selecting programs, we must insure that:

- Technical feasibility is used as a necessary but far from sufficient criterion for proceeding with a program.
- Program progress is geared to demonstrated performance milestones rather than arbitrary schedules or contract constraints. We will support a strong Test and Evaluation program, at the component as well as systems level, to insure performance demonstration throughout development.
- Unnecessary duplication of equipment designed for similar purposes is eliminated.
- Inter-Service developments are used to reduce development, procurement, logistics and support costs.
- Greater emphasis is placed on product improvement as a potentially effective alternative to a new development.

PROGRAM MANAGEMENT. Improved program management is central to our future and should be recognized and rewarded. We will encourage the building of strong career-oriented technical/business management cadres and will delegate wherever feasible.

ASSESSMENT OF NEEDS. Defense R&D goals should be determined by a combination of the potential contribution of the available new technology to specific military needs and the best possible calculated long-term costs.

DESIGN-TO-COST. Design-to-Cost must be evolved as a fundamental and flexible approach to our programs—it can be a central management tool and communication channel between Department of Defense and industry.

INDEPENDENT RESEARCH AND DEVELOPMENT. A strongly supported IR&D Program is essential. It must be well directed, mostly by industry, and the benefits must be clearly visible.

Malcolm R. Currie
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Defense Research & Engineering

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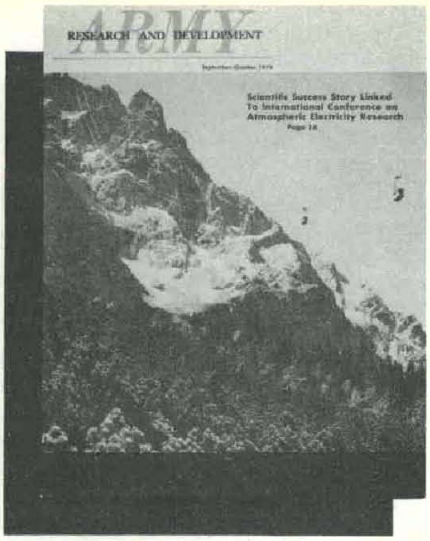

ARMY RESEARCH AND DEVELOPMENT

Vol. 15, No. 5 September–October 1974

ABOUT THE COVER:

Instrumented cable cars traveling from the Zugspitze (altitude 2,964 a.s.l) to the valley floor (700 meters a.s.l) of Garmisch-Partenkirchen, Germany, provide a unique research capability for the Institute of Atmospheric Environmental Research. Normally the cars serve as a ski lift for the famed resort center, where the Fifth International Conference on Atmospheric Electricity, Sept. 2-7, is expected to attract more than half of the world's senior scientists in this highly specialized area of science. Dr. Reinhold Reiter, conference chairman, is director of the institute.

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

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FEATURES

DEPARTMENTS

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OTHER GOVERNMENT AGENCIES' requirements should be submitted directly to: AMCRD-PS-NM, 5001 Eisenhower Ave., Alexandria, VA 22333.

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Selective Scanner . . .

Callaway Addresses Materiel Acquisition Class

Secretary of the Army Howard H. Callaway indicated his strong interest in training to improve capabilities of those involved in the military materiel acquisition process by addressing the recent opening session of the seventh Program Management Class at the Defense Systems Management School.

BG John G. Albert, U.S. Air Force, commandant of the DSMS, Fort Belvoir, VA, introduced Secretary Callaway as a former congressman and a 1949 U.S. Military Academy graduate.

Callaway complimented the 61 students selected for the intensive 5-month systems acquisition process course. He emphasized in his brief remarks that they should always be "candid, honest and forthright, however difficult the circumstances" of their military functions.

EPA Lists 147 High Potential Pollution Areas

Environmental pollution consequential to projected growth within the next 10 years is recognized by the U.S. Environmental Protection Agency in the proposed designation of 147 areas within the U.S. that have the potential for exceeding national air quality standards.

The proposal is an important step toward the formulation of plans by each of the States to ensure standards to protect public health where air pollution is expected to increase, EPA Administrator Russell E. Train said in the announcement.

States would be required by the proposal to submit, by June 18, 1975, an analysis of the impact on air quality of industrial and population growth projected for their problem areas. These would be termed Air Quality Maintenance Areas.

SAM-D Program Entering New Test Phase

Completion of the test program to verify the control system and the structural design of the SAM-D air defense missile—expected with the tenth firing in a series as this edition of the *Army R&D Newsmagazine* went to press—will set the stage for a new series beginning in October.

The new 16-missile test program will prove out the guidance system to be used with the operational missile, known as Track-Via-Missile (TVM) guidance. It employs a phased-array radar and ground-based digital computers to track, guide and command the SAM-D missile in flight.

SAM-D Project Manager BG Charles Means said the over-all performance thus far during the Control Test Vehicle Program, including eight consecutive fully successful firings, "gives us high confidence in missile performance going into the fully guided test program beginning in October at White Sands Missile Range."

SAM-D will provide increased Army capabilities against multiple and maneuvering targets in an electronic countermeasures environment. It is designed for use against high-performance aircraft, and will replace the Nike Hercules and Hawk systems. systems.

3 Projects Aid Army Infantry, Artillery, Aircrews

The U.S. Army Combat Developments Experimentation Command (CDEC), Fort Ord, CA, is conducting three projects titled MAPPRO II; Experiment 43.7 ("Owl Team") Attack Helicopter, Clear-Night Defense; and PARFOX.

During MAPPRO II, infantry platoon leaders, artillery forward observers and battalion survey chiefs are participating in experiments to evaluate six different maps during night operations. CDEC has completed Phases I and IV. Phase III is set in 1975.

Experiment 43.7 is designed to assess the ability of helicopter crews to operate at night, with and without night-vision aids, to determine Army requirements for advanced attack helicopter night-vision equipment. Several configurations of the AH-1 "Cobra" helicopter are being flown in the experiment.

PARFOX is a live-fire experiment being conducted to provide the U.S. Army Infantry School with data for evaluating four types of foxhole positions. During the 3-part exercise, the abilities of riflemen to engage and place effective fire on stationary and moving targets, and the protection afforded by parapet foxholes from shell fragments are being evaluated.

ECOM Displays Army Night Vision Capabilities

U.S. Army night vision capabilities were viewed recently by top Department of Defense research and development managers, the users and the developers during six nights of field demonstrations at Camp A. P. Hill, VA.

More than 450 U.S. Government personnel viewed the demonstrations including three members of Congress, the Director of Defense Research and Engineering, and commanders of the Army Materiel Command, and Training and Doctrine Command.

Because the demonstrations were so well received, repeat performances are planned in September for other members of Congress, Secretary of Defense and Secretary of the Army.

Conducted by the U.S. Army Electronics Command's Night Vision Laboratory, Fort Belvoir, VA, the demonstrations were organized to describe each of the NVL's four systems application areas for NV equipment—the Ground Soldier, Combat Vehicles, Missile Systems, and Army Aircraft.

NVL scientists demonstrated in each application area the past and present capabilities as well as future capabilities as seen through devices now in R&D. The showing stressed "hands-on" familiarization with all of the devices including a 2-mile jeep ride with the NV goggles (AN/PVS-5) and small arms firing with the second-generation Small Starlight Scope (AN/PVS-4).

The TOW Missile System's night capability was proven as attendees observed it strike its target in near total darkness.

A special technology station enabled attendees to observe the internal components of NV devices and learn more of NVL's pursuant technologies of Thermal Imaging, Image Intensifiers and Radiation Sources.

The Standard Far Infrared Components (see May–June 1974 *Army R&D Newsmagazine*) were displayed at the technology station. The packaged modules were also demonstrated through TOW night sights and Modular Observation Device (MOD).

Attendees compared a number of combat vehicle systems, including both image intensifier and thermal imaging driving, viewing and fire control devices.

Searchlight capabilities of combat vehicles were demonstrated with the 2.2 kw, 1 kw and NVL's newest searchlight, the Turret Integrated Xenon Illuminator (TIXI).

Originally planned to be held concurrently with NVL's Night Vision Symposium, Sept. 18–19, the demonstration was moved forward to accommodate additional attendees.

The symposium, which will be limited to government employes, will be held at Fort Belvoir.

Navy Orders First of 10 TRIDENT Submarines

The first of 10 TRIDENT System submarines, developed to preserve the sufficiency and high credibility of our sea-based strategic deterrent throughout this century, will be built under a Navy Sea Systems Command contract.

Stemming from extensive Department of Defense studies, the TRIDENT will be quieter, faster, and better equipped than existing submarines. Its improved sonars and other features are designed to enhance greatly its survivability to threats that may emerge over the next 30 years. General Dynamics Corp. has the initial production contract.

The initial missile for the system, called TRIDENT I or C-4, is designed to the same dimensions as those carried in existing POSEIDON submarines. Scheduled to become operational with the TRIDENT System, the new missile will carry a multiple, independently target reentry vehicle (MIRV) in the same manner as the POSEIDON; however, through improved solid-propellant, electronics and materials, TRIDENT I will be more accurate at a much greater range.

Watervliet Applies CIG for Structural Analyses

MATHEMATICIANS Richard Bair (left) and William Lorensen use computerized interactive graphics to examine output from a finite element structural analysis model at Watervliet Arsenal.

Computorized interactive graphics, a relatively new technology that is serving an increasing number of U.S. Army laboratories, is being applied by two young Watervliet (NY) Arsenal mathematicians to development of a structural analysis technique.

William Lorensen and Richard Bair believe they can apply CIG technology to their task and eliminate the need for much of the tedious computer coding and inspection of printed output now required to examine complex structures.

Interactive graphics provides a pictorial representation of a cannon or other related component. It permits cathode ray tube observation of the effects of differing materials upon a piece of armament. Consequently, engineers are able immediately to introduce graphic changes to a model and transform them to numerical values.

Additional CIG applications include mathematical simulation of 3-dimensional weapons systems, such as tanks or towed artillery pieces, by combining basic geometric solids. Mathematical descriptions could ultimately provide hit-probability data. The system also may be used for modification of engineering drawings for reproduction on drafting machines.

HDL Probes Photovoltaic Effects as Energy Source

Long-range possibilities of applying a recently discovered photovoltaic effect in certain ferroelectric ceramics to produce cheaper electrical energy are being investigated by Harry Diamond Laboratories scientists.

Currently, they have emphasized, the materials under study are too inefficient for the envisioned application to electrical power production. Research findings, however, point to the possibility of changing the composition of the ferroelectric ceramics to increase substantially their potentiality for entering the feasibility area.

Ceramic materials, such as solar cells, the announcement of the new discovery stated, have the advantages of low material and fabrication costs; perhaps more important, they produce high voltages which are dependent only on the length of the unit. One of the materials investigated has produced 4,000 volts per inch when illuminated.

HDL researchers say the discovery of the photovoltaic effect in certain ceramic materials, such as are now widely used as transducers, and impact sensors for projectiles which transmit a sharp pulse to the explosive detonator on impact, points also to expanded civilian applications. Civilian use of such materials currently includes everyday appliances such as the phonograph cartridge for stereo systems.

Other anticipated applications include computer memory circuits and voltage sources for electrostatic particle accelerators.

Type Classified Boat Cradle Enters Production

Following type classification as a Standard item of military equipment, a boat cradle, designed to transport, launch and retrieve the 27-foot boat used for erecting the ribbon bridge, is now in production for Army distribution.

The launching method and the ribbon bridge were developed and tested by the Military Technology Department of the U.S. Army Mobility Equipment Research and Development Center (MERDC), Fort Belvoir, VA.

Mounted on a modified standard M821 bridge-transporter 5-ton truck, the cradle assembly reduces boat launching or retrieval time from 30 to about two minutes, eliminates the need for a 20-ton crane and reduces the crew from six to three.

Under a contract with Pacific Car and Foundry Co., Renton, WA, 54 of the boat cradles are expected to be available for field use in the summer of 1975. This will be concurrent with ribbon bridge units in production under a $10 million contract with Consolidated Diesel Electric Division of CONDEC Corp.

Machine Eases Weapon Components Formation

Many machining operations to form certain weapon components can be eliminated by using an abrasive grinding "one shot crushing process" expected to save more than $500,000 in its first year of operation at Watervliet Arsenal, NY.

Designed by John Rudd, project leader in the arsenal's Engineering Support Directorate, the machine reportedly is capable of turning out in seven minutes an operating crank for a 105mm tank gun that formerly required five different machines and 1½ hours of effort. The machine produces finished components to specified tolerances. Shaping and milling to produce multiple diameters or surfaces are performed in one operation.

Currently the machine is being used to manufacture only three components of weapons, which Rudd estimates will cut costs by $573,614 in one year. All cost savings estimates were substantiated during preliminary testing.

Bendix Automation and Measurement Division built the machine to the specifications drawn by the designer.

Prototype Hellfire Missile Systems Ordered

Fabrication and delivery of competitive full-up prototype Hellfire Module Missile Systems, designed for launch from attack helicopters for engagement against tanks and other hard-point targets, is ordered under two 12-month contracts announced by the U.S. Army Missile Command.

Hughes Aircraft Co. and Rockwell International are each receiving $575,000 as initial increments to contracts valued at approximately $2.3 million each. Hardware will include fire control equipment, equipment, launchers and missiles.

COL John B. Hanby Jr., project manager for the Hellfire system, said that hardware will be tested at Redstone (AL) Arsenal and evaluated by the U.S. Government to establish an overall data base for validating claims made for proposed engineering development designs.

Tactical Facsimile Sets Tested for Field Use

Tactical facsimile sets that can transmit and receive exact reproductions of just about anything written, printed or drawn on a sheet of paper are being evaluated for combat conditions effectiveness by MASSTER (Modern Army Selected Systems Test, Evaluation and Review) at Fort Hood, TX.

Ten "ruggedized" commercial facsimile sets have been built to withstand shock, vibration and other rough handling, such as encountered in field use, for the MASSTER test program. Only six of the sets are at Fort Hood, three owned by the Army and three by the Marine Corps. Armed forces in Switzerland and West Germany each have two sets for test purposes.

Combat troops of the 2d Armored Division and communications personnel from its 142d Signal Battalion have done most of the field testing.

The facsimile sets have been used in tests to date to transmit supply documents and personnel reports that have a lot of statistical information, maps with tactical information, sketches of terrain formation and unit locations, and all kinds of typewritten and handwritten documents.

Researchers report the sets transmit and receive detailed information faster and more accurately than present U.S. Army facsimile or teletype equipment.

More extensive testing under field conditions is planned for the existing sets and for some of the newer models in the future when combat units at Fort Hood go on field maneuvers.

R&D News . . .

Expanded Responsibilities Assigned to New Corps of Engineers R&D Office

Establishment of an Army Corps of Engineers Research and Development Office empowered with authority for all plans, programs, policies and budgetary matters—created to centralize and strengthen the management of laboratories—was announced shortly before press time.

Coincident with the general Corps of Engineers realignment of functions linked to the numerous U.S. Army organizational changes effected May 20, the new R&D Office is assigned substantially expanded responsibilities.

Environmental quality technology and environmental sciences programs in basic research, exploratory development and non-system engineering, formerly assigned to the Director of Army Research, Office of the Army Chief of Research and Development, are now under the OCE R&D Office.

Army R&D efforts in atmospheric sciences, terrestrial sciences, topographic sciences and environmental constraints on military materiel development thus fall within the purview and control of the new office. It will be headed by a PL-313 scientific administrator, who will double as assistant to the Chief of Engineers for R&D.

COL Lawrence R. Smith, acting chief of the R&D Office, has been concerned with all phases of planning, implementing and staffing the new office since work on the Corps of Engineers reorganization was directed by Army Chief of Engineers LTG William G. Gribble, Jr., early in 1974.

The mission statement for the R&D Office lists the following functions:

- Provides the directive authority from OCE to the Corps laboratories in order to assure that their assigned R&D effort adequately reflects the users' requirements. (The user is defined as any agency, to include any element of the OCE organization, that has a problem deemed suitable for R&D.)
- Develops R&D program guidance in conjunction with directorates and issues it to the laboratories.
- Coordinates the review of program and budget plans proposed by the Corps' laboratories and consolidates them into an over-all CE R&D program.
- Provides written program and budget justifications, oral budget presentations, and, in general, supports the Director of Civil Works in presenting and defending the Civil Works R&D program to higher authority. Presents and defends the RDTE program to higher authority.
- Develops a resource allocation plan in conjunction with the OCE directorates, and allocates resources to the Corps' laboratories as approved by the OCE R&D Review Board.
- Exercises OCE staff supervision of Corps' laboratories in their execution of the approved program and assures effective technical monitoring of research by OCE directorates.
- Maintains a Corps laboratory program review system including computer-aided progress reporting, semi-annual oral presentations by the laboratory directors to the OCE R&D Review Board, and Field Managers' oral presentations to the OCE R&D Review Board.
- Assures transfer of R&D results to users.
- Provides staff support to the OCE R&D Review Board, arranges for its periodic meetings, and follows through with appropriate staff actions to assure timely implementation of the Board's decisions and guidance, both by other elements of OCE and by the labs.
- Develops and recommends definitive guidance for content and balance of programs and projects in research, exploratory development, non-systems advanced development, and associated development testing in mapping, geodesy, military construction, geographic, terrain and engineering sciences, to assure the continuing scientific study within the Department of the Army of the RDTE Environmental Sciences Research and Technology Program.

The R&D Office is authorized fourteen personnel. It is unstructured and will operate with three action groups as follows:

Guidance and coordinating actions associated with military RDT&E programs, plans, budgets and staff supervision of approved military programs will be provided by the RDO Military Programs Group. Headed by Merrill V. Kreipke, it includes Dr. Fernand P. dePercin and LTC Douglas A. Hughes. One position is vacant.

The Civil Works Programs Group, which serves as a point of contact for all R&D in CW, is staffed by Melvin L. Martin, chief, and Robert F. Jackson. One military position is vacant.

Policy and regulatory matters involving managerial, administrative, support, organization, manpower, program review and analysis, and personnel activities are assigned to the Laboratory Operations Group, currently staffed by Alfred E. Simonini, Chief, and Olga Lansing.

OCE laboratories include the Waterways Experiment Station (WES), Vicksburg, MI; Coastal Engineering Research Center (CERC), Fort Belvoir, VA; Construction Engineering Research Laboratory (CERL), Champaign, IL; Cold Regions Research and Engineering Laboratory (CRREL), Hanover, NH; Engineer Topographic Laboratory, Fort Belvoir, VA.

ASA (R&D) Augustine Reviews Tropic Test Center

Assistant Secretary of the Army (R&D) Norman R. Augustine donned "fatigues" and conducted his first inspection of activities at the U.S. Army Tropic Test Center, Panama Canal Zone, dressed like any combat soldier on a recent visit.

During his entire stay in the Canal Zone, July 15–26, he traveled with an escort officer and coordinated his visits to other military and civil areas. Tropic Test Center officers briefed him on TTC's mission, organization and ongoing research, development, test and evaluation programs and projects.

TTC Commander COL A.M. Sargeant, Technical Director F. S. Mendez, Dr. D. A. Dobbins, chief of the Test Analysis Branch, and MAJ C. A. Novack, chief of the Pacific Test Branch participated with Secretary Augustine in a one-hour informal discussion on the philosophy of testing.

Frank statements of personal opinion were solicited by Mr. Augustine on: (a) a concept for an organizational structure for testing assuming there were no U.S. Army testing organizations in existence today; (b) relationships and responsibilities among organizations involved in the materiel acquisition cycle from statements of requirements to limited production.

The secretary also asked for opinions on: the optimum time phase in the materiel acquisition cycle for tropic environmental testing; Continental U.S. (CONUS) analogs to Canal Zone climate and terrain; advantages and disadvantages of chamber testing as compared to natural environmental testing; acceleration of tests conducted in a natural tropic environment; and the impact of the current Department of Defense 5-year rotation policy on oversease RDT&E organizations.

ASA (R&D) Norman R. Augustine is briefed by MAJ C. A. Novack on the Woodland Lightweight Camouflage Screening System.

EPA Administrator for R&D Says Pollution Policy-Makers Must Act

World policy-makers concerned with pollution problems cannot allow themselves the luxury of waiting for scientific perfection before establishing effective controls—in view of the pace of environmental degradation.

U.S. Environmental Protection Agency Acting Administrator for Research and Development A. C. Trakowski expressed this view after returning from an international conference on health effects of pollution in Paris, France.

More than 500 representatives from 46 nations participated in the symposium, cosponsored by the Commission of European Communities, the World Health Organization and the U.S. EPA.

Trakowski explained, in his summary statement of the meeting, that the scientific potential to establish a precise and complete means for environmental protection doubtless exists in theory at present. "Right now," he said, "we know of no other way than to offer the best data available to help guide the world's policy-makers who must meld environmental priorities into their governing task."

Radar Scattering Screening Systems Advance U.S. Army Warfare Camouflage Capabilities

Warfare camouflage has advanced to a new degree of sophistication with the introduction of radar scattering screening systems undergoing laboratory testing at Aberdeen (MD) Proving Ground.

Notable innovations include the lightweight polyester netting with attached camouflage material, hexagonal and diamond shapes which offer a variety of camouflage versatility, and drastically modified support equipment, such as lightweight lanyard cord, retractable support poles, lightweight spreader assemblies, and complete repair kits.

The most significant change is the addition of a radar scattering material designed to prevent enemy surveillance aircraft from "seeing through" the physical camouflage and detecting a vehicle weapon, ammo dump, or other objects, with sophisticated radar devices.

Some of the new screens are designed to be radar transparent—to maintain all the characteristics of the newly developed screening systems except they do not contain the radar-scattering material.

Three models have been developed for adaptation to various environmental and geographic conditions—the woodlands, the arctic, and the desert models.

Various phases of testing are underway at a number of sites, principally at Aberdeen Proving Ground (APG); the U.S. Army Arctic Test Center, Fort Greely, AK; the U.S. Army Tropic Test Center, Fort Clayton, Panama CZ; and the U.S. Army Electronic Proving Ground, Fort Huachuca, AZ.

Fabric and materiel component testing is being handled by APG's General Equipment Division, Materiel Testing Directorate. The division is also testing maintenance requirements, safety features and other human-factor aspects.

Environmental testing is being handled at Forts Greely and Clayton and radar testing is being completed at Fort Huachuca.

The screening systems were developed at the Mobility Equipment Research Development Center, Fort Belvoir, VA.

Final review of all testing will be conducted by HQ U.S. Army Test and Evaluation Command at the APG.

Testing on both the radar-transparent and radar-scattering systems started in January and is expected to continue through CY 1974. The Army hopes to have the first operational system in use in October.

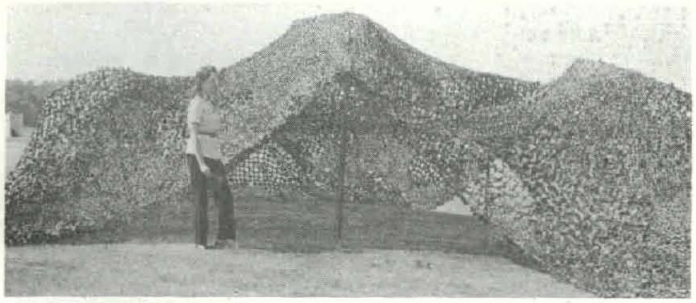
A complete 110-pound module comes in two components: the packaged screening system weighing 65 pounds and the 45-pound packaged support system. The screening system contains man-portable storage case complete with one hexagonal-shaped (or six-sided) screen; one rhombic-shaped (diamond, or 4-sided) screen; three lightweight lanyard cords with pins; and the complete repair kit containing 16 feet of edge reinforcement cord, 200 plastic straps, 30 quick connect-disconnect devices and pins, one square meter of garnish netting, 20 square feet of camouflage cloth garnish, and six 5-foot lengths of twine.

The support system includes transport case, 6 retractable pole assemblies, 6 screen spreader assemblies, and 18 stakes to secure the screening to the ground.

Each screen is 4.9 meters (or 16.1 feet) per side. The diamond- and hexagonal-shaped screens can be interlocked with a number of other modules to provide a variety of camouflage setups. All screens are equipped with quick connect-disconnect devices to allow multiple screening combinations.

The woodlands system is reversible, with two different color patterns to correspond to primary and secondary seasonal characteristics.

One module is expected to cost approximately $500. The current conventional system it will replace is time-consuming to erect and disassemble. It is bulky to transport and does not include the newly developed radar-scattering feature.



RADAR SCATTERING Camouflage is examined by Mrs. Nancy Hill, a textile technologist with the General Equipment Division, Materiel Testing Directorate, Aberdeen (MD) Proving Ground.

TRIPLE-HOOK capability is demonstrated by CH-47C Chinook during recent tests in which Boeing Vertol Co. investigated the potential of transporting various loads ranging as high as 20,000 pounds. International Standards Organization (ISO) Standard 8′ × 8′ × 20′ MILVAN containers ballasted up to 18,500 pounds were transported during Phase I tests. With the improved load stability provided by the new cargo hook locations, the CH-47C was able to transport the empty 4,800-pound MILVAN container at the power-limited airspeed of 110 knots, representing a 50 percent improvement in the external load capability of the aircraft. During Phase II, various combinations of 500-gallon water bags (ballasted to 4,500 pounds) were transported on each of the hooks. The demonstration included the helicopter's capability to place three loads at different points within one area or three widely separated points in a combat area without rerigging.

ICST Reports on 'Bridging for the '80s'

"Bridging for the 1980s," a final report by the International Concept Study Team (ICST), was accepted during a week-long International Steering Committee meeting at the Military Vehicles and Engineering Establishment, Christchurch, (MVEE(C), England.

Engineers from the Federal Republic of Germany, the United Kingdom and the United States conducted a Joint Studies Program aimed at definition of one or more concepts for bridging and river crossing.

Under a formal Memorandum of Understanding, the 6-member ICST, including two members from the Marine and Bridge Division of the U.S. Army Mobility Equipment R&D Center, Fort Belvoir, VA, has been at work on the project.

Guidance for the team was provided by a steering committee comprised of senior technical managers from the three cooperating countries. The U.S. Army Standardization Group (UK) has provided support and liaison with the Office of the Chief of Research and Development and Acquisition, Department of the Army.

More than 100 concepts, ranging from "sky hooks" to antigravity devices, received consideration in the study. A special computorized assessment model was developed, permitting separate weighting to be given to the various parameters in the operational requirements.

To achieve major logistical savings, a Family Concept is advocated by the team, with the main structural components being common to all three roles—assault, support wet and support dry.

This wheeled transporter vehicle may be adapted from standard military vehicles currently available to or planned by each of the three armies. It may be decided to develop a special-purpose vehicle.

To reconcile the design and testing procedure of the three countries, it was necessary to set up two working parties outside the team membership but under control of the Steering Committee.

One concept, with several variations, has been accepted for further definitive study. It will include a wheeled transporter vehicle for the support dry role to decrease erection time and the people involved.

These groups—the International Working Group of Military Bridge Designers and the International Structural Analysis Committee—will continue their deliberations through the end of 1974, or until solutions agreeable to all three countries are achieved.

Prospects at this time point to a potential for saving several millions of dollars in R&D costs by entering into a cooperative development program, according to the ICST report.

Negotiators from the International Division, Office of the Chief of Research, Development and Acquisition, U.S. Army, have developed a draft Memorandum of Understanding for a follow-on effort and several meetings have served to bring this into final focus.

R & D NEWS

Army Updating FARRP System To Ease Helicopter Operations

New concepts and new equipment are being considered with respect to the problem of rearming and refueling Army helicopters in combat situations by MASSTER (Modern Army Selected Systems Test, Evaluation and Review), Fort Hood, TX.

Aviators, technicians and ground support personnel are trying to come forth with an updated version of the FARRP (Forward Area Refueling and Rearming Point) system. FARRP I was successful in reducing the time to refuel and rearm attack helicopters during 1972 and 1973 activities.

Using the FARRP in that time frame, a crew of 14 trained soldiers was able to service five helicopters in about five minutes in remote areas. The objective of the new program is to improve efficiency, although not much of a time saving is envisioned. FARRP II additions incorporate the recommendations of pilots, armament specialists and others in FARRP I.

The basic equipment in FARRP I was a 5-point refueler with five long hoses and a gasoline or electric engine to run the pump. A special vehicle built like a low-slung forklift was developed to carry pods of ammunition attached to the helicopter wings.

One of the new concepts uses electric power from the aircraft being refueled to operate the 5-point refueler. This method eliminates the need for an auxiliary generator or gasoline engine to run the refueler pump.

Five Cobra attack helicopters and three OH-58 observation helicopters from A Troop, 7th Squadron, 17th Cavalry, of the 1st Cavalry Division, have been modified with internal aircraft fuel control switches. A pilot can sit in his cockpit, monitor his gauges, and control the amount of fuel being pumped.

AMMUNITION LOADERS move 7.62mm ammunition into a Cobra attack helicopter container from a storage drum designed for use in a Forward Area Refueling and Rearming Point (FARRP) during test.

Four new vehicles will also be studied as possible replacements for the current FARRP forklift vehicle. One is a multiwheeled forklift with a low silhouette; another is a commercial front-loader with the bucket scoop removed and a forklift installed; and a third is a 4-wheel drive forklift designed for rough terrain.

Consideration also is being given to an exotic loader with two mechanical-hydraulic arms that closely resemble those scientists use to handle radioactive material in laboratories.

Working on a force-feedback principle of control, the operator exerts 10 pounds of force which translates into perhaps 1,000 pounds of force at the end of the arms.

Whether it be a forklift or mechanical arms, the role of the FARRP vehicle is to lift and carry ammunition for the helicopters. Several new concepts in the packaging of ammunition also will be examined—specifically, prepackaged containers loaded with ammunition for the Cobra's 7.62mm machineguns, 40mm grenade launchers and 2.75-inch rockets. The containers are designed to be inserted into the Cobra's chin turret system or attached to the undersides of its wings.

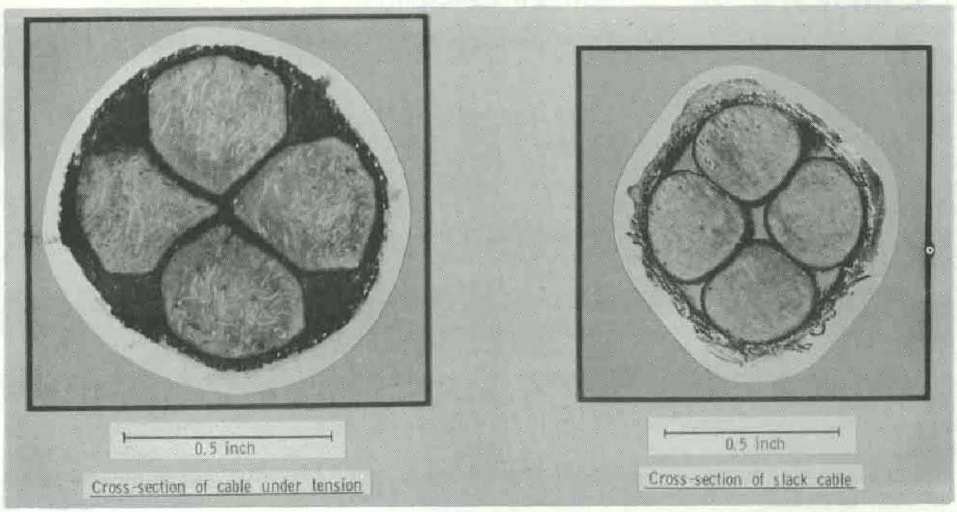
Additionally, a new tactical support container will be used in the FARRP operation to help with resupply. It can carry up to 6,000 pounds of ammunition and other equipment, including as many as ten 19-round drums loaded with 2.75-inch rockets. One side of the container lets down to form a ramp for the FARRP vehicle to begin unloading ammunition immediately following aerial delivery.

MAJ Richard O. Fish, project test officer, said that ideally, the men in the FARRP vehicle should be able to reload empty containers after a Cobra leaves and have the complete ammunition unit ready to install by the time it returns.

"We think use of live ammunition in reloading and firing exercises by Cobra crews in FARRP II will make the test more realistic," said MAJ Fish, "because the FARRP will have to be moving around frequently to different landing zones on Fort Hood. It will give us a good chance to look at all the new equipment in actual situations."

Bell XV-15 scale model with rotors in flight mode. Under a NASA contract and a program sponsored jointly by the Army, Bell Helicopter Co. will design, build and test two such aircraft to assess applications of tilt-rotor technology. Rollout of the first aircraft is targeted for August 1975, with flight tests scheduled to begin in 1976.

New Helicopter Lift Cables Provide Greater Stability



Conventional steel helicopter lift cables normally cause the hook to swing unpredictably when an air drop is made, but an experimental cable made of Kevlar—the remarkably strong synthetic material used in new lightweight armor vests—has eliminated the "bounce."

Stability quality of the new cable was demonstrated impressively in a recent test under sponsorship of the U.S. Army Materials and Mechanics Research Center (AMMRC), Watertown, MA. Following an air drop from the hoist tower of Sikorsky Aircraft, Stratford, CT, the cable and the hood literally "played dead."

Material in the new cable, which weighs about 20 percent of the currently used steel cable, is Kevlar-49, a high-modulus fiber developed by DuPont. Four strands laid parallel are contained in a nylon sheath. Designed to carry a 25-ton load, the cable showed no adverse effect when weighted with a dead load of 26,775 pounds.

The demonstration was witnessed by representatives from DuPont, Cortland Line Co., the Army Air Mobility Research and Development Center (Eustis Directorate) and the AMMRC. Credited with the cable concept are Dr. Eraldus Scala, former technical director of the AMMRC now with Cortland Line, and Dr. George A. Thomas of the AMMRC. Ms. Elizabeth Cilley, AMMRC physicist, directed implementation of the concept.

Army Reviews AF Electronics Cost Reduction Study

Substantial economies achievable in military materiel acquisition through improved manufacturing technology were reported, as based on an Air Force study resulting from over-all life cycle costs, in a recent briefing at HQ U.S. Army Materiel Command.

Sponsored by the Production Engineering Branch, Engineering Division of the AMC Directorate of Research, Development and Engineering, the briefing was given to 23 representatives of the Office of the Assistant Secretary of Defense (Installations and Logistics) and AMC's subordinate commands.

Deputy Assistant Secretary of Defense (I&L) J. S. Gansler has stressed that all new efforts will be judged on their contribution to reduction of life cycle costs of materiel. Charles Downer of his office made this statement in introducing Air Force MAJ Thomas Fiorino, who gave the briefing on results of the Joint AF-Industry Electronics Cost Reduction Study.

Initiated in October 1973, the study was controlled by a steering committee which set up six panels for specific areas such as Navigation; Radar; Electronic Countermeasures; Flight Controls; Communications; and Electro-optics.

Participants from industry included such major manufacturing organizations as Actron; Boeing; Fairchild; Hamilton Standard; Honeywell; Sanders Associates; Texas Instruments, and others.

MAJ Fiorino is chief of the Electronics Branch, Manufacturing Technology Division, Air Force Material Laboratory. He said results of the study would impact the Air Force Manufacturing Technology Program at the earliest in FY 1975 and be the major thrust in FY 1976 and future years programs.

Using a breakdown technique for each of the study areas to determine major high-cost elements, the six panels then scrutinized factors believed most susceptible to cost reduction through refined or new manufacturing methods and technology.

Study results identified a number of areas of potential economies. Projections of future procurements were directed especially toward items now within the state-of-the-art, or technology rapidly becoming available, that can be addressed to reduce acquisition costs.

The Air Force is continuing the study to identify high maintenance cost areas, with a view toward reducing the over-all life cycle costs by using the same and similar techniques.

Materiel items identified as most promising to cost reduction in the manufacturing processes included: sensors in scanning devices; electronics of communication equipments, and large-scale integrated (LSI) circuits.

MAJ Fiorino cited as one study example a "model" navigation system that would be procured at a cost of $180,000 for each unit and that with study suggestions could cost $111,000, a saving of about 38 percent.

Development of proper manufacturing technology in future procurement of LSI systems, it has been estimated, offers the possibility of about $1.4 billion reduction in costs on procurement in excess of $5.6 billion.

The major "cost driver," conventional electronics, has also been identified by the U.S. Navy. The Navy Standard Hardware Program (SHP), sometimes referred to as Standard Electronics Modules, is under review by the Air Force and the Army—with a view to joint services adoption.

An AMC spokesman said that "even improved manufacturing technology in production of the basic materials used in electronics would result in considerable savings. The Army is awaiting publication of the Joint AF/Industry Electronics Cost Reduction Study this fall. It will be reviewed for all possible implementation in our current and future Manufacturing Methods and Technology (MM&T) Program."

The Tri-Service Manufacturing Technology Advisory Group (MTAG) is expected to task the Electronics Working Group to review the Air Force study and the SHP toward applying recommendations singularly or jointly.

TACOM Assumes Responsibility For Materiel Handling Equipment

Transfer of the U.S. Army Troop Support Command's responsibility for commercial construction and materiel handling equipment to the U.S. Army Tank-Automotive Command, programed for completion in June 1975, recently entered its second phase.

Designated materiel handling equipment includes cranes, fork lift trucks, dump trucks, tractors, graders, scrapers, assorted trailers, etc. Transfer of these items is coordinated by various TACOM offices and directorates. Lou Newton, Plans and Analysis Directorate, is command coordinator.

Other TACOM coordinators include Robert McGregor, Comptroller Directorate; Orville Nutkins, Materiel Management Directorate; Bill Lamm, Procurement and Production Directorate; Lou Mortenson, Maintenance Directorate; Aubrey Hutchison, Product Assurance Directorate; Ron Patek, RD&E Directorate; and

Larry Cook, Special Items Management Office; Kendall Winter, Data Systems; Jack Simmon, Office, Civilian Personnel Director; Bernie Stroll, HISA; and Don Clark, Plans and Analysis Directorate.

APG Applying Flash Radiography to Ballistics Research

Remember those early fascinating electronic strobelight photographs that showed a bullet "frozen" in flight as it exited a rifle's muzzle?

Now, after more than two decades of research and development to advance the state-of-the-art in ballistics measurement technology, Army scientists not only freeze the action—by films exposed at one five-millionth second duration—but can actually peer inside the missile.

Moreover, instead of a single picture at that fantastic speed, thousands of times faster than the blink of a human eye, they can produce in current testing as many as 160 radiographs from a single firing.

Currently, the system is being used to study the terminal ballistics of high-velocity projectiles fired at heavy armor plating. Designers say the results provide hitherto unknown information on the penetration process for large caliber armor-piercing projectiles and should influence the course of future projectile designs.

Flash radiography is a practical application of X-rays to the solution of ballistics research problems, stated R. L. Huddleston, acting chief of the Physical Test Section of APG's Materiel Testing Directorate.

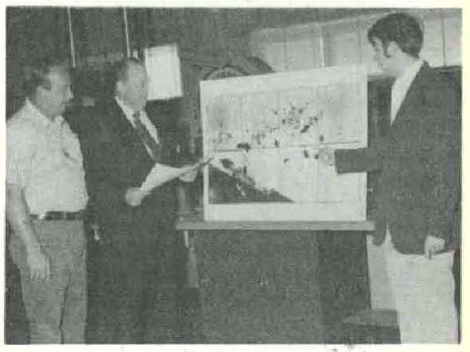
"Imagine a camera with a shutter speed of one five-millionth of a second, with the added advantage of being able to see through armor plate, smoke, flame and dust in order to view the test object," he added.

"Armor-piercing projectiles can be examined before, during and after they penetrate the armor plate. Ballistics measurements of great value to armament designers have been made possible by this means."

Radiography facilities at the Materiel Testing Directorate are believed unique. APG officials claim it is the only place in the world where this type of large-scale testing can be performed.

Huddleston said plans have been drawn for adding a 2.3-million volt system to make it possible to examine a fast-moving object behind thick steel. He cited large artillery shells moving inside a heavy cannon tube as an example.

Willard Caudill, leader of the MTD flash X-ray field crew, said the wealth of information obtained by the system has led to increased requirements for X-ray assistance on a variety of research and development projects, including some from the other military services.



FLASH-X-RAY field crew members examine pieced-together photographs of a projectile breaking up after impact with a heavy armor plate. Shown from left are Willard Caudill, crew leader, Leo Heppner, statistician, and Jim Finera, mechanical engineer, Aberdeen Proving Ground, MD.

Recent work on artillery and small arms projectile designs has required the X-ray system to provide the data necessary for calculating the striking and residual velocities of projectiles, and the mass and velocity of their fragments.

"Such information is vital to the designer and cannot be obtained by any other technique," Caudill stated.

Since X-rays cannot be reflected or focused, like light, the film must be set up dangerously close to the path of the projectile and object it will hit. Heavy armor shielding, baffles and blast and fragment detectors are installed to protect the film and equipment. X-ray tubes costing about $1,000 each can be broken easily if not properly protected.

Despite the severe blast environment and the risk of damage to film and equipment, losses have been minimized. Occasional unexpected breakages continue to occur but the yield of useful data remains high and is quite acceptable to the customer.

Alcoholism Environment Probed . . .

Monkeys Taught to Drink in Search for Cure

Humans are not the only primates who will drink excessive amounts of alcohol. Dr. James E. Barrett, a psychologist at the University of Maryland, has demonstrated that it is possible to get squirrel monkeys to ingest substantial amounts of alcohol when certain laboratory conditions are created.

The object of the 2-year Army supported contract is the establishment of a primate model to study alcohol abuse. The project entails the investigation of environmental factors associated with the initiation as well as the maintenance of alcohol abuse.

The initial task of the researchers was to engender the ingestion of alcohol in monkeys to the extent of intoxication, a phenomenon not previously reported. This objective was accomplished using a technique known as schedule-induced drinking.

The technique previously had produced excessive fluid intake (polydipsia) in other animals, mostly rats, and involves presenting food intermittently to a food-deprived animal. Under certain temporal reinforcement conditions, animals ingest quantities of water in excess of their normal intake.

By using this method and gradually increasing the percentage of alcohol in the animal's water supply, Dr. Barrett was able to induce the animals to consume as much as 3.50 g/kg of 6 percent alcohol solution in a 3-hour experimental period.

During the early phases of the experiment, when the alcohol concentration was increased from one to two percent, the monkeys showed signs of gross intoxication—manifested by motor incoordination and drowsiness.

The inebriated animals were unable to sit on their home-cage perch and ultimately assumed a curled-up posture on the floor. As the concentration increased to six percent, these behavioral signs decreased and it appeared that behavioral tolerance to alcohol had developed.

The interaction of drugs and alcohol consumption is also of interest to Dr. Barrett. In an experiment looking at the effects of chlordiazepoxide (Librium) on alcohol ingestion, monkeys significantly increased their drinking. This was an unexpected finding since Librium is often used in the treatment of alcohol withdrawal.

Future experiments will investigate the continued effects of drinking such as tolerance, withdrawal and changes in ongoing behavior. Further study of drugs that might decrease alcohol consumption is also planned.

The results of Dr. Barrett's work has implications for human alcoholics; however, he is unwilling at this stage of the project to extrapolate from subhuman primates to human beings.

Secretary Callaway Addresses AMC 12th Anniversary Gathering

Secretary of the Army Howard H. Callaway addressed participants in the U.S. Army Materiel Command's Aug. 19 Twelfth anniversary celebration, a picnic at Cameron Station, VA, but AMC Commander GEN Henry A. Miley had to dispense with the ceremonial cake slicing—due to a handling accident during transit.

Secretary Callaway commended AMC employes for 12 years of notable sustained accomplishment, particularly in meeting the tremendous demands and problems of the conflict in Southeast Asia as well as the difficulties of coping with challenges of ever urgent requirements with continually diminishing resources.

Demands of providing for the Volunteer Army, by supplying superior weaponry and equipment despite manpower and funding cutbacks, will call for total commitment to the task and the highest standards of initiative, innovation and resourcefulness, Secretary Callaway stated.

General Miley's anniversary message stated, in part: "The Army Materiel Command came into being on 1 August 1962 to meet the challenging logistical needs of the Army. In these 12 years, it has met most of the demands placed upon it, becoming the 'soldier's lifeline.'

"Our record of logistical responsiveness is a source of pride to me and should be to all of you. It is a reflection of the dedication and 'can do' attitude displayed by the entire AMC work force. We have matured into a team of professionals, recognized as an organization which welcomes the challenging task. . . ."

Safer TNT Production Assured With New Automated Facility

Installation of the "first completely automatic and remote controlled TNT production facility in the world," capable of manufacturing up to one million pounds of TNT daily, has been announced by the Volunteer Army Ammunition Plant, Chattanooga, TN.

Described as the result of a Manufacturing Methods and Technology (MM&T) project which applied state-of-the-art systems technology to the TNT manufacturing application, the Direct Digital Control System is designed to control safely the complex and hazardous chemical processes in production of TNT.

All phases of manufacturing, from plant start-up, emergency shutdown and varying production levels, are automatically controlled. The plant is a part of the Department of Defense Munitions Modernization Program.

Operators will be able to make decisions during emergency situations without having to consider their own safety, since they will be in an area remote from plant production facilities.

The announcement said that in addition to personnel safety, the system will ensure equipment safety and increased yield as well as improved quality of munitions. Two computers (one control and the other supervisory) are interconnected to insure continued operations in case one should fail.

Other vital components, such as control panels, signal equipment and multiplexers, are "backed up" by as many as five levels of control for safety. The operator will be informed of a failure as the back-up component takes over. Should a total failure occur, the system will automatically take all hazardous processes to a safe level or "fail safe."

The control computer accomplishes monitoring, controling and alarming functions. In addition to providing back-up, the supervisory computer "can be used for optimization functions." Changes drastically affecting process procedures can be initiated only by the supervisors, and can be made without interruption of production.

Closed-circuit television monitors are located at strategic points for surveillance of the manufacturing processes.

AMRDL Awards Contracts Totaling $1.1 Million For Quieter, More Stable Helicopter Elements

Contracts announced recently by the U.S. Army Air Mobility Research and Development Laboratory (AMRDL) include two grants totaling more than $836,000 for the design of quieter and more dynamically stable helicopter components.

Kaman Aerospace Corp. ($493,268) and Boeing Vertol Co. ($342,807) will attempt to reduce vibration levels of transmission components and produce a more stable vehicle with lower operational noises. Initially, an analytical evaluation of the dynamic behavior of a transmission will be conducted.

Following initial testing, modified transmission components will be designed and analyzed. After an adequate configuration is obtained, these components will be fabricated and the entire transmission retested. Ultimately, both contractors will compare their analyses to insure feasibility.

Paul F. Yaggy, director of AMRDL, also announced the following grants: Curtiss-Wright Corp. is receiving $68,000 for continued testing of a free planet transmission concept which may eliminate planet carriers, planet pinion bearings and failures associated with their malfunction; and Grumman Aerospace, $59,000 to improve the survivability of the OV-1D aircraft against selected ballistic threats; Dynamic Science Division of Ultrasystems, Inc., $64,000 for testing safer helicopter seat belts for Army aircraft troops; and Boeing Vertol Co., $93,000 for test and evaluation of improved forward-and-aft-facing crashworthy troop seat designs.

ARMY TESTERS fire M47 Dragon missile on the Pina Light Artillery Range, during U.S. Army Tropic Test Center evaluation.

ASA (R&D), CRDA Establish Advanced Concept Team

Joint action by Assistant Secretary of the Army (R&D) Norman R. Augustine and Chief of Research, Development and Acquisition LTG John R. Deane Jr. has established an Advanced Concept Team.

An announcement said the purpose of ACT is to benefit more effectively from concepts and ideas originating in industrial laboratories and other R&D organizations, by applying advanced technology to improve Army weapon systems and equipment.

The ACT will function to simplify the transfer of technology by making available to the general R&D community outside the Army the expertise of a "small, centralized group of highly qualified individuals."

Created to provide a quick and objective evaluation of the new concepts and ideas, the ACT will recommend implementive action based on military merits. Proposing organizations will thus get the desired response without the necessity of repetitive and time-consuming efforts.

The announcement said the ACT "will be receptive to concepts which have had the benefit of some analysis by the proponent in order to assess the technical risks, the expected operational effectiveness, and the estimated costs." Concepts desired are those which "promise to make a significant impact on the operational capabilities of the Army."

Candidate concepts and programs will be reviewed for timely inclusion in the budgetary cycle of the Chief of Research, Development and Acquisition.

The team will consist, as a minimum, of the assistant director, Technology Overview, Directorate of Army Research (DAR), who will serve as the executive secretary; scientific adviser, Directorate of Weapon Systems, OCRDA; and the scientific adviser, Directorate of Combat Support Systems, OCRDA.

Others who will serve on the team as required are the adviser on research, development and acquisition to the Chief of RDA; assistant director, Research Programs, Directorate of Army Research; and the assistant director, Laboratory Activities, DAR.

The chairman of the team will vary, with the assistant director of Technology Overview serving in concepts relating to his directorate, and the scientific advisers serving on concepts relating to their directorates.

Established for an indefinite period, subject to decision by the Chief of Research, Development and Acquisition, the team will receive administrative support from the Director of Army Research, Dr. Marvin E. Lasser.

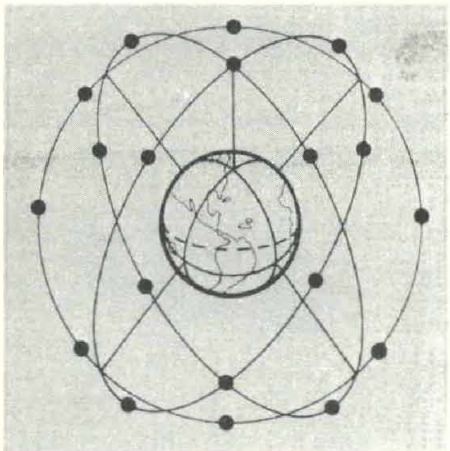
Further information or appointments may be obtained by contacting the Office of the Director of Army Research, HQ Department of the Army, Room 3E365, Washington, DC 20310, ATTN: Dr. Charles H. Church, 202-(695-3718) or Manfred Gale, 202-(697-3651).

Army Developing Terminals for NAVSTAR GPS

Army Satellite Communications (SATCOM) Agency efforts are being directed toward development of Army user equipment for use in the NAVSTAR Global Positioning System (GPS), which will enable field elements to determine their precise location anywhere in the world.

Under a joint-service development program headed by the Air Force, the GPS is intended to provide the armed forces with a positioning and navigation capability based on a worldwide common coordinate grid.

Scheduled for operation by the mid-80s, the system will consist of 24 satellites in 12-hour, circular orbits at an altitude of about 12,500 statute miles. Eight equally spaced satellites will be placed in each of three inclined orbital planes spaced 120 degrees apart. A minimum of six satellites will be in view and available for use from any location on Earth at any given time.



24-SATELLITE Orbital Configuration (artist's concept).

The network's ground control system will consist of a master control station; several widely separated monitor stations to provide tracking data to the master station's data processing center; a tracking, telemetry and command station using a standard space-ground link system; and an upload station to transmit data to the satellite as directed by the master station.

Under field conditions, for example, an infantryman equipped with a manpack, will use signals transmitted from four satellites to determine his position. Each satellite will transmit its ephemeris or position in space along with system-timing signals to a high degree of accuracy. Signals will be updated daily to insure that accuracy is maintained.

Self-contained receiving, processing and computing equipment in the manpack will in real time determine the infantryman's position. System time will be provided by the satellite through a highly stable clock or frequency standard updated as required by the ground control station.

Each of the 24 satellites will generate an individual coded navigation signal, referenced to the system time and transmitted with position coordinates and time data. Synchronization of the user equipment to obtain positioning data is accomplished by an internally generated coded signal duplicating the satellite code.

Secure and resistant to jamming, the system can serve an unlimited number of users since they do not transmit to the satellites. Precise positioning and navigation information will be instantly available throughout the world at any given time. Accuracy of horizontal positioning will not be degraded by a change in altitude of user equipment.

The Army expects the system to provide all-weather positioning and navigation functions, system and world time, and accurate velocity and azimuth bearing. Improved effectiveness of surface and aerial navigation, location of sensor systems and forward observers, mapping, and missile and artillery surveys also are expected.

The first developmental phase, scheduled for completion in 1978, seeks to demonstrate the system concept and capabilities with four satellites in representative orbits.

The GPS is expected to reduce the proliferation within the armed forces of specialized positioning and navigation equipment and systems now in use or in various stages of development.

Army Research Institute Article Rescheduled for Nov-Dec Edition

The July-August edition of the Army Research and Development Newsmagazine, *in a report on the 1974 biennial Army Science Conference at the U.S. Military Academy, carried an italicized paragraph announcing that:*

"Special treatment of some of the panel presentations (Panel on 'The Volunteer Army's Investment for the Future') with respect to the important role of the Army Research Institute for the Behavioral and Social Sciences (ARI) is planned for the Sept.-Oct. edition. . . ."

Circumstances beyond control have necessitated a delay of this feature until the November-December edition.

HumRRO Publication Analyzes Morale Among Army Enlistees

Prediction of Delinquency Among Army Enlisted Men: A Multivariate Analysis is the title of a recently issued publication prepared for the Office of the Chief of Research and Development, Department of the Army, by the Human Resources Research Organization (HumRRO).

Technical Report 74-3 is the result of a study to develop measuring techniques for determining the sources of low motivation and attitude deterioration among U.S. Army enlisted men.

The report cites Army statistics showing that absent without leave (AWOL) and desertion rates increased threefold between 1967 and 1971. Confinement of offenders and reductions in morale resulted in further losses of manpower and lowering of over-all effectiveness.

Delinquency and AWOL information on 1,199 enlisted men, assigned to the U.S. Army Training Center, Fort Knox, KY, was subsequently gathered by HumRRO personnel. Each soldier completed the Minnesota Multiphasic Personality Inventory and other personality screening tests.

Results of this research indicate that substantial percentages of soldiers who go AWOL or become delinquent can be identified in advance by use of background data and delinquency scales. Although prediction capabilities are limited, the study shows, they may be improved with increased use of predictor variables.

Computers Aid Trans-Atlantic Phone Transmission

Advanced computer technology being developed for the Management Information Systems Directorate, U.S. Army Materiel Command, was demonstrated in a recent historic "first"—telephone transmission via satellite of analog computer signals from the Netherlands and West Germany to Orlando, FL.

Information transmitted was obtained from a missile simulation program running on the Martin Marietta Corp. hybrid computer, being controlled from overseas. Army scientists participating in the demonstration stated that perfection of the process "would be a big boost to the Army in its design and analysis of weapon systems and components."

The goal is to combine the best features of analog and digital computers in a hybrid computer. With a digital terminal little larger than a typewriter, together with an experimental analog computer signal phone transmitter, an engineer could plug into a phone line anywhere in the world and feed information to a hybrid computer anywhere and receive desired results in analog and digital form.

Digital computers have been operated in this way for years, but it is a new field of endeavor for hybrid computers, Army scientists participating in the recent demonstration said. Proper comprehension of the significance of the achievement requires a knowledge of the difference in capabilities of analog and digital computers.

An analog computer solves differential equations representative of engineering or scientific problems, that is, it is capable of processing simulations of gun systems, missiles, rockets, and chemical reactions.

The solutions to problems show up as curved lines on a chart, or a strip chart with lines depicting the sequence of an event, such as a projectile leaving a gun tube. The charts enable an engineer to gain vital information.

Digital computers process data serially and can likewise be used for solving complex scientific and engineering problems. Magnetic tapes and discs are used to store large files of information. Problem solutions of the hybrid computer are provided in both analog and digital form, and have been available for some time to engineers—but not by means of telephone lines transmitting information via satellite.

Among U.S. Army participants in the demonstration of this new art were Aldric Saucier, project leader for Advanced Hybrid Computer Systems with the U.S. Army Materiel Command's HQ Management Information Systems Directorate; Gerald Edwards, chief of the Analog-Hybrid Analysis Division, Management Information Systems Directorate, Picatinny Arsenal; and COL Philip Enslow, chief, U.S. Army Information Science Branch, U.S. Army R&D Group (Europe), London, England.

George Wilson, principal computer systems designer of Martin Marietta Corp. also was at the European end of the demonstration.

ANALOG COMPUTER signals are transmitted for the first time by telephone lines and satellite from Germany to Orlando, FL. At the keyboard is George Wilson, Martin Marietta Corp. Looking on are Aldric Saucier (center), AMC HQ, and Gerald Edwards of Picatinny Arsenal.

R & D NEWS

Armor Spinoff May Reduce Cost of Lasers

Technology developed for the production of transparent armor has been adapted for the growth of laser single crystals at the U.S. Army Materials and Mechanics Research Center, two AMMRC scientists report.

Dr. Jaroslav Caslavsky and 1LT Clifford Ballard say they have modified the Gradient Furnace Technique. Initially developed at the AMMRC for the growth of large diameter sapphires, the technique has produced undoped yttrium aluminum garnet (YAG) single crystals of optical quality up to three inches in diameter—twice the size of the former largest YAG crystals.

Studies of the growth of neodymium-doped YAG crystals were started recently and results are "most promising." By growing larger crystals, more rods can be cut from a single boule, thereby reducing the end-item cost.

Solid-state range finders and target designators which operate in the infrared have proved their effectiveness as a functional component of numerous weapon systems. Widespread use of such devices has been limited by the high cost of preparing single crystals boules from which the lasers are cut.

YAG has a termal conductivity about one-third that of sapphire. Adapting the original technique to produce slow, controlled growth of high quality, YAG required the design of a water-cooled, copper-graphite heat exchanger having precise heat extraction specifications.

The vertical temperature profile within the hot zone of the graphite resistance vacuum furnace had to be controlled with great precision at temperatures up to 3,800° F.

Calculated thermal gradients projected in this manner promote cooperative growth from a previously oriented seed crystal into the melt surrounding it. Slow cooling of the furnace results in growth rates on the order of 1/16 inch/hour. The crystals take the shape of the molybdenum crucible in which they grow.

GROWING LOW-COST SINGLE CRYSTALS is a project of Dr. Jaroslav Caslavsky and 1LT Clifford Ballard at the U.S. Army Materials & Mechanics Research Center.

Army Tests Flywheel-Powered Helicopter Hoist

Prototype development of a new flywheel-powered helicopter hoist, believed capable of lifting at speeds six times greater than conventional systems, has been successfully demonstrated at Arthur MacArthur Field, Fort Sam Houston, TX.

Developed for the Army by Lockheed Missiles and Space Co., the system is expected to reduce hovering time during rescue operations when the helicopter is at a critical altitude, at maximum rotor power or when it is vulnerable to ground fire.

Storage of energy in the flywheel permits the hoist to provide significantly more lifting power than is currently possible with existing systems. The new hoist has already demonstrated lift capabilities of 580 feet-per-second, as compared to 100 feet-per-second for conventional types.

Utilizing a 2-horsepower motor to maintain a flywheel speed of 30,000 revolutions per minute, the unit features a mechanical clutch to couple flywheel power to the hoist and a vacuum system for cutting windage losses. Output power may be taken from the flywheel at levels in excess of 11 horsepower.

In contrast to conventional hoists, the new unit does not require a cooling period after consecutive lift operations. In fact, as many as nine consecutive high-speed lifts have been made without encountering heat problems.

Additional features of the prototype include a motorcycle-type twist grip control handle that permits easy single-handed operations. A switch gives the operator the option of an automatic swing-in system or a manual system of boom rotation.

System demonstrations at Fort Sam Houston have thus far included lifts of a weighted dummy on a jungle penetrator device, a 200-pound dead weight, a weighted rescue basket, and a weighted Bradford litter. Designed to fit the area now occupied by conventional hoists, the Lockheed system may be adapted in about one hour per vehicle.

Flywheel-powered Helicopter Hoist

APG Quadruples Power for Nondestructive Testing

Nondestructive testing capabilities have been quadrupled in power at the U.S. Army Aberdeen (MD) Proving Ground by addition of a 4-million-volt linear accelerator, one of the world's largest industrial X-ray machines.

Installed to replace a million-volt X-ray, the unit has a capability of "seeing through" 12 inches of solid steel and locating flaws as small as one-tenth of an inch in diameter. Flaws as small as one hundredth of an inch can be spotted in steel one inch thick.

R. L. Huddleston, acting chief of the Materiel Testing Directorate's X-ray building, said the increased flaw-detecting power of the testing machine enables the APG laboratories to examine large artillery shells, heavy armor castings and welded structures.

Improved nondestructive test capabilities of the new machine will make it possible to better determine causes of projectile malfunctions in large cannon. Critical-size flaws in metal parts or filler of the shell, or the wall of the heavy tube, can be detected to prevent costly and dangerous in-bore premature firings. If a premature occurs, inspection of unfired like components may solve the problem.

The accelerator's "tubehead" section differs from that of older models in that a built-in laser beam is used to accurately line up targets regardless of light exposure in the testing room. A computer control panel no larger than a table-top kitchen broiler features built-in safety and a digital panel that instantly flashes all the latest data an operator needs.

Films of the X-rays are processed automatically in a new single machine that develops, washes and dries as many as 60 large film prints an hour.

4-MILLION VOLT X-RAY machine can "see through" 12-inch-thick steel plate and find flaws as small as one-tenth of an inch in the metal. When used on steel with a thickness of an inch or less, the machine can spot a flaw as small as one one-hundredth of an inch in diameter. It is used to examine large artillery shells, armor castings and welded structures.

MASSTER Testing Indicators To Determine Field Location

Five new electronic location indicators designed to enable a soldier to pinpoint the location of his vehicle on a cross-country trip or in a combat environment at any given time are being subjected to MASSTER (Modern Army Selected Systems Test Evaluation and Review) experimentation.

Under study also is an automatic indicator that measures electronically the distance a soldier has walked, despite differences in strides. Test officers term both the distance indicator and the location indicator "products of very advanced technology."

Transistors and computer concepts incorporated in the new systems have produced a vast improvement over the bulky, heavy and often fragile indicators developed a decade ago. The indicators being examined by MASSTER are basically similar in that they operate with a mixture of gyroscopes and magnetic compasses linked to a simple computer and the vehicle transmission.

The test program calls for controlled exercises to examine the accuracy of the instruments over known terrain. The coordinates of each location will be determined accurately in advance. Differences in readings on the indicators being tested will thus be clearly evident.

Later tests will probe the soldier's ability to find their way over unknown terrain, both with and without the aid of the navigation devices. The soldiers will have to do things corresponding to required actions in a combat environment.

The distance indicator for foot soldiers is a small electronic package that attaches to their belts. A wire from the unit attaches to an antenna on each heel of the wearer's boots, and the distance measured as he walks is shown on a small screen in the waist-level package. The back-carried location and distance indicator is similar in appearance.

MASSTER Evaluating Mini Thermal Bar Torch

Researchers at MASSTER (Modern Army Selected Systems Test, Evaluation and Review) are evaluating field test results of a Miniature Thermal Bar Torch (MTBT) that has far greater cutting power and operating capabilities than the oxyacetylene torch.

Developed by the former Land Warfare Laboratory (LWL) at Aberdeen Proving Ground, MD, the MTBT can operate effectively above the 6,000-degree range of the oxyacetylene torch. It can be lit and operated on land or water without prior preheating or special preparation, and can be carried and operated by one man.

MINIATURE THERMAL BAR TORCH cuts through steel I-beam in seconds during recent field tests at MASSTER, Fort Hood, TX. The torch attaches to one bottle of oxygen, burns at a higher temperature and is less bulky than the oxyacetylene torch, and can cut through stainless steel, armor plating, concrete and earth.

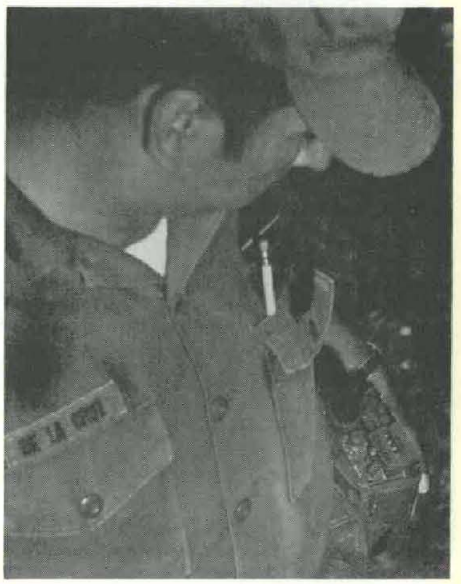
"The mini torch can cut through eight inches of armor plating in 42 seconds, which could be significant in rescuing men from a damaged tank or armored personnel carrier when time is a critical factor," said Jay Austin, test project officer at MASSTER, Fort Hood, TX.

Austin also explained the potential of the mini torch for use in nonexplosive demolition roles. "It could be an effective tool to replace thermite or other explosives to destroy vehicles, bridges or concrete field fortifications."

Although the mini torch has numerous possibilities as a military implement, Austin and the developers also see it as a tool needed for certain civilian rescue operations, such as car wrecks where victims are trapped inside.

"Any ambulance, police car, fire truck or rescue vehicle could easily carry one or more of these torches and be prepared for any type of emergency cutting operation," he said.

MASSTER tests of the torch included timed tests for man portability (it operates on a small backpack tank), mobility, speed of operation and assembly. Soldiers from the 1st Battalion, 50th Infantry, 2d Armored Division, were trained to operate the torch on a variety of materials, including steel I-beams, armor plating, helicopter bodies, concrete and earth.



DISTANCE INDICATOR is part of a test being conducted by MASSTER to examine new navigational devices that can be used by infantrymen. The device determines distance by measuring electronic signals from antennas attached to each boot heel.

U.S. Army Engineer Topographic Laboratories, Fort Belvoir, VA.

ETL Staff Relocates to New $6 Million Complex

More than 14 years after the U.S. Army Engineer Topographic Laboratories (ETL) separated from the Mobility Equipment R&D Center (MERDC) to become a field agency of the Office of the Chief of Engineers, ETL personnel occupy a new $6-million building at Fort Belvoir, VA.

About 300 military and civilian personnel, of whom 78 percent are scientific and technical, moved into the 100,000-sq. ft. laboratory and administrative facility in September. The relocation culminated a 5-year plan to centralize the ETL's R&D elements.

Since 1960, the ETL has been a tenant agency within the MERDC complex, occupying 34 trailers and portions of three buildings, with remote facilities in Alexandria, VA, and Brookmont, MD.

Under Commander and Director LTC Alfred B. Devereaux Jr., the ETL has consolidated all except one element within the new building. The Engineer Agency for Resources Inventories (EARI) will be relocated into the Ruth Building, Defense Mapping Agency Topographic Center (DMATC), Brookmont. MD.

Specifically, ETL's mission is to accomplish RDT&E of systems, equipment, procedures and techniques applicable to the terrestrial and topographic sciences, including mapping, surveying, geodesy, photointerpretation, military geographic information, and the analysis of environmental data relevant to military operations and materiel development.

SECRAC Program Saves $38 Million on Sam-D

Initiated in May 1972, SECRAC, a trend in Army materiel acquisition which assigns one contractor to monitor another, has resulted in cost savings to the Army of about $38 million on the SAM-D (Surface to Air Missile Development) program.

SECRAC denotes System Engineering Cost Reduction Assistance Contractor, and was inaugurated when the Project Office at Redstone Arsenal, AL, awarded a $2 million contract to IBM with instructions to: "Monitor the total SAM-D concept and design program, evaluate the systems engineering process, and study ways to reduce production costs."

Teaming with ITT Gilfillan, which provides expertise in radar technology, IBM assembled about 40 people at Research Park in Huntsville, AL, and began to work with Raytheon Co., SAM-D prime contractor.

One of the first tasks was a study to review potential candidates for the SAM-D weapon control computer. IBM confirmed that the Raytheon-designed computer was the most effective approach.

One of the major cost savings resulted from an IBM recommendation to simplify launcher electronics, communications and structural elements. Another suggestion changed the data link between the radar group and weapon control group. The baseline design called for a radio frequency system but IBM recommended use of a lightweight cable.

IBM also has conducted studies in the computer memory, software, nuclear hardening and radar areas. Thus far, eight of 33 changes recommended by IBM have been approved and implemented.

Future IBM efforts will be directed at ongoing design and test programs and in the conduct of system engineering studies to assure that SAM-D system performance is achieved at the least cost.

SAM-D Project Manager BG Charles Means says the SECRAC program "has really paid off." He explains that for an investment of nearly $5 million, the Army has realized savings of nearly eight times that amount.

"IBM brings to the SAM-D development program," he added, "a wealth of manufacturing experience from Air Force, space and commercial programs that is not available elsewhere."

EPA Designates Noise Reductions For Interstate Railroad Carriers

Noise reduction standards that would require trains operated by interstate rail carriers to install controls at an estimated cost of $80 to $100 million dollars are proposed by the U.S. Environmental Protection Agency.

The announcement by EPA Administrator Russell E. Train said the proposed standards "would bring substantial relief from railroad noise to the more than 500,000 Americans exposed to high levels" of contamination. Approximately 27,000 diesel engine locomotives are in service in the U.S.

Installation of the noise mufflers required by the standards would cost about $200 to $500 for switcher locomotives and about $1,500 for those used on regular runs. Additional hardware would range up to $2,500 for the road locomotives, Train stated.

Army Plans Operational Tests Of Hellfire Weapon System

Operational tests of the Hellfire weapon system, equipped with a laser seeker, will begin early in September at the Army's Hunter Liggett Military Reservation, CA, following successful completion of system tests.

The recent integration and system tests by Rockwell International marked the first time the complete Hellfire system had been installed on the Cobra helicopter. During this same period, U.S. Army Missile Command (MICOM) engineers conducted in-flight vibration and launcher jettison tests from the Cobra at Redstone Arsenal, AL.

Hellfire is being developed to provide the Army with a family of terminal homing-seeker modules and a common airframe to engage a variety of tank and hardpoint targets. It is the first antitank weapon specially designed for launch from attack helicopters.

COL John B. Hanby Jr. is Hellfire project manager at Redstone Arsenal. MICOM test engineers are Larry Johnson and Terry Farris of the Test and Evaluation Directorate. The test program is being directed by Ray Cox, acting chief of the Hellfire Product Assurance and Test Division.

Army Considers SB-3614 System For Combat Communications

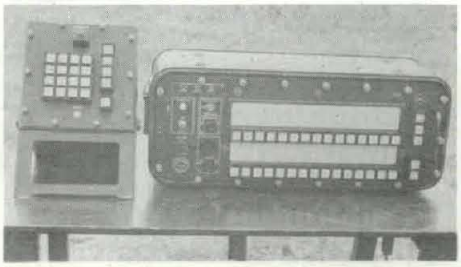
The SB-3614 telephone switchboard, developed by the U.S. Marine Corps may provide U.S. Army troops with an effective means of communication in combat situations.

The equipment is being evaluated following Modern Army Selected Systems Test, Evaluation and Review (MASSTER) tests at Fort Hood, TX.

Small, rugged and electronically advanced through integrated circuitry, the SB-3614 can be operated individually as a 30-line switchboard or it may be connected with additional switchboards and a converter to form a 60- or 90-line switchboard.

In addition to the familiar features found in a commercial telephone line, the new switchboard can also preempt any call with a high-priority call, provide a priority subscriber service, and establish two 10-party conference lines.

LTC Richard P. Talley, chief of the Communications-Electronics Division in MASSTER's Command, Control and Communications Directorate, said the new switchboard ". . . will be recognized as a giant step within the communications field, if the SB-3614 meets standard Army criteria."



SB-3614 SWITCHBOARD, with push-buttons and electronic circuitry, is being evaluated following MASSTER tests as a possible replacement for existing Army switchboards with plug-in connectors.

AMARC Publications Released
First Volumes of Report Portend Major Impact on Army RD&A

Long-awaited release of the first two volumes of the Army Materiel Acquisition Review Committee (AMARC) report, expected to impact profoundly on the Army R&D community, was announced Aug. 15 when the manuscript packet for this edition was ready to go to the printer.

Rapid scanning of the volumes clearly indicated to our editorial staff that the contents are of paramount interest to our readers, many of whom have been getting "grapevine" information from various sources.

Although the information is now "in the public domain" for representatives of the commercial news media, the pyramidal coordination and review process required for material published in the *Army Research and Development Newsmagazine* precludes the possibility of a comprehensive treatment even by pushing back the printer's deadline.

Currently, numerous studies at Department of the Army, U.S. Army Materiel Command, the Troop Support Command, Force Command, and major R&D installations that may be affected by the recommendations in the AMARC report, are in progress. Some of the recommendations have been or are being implemented; others may be delayed several months.

MG George Sammet Jr., AMC deputy commander for Materiel Acquisition, indicated general approval of the report in a recent speech to the American Defense Preparedness Association and the National Industrial Association seminar.

"We agree with well over 90 percent of them (recommendations)," he said.

One of the major responses to the recommendations, as announced May 20, was the establishment of an Office of Research, Development and Acquisition, with substantially expanded functional responsibilities transferred to the former Office of the Chief of R&D from other agencies to strengthen acquisition management. The OCRDA will function as a single DA staff agency to monitor the acquisition process.

Other actions to implement the AMARC recommendations include:

- Directing the U.S. Army Operational Test and Evaluation Agency to report directly to the Chief of Staff.
- Transferring the U.S. Army Safeguard System Evaluation Agency analytical capability from Safeguard to the U.S. Army Training and Doctrine Command (TRADOC).
- Improving the materiel acquisition personnel posture through a personnel development program which will grant proper recognition to the project manager because of his value as a resource manager.

In the process of implementation is the improvement of TRADOC's force development testing capability by transferring Modern Army Selected Systems, Test, Evaluation and Review (MASSTER) to TRADOC, and developing ways to improve the professionalism and incentives of civilian cost analysts and testers.

AMARC major recommendations under study by the Army include further reduction in organization, layering and fragmentation of staffs.

- Delay in settling on a required operational capability until after successful completion of advanced development.
- Consolidation of AMC Research, Development and Engineering activities into several system development centers.

Until initial results of studies and plans relating to the establishment of development centers are completed, expected late in 1974, the Army is "not in a position to render decisions in this multifaceted and difficult area."

Established in December 1973 by Secretary of the Army Howard Callaway, the AMARC was tasked to conduct a comprehensive review and analysis of the Army's acquisition process and make recommendations for improvement.

Dr. Wendell B. Sell, president of Hoffman Electronics in Los Angeles, headed the committee consisting of leaders from industry, academia, consulting firms or government agencies other than the Department of Defense. Six teams were formed: Requirements and Concepts, Development, Production, Costing, Testing, and Science and Technology.

MASSTER Evaluates GLLD for Impact on Artillery Tactics

Artillery doctrine and tactics conceivably could be "revolutionized" by a new laser-guided weapon system being examined by researchers at Fort Hood, TX, home of the Modern Army Selected Systems Test, Evaluation and Review.

The optimistic viewpoint was expressed by personnel of MASSTER's Combat Support Directorate as members of a forward observer team equipped with the Ground Laser Locator Designator (GLLD), which is designed to accurately guide projectiles onto a target.

The field artillery forward observor team's current practice is to operate on the front lines and watch where artillery projectiles land. Using binoculars, a map, a compass, a radio and their own judgment, the observers tell cannoneers how to adjust their fire to hit the target.

Modern technology, however, has developed devices that can identify and seek the point illuminated by a laser (Light Amplification by Simulated Emission of Radiation) beam. Equipped with something like the GLLD, a forward observer team can pinpoint a target with a laser beam, whether the target is moving or stationary.

While in the air, the artillery shell senses the reflected laser energy from the target and is guided toward the "bright" spot.

There are distinct advantages of this type of laser system, test officer MAJ Thomas M. Brown explained. "First, the artilleryman receives a very accurate target location. The GLLD measures the time to receive a return of reflected laser energy and computes the exact distance to the target while at the same time measuring the target's direction. This is the fastest method of locating the target that is available now."

Since the shell is terminally guided to the reflected bright spot, he said, the artilleryman can hit a moving target, such as a tank. The GLLD sits on a tripod and is linked to another box of electronic components. In a matter of seconds the forward observor team can have the needed information to control the firing of the guns onto the target.

Emphasized by MAJ Brown is the facet that MASSTER is using a simulator rather than the actual laser device in the field test program. This avoids the potential danger of exposing the naked eye to direct or reflected laser energy, thus causing injury to the retina. If a laser were used, a site survey would first have to be made through the Environmental Agency of the Army Surgeon General's Office to insure no harm would result.

The test program also is being conducted without the firing of artillery projectiles of any sort. Instead, situations are simulated through a computer system linked to an electronic tracker that reports the target's exact location at any time as it moves. The time used by GLLD-equipped teams is compared with the times recorded by teams using conventional methods.

Readings are broken down exactly into the time the forward observer team took to do its job and how much time was used by the fire direction center.

The computerized operation is much cheaper than using live lasers and real artillery pieces, in addition to insuring a test with minimum hazards. In actual field use, the GLLD adds 65 pounds of equipment to the gear carried by a 3-man forward observer team, and test officials are studying this aspect.

PINPOINT LOCATION—SGT Russell Crouch, left, sights a Ground Laser Locator Designator (GLLD) with assistance from PFC James Lawrence.

Improving Technical Organizational Memory in Weapon System Development

By Dr. John L. McDaniel and Dr. Julian S. Kobler

Just a few years' experience in weapon system development will bring the realization of how useful and economical it would be—how much it would reduce management risk—to have ready access to what could be termed a Technical Organizational Memory.

A precise definition of that term would be the capability of recalling solutions to technical problems encountered in prior systems for transfer to future systems.

The management of weapon system development programs is becoming increasingly difficult in the face of rapid technological advances and the consequent need for greater sophistication. Adding to the difficulties is an accompanying decrease in allowable time and available funds and other resources for such programs—a situation that cannot be reversed but only aggravated in the foreseeable future.

Given these two mutually frustrating sets of restrictions, the development of a system cannot be a one-man or one-group show, but must tap every source that can contribute anything to its success or can help reduce the time and cost of completion.

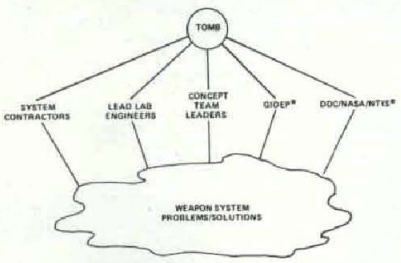
What would seem the most unnecessary waste would be to repeat a mistake—to pursue a concept or design a component that has already proved to be unworkable, or spend time and money solving a problem that has already been resolved. In the complex systems of today, problems with even relatively small components or functions can be quite costly in terms of the over-all system. Yet we all know this repetitive problem solving has happened many times and is probably occurring right now, in not one but many programs.

Two cases drawn from Army missile system development programs showed contractors repeating mistakes that their own organizations had learned to correct in previous programs. In both instances, and due largely to fortunate coincidences, the problems finally came to the attention of engineers who had solved the problems originally.

The duplication of effort occasioned by the delay in recall, however, consumed funds and time, most likely at government expense, that could have been saved had the appropriate technical memory been available.

Any attempt to "fix the blame" would be unrealistic: these particular contractors have had the primary responsibility for many defense programs and their high level of competency is widely known.

Similarly, the government management teams in all cases had a creditable record.



*GIDEP — Government-Industry Data Exchange Program;
DDC — Defense Documentation Center;
NASA — National Aeronautics and Space Administration;
NTIS — National Technical Information Service (Department of Commerce).

TOMB Operational Concept

There was simply no source they could have consulted for the technical history they needed.

In view of this difficulty of transferring knowledge within a company, it is obvious that only a centralized and specialized memory would be adequate for transfer of technical problem and solution data among contractors and research agencies.

Problem/solution data are most frequently reported in internal documents or stored away in some engineer's mind. Even while data exist, there is no central key for locating them, and they will soon be lost beyond recall. Formal reports that include such information are seldom identifiable by title or abstract, and searching all possibilities in large depositories would be too time-consuming to be useful.

Numerous information analysis centers can provide or lead you to technical data on a multitude of subjects, but none of these, in the Defense Establishment or anywhere in government, can identify past system failures with anything approaching a practical speed and coverage.

Surely we should not let this data source elude us even if we could afford the redundant effort. More than a decade ago, the now famous Weinberg Report* firmly supported the concept of specialized information centers and provided some general guidelines for their conduct:

"We believe that the specialized information center, backed by large central depositories, might well become a dominant means for transfer of technical information. . . . Specialized information centers, to be fully effective, must be operated in closest possible contact with working scientists and engineers in the field. . . . The centers not only disseminate and retrieve information; they create new information. . . ."

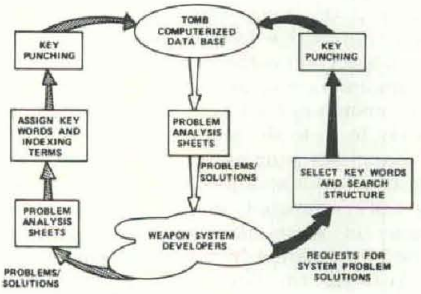
Advances in computer technology since that time have greatly increased the potentials of specialized data bases. We believe that the establishment of a Technical Organizational Memory Bank, or TOMB, is now feasible.

Dividends accruing from such a service would far exceed any expenditures involved. This statement is made with full recognition of the fact that assembling and handling of problem/solution data would present challenges not encountered in other information banks.

Briefly described in the ensuing paragraphs is a suggested plan for such a repository. The basic concept is similar to that of two specialized data banks already in operation at the Army Missile Command, respectively concerned with Independent Research and Development tasks and Terminal Homing data.

Certain general provisions, in addition to the computerization and the problems/solutions restriction, can be assumed. The coverage would be comprehensive: data from both

*Weinberg, A. M., et al., *Science, Government, and Information: The Responsibilities of the Technical Community and the Government in the Transfer of Information:* Report of the President's Science Advisory Committee, Jan. 10, 1963.



Documentation Flow Chart

contractors and government laboratories, and classified as well as unclassified material, would be included. The coding system of key words and other indexing terms would be devised according to conventional procedures for automated storage and retrieval.

The operational concept need not be complicated (see diagram). The major sources of information, represented by the five "feed lines," will be tapped through established channels, either by a deliberate search in response to a problem alert or by routine notification from the source.

One of the foreseeable challenges is overcoming the normal disinterest in, or maybe even resistance to, recording of "trouble" data. Engineers and scientists are not as eager to report problems as they are to announce discoveries or advances.

The reluctance to admit the existence of a problem plays only a small part in this lack of interest; primarily it is due to their much greater desire to solve the problem than to document it, particularly under the schedule and funding constraints that are part of every government development program. Once they have a solution, they will not face the same problem again, and the main concern becomes one of getting on with the program.

The establishment of a Technical Organizational Memory Bank—a repository that can reciprocate—will give some initial impetus, but it is improbable that completely voluntary responses would be adequate to build and maintain a viable information center.

This natural inertia could be counteracted by an aggressive data bank staff, actively promoting the collection and dissemination of data and operating through established contacts, or "sensing points," at the working level.

This concept is an innovation and one of the key features we propose for TOMB. Within R&D organizations, one engineer or scientist in each weapon system development program would be responsible for reporting the existence of a problem and serve as the principal source of data for that system.

In response to each alert, a TOMB representative would search the data base and other sources for records of a prior solution. If no assistance could be found, and the problem had to be solved by the reporting group, the staff member would follow the effort and compile a summary to be added to the bank.

This close and regular contact with working engineers and scientists would enable individual members of the TOMB staff to

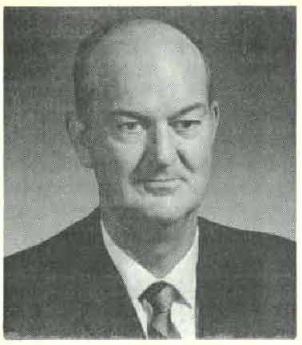
exercise considerable initiative in researching and even detecting problems.

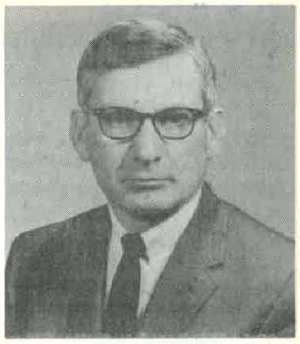
Another area that calls for special consideration is the format for collected data. The objectives of TOMB could not be served by a mere listing of problems by weapon system, component, agency, etc., or by references to other documents. The data base items must be originals specifically designed for TOMB, and must be complete enough to be immediately recognizable as applicable or non-applicable.

Suggested for this purpose is a Problem Analysis Summary Sheet that would contain, in addition to weapon system identification, a concise description of the problem and corrective action and a list of references and contacts. Here, again, the active participation of staff members is all-important.

Preparing such summaries is admittedly not a simple task. The facts may have to be pursued through several organizations and information bases—and may even then be located only in such private repositories as laboratory notebooks, technical memoranda, and personal memories. However, the coverage is essential and the effort involved would decrease rapidly with continued operation of the system.

The general plan for implementing a computerized problem/solution data bank is indicated in the documentation flow diagram—the preparation/filing of summary sheets on the left and the retrospective searching on the right. Each summary would be assigned a problem number and problem title for indexing into a storage/retrieval system.





Dr. McDaniel is director of the U.S. Army Missile Research, Development and Engineering Laboratory, U.S. Army Missile Command, Redstone Arsenal, AL. Dr. Kobler is project director of the same laboratory.

Based on a written or verbal request from a weapon system developer, an information specialist could initiate and rapidly complete a retrospective search of problems and solutions. Any problem analysis sheets identified as relevant would then be extracted from the TOMB files and forwarded to the requester.

The data bank would, of course, have the expansion potential inherent in automated systems. One additional service that is easily incorporated, and could be established almost simultaneously with the basic system, is a program of selective dissemination of information based on user interest profiles.

Profiles would be developed by TOMB personnel, and each registered user would automatically receive copies of all new summaries related to his area of work. It is not inconceivable that the service could act as "preventive medicine," enabling a developer to sidestep completely a problem he would otherwise have encountered.

Although this presentation could outline only the features considered essential in a Technical Organizational Memory Bank, a more detailed consideration of implementation procedures disclosed no barriers that would render it unworkable or impractical.

We not only believe the TOMB plan is feasible, but we are also convinced that the costs involved—both initial and operating—would be so small that retrieval of one solution a year to a major development problem would recover all expenditures. This belief, of course, assumes locating the data base where adequate computer facilities are already available.

A basic TOMB system within just one of the major R&D organizations of the Department of Defense would more than pay its way. Once such a system is in full operation, the potentials for expansion and refinement are unlimited.

DPG Performing Environmental Protection Agency Tasks

By Victor Pratt

An Interagency Agreement between the U.S. Army Materiel Command (AMC) and the National Environmental Research Center of the Environmental Protection Agency (EPA) in Cincinnati, OH, assigns a $105,000 solid-waste research project to the U.S. Army Dugway Proving Ground (DPG), Dugway, UT.

Dugway is a subordinate installation of the U.S. Army Test and Evaluation Command (TECOM), Aberdeen (MD) Proving Ground and the agreement was the culmination of an initiative begun by AMC with the EPA in 1972. The EPA then was advised that AMC Laboratories were encouraged to participate in Interagency Agreements where their expertise could help solve domestic problems.

Responding favorably to this initiative, the EPA suggested that their published extramural contract program be examined for suitable tasks. Resulting candidate tasks included one with the Solid and Hazardous Waste Research Laboratory in Cincinnati related to characterization of the effects of various soils in land fills on leachate composition. Leachate is the liquid resulting from the percolation of surface water through a land fill area.

Before describing Dugway's contribution to this task, it is necessary to examine briefly the over-all problem of solid-waste disposal.

Figures available in 1967 reveal that the nation was generating daily upwards of 400 million tons of household, commercial, industrial and municipal solid wastes. The principal source is household refuse, which is not normally combined with industrial waste.

Solid waste is deposited most commonly in sanitary land fills as a means of eliminating open burning. Layers of waste about two feet thick are compacted and covered at the end of each day with six inches of soil. Alternate layers of waste and soil are deposited until the predetermined depth is reached. A final cover of two feet of compacted earth is then emplaced to top the site and form a base for light structures or a recreational area.

A completed land fill does not reveal to a casual viewer that the compacted wastes are undergoing a dramatic change. Biological and chemical reactions transform the waste into other solid, liquid and gaseous products. Metals are oxidized. Organic wastes are consumed by microorganisms, first through aerobic and then by anaerobic processes.

Released carbon dioxide affects the acidity of the fill, further stimulating chemical transformations. The process varies from site to site and depends on the fill composition, the compactness of the fill, and many other physical and chemical factors.

Ground or infiltrating surface water, moving through the fill, produces a liquid leachate containing dissolved and finely suspended solids and microbial waste products. This liquid will leave the fill and percolate through the rock and soil surrounding the site and may ultimately enter water supplies or streams.

The nature of the soil at the site affects the composition of the leachate which leaves the fill by attenuating or removing undesirable elements. This is accomplished through processes such as ion exchange, filtration, adsorption, complexing, precipitation and biodegradation.

Many studies have broadened knowledge of the complex attenuation processes and the factors affecting transformation and migration of toxic and hazardous elements through the fill. EPA's Office of Solid Waste Research is currently conducting a study of migration of leachate through a domestic waste land fill site to obtain data on the process.

In March 1973, the SWR office issued an interim report on the field study made at a site in Boone County, KY. This work is expected to continue for several years to measure slow changes which continue for decades.

EPA's interest in the leachate from land fills containing industrial waste is the origin of the Dugway task. Wastes containing hazardous materials such as asbestos, mercury, copper, beryllium, cadmium, selenium, pesticides and chlorinated hydrocarbons are deposited directly in the fill or as scrapings from the bottoms of disposal lagoons.

To develop practicable safety regulations, it is necessary to ascertain the processes which transform these toxic materials in the landfill environment. Dugway will support this investigation in an 18-month period divided into three parts.

The first phase involves detailed chemical analysis of selected industrial waste stream samples to determine the content of water-soluble compounds. Leachate from existing

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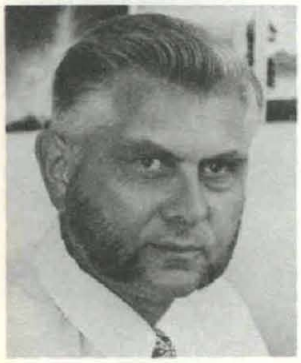
Atmospheric Electricity Phenomena . . .
Worldwide Interest Focuses on Research Reports at Conference



Dr. Reinhold Reiter

Awesome power of electrical storms, which has frightened and fascinated mankind since primeval days, will be considered with related scientific phenomena of increasing interest at the Fifth International Conference on Atmospheric Electricity in Garmisch-Partenkirchen, Germany.

One of the inspiringly stimulating scientific success stories of modern times led to the Institut fur Atmospharische Umweltforschung (Institute for Atmospheric Environmental Research), which is linked to the Sept. 2–7 meeting of an anticipated more than half the world's senior scientists in this highly specialized area. The institute's director, Dr. Reinhold Reiter, will be the conference chairman.

Established with meager resources as the Physikalisch Bioklimatische Forschungsstelle in 1950 in Munich, the institute was moved to Farchant near Garmisch in 1954. The first laboratory there was a rough-sawed lumber rehabilitated sheep pen. When it was having funding difficulties a few years later, its survival was aided by grants from U.S. Department of Defense agencies interested in broadening their base of important scientific knowledge.

With that critical support, subsequently augmented predominantly (about 90 percent of the total current funding) by the Federal Republic of Germany, the Bavarian State Government, other German agencies, and citizens of the world-famed resort center of Garmish-Partenkirchen, Dr. Reiter founded what now includes a unique capability for atmospheric electricity research.

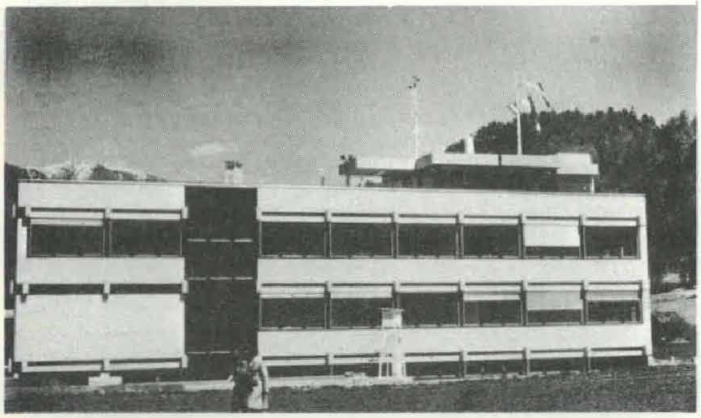
Funds provided by the Bundesministerium für Forschung und Technologie der B.R.D. (Ministry for Research and Technologie, Federal Republic of Germany) enabled the newly renamed Institute for Atmospheric Environmental Research to move into its own 3-story modern large building in March 1973. Laboratory facilities are extensive and ultramodern, including highly sophisticated research equipment.

United States scientific interest in the programs of the Institute is widespread. Currently it includes, in addition to the U.S. Army R&D Group (Europe), London, England, an element of the U.S. Army Materiel Command, such organizations as the National Center for Atmospheric Research, the National Oceanic and Atmospheric Administration, and the U.S. Atomic Energy Commission.

Interested also are the U.S. Army Electronics Command, particularly its Atmospheric Sciences Laboratory at White Sands (NM) Missile Range; U.S. Army Deseret (UT) Test Center; U.S. Naval Research Laboratories, Washington, DC; and U.S. Air Force Cambridge Research Laboratories, Bedford, MA.

(A detailed description on the facilities, capabilities and historical background of Dr. Reiter's laboratory will follow this report on the program and participation in the conference.)

About 50 percent of the more than 200 anticipated participants in the Fifth International Conference on Atmospheric Electricity will represent the United States. It will be staged in the Garmisch convention hall, not far from the Institute for Atmospheric Environmental Research.



NEW Institute Building in the valley of Garmisch-Partenkirchen.

SHEEP-FOLD, historic building of the Physikalisch-Bioklimatische Forschungsstelle in Farchant near Garmisch-Partenkirchen during the period 1954–62.

Scientists of 24 nations had signified intention of participating as this edition of the *Army Research and Development Newsmagazine* went to press in August. Host for the conference is the Fraunhofer-Gesellschaft fur Angewandte Forschung (Fraunhofer Society for Applied Research), headed by Prof. (Dr.) Otto Mohr. The sponsor is the International Commission on Atmospheric Electricity and the co-sponsor is the World Meteorological Organization.

Contributions from the Federal Republic of Germany, through its Deutsche Forschungsgemeinschaft (comparable to the U.S. National Science Foundation), the Bavarian Government, other German agencies and Garmish-Partenkirchen citizens are supporting the conference.

The program includes 10 invited technical papers authored by internationally renowned leaders in atmospheric electricity research, 100 contributed papers, 10 discussion sessions, and a general discussion on priority research problems viewed within a 5 to 10-year framework.

Other highlights are consideration of a 10-year program of atmospheric electricity research and a special discussion on providing improved protection for people against lightning. Twelve experts from various nations have given extensive study to the protection problem and have developed suggested precautionary measures, some of which conflict with current beliefs and practices.

Additional scheduled features are two sessions devoted to applications of atmospheric electricity for meteorologists, and to methods of monitoring the lightning activity over the entire world. Five excursions to institutes in southern Germany and Switzerland concerned with research in atmospheric electricity will follow the conference.

Preparations for the conference have been made by a panel consisting of Prof (Dr.) L. Koenigsfeld of Belgium, Dr. R. D. Bojkov of the World Meteorological Organization, ICAE Secretary Hans Dolezalek, who is a physicist with the U.S. Office of Naval Research, and Dr. Reiter. Support has been provided by an Advisory Board of 19 scientists from 11 countries.

One of the senior U.S. scientists will be Dr. Samuel C. Coroniti, now with the U.S. Department of Transportation Climatic Impact Assessment Program in Washington, DC. Dr. Coroniti has been deeply involved with arrangements for all of the previous conferences and was the principal organizer of the past two.

Prof. Helmut E. Landsberg, for many years the director of Climatology, U.S. Weather Bureau and now a professor at the University of Maryland, is programed for the banquet address.

Four of the 10 invited papers will be presented by U.S. participants, namely: Dr. Martin A. Uman, professor of electrical engineering, State University of Florida, and author of several books on lightning; Dr. Volker A. Mohnen, State University of New York at Albany, famed for his work on atmospheric ions; Dr. Heinz W. Kasemir, head of the Atmospheric Electricity Branch, Environmental Research Laboratories, National Oceanic and Atmospheric Administration, Boulder, CO; and Robert V. Anderson, Naval Research Laboratories.

Among other U.S. participants scheduled to present papers are Dr.

Edward T. Pierce, Stanford Research Institute; Dr. Frank Eden and Dr. Robert Manka, National Science Foundation; and Dr. Richard E. Orville, State University of New York at Albany.

U.S. session chairmen will include Dr. Bernard Vonnegut, known as one of the leading U.S. authorities in atmospheric electricity research and also as a professor at State University of NY; Dr. Lothar H. Ruhnke, head of the Atmospheric Science Branch, Naval Research Laboratories, White Oak, MD; and Dr. George A. Dawson, University of Arizona.

Other renowned members of the U.S. group will be Prof. Leonard B. Loeb of the University of California at Berkeley, an authority on ion physics, plasmas, lightning and static electricity; Dr. Marx Brook, a senior scientist in thunderstorm research and professor of New Mexico Institute of Mining and Technology; and Prof. Charles B. Moore, also of NMIMT.

Canada's leading representative will be Dr. D. R. Lane-Smith, who is listed to present one of the invited papers. Dr. Bhartendu, Canadian Atmospheric Environment Service, submitted several papers.

Japan's participant list will include Dr. Haruji Ichikawa, director of the Japanese Institute of Atmospheric Research; Prof. A. Kimpara, a senior authority in thunderstorm research; Prof. Choji Magono from Sapporo, one of the invited speakers; and Dr. N. Kitagawa, a session chairman.

Dr. Ralph B. Anderson will attend as a member of the South African Council for Scientific and Industrial Research. Nigeria will be represented by Prof. A. I. I. Ette of the University of Ibadan. Australia's group includes Prof. S. Prentice, a lightning expert, and from India will come Miss Anna Mani, director of its Meteorological Department.

England is expected to have a substantial representation and Dr. John Latham, University of Manchester, is programed as an invited speaker. Among Sweden's representatives are Dr. R. Siksna, University of Uppsala, and Dr. Rolf Boström, Institute of Technology in Stockholm, a session chairman.

Belgium's principal participant will be Prof. (Dr.) L. Koenigsfeld, president of the International Commission on Atmospheric Electricity, and from France will come renowned Prof. (Dr.) J. Bricard of the Sorbonne in Paris. Prof. (Dr.) Karl Berger, Dr. Leonard Saxer, a session chairman, and Dr. A. Aufdermaur are among those expected from Switzerland.

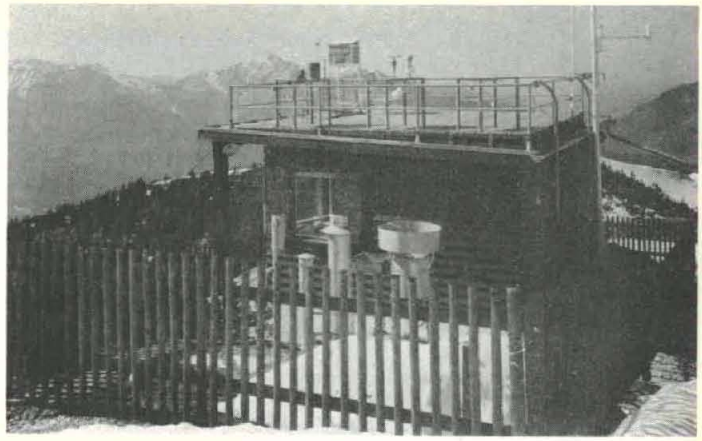
In addition to General Chairman Dr. Reinhold Reiter, Western Germany's participation includes three of the invited speakers: Prof. (Dr.) Richard Mühleisen, University of Tübingen; Prof. (Dr.) Hans Volland, University of Bonn, and Dr. W. Harth, Max Planck Institute for Radio Astronomy. Prof. (Dr.) Otto Mohr will attend as president of the Fraunhofer Society.

Listed with the anticipated Russian participants are Dr. V. P. Kolokolov, director of Atmospheric Electricity Department of the Main Geophysical Observatory in Leningrad and Dr. I. M. Imyanitov of the same institute, along with Dr. N. V. Krasnogorskaya, a distinguished female scientist in Moscow.

Prof. (Dr.) L. N. Carapiperis of the National Observatory in Athens is expected from Greece, Prof. (Dr.) Aleander Grigoriu from Romania and Dr. Zev Levin of Tel Aviv University from Israel.

Scientists from other countries that have indicated they will participate are from Austria, Czechoslovakia, Denmark, Finland, East Germany, Hungary, Ireland, Italy and New Zealand.

VIEW from Zugspitze Peak to the south into the Austrian Alps.



WANK PEAK Observatory.

IAERFS Historical Background, Mission.

What is today the Institute for Atmospheric Environmental Research of the Fraunhofer Society in Garmisch-Partenkirchen, in one of the most beautiful areas of the Bavarian Alps of West Germany, might well be said to be a serendipitous product of concern for amputee veterans of World War II.

Dr. Reinhold Reiter, the IAERFS founder and director, was fresh out of the University of Munich, where he later obtained his doctorate, when he began thinking of an arm prosthesis that could be controlled by the amputee via the biological electric potentials at the nerves of the stump.

Dr. Reiter engineered and built a prototype to demonstrate that the nerves could be used to energize a control system. Lack of funds and of sufficiently miniaturized electronic components pushed the project into the background. Meanwhile, he thought about the acute weather-dependent pains amputees experienced, and thus turned his attention to biometeorology.

In 1950 he founded the Physical Bioclimatological Research Laboratory (English translation) and with the aid of Dr. G. Kampik, a physician, demonstrated by more than a million individual facts that the behavior of both healthy and sick persons is subject to weather influences.

Periods of atmospheric instability, he found, are accompanied by an increase in births and deaths, of traffic and industrial accidents (even in underground mines), length of reaction time, frequency and pain intensity of many diseases, heart failures, circulatory troubles and other effects.

Satisfied that atmospheric-electrical parameters do have a distinct influence on physiological systems, following preliminary animal tests, he directed his attention to this area of scientific investigation. Since the available information was meager, he decided to devote several years of intense work to increase his knowledge.

Backed by the first U.S. funding of his research, provided by the U.S. Air Force, he moved the Physical Bioclimatological Research Laboratory to Farchant near Garmish-Partenkirchen in 1954. His concept was to install mountain research stations at altitudes ranging from 700 meters (2,310 feet) to 3,000 meters (9,900 feet), and to make synoptic atmospheric electrical measurements of conditions.

Assisted by his wife, also a physical chemist, he collected data from between six and nine stations—information on cloud and thunderstorm electricity, electric charges on precipitation, and some initial determinations on solar-terrestrial relationships. The first laboratory at Farchant, as mentioned earlier, was a rehabilitated sheep pen of rough boards.

Dr. Reiter recently explained: "An atmospheric electrician attempting to get to the basis of relationships cannot just stick to measuring fields, currents and conductivities. He must also look into the ionization processes generating those ions which move in the electric fields; he must also study the concentration and mobility of the ions.

"This means he must study the variables having a strong impact on ionization, particularly the natural and artificial radioactivity of the air, and he must investigate by what aerosol particles the primary ions generated by ionization are captured."

Inclusion of these objectives has greatly expanded the scope of research and the capabilities, with respect to staff expertise, laboratories and scientific equipment, including advanced data processing.

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Recordings are being taken of radon and thoron decay elements and of fall-out elements in air and precipitation at three stations, viz: valley floor (700 meters above sea level) Wank peak station (1,780 meters) and Zugspitze station (2,964 meters).

Impressed by the growing international interest in this research, and the profitable flow of visitors, city officials of Garmish-Partenkirchen made new laboratory facilities available in the ski stadium in 1962. The staff also was increased to include two scientists and six technicians.

The Zugspitze station is within the advection layer of atmospheric flow and natural radioactivity there is very low due to its altitude. Consequently, instrumentation will promptly record newly arrived fallout. Ways were found to use the fallout radioactivity in air and in precipitation measured simultaneously at 700 meters, 1,780 and 2,964 meters, to study the atmospheric washout.

In this research effort, a contract of several years duration with the Ministry of Defense, Federal Republic of Germany, permitted for the first time a thorough investigation of changing atmospheric factors. The U.S. Army Research Office (now the U.S. Army R&D Group (Europe in London, England) also became interested and provided funding support in the early 1960s. This, in turn, encouraged the German government to increase support on a cost-sharing basis.

Zugspitze is known worldwide to skiers. Cable cars transiting between there and Garmish-Partenkirchen give them a panoramic scan of Alpine beauty. Dr. Reiter and his associates conceived the idea of instrumenting the cable cars to record data at different altitudes along the way and transmitting it by telemetry to the ground level lab. Numerous profiles are obtained each day by this inexpensive method.

The fine structure of vertical distribution of aerosol concentration is thus obtained directly as a function of the fine structure of aerological parameters. Based on thousands of runs, it was possible recently to parametrize the dependence of the vertical aerosol exchange on the aerological structure.

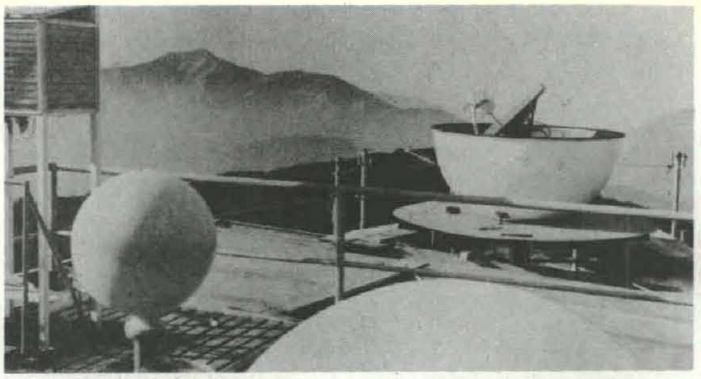
Atmospheric electrical studies have resulted in a new concept concerning generation of electric charges in shower and storm clouds—that it is a "feedback process" which may explain the frequent arerlange-like increase of charges.

Global atmospheric electrical studies include solar-terrestrial relationships. Instruments at the Zugspitze station have shown that two to three days after solar flares, the electrical potential of the ionosphere will increase significantly. The work is supported by contracts with the U.S. Naval Research Laboratory and the U.S. Atomic Energy Commission.

Current investigation also includes the retention of aerosol particles in the respiratory tract as a function of particle size, electric charge, hygroscopicity and other factors.

Dr. Reiter said that precise knowledge of the retention functions is indispensible for recognition of the effective biological hazard of an aerosol. A retention simulator was developed to indicate particle distribution of an unknown particle in the respiratory tract.

Dr. Hoyt Lemons, U.S. Army R&D Group (Europe), recently stated: "There are several Army objectives in this program and they include: study of the inflow of air into the valley from distant regions, and inflow at both low and high levels of the atmosphere; study of pollutants and the sources of origin; turbulent mixing and circulation within the valley and how this is influenced by the inflow of air; and extrapolation of the findings in this valley to other regions of the world, mountainous and nonmountainous."



RAWINSONDE SYSTEM on the Wank Peak Observatory.

U.S. Army support of the institute is "carefully integrated" into the atmospheric research programs of the Atmospheric Sciences Laboratory at White Sands (NM) Missile Range, the R&D testing program at Dugway (UT) Proving Ground, the U.S. Army Electronics Command, Fort Monmouth, NJ, and the atmospheric research program of the Missile Command, Huntsville, AL.

Capabilities for Research. Currently, the programs of the institute are supported about 70 percent by the Federal Republic of Germany, 20 percent by the Bavarian government and other German agencies and 10 percent by United States agencies. The U.S. Army investment is small, averaging about $20,000 annually, in addition to the loan of some equipment.

Dr. Reiter's staff includes Dr. W. Carnuth, physicist; Dr. K. Poetzl, chemist; J. Kanter and R. Sladkovic, meteorologists; and M. Littfa, mathematician. Four additional personnel man the mountain stations, three serve as chemical assistants, eight are employed in data processing, one provides library service, and five are classed as mechanics.

The 3-story laboratory building has a roof terrace used for launching radiosonde balloons and also carries miscellaneous measuring instruments. Workshops for precision mechanics and electronics, an aerosol test laboratory, the records office, store rooms and other facilities are in the basement.

Laboratories for physics, aerosol physics, nuclear physics, physical chemistry and chemistry are on the first floor, along with the library and conference rooms. Offices of the director, key personnel, atmospheric recorders and measurement instrumentation, and data processing facilities are on the second floor.

The third floor serves as a recording room for a high-power lidar system and an observation room glassed-in on all sides. The 100-megawatt pulse ruby and ultaviolet intensity lidar system has a 20 nanoseconds pulse length with a maximum height shot of about 100 kilometers (62.5 miles) using single photon counting. Recordings by camera use a double-beam oscilloscope displaying simultaneously fine and coarse structure of aerosol layers. Electronic data processing uses an extremely fast memory with magnetic tape recording.

Dr. Reiter explained that "there is hardly anywhere else where the lidar system can be absolutely calibrated in the spectrum between 700 and 3,000 meters above sea level. Measurements of aerosols are obtained at the mountain stations and by the cable-car soundings."

DPG Performing Environmental Protection Agency Tasks

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land fill sites will be used to determine its solvation power relative to water.

In the second phase, water and leachate will be passed through columns of various types of soil to evaluate the ability of the soil to retain the toxic materials. This will help establish criteria for selection of new land fill sites. Findings should help to define engineering requirements for protective soil depths required to protect underground potable water supplies.

The final phase will be directed to examination of the data obtained in phases I and II to define mechanisms active in removal of the hazardous materials. Development of an "attenuation coefficient" for a range of soil categories should provide a basis for drafting new disposal regulations.

The Dugway task will be supervised by Dr. Mike Roulier, soil scientist of EPA's National Environmental Research Center in Cincinnati. Ronald Bell, chief of the Dugway Chemical Technology Branch, will serve as project manager and Martin Houle, also of Dugway, will be the technical project leader.

Dugway research leaders expect that the initial task results will lead to follow-on task assignments from the EPA. These and other tasks currently being negotiated will help even out the peaks and valleys in Dugway's prime mission workload, and thus help maintain the professional competence of the technical staff.

VICTOR PRATT, general engineer in the Program Control Office at Dugway Proving Ground, earned a bachelor of chemical engineering degree at the Pratt Institute, Brooklyn, NY. He served as a project engineer at Fort Detrick, MD, for 12 years, and was reassigned as a general engineer to the Deseret Test Center, Fort Douglas, UT, in 1962. When the Deseret Test Center and Dugway Proving Ground were merged July 1, 1968, Pratt assumed responsibility for the Combined Contract Program as staff engineer to the director of Technology and Technical Support. He is a licensed professional engineer and a member of the American Ordnance Association.

X-Ray Device Aids Analyses of Shaped Charge Jets

By John G. Schmidt
Special Assistant to the Director
U.S. Army Ballistic Research Laboratories, APG, MD

What is believed the first flash X-ray system for recording X-ray diffraction patterns in a shaped charge jet has been assembled and tested at the U.S. Army Ballistic Research Laboratories, Aberdeen Proving Ground, MD.

Using a film exposure time of 70 nanoseconds (70×10^{-9} seconds), the system recorded an X-ray diffraction pattern from an aluminum jet 80 microseconds (80×10^{-6} seconds) after detonation of a shaped charge.

The system's capability to provide such diffraction patterns gives the Army an important new device for studying the details of the jet's internal structure and the behavior of other solids, particularly metals, subjected to stress at very high loading rates.

The system and the radiograph are the results of a 6-month effort by Prof. Robert E. Green, Johns Hopkins University, who has long been interested in dynamic X-ray diffraction. The Army's Laboratory Cooperative Research Program enabled Dr. Green to be employed at the laboratories during part of a one-year sabbatical from the university.

Briefly, the problem which he considered, suggested by Dr. Coy M. Glass of BRL, was to determine which sort of flow, i.e., ordered liquid, crystallographic, or amorphous, a solid exhibits under explosive shock conditions. The flash X-ray diffraction technique showed promise for providing the information about the solid's response.

BRL scientists have demonstrated, in the recent past, how material properties influence the flow of explosively loaded solids. For example, Dr. Glass and his coworkers achieved a major breakthrough in the study of solid explosive interactions. They showed that crystallographic orientation of the grains in a metallic polycrystalline conical-shaped charge liner is the controlling factor in causing a liner to collapse in certain directions with respect to the cone's axis.

Dr. Glass' experimentation showed that in single metal crystals, fractures caused by explosive shock waves follow paths that are dependent upon the metal's structure.

However, this qualitative information does not permit the development of a mathematical model that would describe the reaction of a metal in terms of the magnitude of a shock wave, the strength of the metal crystals, or the ultimate strength of the metal. Nor does it give insight into the state of a shaped charge jet before it strikes its target.

Knowledge of exactly how the metal reacts during the passage of a compressive shock and during the tensile shock reflection cycle would permit development of a mechanistic theory on the material's behavior. Such a theory would then permit BRL terminal ballisticians to specify the properties of materials to be used in Army warheads.

For his work at the Ballistic Research Laboratories, Dr. Green selected a Hewlett Packard Field Emission Corp. flash X-Ray system with a 150-kilovolt pulser and an X-ray tube with a molybdenum target and beryllium window. The X-ray tube with its molybdenum target, which provides soft X-rays, was developed specially for BRL.

Except for an image intensifier tube, the system used to detect the diffracted X-rays was similar to one developed previously by Dr. Green and Dr. K. Reifsnider under BRL contract.

Figure 1 is a drawing of the experimental arrangement. The shaped charge, cast from 1.5 pounds of Pentolite explosive, had a 60° conical aluminum liner with a wall thickness of 0.120 inch and an outer diameter of 3.25 inches.

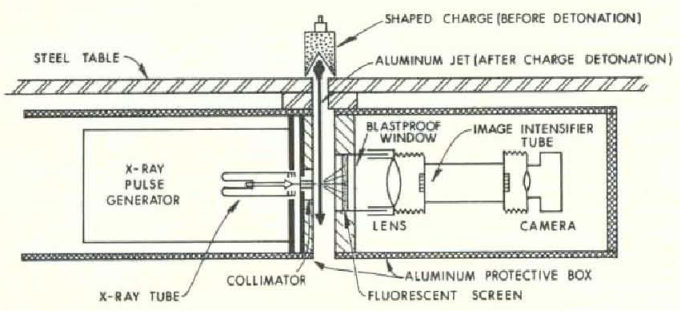


Fig. 1. Experimental shaped charge and flash X-ray system.

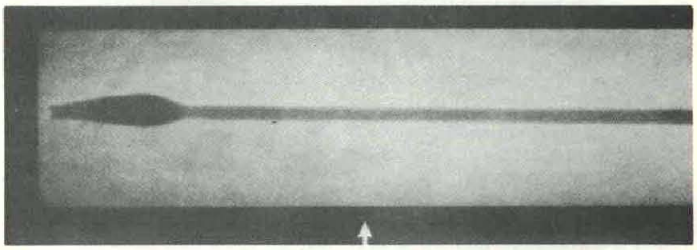


Fig. 2. Flash X-ray radiograph of aluminum jet taken 80 microseconds after detonation at Aberdeen Proving Ground.

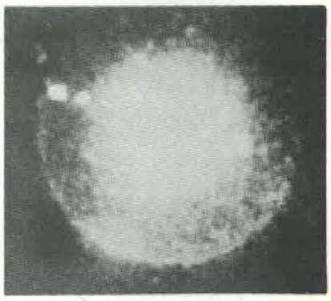


Fig. 3. X-ray diffraction of aluminum shaped-charge jet.

The charge was placed on a steel table; the apex of the liner was placed directly above the center of a one-inch diameter hole passing through the table top. Upon detonation of the charge, the aluminum jet passed directly through the hole while much of the blast was diverted.

The pulse generator was placed in an aluminum box beneath the table, mounted so the X-ray beam traveled horizontally. A steel collimator, fastened directly to the face of the pulser, was mounted so that the collimator hole was aligned precisely with the beryllium window of the X-ray tube.

The detector system was placed in a similar protective box also mounted horizontally beneath the table. A blast-proof window in the front of the box permitted the X-ray beams diffracted by the jet material to enter the detector.

The window consisted of a sheet of mica, a sheet of aluminum foil, a disk of styrofoam, another sheet of aluminum foil, a sheet of black plastic, a zinc cadmium-sulfide fluorescent screen with its phosphor face toward the image tube, and a one-inch thick bullet-proof glass.

To take an X-ray diffraction photograph of the jet, the pulser is triggered automatically 80 microseconds after the shaped charge is detonated. Diffracted in their passage through the aluminum jet, the X-rays are converted by the fluorescent screen into visible light. This is transmitted through the glass plate and the lens and projected on the input face plate of the image intensifier tube.

The intensified image appearing on the output face plate of the intensifier tube is photographed with a modified oscilloscope camera using Polaroid Type 107 film.

Figure 2 is a flash X-ray radiograph of the aluminum jet taken 80 microseconds after the charge was detonated. The white arrow shows the position along the jet where the X-ray diffraction photograph was taken; the jet diameter was approximately 3/16 inches in diameter.

Figure 3 shows the first X-ray aluminum jet diffraction pattern indicating that the jet is composed of a cold-worked particulate solid. Analysis of the pattern shows that the jet consists of a particulate solid with a grain size distribution from about one millimeter down to about one one-hundredth of a millimeter.

Measurements of the diffraction pattern also support the conclusion that the jet is particulate; the diameter of the outer ring of the diffraction pattern agrees within experimental error with theoretical calculations of the diameters of both the (111) and (200) diffraction rings for an aluminum powder irradiated by molybdenum K_{α} X-rays.

The relatively continuous pattern from the center out to the terminal ring indicates line broadening characteristic of diffraction radiographs associated with cold-worked metals. Some of the individual spots exhibit asterism (a star-shaped pattern), also associated with cold working.

Results from additional experiments currently in progress at BRL and in Dr. Green's laboratory should ultimately permit more detailed analyses of flash X-ray diffraction patterns from shaped charge jets.

For many years, Dr. Floyd A. Odell, Associate Director of the BRL, has advocated the use of flash X-rays to obtain dynamic diffraction records. The success of this shaped-charge experiment to a large measure reflects his interest and encouragement.

In this cooperative Army laboratory-university research, industry played a role through help provided by Dr. Francis Charbonnier and Richard Espejo, Field Emission Corp.

Optical Design of Day/Night Periscopes for Combat Vehicles

By Wright H. Scidmore

Frankford Arsenal at Philadelphia, PA, is responsible for developing weapons fire control materiel for the U.S. Army and, in this capacity, has designed and developed, in-house, several day/night sighting systems.

The optical concept and design of a select five of these day/night passive periscopes for combat vehicle use will be reported in this article. The M44, M50 and M51 periscopes use catadioptric objective systems with a first-generation, 3-stage image intensifier tube.

The M32/35/36 and COP systems use "wide band" refractive objectives with a second-generation image intensifier tube for the night sight channel.

In all cases, the passive capability can be augmented, if desired, with a searchlight equipped with a "pink" filter to extend useable range under low levels of illumination.

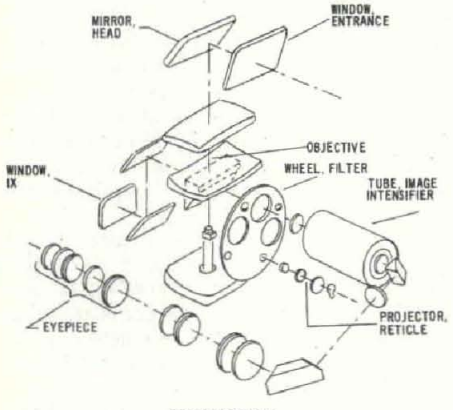
The M44 Periscope was designed in 1961 for use by the gunner in the Sheridan M551 vehicle. Pilot models were tested at Aberdeen Proving Ground, Fort Knox, Fort Greely, and by the U.S. Army in the Canal Zone, resulting in follow-on production and fielding of this periscope.

The M44 provides high-power night sighting and unity power (heads up) day surveillance capabilities in a compact periscopic configuration. High-power day-sighting capability is provided by a separate articulated telescope. The optical system for this periscope is shown in Figure 1.

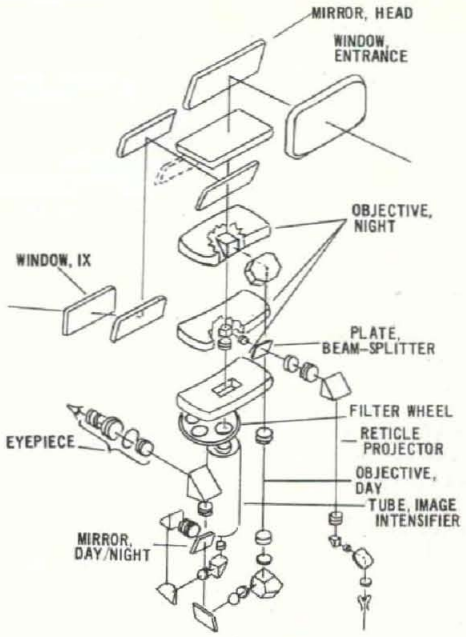
A "rectangular" catadioptric objective was devised to give maximum light-gathering power for a conventional rectangular hole in the turret roof. This permitted the use of a relatively small head mirror for the −18° to +22° elevation coverage, thereby keeping the entrance window aperture and periscope head silhouette small.

The reticle projector and the unity power channel are introduced into the central obscured area of the catadioptric objective, thereby keeping the size of the head assembly to that required for the night sight by itself. This eliminates the need for a switching device, since both day and night channels are always available for use.

Control of light level at the photocathode and protection during non-use is provided by a 4-position filter assembly. A specially designed long eye relief eyepiece, together with an eyeguard, affords eye protection against the severe gun recoil of the Sheridan vehicle.



PERISCOPE M44
Fig. 1



PERISCOPE M50
FIG. 2

The M50 and M51 Periscopes were designed in 1964 for the gunner and commander, respectively, in the M60A2 tank. Tests conducted at Aberdeen Proving Ground and at Fort Knox resulted in type classification and follow-on production. These periscopes provide high-power day and night sighting and unit power, heads-up surveillance capabilities.

Although the functions of both periscopes are nearly the same, two different optical concepts were required. Space considerations dictated the use of a narrow M50 head assembly in the gunner's station and a short M51 body assembly in the commander's station. Optical systems for these periscopes are shown in Figures 2 and 3.

"Rectangular" catadioptric objectives, eyepieces and filter assemblies similar to the M44 were used for the M50 and M51 to provide the advantages discussed above. A single reticle projector, having a central lay-type reticle driven by a ballistic computer, and a single eyepiece were used for both the day- and night-sighting channels.

Commonality of components is good from a human factors standpoint because it requires only one set of conventional boresight adjustment knobs, a single rheostat for controlling brightness of the reticle pattern, and a simple, reliable headrest for both day and night operation.

The only significant difference in the functions of the two periscopes is the M51's 78° elevation coverage (−18° to +60°) compared to the M50's 40° coverage (−18° to +22°).

The M32/35/36 Periscopes were modified in 1972 to provide passive night-sighting capability for the gunner and commander in the M60A1 tank. The modification is relatively inexpensive and affects only the night sight elbow assembly, which is common to both the gunner's M32/M35 and the commander's M36 periscopes. Retrofit can be accomplished simply by interchanging a new elbow for the old one in the field. The 8X day-sighting system, the unit power heads-up surveillance channel, the night sight reticle projector system, and the common day/night head assemblies remain unchanged.

Prototypes have undergone successful testing in the MASSTER V and Armor School tests and proved their field worthiness when used by combat troops in Vietnam. The M60PI tank equipped with these modified periscopes is undergoing DT/OT (Design/Operational Testing) at Aberdeen Proving Ground and Fort Knox.

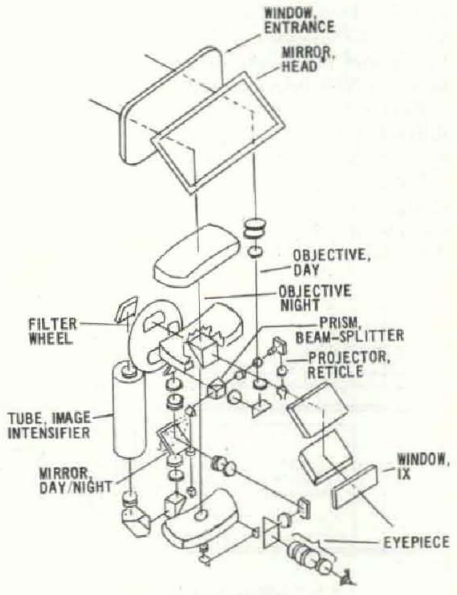
The MICV project manager also plans to equip the Mechanized Infantry Combat Vehicle with modified M36 periscopes for DT/OT II, scheduled to start about February 1975.

A complete redesign of the objective and eyepiece was required. The active IR elbow embodied a 6914 image converter tube which has a curved, S-1 photocathode that is sensitive to near infrared energy and suffers from considerable distortion.

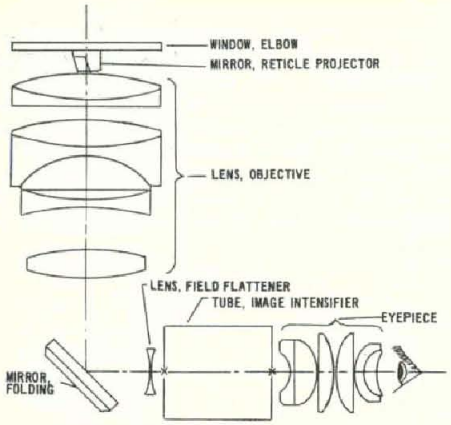
The second-generation image intensifier tube used in the new elbow has much less distortion and employs a flat, S20ER photocathode sensitive to visible and near infrared energy. The optical system for the elbow is shown in Figure 4.

A refractive objective was designed for this "wide band" system, instead of a catadioptric objective, to maximize the light-gathering power of this elbow, limited to about a 4-inch objective aperture. Producibility and performance were optimized by minimizing the effects of manufacturing tolerances, the number of different lens radii, and the number of surfaces requiring antireflection coatings. The 6-element eyepiece, which is in reality a magnifier, was designed to give a system magnification of 7X and a useable exit pupil diameter of 15mm.

The Compact Periscope (COP) for day/night operations was designed in 1972 for possible use in combat vehicles under develop-



PERISCOPE M51
Fig. 3



PERISCOPE M32/35/36 ELBOW
Fig. 4

ment, such as the MICV, ARSV (Armored Reconnaissance Scout Vehicle) and XM-1 main battle tank, and as a possible retrofit for other vehicles such as the M60 tank.

Designed to provide performance equal to or surpassing that specified for the Scout (ARSV), the COP pushes the state-of-art for day- and night-sighting, excluding thermal imaging. The design facilitates addition (or deletion) of subassemblies/functions, thereby providing a cost-effective, compact periscope that could suit several vehicles needs with minor modification to the baseline design.

Dual-power day/night sighting and unity power heads-up surveillance are provided together with the capability for adding on modular assemblies for ballistic or computer-driven reticles and for laser rangefinder/designator systems.

An austere, single magnification COP model, which may prove cost-effective for certain applications, is not discussed here, since models have not been manufactured. An engineering breadboard of COP, completed in 1973, demonstrated the expected night-sighting performance. An optical schematic of this periscope is shown in Figure 5.

Dual-power day/night sighting and laser receiving are provided through a single refractive objective. Laser transmission/unity power surveillance share another aperture, thereby minimizing the size required for the head assembly and resulting in over-all compactness of this periscope.

Switching from high-power day/night to low-power day/night is accomplished by rotating the Galilean telescope magnification assembly 180 degrees.

Two reticle projector modules are available, one with a computer-driven central lay-type reticle, the other with two selectable ballistic reticles. These reticle projectors, used for both day and night modes, require only one set of conventional boresight knobs.

A simple in-view reticle, consisting of concentric circles, provides reference for low-power day sighting and for laser rangefinding/designating functions. Two separate filter wheels are incorporated in the day system to provide protection from laser radiation, and to improve scene contrast by controlling brightness and reducing the effects of glare and haze.

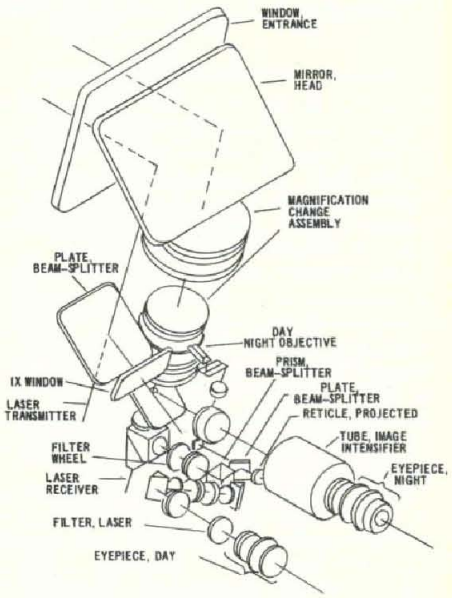
Separate eyepieces are used for day and night systems for simplicity and to permit the use of a biocular eyepiece for viewing the night-sight display if desired, and the resultant reduction in magnification can be tolerated.

Laser transmitter/designator capability is provided by an add-on modular assembly. This directs the expanded output beam upwards through the unity power beam-splitter plate, head mirror and then out through the entrance window to the target of interest.

Different transmitter modules can be accommodated and an internal check sight can be provided if deemed necessary. The laser receiver is also contained in this add-on assembly, the energy for this receiver being collected through the common day/night objective lens.

In conclusion, the M44, M50 and M51 periscopes have proven their effectiveness as day/night sights for the M551 Sheridan vehicle and the M60A2 tank. The modified M32/35/36 elbow promises to be a cost-effective means for retrofitting M60A1 tanks with passive night sighting capability. The COP is a baseline design awaiting its call to update the day and night sighting capabilities of future combat vehicles.

Acknowledgement is made to Messrs. J. Shean, R. Wolfe, R. O'Shaughnessy and E. Weitzel who contributed to the optical concept and design of the periscopes discussed in this article.



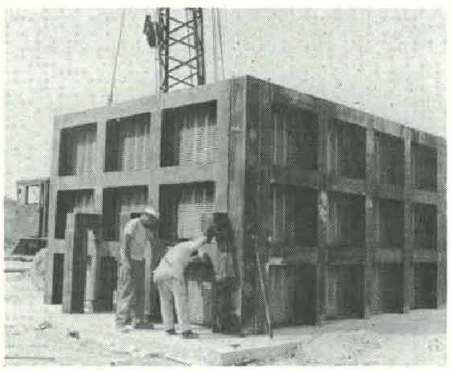
COMPACT PERISCOPE (COP)
FIG. 5

WRIGHT H. SCIDMORE is a physicist in the Optical Branch, Fire Control Development and Engineering Directorate, Frankford Arsenal. Recognized as an authority and USAMC's principal consultant and adviser in the field of optical design technology, he provides consultant services in subject field throughout the Department of Defense.

DPG Testing Prototype Protective Shield Facility

The Hazardous Material Engineering Office, Edgewood Arsenal, MD, has assigned to Dugway (UT) Proving Ground responsibility for the conduct of evaluation tests, including fabrication and testing of protective shielding facilities.

One item which has demonstrated effectiveness in engineering tests, identified as a "suppressive shield," utilizes a series of baffles to eliminate fragmentation hazards and effectively reduce blast pressures resulting from an accidental explosion. It is being applied to a prototype system under construction at DPG.



CONSTRUCTION of Suppressive Shielding Chamber at Dugway Proving Ground.

The completed system will consist of a 23x18x11 foot shield covered by a 50x90x24 foot plenum chamber. This, in turn, will be covered by a metal building which will serve as a sampling space outside the containment chamber.

The 57-ton steel prototype will be tested by detonating various munitions, to prove that in an accidental explosion, the shield will reduce blast parameters to such a level that no explosive hazard will exist in the outside environment. Applications of this concept include ammunition manufacturing, transport, storage and disposal.

Emphasis is being given to application of the technology in the Army's production plant modernization program to provide improved protection to operators, equipment and structures "close in" to explosive processing operations; also, to reduce safety distance factors for plants engaged in these operations, thereby releasing real estate to other uses.

Supervisor Course Announced

Inauguration of a training supervisor correspondence course has been announced by the Army-Wide Training Support Division of the U.S. Army Quartermaster School, Fort Lee, VA.

Composed of 11 subcourses, the instruction is designed to provide an over-all working knowledge of training procedures and relevant techniques. Detailed course information may be obtained from: Chief, Correspondence Course Branch, Army-Wide Training Support Division, Quartermaster School, Fort Lee, VA 23801.

AMMRC Concentrates on Titanium-Coated Graphite Fibers In Search of Superior Composite System for Army Aircraft

By A. P. Levitt and E. DiCesare

Since the great potential of graphite fiber-reinforced magnesium for U.S. Army aircraft was reported in our bylined article in the May–June 1972 *Army Research and Development Newsmagazine,* further significant progress has been achieved at the Army Materials and Mechanics Research Center.

In that first article it was noted that molten magnesium neither wets nor bonds to graphite, a problem solved by the discovery that titanium coatings on graphite fibers promote wetting, bonding and infiltration by molten Mg. Flat rectangular specimens made by using a liquid-phase, hot-pressing technique were found to have markedly higher strength and stiffness than unreinforced Mg.

The early results were very encouraging, but required additional efforts to improve this composite system. This article summarizes subsequent advances.

One of the problems associated with the titanium-coated fibers was the coating thickness. Although the absolute coating thickness was very small, about two microns, such a coating on a 7.5 micron diameter fiber had a cross-sectional area larger than the fiber.

Consequently, the maximum fiber volume fraction attainable was limited severely by the coating thickness. Subsequent experiments with progressively thinner vapor-deposited coatings indicated that Ti coatings having negligible thickness are still very effective, as illustrated in Figures 1, 2, 3.

Fig. 1 shows a 2-micron Ti coating on Modmor I graphite fibers fully infiltrated by the Mg, which is the white area surrounding the fibers. The thinner Ti coating (Fig. 2) shows equally good wetting. The coating in Fig. 3 is so thin that its volume fraction is negligible. Nevertheless, it has induced excellent wetting, bonding, and infiltration by the molten Mg.

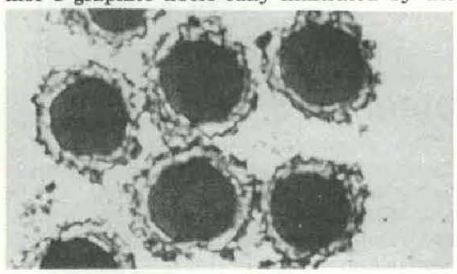


Figure 1

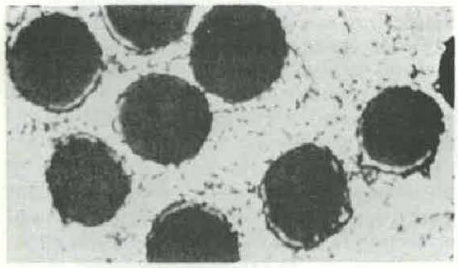


Figure 2

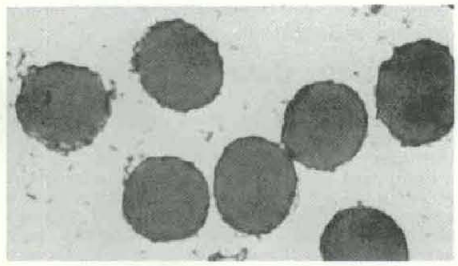
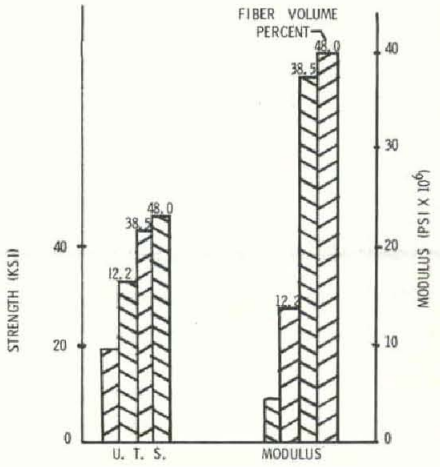


Figure 3

Elimination of the volume fraction limitations of the Ti coating made possible experimental composites having fairly large fiber volume fractions (up to 48 percent) in



COMPARISON OF MECHANICAL PROPERTIES OF UNREINFORCED VERSUS GRAPHITE REINFORCED Mg ALLOY AZ91C

Figure 4

the magnesium alloy AZ91C, using the liquid-phase, hot-pressing technique. Specimens were scaled up from 1½″ x 0.25″ x .10″ to 3½″ x 0.50″ x 0.10″ to square plates 4″ x 4″ x 0.10″.

The tensile strengths and elastic moduli of composites containing 12.2, 38.5 and 48.0 volume percent Modmor I fibers are compared in Fig. 4 with the unreinforced alloy AZ91C made by the same process. Again, significant strengthening and stiffening were obtained as compared to the unreinforced alloy.

Although this method permits fabrication of a variety of composite sizes and shapes, researchers decided that a method which used infiltrated tows or yarns of graphite fibers would be even more versatile. The wirelike infiltrated tows could be easily handled, wound, or cut to fit any size die, and then hot-pressed to form the final structure.

With this objective, efforts were then di-

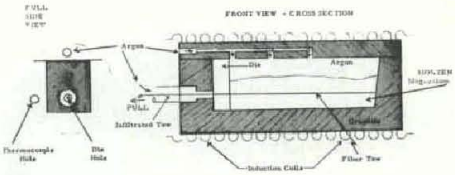


Figure 5

rected toward the development of infiltrated tows to achieve this added versatility. Again, Modmor type I tow was selected for initial studies because it has a round cross-section. Each tow contains 10,000 fibers, each of about 7.5 microns in diameter. The melt drawing apparatus is shown schematically in Fig. 5.

In operation, the Ti-sensitized fibers are placed in a groove between two solid pieces of pure Mg which fill the graphite crucible. The pure Mg is heated until it is molten under an argon gas atmosphere. The tow is held in the molten Mg long enough to permit

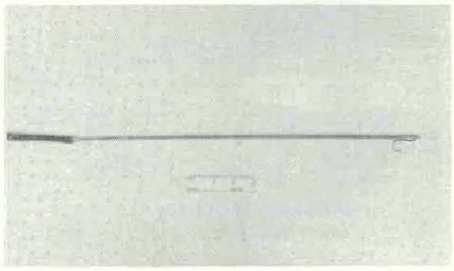


Figure 6

wetting, bonding and infiltration to occur (1–10 minutes). Then it is drawn through the die hole at the end of the crucible, which removes excess Mg and produces an infiltrated tow of uniform cross-section.

A photograph of a typical infiltrated tow is shown in Fig. 6. Mechanical tests of this tow have yielded the highest values for tensile strength and modulus of this composite up to the present time. At a fiber volume frac-

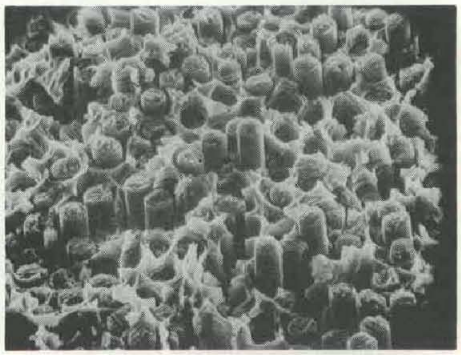


Figure 7

tion of 40 percent, tensile strength was 93,400 psi and elastic modulus was 27.9 x 10^6 psi. These values exceed those of the unreinforced Mg by 580 and 430 percent respectively.

The scanning electron fractograph (Fig. 7) of an Mg-infiltrated tow broken in tension shows excellent wetting, infiltration and bonding to the graphite fibers. This permits complete load transfer from the weak Mg matrix to the strong graphite fibers. Thus, tensile strength approached the theoretical rule of mixtures value, while elastic modulus exceeded it. We now have a material which is as light as Mg, about twice as strong, and 4 times as stiff as the best available alloy.

The wire-like form of this composite lends itself well to secondary fabrication by hot pressing. This composite is especially attractive for stiffening helicopter transmissions housings, missile gyroscope gimbals, missile stiffeners and supports, and other Army applications where very lightweight, high strength, and high stiffness are required.

Future studies will be aimed at (a) developing a facility for producing infiltrated tows on a continuous basis, (b) using these tows to fabricate structural parts by hot pressing, and (c) evaluating these composite structures for Army applications.

Conferences & Symposia . . .

Defense Leaders Address AMC Foreign Intelligence Officers

LTG John R. Deane Jr.

Procedures to improve collection and utilization of intelligence information critically important to decision-makers for design and development of superior military materiel were considered at the 1974 Army Materiel Command Foreign Intelligence Officer Seminar.

The U.S. Army Foreign Science and Technology Center, Charlottesville, VA, was host to the 4-day meeting attended by about 125 FIOs representative of all U.S. Army major command elements involved in RDT&E programs.

Army Chief of Research, Development and Acquisition LTG John R. Deane Jr. gave the keynote address. Currently doubling as Acting Assistant Secretary of the Army (Installations and Logistics), he took time out of his busy schedule to fly by helicopter from the Pentagon and returned immediately following his presentation.

Defense Intelligence Agency Deputy Director for Scientific and Technical Intelligence Dr. Jacques Heilfron made a classified presentation on "DIA Overview of AMC (U.S. Army Materiel Command) Field Intelligence Production Requirements."

Dr. J. V. R. Kaufman, who retired recently as deputy to MG Stewart C. Meyer, AMC Director of Research, Development and Engineering, spoke on his behalf in discussing "Trends in the Use of Intelligence in AMC's Research, Development, Test and Evaluation." MG Meyer has since taken command of MASSTER (Modern Army Selected Systems Test and Evaluation), Fort Hood, TX.

Speaking on behalf of Assistant Chief of Staff for Intelligence MG Harold R. Aaron, special assistant Herbert Taylor discussed "Intelligence Support to Research, Development, Test and Evaluation," with emphasis on the threat analysis. The presentation was classified.

Dudley Holstein spoke on "DA Level RDTE/Intelligence Interface in the Weapon System Acquisition Process and AR 381-11." Expected to be distributed in the near future, the new regulation was approved by the Army Chief of Staff June 17 and will provide over-all guidance to FIOs and others engaged in threat analysis efforts. Holstein is in the Intelligence Threat Analysis Detachment, Office of the Assistant Chief of Staff for Intelligence, HQ DA.

LTC Thomas F. Connolly, deputy commander, gave the welcoming remarks on behalf of COL R. A. Dyer, commander of the Foreign Science and Technology Center, who was on a TDY assignment. FSTC Technical Director Dr. John A. Ord explained the organization of the center and method of operation.

LTG Deane was introduced by COL William I. Fox, chief of the Army Materiel Command Foreign Science and Technology Division, who described him as "probably one of the busiest men wearing the Army uniform," in performance of his dual role of Chief of RD&A and acting DASA (I&L).

General Deane commended the foreign intelligence officers for their significantly important contributions in recent years to aid decision-makers at various levels in the research, development, test and evaluation process of producing superior weaponry.

Improvements in recent years in the collection and processing of foreign science and technology information, General Deane said, have enabled decision-makers to proceed "with some reasonable degree of confidence in coming up with the right answers." He cited particularly his concern about the Bushmaster system and his action of slowing down development until the intelligence community provided the information he required.

General Deane also mentioned other weapon systems development that had been influenced by reliable reports from FIOs, "ascertaining the real threat, (and) thereby providing information for design of superior systems" to meet the threat at an affordable cost.

Timeliness of intelligence reports for decision-makers in the RDT&E process was stressed equally with the requirement for reliability when General Deane told about his brief experience as an intelligence officer.

SEMINAR DIGNITARIES (l. to r.) Dr. J. V. R. Kaufman, Army Materiel Command; COL William I. Fox, chief, AMC Foreign Science and Technology Division; LTC Thomas S. Mayberry, senior representative of the Training and Doctrine Command; Bill G. Pales, deputy chief, AMC FSTD and seminar chairman.

"I got the information the commander requested on a crash basis by 5 o'clock one day . . . but the order of the commander came out at 4 o'clock."

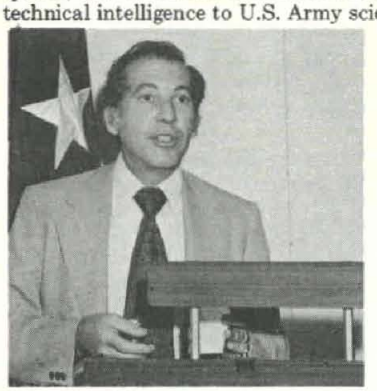
In using resourceful initiative to get desired information, he emphasized that intelligence officers "must be aggressive" and must charge ahead persistently despite obstacles. He also discussed the role of the Defense Intelligence Agency in the data collection network.

DR. J. V. R. KAUFMAN spoke for MG S. C. Meyer as the FIO of the Army Materiel Command at the time of the conference. He stated, in part:

". . . The availability and quality of technical intelligence information has improved significantly during the past two years, as has its timeliness. Furthermore, AMC, the project managers, the commodity commands and the laboratories have become more aware of the need for sound technical intelligence and have put it to work for them."

Dr. Kaufman said that the "lessons learned" from the October 1973 Mideast War have provided the most valuable intelligence product during the past year, with respect to ongoing and future RDT&E programs, by updating the threat and "the spin-off of Russian technology to our program."

In restating several of the key points of General Deane's keynote speech, Dr. Kaufman advocated an aggressive attitude in providing technical intelligence to U.S. Army scientists and engineers on a timely basis for potential application to RDT&E decision-making.



Dr. Jacques Heilfron

"Because of the highly classified nature of many intelligence reports," he said, "they (scientists and engineers) may not be aware that they even exist. It is your job, first, to hold classification to the lowest level possible and, second, to sell the value of technical intelligence at every opportunity.

"Make your voice heard at technical conferences, IPRs (In-process Reviews) and other meetings. Become familiar with every project your activity is involved with and look for applications of technical intelligence. Then sell it."

DUDLEY HOLSTEIN stated that the Army Materiel Acquisition Review Committee (AMARC) recommendations for "significant changes to present procedures" in the RDT&E intelligence interface in the weapons system acquisition process are being considered by OACSI and that plans for implementation are being formulated.

The Office of the Assistant Chief of Staff for Intelligence has provided the threat, or helped the agency performing the study to develop the threat, he said, "for every major system which has had a task force

this last year. OACSI provided the threat to the Shorad and Pershing II task forces."

The forthcoming AR 380-11, he said, prescribes that studies or systems requiring Department of the Army approval will use OACSI validated threat analyses. Its purpose is to establish policy, responsibilities and procedures for the coordination and supervision of threat analysis operations, and the development and provision of threat products in support of the Army General Staff and major commands.

In discussing specific details of the new regulation, Holstein said that OACSI is working closely with the Training and Doctrine Command (TRADOC) in the development of standard scenarios in their formative stage—"so there will not be any conflicts with the Army planning system."

Threat analyses, including scenarios, "must be objective and related to real contingencies . . . data used must be absolutely correct and must provide a sensible threat base for us to work from."

PRESIDING CHAIRMAN Bill G. Pales submitted a "Progress Report on the FIO System" in his introductory address. He described the FIO as "the connector between the intelligence production community and R&D users of intelligence."

Pales said that during FY 1974 the FIOs were more involved in foreign materiel exploitation "than ever before in AMC's history," and that some of them devoted as much as 90 percent of their time to foreign materiel evaluation. "These FIOs can well be proud of what they achieved."

Employed since 1970 as deputy chief of the AMC Foreign Science and Technology Division, Pales detailed the progress that has been made to improve collection and utilization of intelligence data in the various major commands under the AMC during four years.

CLEVES H. HOWELL, a member of the AMC FSTD, relieved Pales by presiding at some of the sessions and also made two presentations, "AMC RDT&E/Intelligence Interface in the Weapon System Acquisition Process" and "AMC Plans for Intelligence Support."

"The importance of valid, realistic threats to the entire Army materiel acquisition process is growing by leaps and bounds," he said in his first presentation. He attributed the accelerated effort to congressional pressure, high-level criticism, the 1973 Mideast War, growing national recognition of Russia's strength, relief from immediate pressure caused by withdrawal of U.S. Forces from Vietnam, and shrinking (at least relatively) of RDT&E budgets.

WOMEN ASSIGNED to FIO duties comprised nearly 10 percent of the conference participation, and one of the important presentations was that of Mrs. Mary F. Manby, a member of the AMC FSTD staff. Her topic was "Review of Results of FIPR (Foreign Intelligence Production Requirement) Submissions."

LTC WILLIAM DELORENZO, another member of the AMC FSTD staff, presented a classified discussion of "Foreign Materiel Exploitation," in which he described ongoing research, development, test and evaluation programs as impacted by foreign intelligence.

TRADOC CONCERN with the foreign intelligence collection and utilization of data was explained by MAJ Denzil R. Walton of the command's Threat Branch, Intelligence Division. His subject was "ROC (Required Operational Concept) Process, Role of Threat Managers, and Standard Scenarios."

HERBERT L. SCHEINER Jr. of the Threat Branch, U.S. Army Operational Test and Evaluation Agency (OTEA) explained the agency's missions and functions.

Established in September 1972, OTEA operated as a field element of the Army Assistant Chief of Staff for Force Development until May 20, 1974, when agency supervision was transferred to the Office of the Army Chief of Staff.

WOMEN PARTICIPANTS in the seminar comprised nearly 10 per cent of the total attendance. Intelligence assistants (1. to 4.) are Janice Neely, Missile Command; "Bert" Mims, White Sands Missile Range; Mary Mandy, Army Materiel Command; Emma Luke, alternate field intelligence officer, Electronics Command.

SEMINAR SPEAKERS included (l. to r.) Dennis M. Gormley, FIO, Harry Diamond Laboratories; Wayne A. Silbert, RD&E Directorate, AMC; Cleves H. Howell, AMC Foreign Science and Technology Division; MAJ Charles O. Pflugrath, Office of the Assistant Chief of Staff for Intelligence, HQ Department of the Army; and Veikko Jappinen, U.S. Army Intelligence Agency.

MAJ CHARLES O. PFLUGRATH of the Directorate of Intelligence, Office of the Assistant Chief of Staff for Intelligence, discussed "Army Intelligence Support" under the provisions of Army Regulation 381-19.

AIR FORCE SYSTEMS COMMAND intelligence policies and procedures were described by COL Jesse H. Johnson, including the organizational structure of the command and its 29 facilities outside the United States.

THE ROLE OF THE U.S. ARMY Foreign Science and Technology Center was explained in three presentations by staff members. Jacob Brodzinsky spoke on "Intelligence Collection Requirements," and J. A. Maslyk on "FSTC Oversea Teams and the Army Materiel Command Research, Development, Test and Evaluation Program," and Lester C. Bennefeld on "Translation Support."

Charles Mangio, U.S. Air Force Foreign Technology Division, Wright-Patterson, Air Force Base, Dayton, OH, presented a status report on the Air Force-managed Department of Defense Technical Intelligence data base, known as CIRC/CIRCL, which is extensively used by AMC FIOs.

FIO PRESENTATIONS representative of AMC commodity commands or laboratories included: Dennis M. Gormley, Harry Diamond Laboratories; Robert E. Simak, Armament Command; Herman Nadler, Tank-Automotive Command; William F. Skidmore, Test and Evaluation Command; and Martin Johnston, Natick Laboratories.

DR. EDWARD TELLER, second from right, one of the nation's foremost nuclear scientists and now with the Lawrence Radiation Laboratory of the University of California, made a presentation at the 26th Power Sources Symposium on the impact of the energy crisis. The symposium, one of the largest in its field, was sponsored by the U.S. Army Electronics Command, Fort Monmouth, NJ, in conjunction with other U.S. Government laboratories. With him (l. to r.) are David Linden, symposium chairman and chief, Power Sources Technical Area, ECOM; T. G. Kirkland, acting technical director, U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, VA; and William Doxey, acting chief engineer, ECOM.

Terrain Information System . . .

Critical for Future Combat

By Francis G. Capece and Regis J. Orsinger

FRANCIS G. CAPECE and REGIS J. ORSINGER are mathematicians in the Tactical Systems Branch, Geographic Applications Division, Geographic Sciences Laboratory of the Engineer Topographic Laboratories. Presently they are involved in the development of the Army Terrain Information System. Capece received a BA in mathematics in 1968 from the University of Connecticut, joined the ETL staff that year, and received an MS degree in technology of management (operations research/computer systems) from the American University in 1972. Orsinger received a BA in mathematics from Saint Vincent College in 1967, became an ETL employe in 1970, and is pursuing an MS degree in operations research at George Washington University.

Primary responsibility for development of the Army Terrain Information System (ARTINS), envisioned for deployment in the early to mid-1980s, is assigned to the U.S. Army Engineer Topographic Laboratories, Fort Belvoir, VA.

Terrain and weather conditions have been critical factors with which to cope in virtually every major military engagement throughout history. Frequently the victor is determined by superior knowledge of how to deal the most successfully with these variables.

Importance of this capability is expected to increase considerably with the development of highly mobile forces equipped with automated data systems such as the Tactical Operations System (TOS) and the Air Traffic Management System (ATMS). Effectiveness of quick response to rapidly changing battle situations will depend, to a large extent, on timely availability of high-quality terrain information to the commander and his staff.

The objective of ARTINS, as the source of terrain intelligence for the Army in the field, is to satisfy operational requirements of all U.S. Army elements. It will be a highly automated system to provide for storage, processing, retrieval, dissemination, and updating of terrain information.

Topographic engineer field units will undergo an evolutionary reorganization and reoutfitting to insure capability of adequately supporting field armies in all environments. The first step in this process is to bring topographic units to the present state-of-the-art capabilities.

This objective is being accomplished under an Army Materiel Command project titled "Topographic Support System" (TSS). The TSS concept is to provide a reproducible data base, as well as updated equipment and personnel structure, to enable topographic units to meet support requirements for the field commander in the 1977–1982 time frame.

ARTINS components will be located at Theater, Corps, and Division levels as required. In all cases, provisions will be made for continuity of operations. Critical holdings in the Division element will be duplicated at Corps level and at Theater level.

ARTINS will be an integral part of the total topographic system at these levels, and will utilize existing photographic, cartographic, reproduction, and point-positioning capabilities. An ARTINS element at Division level may be collocated with, or in close proximity to, the TOS facility.

The functioning of ARTINS will parallel the present terrain intelligence cycle. Briefly, the cycle begins with data collection and proceeds through data reduction, storage and retrieval, and final output processing of the information.

Envisioned is a CONUS facility that will provide data base materials for field updating. Additionally, ARTINS should be capable of responding effectively and continually through its own resources. This data base will be updated from textual sources, airborne sensors, and other sources. Maximum availability of current data will be insured by close working relationships with the field Military Intelligence units and their Navy and Air Force counterparts.

Data reduction involves automated and manual processes, including review, analysis and evaluation of raw data to select the most recent and reliable information for storage. Mensuration techniques, photointerpretation, mathematical computations, and other professional skills are required. Reduced data will be in digital and graphic form.

Graphics, such as maps, imagery, overlays and other items will be contained in a microminiaturized form on a computer-controlled micrographic storage device. This will permit retrieval, display, enlargement, modification and hard copy reproduction.

The ARTINS digital data base will consist of 15 data fields such as vegetation, hydrology, lines of communication, and settlements. Included are all items recommended by previous studies and additional items found essential during recent liaison visits with potential users.

Random Access Memory (RAM) and magnetic tapes will contain all the necessary terrain intelligence data. Response time requirements, frequency of use and change will determine what data will be stored off-line.

ARTINS will require a militarized computer with considerable core memory; RAM and magnetic tape storage; interface to a micrographics subsystem; line printer; message input/output devices; and analyst/graphics consoles for communication with the computer.

Software required to support this hardware includes an operating system, a data management system, and application programs. The operating system will control the total environment of the computer system. The data management system will permit ARTINS to define, organize and maintain the digital data base. Application programs will provide a data processing capability for estimation of terrain effects on tactical operations.

In this manner, software packages will aid greatly in the preparation of special topographic products and studies. Examples of such application programs are line-of-sight and cross-country movement models.

Upon receipt of a user query, ARTINS will move into action. If the answer is contained in the terrain file, the request will be processed in accordance with user priority. It is likely that some sort of analysis or manipulation will be required to generate a satisfactory response.

A terrain analyst may perform a manual or computer-assisted analysis or a terrain-effects prediction model may be called from the program library for an automated analysis. Collection requirements will be generated if the necessary information is not contained in the terrain file.

Some mention of possible system outputs is in order. TOS may have the greatest need for terrain information, including information ARTINS has obtained from engineer minefield and demolition teams.

The output of automated terrain effects prediction models also will be available. One such item is a line-of-sight model which uses digitized elevation data, enabling Missile Minder to develop plots of masked areas around artillery emplacements.

A family of map products, currently being designed to support Infantry and Armor operations, also will be available to other users of ARTINS. One such Infantry product is presented on the back of a 1:50,000 scale topographic map, consisting of four separate graphics at 1:100,000 scale that portray information vital to operations.

A landform graphic, which features a simulated perspective view designed to supplement the relief data appearing on the topographic map, will facilitate identification of corridors and suitable observation sites. A movement graphic provides information concerning the maximum cross-country speeds and inaccessible areas for foot soldiers and a variety of vehicles.

A third graphic predicts the probability of aerial detection, horizontal visibility, and fields of fire. Another graphic indicates the amount of overhead protection offered by vegetation and the estimated digging times for construction of foxholes and mortar pits.

Many additional map products are invarious stages of development at the present time. In each case, user requirements will be analyzed to determine if the product will be cost-effective to include that capability in the automated process.

After user requirements are identified, and a final format is established for the cost-effective product, the generation process will be automated. In all cases, system outputs will be provided in a form satisfactory to the user–including direct oral reply, console display, and hard copy.

How will ARTINS operate in modern field army environment, and how will it relate to the other tactical data systems now being developed? Naturally, at this early stage of development, the operational concepts under consideration are many and varied.

Generally, the concepts are in consonance with the premise of the TOS Terrain Functional Area Description (FAD)–that the Engineer Terrain Detachment will be the primary source of terrain information.

One concept calls for ARTINS to interface directly with the other tactical data systems in providing initial loading and updating for each system, or serving as sole repository and respond to queries from these systems. A second concept sees ARTINS responding to all queries

(Continued on page 29)

18 AMC Personnel on DoD Conference Program

Sixteen speakers and two session chairmen will represent the U.S. Army at the 23d Defense Nondestructive Testing Conference, San Francisco, CA, Sept. 4–6. Sydney Lorber, director of Quality Assurance, U.S. Army Materiel Command, is programed as the keynoter.

Robert Clem of the U.S. Army Missile Command, Redstone (AL) Arsenal will preside as chairman at Technical Session I and C. P. Merhib, Army Materials and Mechanics Research Center (AMMRC), Watertown, MA, also is listed in the agenda as a chairman.

Army scientists who will report on research and their topics are: I. Binder and D. Gamache, Tank-Automotive Command, Molybdenum Sprayed Engine Cylinders; W. H. Schoeller, Picatinny Arsenal, Determine Soundness of Brazed Joint of Adapter Booster of Bomb, Tail, M147;

H. Frankel, Watervliet (NY) Arsenal, NDT/Inspection of Fiberglass Composite of 81mm Recoilless Rifle; J. R. Wamsley, U.S. Army Foreign Science and Technology Center, Soviet Efforts in Radiography for Increasing Productivity; K. F. Knowles, Redstone Arsenal, Testing of Conformal Coatings by Using a Thermomechanical Test Method to Measure the Glass Transition;

A. G. Martin, AMMRC, Ultrasonic Phase Velocity Measurement by Phase Comparison of Continuous or Pulsed Waves; J. Patt, Tank-Automotive Command, Readout of Ultrasonic Inspection by Means of Photographic Film; P. Kisatsky, Picatinny Arsenal, An Assessment of Ultrasonic Imaging in NDT by Means of Liquid Surface Holography;

A. Kuma, Construction Engineering Research Center, Radiographic Image Enhancement and Analysis; P. E. J. Vogel, AMMRC, Infrared NDT and Energy Conservation; M. Budnick, Natick Laboratories, A Progress Report on the Use of Holography; P. C. McEleney, AMMRC, Bond Inspection of Service Ward Containers and Air Delivery Platforms;

J. V. E. Hansen, Natick Laboratories, An NDT Approach to the Assessment of Degraded Textile/Fibrous Material; C. F. Grogran, Watervliet Arsenal, Enhancement of Duplicare Radiographs; J. E. Cole, Aberdeen (MD) Proving Ground, The Use of X-ray Radiography to Support Explosive Processing.

GIDEP Workshop Reviews Gains in Technology

The 1974 Workshop Conference for the Government-Industry Data Exchange Program (GIDEP), Oct. 16–18 at San Jose, CA, will feature four distinguished executives as guest speakers.

Former Assistant Secretary of Defense (Installations and Logistics) Barry J. Shillitto, now president of Teledyne Ryan Aeronautics, is programed for the keynote address. Dr. Flynn Lunney, manager of the Apollo Spacecraft Office, National Aeronautics and Space Administration (NASA), will give the banquet address.

Listed as luncheon speakers are J. C. Ryan, assistant general manager for administration, U.S. Atomic Energy Commission (AEC), and Dr. D. A. Stuart, vice president and general manager, Missile Systems Division, Lockheed Corp.

The purpose of the workshop is to provide GIDEP representatives and their managers exposure to the state-of-the-art developments, and GIDEP improvement/expansions.

Further information on the program and registration forms can be obtained from: Fleet Missile Systems Analysis and Evaluation Group, Code 862, ATTN: GIDEP Operations Center, Naval Weapons Station, Seal Beach, Corona, CA 91720. Phone: 714-736-4677 or Autovon 933-4677.

GIDEP is centrally managed and funded by the U.S. Government. Participating organizations are the Army, Navy, Air Force, Marine Corps, Defense Supply Agency, NASA, Federal Aviation Administration, AEC, Small Business Administration, National Security Agency, General Services Administration, the Canadian Department of Defence, and hundreds of industrial commercial contractor organizations.

Established to make maximum use of existing knowledge, GIDEP provides a means to exchange automatically certain types of technical data essential in the research, development, production and operational life cycle. Participating agencies can communicate on problems of design, development and production in the interest of economies, improved reliability and quality of materiel and equipment.

GIDEP participants have access to four major data banks, one of which contains engineering evaluation and qualification test reports and related materials on parts and materials. The Metrology Data Bank contains test equipment calibration procedures related to data. The Failure Experience Data Bank is a source of objective failure information. The Failure Rate Data Bank provides information on parts based on field performance and reliability demonstration tests.

NLABS/NRC Sponsoring Food Conference

Objective Methods for Food Evaluation is the subject of a symposium scheduled Nov. 7–8 at Newton, MA, under joint sponsorship of the U.S. Army Natick Laboratories and the Committee on Food Stability, Advisory Board on Military Personnel Supplies, National Research Council.

The purpose is to explore and summarize the current status of objective methods for clarifying and improving specifications for procurement of foods for the military; predicting storage life or determining the history of military food items; and evaluating by appropriate research results the applicability of existing objective methods for new products.

Persons interested in attending or gaining further information about the symposium may call or write Dr. J. Walter Giffee, chief, Food Chemistry Division, Food Laboratory, U.S. Army Natick Laboratories, MA 01762.

RAM Project Officers Consider Goals, Procedures

Upgraded goals and procedures for RAM (Reliability, Availability and Maintainability) in the military materiel acquisition cycle were detailed and discussed by about 200 RAM project officers at a recent 2-day seminar.

General Henry A. Miley Jr., commander of the U.S. Army Materiel Command, emphasized in his introductory remarks that "RAM will not be traded off against design-to-unit production costs."

The joint Army Materiel Command and Army Training and Doctrine Command meeting followed a Memorandum of Agreement dated May 16, 1974, between AMC and TRADOC. The agreement provides interim policy and procedures to be implemented immediately and to serve as the basis for forwarding to HQ Department of the Army recommended changes to Army Regulation 702-3.

AMC Director of Quality Assurance Seymour J. Lorber welcomed the group. Following a 45-minute briefing titled "Review of the Materiel Acquisition Process," by Henry Mlodozeniec of the AMC Research, Development and Engineering Directorate, the "AMC/TRADOC RAM Memorandum of Agreement" was discussed by John V. Lavery, Reliability and Systems Assessment Division, AMC QA Directorate.

ROC (Required Operational Capability) was discussed by LTC Luke Vavra of the Army Logistics Center (LOGC), Fort Lee, VA, with respect to "Operational Mode Summary and Missions Profile." He followed with a presentation on "Failure Definition and Scoring Criteria." MAJ Joseph McDaniel, also an LOGC staff member, spoke on "Policy on RAM Requirements."

Closing the first day presentations were "RAM Baseline Analysis," by Arlin E. Dillon of the Armament Command and "RAM Tradeoffs" by J. V. Lavery.

MG Erwin M. Graham Jr., commander of the Army Logistics Center, TRADOC, opened the second-day session with introductory remarks about RAM objectives with respect to logistics management. He termed the Memorandum of Agreement with the AMC a significant step forward, and emphasized that RAM should not conflict between AMC and TRADOC since we both have "commonality of desire to get the best equipment for the Army."

Clyde B. Meade of the AMC Quality Assurance Directorate followed with a discussion of "RAM Plans for System Development." Other presentations included: "Reliability Growth," Dr. Larry H. Crow, Army Materiel Systems Analysis Agency; "Coordinated Test Program RAM Aspects," Dr. William B. McIntosh, Test and Evaluation Command; "Ram in Operational Testing," Michael D. Jones, Operational Test and Evaluation Agency (OTEA).

"Logistics Support Planning," AMC Maintenance Directorate, Boris Levine; "Life Cycle RAM Assessment," Marvin Blitzstein, AMC Comptroller Directorate; and "Design to Unit Production Cost," John D. Blanchard, AMC Assistant Deputy for Materiel Acquisition.

The seminar concluded with an extended panel discussion on RAM as related to the AMC/TRADOC Memorandum of Agreement. Panel members were Seymour Lorber and J. V. Lavery of the AMC and John Johnson and COL George Morris of TRADOC.

Seminar proceedings are being distributed to all participants and a

limited number of extra copies will be available upon request from Commander, AMC, ATTN: AMCQA-E, 5001 Eisenhower Avenue, Alexandria, VA 22333.

Watervliet Scientists Report on Research

Evidence supporting the importance of research activities at the U.S. Army's Watervliet (NY) Arsenal is presented in three technical papers by scientists at national or major conferences.

Dr. Joseph Pepe reported on "Defect Formation During Cold Hydrostatic Extrusion" at the national meeting of the Society of Manufacturing Engineers.

Dr. Robert S. Montgomery's paper on "Effect of Surface Profiles on Characteristics of Concentric Recoil Bearing," presented at the Gordon Conference on Frictions, Wear and Lubrication in London, NH, is also scheduled for presentation at the May 1974 national meeting of the Society of Lubrication Engineers in Atlanta, GA.

"Electrodeposition of Cobalt-Rhenium Alloys" was published in the May 1974 edition of *Plating*, the journal of the American Electroplaters Society. Coauthored with Paul J. Cote, this report was presented by V. P. Greco at the 1973 national meeting of the society.

Watervliet Hosts Composites Conference

One of the U.S. Army Research Office priority areas of effort, indicated by its status in the Military Themes category of programing, was reviewed recently when "Structures and Properties of Composites" was considered at Watervliet (NY) Arsenal.

The arsenal also was host to a July 23–25 workship conference on "Numerical Methods of Solution of Systems of Linear and Nonlinear Equations," under sponsorship of the U.S. Army Research Office, Durham, NC. Military, industrial and academic representatives attended.

Thirty experts submitted reports and participated in the discussion of "Structures and Properties of Composites." Attendees included representatives of Northwestern University, University of California at Los Angeles, Cornell University, United Aircraft Research Laboratories and the Singer Co.

Military participants included researchers from the Army Research Office, the Army Materials and Mechanics Research Center, Aberdeen (MD) Proving Ground, and the Army Tank-Automotive Command, Warren, MI.

Dr. Jagdish Chandra, chief of the Army Research Office mathematics section, directed the workshop conference of mathematicians. Thirteen ongoing programs were considered by representatives of the U.S. Army, Knolls Atomic Power Laboratory, General Electric Co., Rensselaer Polytechnic Institute, Troy, NY, California Institute of Technology, the University of Wisconsin, Princeton University, Stanford Research Institute and the University of Utah.

PARTICIPANTS at 3-day conference of mathematics workshop at Watervliet Arsenal included, from left, Dr. Frederick W. Schmiedershoff, arsenal research director; Dr. Melanie Lenard, U.S. Army Mathematics Center, University of Wisconsin; and LTC Duff G. Manges, deputy chief of research at the arsenal.

Reader's Guide . . .

HumRRO Publishes 4 New Research Reports

The Human Resources Research Organization, which for about 18 years was a major U.S. Army contract agency known as the Human Resources Research Office, but which since 1969 has served an increasing variety of federal and other agencies, has issued four new reports. They are:

CR-ED-74-1 is a July 1974 Consulting Report prepared by the HumRRO Eastern Division for the Office of the Assistant Secretary of Defense (Manpower and Reserve Affairs). It is *Attitudes of Youth Toward Military Service in the All-Volunteer Force: Results from National Surveys Conducted Between May 1971 and November 1973,* by John R. Goral and Andrea Lipowitz.

TR 74-14, *An Axiomatic Theory of Subject Matter Structure,* by John Stelzer and Edward H. Kingsley, June 1974. This report can be viewed as a first step toward development of a formal theory of instruction. An axiomatic theory of subject matter was formulated, including content and task components.

TR 74-15, *A Longitudinal Study of Attitude Change and Alienation During Basic Combat Training,* by Eugene H. Drucker, June 1974. This report describes results obtained when a questionnaire containing attitude and alienation items was administered in 1970 to 1974 enlisted men at Fort Knox, KY.

TR 74-17, *The Effects of Basic Combat Training on the Attitudes of the Soldier,* by Eugene H. Drucker, June 1974. In April 1971, a questionnaire was administered to soldiers entering basic training at Fort Knox, KY. A second questionnaire was administered to soldiers who had completed basic training, and to noncommissioned officers assigned as cadre. The results of these administrations of attitudinal questionnaires are reported.

Career Bibliography, Computer Guide Published

Personnel Development for Career Education: A Selected Annotated Bibliography is available for $12.50 from the Product Utilization Section, Center for Vocational and Technical Education, Ohio State University, 1960 Kenny Road, Columbus, OH 43210.

The 200-page compendium resources on career education from 35 books, 283 dissertation abstracts, 179 periodicals and 306 other documents.

The Social Security Administration has published *How Important Are Computers?* In 1960 the SSA had three computers. By 1973, the last year discussed, it had 51 machines with an installed value of $61 million and an annual operating cost in excess of $60 million.

HumRRO Report Outlines Aircrew Training

Simulation and Aircrew Training and Performance is the title of a recently published technical report coauthored by Wallace W. Prophet and Paul W. Caro of the Human Resources Research Organization (HumRRO) and presented at a conference sponsored by the former Office of the Chief of R&D, HQ DA, at the U.S. Army Aviation School, Fort Rucker, AL.

The report outlines some major areas of use of simulation in Army aviation, comments on current training methodology research, and anticipated longer range requirements. Equipment development, crew performance studies, concept development and simulation systems are discussed.

A broad program of simulation research, with emphasis on engineering design and behavioral sciences studies, is suggested to improve aircrew performance. Significant research problems unique to the Army are identified and safety considerations, including cost reduction, involved with simulators and training devices are discussed.

ECOM Film Depicts Integrated Circuitry Designs

The U.S. Army Electronics Command has developed a short film depicting its capability of designing and manufacturing large scale integrated (LSI) circuits using interactive computer graphics (ICG).

Masks to fabricate these devices are generated by ECOM's Applicon System. A recent executive seminar in Computer Aided Design and Engineering (CAD-E) at the U.S. Military Academy, West Point, NY, featured the film showing how the new techniques reduce cost and time to design and fabricate LSI devices.

The film is available from Randy Reitmeyer, AMSEL-TL-IG, Fort Monmouth, NJ. AUTOVON 995-1702.

Women in Army Science . . .

Fortuitous Trail to Success . . . APG Scientist Finds Rewarding Career by Chance

Chemistry became a fascinating field of endeavor quite by accident for LT Rosa Maria Rodriguez, leading her into a career that has been distinguished by rewarding "firsts," with a doctorate envisioned by way of GI Bill educational support.

Until she was asked to teach chemistry in high school in her native Puerto Rico, LT Rodriguez was not even mildly interested in that scientific discipline. She held a BA degree in education and she decided to return to school to obtain a BS degree in chemistry. In turn, that led to an MA degree in chemistry.

When she decided to enter the Army, she received a direct commission in January 1973. She and two other WAC officers became the first women ever enrolled in the Ordnance Officer's Basic Course at the U.S. Army Ordnance Center and School, Aberdeen (MD) Proving Ground.

Following graduation, she became one of the first two women ever enrolled in and graduated from the Chemical, Biological and Radiological (CBR) Staff Officers Class at USAOC&S. She was the first female class leader in the Ordnance School.

Today, she handles a variety of chemical analysis projects for the Physical Test Section in the Materiel Testing Directorate (MTD) at the Aberdeen PG. Enthusiasm for her work prompts many hours of voluntary overtime duty in the MTD labs or at libraries gathering background information.

Educational aptitude was demonstrated by LT Rodriguez when she entered elementary school. Just halfway through first grade in her home town of Catano, PR, she was jumped to second grade for the second semester. She skipped a second semester in the second grade and was advanced to the fourth grade by school administrators impressed by her learning ability.

Using summer school credits, she graduated from high school in two years, shortly after she was 16, finishing as an honor graduate in a class of more than 300 seniors.

Then she entered the University of Puerto Rico, where she earned BS, BA and MA degrees. Next she graduated with a perfect 4.0 average from the National Science Foundation Institute at the University of Puerto Rico after two years of concentrated study in science and mathematics. Next, she finished three years of law school at Puerto Rico's Inter-American University.

All during this intensive study, she worked as an interviewer for the U.S. Department of Labor, taught high school math, general science and chemistry—and even came to the U.S. for additional graduate level work at Bowling Green (OH) State University.

During her assignment at Aberdeen PG, she has added postgraduate credits in advanced calculus and advanced chemistry at the University of Delaware. When she finishes her tour in the Army, she plans to return to the University of Puerto Rico to study for her doctorate in chemistry, using GI Bill educational funding.

Her long-range goal is to become a chemistry professor at the University of Puerto Rico. Meanwhile, she is toying with the idea of writing her doctoral thesis on "Spectro-Chemical Analysis Using X-Rays." But first she has to study some more—"It's a fascinating field I want to learn more about."

'Builds Self-Confidence' . . . Female Test Director Boosts Engineering Career

Tooting a silver whistle, coveted emblem of a test director of artillery firings at Aberdeen (MD) Proving Ground, was exclusively a man's role until Miss Donna Caputo recently invaded that domain, following completion of a 6-week test director's orientation program.

Graduated from Douglass College of Rutgers University with a degree in chemical engineering—one of two women to have achieved that distinction at that time—Miss Caputo entered Federal Civil Service as an engineering aid at Picatinny Arsenal, Dover, NJ.

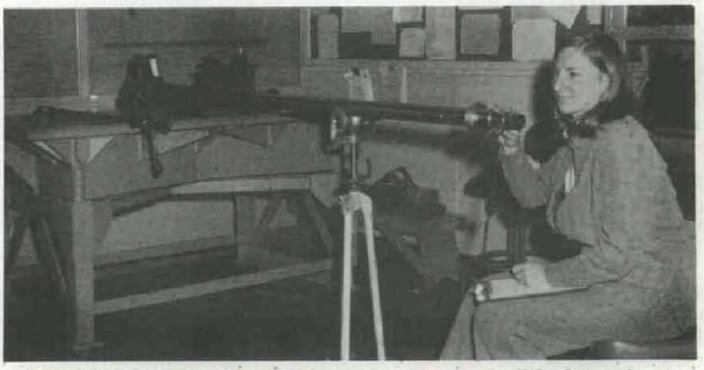
Her 1969 contributions at Picatinny earned her a Certificate of Achievement for work on the 4.2-inch mortar system, followed in 1970 by a letter of appreciation for her continued efforts.

Permanently assigned to the arsenal in 1971 as a chemical engineer with the Ammunition Development Engineering Directorate, she was credited with playing a major role in developing ignition systems for the lightweight 4.2-inch mortar, 81mm mortar, and 60mm mortar.

Miss Caputo says of her new assignment, "Now I'll be the test director of some items I helped to develop at Picatinny." Her responsibilities include organizing test projects and preparing cost analyses.

Miss Caputo believes that current trends in equal opportunity programs are having a major impact and that more colleges and universities are opening their undergraduate engineering programs to women.

She urges any girl who has a sincere interest in science or mathematics to consider pursuing an engineering career. "Engineering is a great field for females; it is interesting and exciting. It helps round out a person through exposure to others and job experiences. . . . It builds self-confidence!"



DONNA CAPUTO adjusts borescope to spot possible flaws, imperfections or worn areas on the inner lining, during inspection of a 4.2-inch mortar tube at Aberdeen Proving Ground, MD.

Detroit Board Honors TACOM Mathematician

Detroit's Federal Executive Board has honored a U.S. Army Tank-Automotive Command mathematician, employed as an operations research analyst, as the outstanding woman in the professional-scientific category among 45 Southeastern Michigan agencies.

Mrs. Annie G. Newell's selection by a distinguished panel of judges marked her tenth year as a U.S. Government employe, beginning as a GS-7 with the Naval Research Laboratories, Washington, DC.

Employed since 1970 by TACOM, Warren, MI, she is currently a GS-13 specialist for analyzing, evaluating and developing cost factors, including mathematical cost models applicable to cost-analysis.

The citation accompanying her award, presented by TACOM Deputy Commander BG Anthony F. Daskevich at a Federal Executive Board honorary luncheon for winners in the five categories, specifically cited Mrs. Newell's 1973 accomplishments.

Special reference was made to her work in analysis of historical price data related to development of inflation/escalation price indices applicable to TACOM commodities and resources. Her efforts resulted in preparation and dissemination of a command paper, "TACOM Inflation/Price Escalation Instructions."

Listed in the 1963 *Who's Who* of American Colleges and Universities, and a recipient of several honorary awards, Mrs. Newell is a *Summa Cum Laude* graduate of North Carolina A&T University, Class of 1963, and is working for a master's degree in operations research/computer science at Wayne State University.

Career Programs . . .

Callaway Stresses Support for OPM System

Secretary of the Army Howard H. Callaway has announced, in an Aug. 14 letter to editors of military publications, his complete support of the implementation of a new Officer Personnel Management System (OPMS).

The letter states that he considers the OPMS "essential to the future effectiveness of the Army Officer Corps. . . . I want the Officer Corps to know that I am fully behind the OPMS and intend to see it work. . . ." Secretary Callaway's letter further explains:

"Under the OPMS concept, each officer is expected to develop skills in two specialties. One is his basic entry specialty and the other is his designated alternate specialty. The objective is to ensure that an officer receives assignments and schooling which will enable him to attain the full professional development necessary for his specialties.

"This will assure that we develop, advance and retain officers with the skills so critical to the management of Today's Army. We will have a system which recognizes the importance and contributions of officers in all specialty fields. In addition, OPMS will provide evidence of the equal opportunities for advancement in career fields other than the traditional command oriented assignment patterns. To stress this point, I personally emphasize OPMS in my orientation to all officer promotion boards.

"Successful implementation of OPMS will depend in large measure on each officer realizing its importance and readjusting his own thinking concerning the traditional value system within the Officer Corps. . . ."

A synopsis of discussions with the Army Chief of Staff attached to Secretary Callaway's letter further explains: "In a broad sense, OPMS represents a shift from a long existent, traditional value system within the Officer Corps to a system consonant with the contemporary needs of the Army and the individual. This shift places greater emphasis upon the need for and the importance of specialists. However, it is possible that this inevitable shift could be unintentionally delayed through a lack of coordination between the personnel management policies of assignment, distribution, promotion and school selection. . . ."

AMMRC Offers Nondestructive Test Course

Numerous courses in Nondestructive Testing of material and inspection techniques are offered by the Industrial Training Branch, AMXMR-MT, U.S. Army Materials and Mechanics Research Center, Watertown, MA.

Course titles include Nondestructive Inspection of Material, Magnetic Particle and Liquid Penetrant Inspection, Radiographic Inspection, Ultrasonic Inspection, Special Course in Ultrasonic Inspection of Welds, Weld Inspection Course. All courses are 40 hours except Radiographic Inspection, which is 80 hours. More information may be obtained by writing to the ITB, AMXMR-MT, U.S. Army Materials and Mechanics Research Center, Watertown, MA 02172.

Army Terrain Information System

(Continued from page 25)

through TOS. A third possibility is found in a blend of these two approaches.

ARTINS also is planned to support users not possessing automated capabilities, including construction groups, communications zone elements, and transportation battalions. Requests would be made via phone, radio, or courier, and output could be either hard copy or oral reply.

Major efforts during FY 74 include preparation of a General Functional System Requirement (GFSR) document and a Data Element Dictionary; also, participation in the ARTINS Requirements Coordination Committee (ARCC) meetings to assist in identification and fulfillment of user requirements, and to insure compatibility and interoperability with other systems.

Currently in the concept formulation phase of the R&D life cycle, awaiting action on a proposed Required Operational Capability, the ARTINS effort is being pursued under an approved OCE R&D project of the Office of the Chief of Engineers, Department of the Army.

AMC Sponsors Graduate-Level CAD-E Training

In its efforts to provide the RD&E community with a cadre of experts, the Army Materiel Command (AMC) sponsors a graduate-level program in Computer Aided Design and Engineering (CAD-E) at the University of Michigan in Ann Arbor.

Recognized as a leading U.S. institution in computer science, the University of Michigan offers select AMC engineers 30 credit hours of graduate work that includes meeting an AMC requirement for a thesis project. Options for higher academic workloads are also available.

Candidates for the program are reviewed by screenings at local and functional levels. Final approval rests with the AMC deputy commander based on recommendations of the AMC Executive Development Board. The Civil Service grades of selectees have ranged from GS-7 to GS-14, with the greatest number in the GS-11 and GS-12 range. The average grade is slightly over GS-11.

Designed to broaden the student's knowledge of the effective use of "in-house" computer equipment in design and engineering, the training also prepares graduates with the expertise to assist management in developing specifications for procurement of computer equipment, including central processor and interfacing peripheral items.

The CAD-E education program is also aimed at providing the student with a capability to evaluate the technical correctness of contractor and/or subelement proposals and reports. Graduates will serve as on-site consultants to assist designers and engineers in facilitating work by using a computer.

Since initiation of the University of Michigan program in 1973, there have been two classes of 17 graduates. Sixteen students are in residence in the Class of '75.

The Army Materiel Command is soliciting applications for the Class of '76. This class starts in July 1975, a change from the May starting date of prior years. Science and engineering employes are invited to examine their qualifications, in terms of program prerequisites, and to consider submitting an application.

ALMC Initiates 5-Phase R&D Career Program

Initiation of a 5-phase educational program for Army Reserve R&D Career Program officers and other science and engineering personnel has been announced by the U.S. Army Logistics Management Center, Fort Lee, VA.

Similar to ALMC's Associate Logistics Executive Development course, the new program consists of five 2-week training periods encompassing R&D/Test and Evaluation Management, Cost Estimating for Engineers, Risk Analysis, and Logistics Support Design Management (parts I and II).

Phases may be taken in any sequence with the exception that Logistics Support Design Management I must be completed prior to enrollment in part II. Research and Development Mobilization Designees (MOBDES) may request this course in lieu of required annual training or as additional active duty for training.

Additional information regarding the program may be obtained from: Commandant, U.S. Army Logistics Management Center, ATTN: AMXMC-LS-R, Fort Lee, VA 23801.

IITR Plans Nondestructive Methods Conference

A review of the present state-of-the-art and discussion of potential developments of automated inspection and nondestructive evaluation methods will be held Oct. 15-17 at the Illinois Institute of Technology Research. For details contact: Keith McKee (technical) or Edward Fahy (administration) IITRI, 10 West 35th St., Chicago, IL 60616.

HDL Student Program Pays Off to Pro Staff

Leaders of the Harry Diamond Laboratories have repeatedly drawn high praise from congressional and Department of Defense leaders for notable contributions to the defense of the nation, but one of their major sources of pride is the success of their Summer Student Training Program.

A recent review of results of this program disclosed that 121 of HDL's current professional staff of about 400 scientists and engineers were recruited through the SSTP, inaugurated 20 years ago.

Nearly 50 students who major in science and engineering at about 30 colleges and universities are provided an opportunity to earn good salaries while performing experiments in HDL under the guidance of senior S&E personnel. They may work in such areas as fuzing systems, fluidics, nuclear weapons effects testing of components, and advanced radar techniques of microminiaturization of electronic circuits. Results of their efforts are reported in mid-August during a 2-day SSTP symposium marked by several awards.

About 100 students are employed in summer support activities.

People in Perspective

Safeguard Officer Adds Zest . . .
Performing With His Wife in Amateur Musicals

"Put a little fun in your life" is advice oft repeated by TV advertisers and MAJ Craig Ailles, a research and development coordinator at HQ U.S. Army Safeguard System Command, Huntsville, AL, heeds it most gratifyingly.

When his daily responsibilities for analysis of foreign strategic weapons systems and tactics are over (he was the author of "Anti-ballistic Missile System Evaluation" in our May-June 1974 edition), MAJ Ailles joins with his petite wife Marilyn as a song-and-dance team in amateur theatricals. They recently performed in a production of Meredith Wilson's "Music Man."

The experience was not a new one. In fact, 10 years ago, when he was first stationed at the Army Missile Command, they performed in the Huntsville Community Chorus production of "Brigadoon." They also have displayed their talents in numerous other musicals, including "Fiddler on the Roof" and "Camelot," and are active in the choir of the First Methodist Church of Huntsville.

Some people might believe that Army life would limit the Ailles' chances for "showing their stuff." But he says, "It just ain't so!" The Ailles have joined musical activities wherever they have been stationed. They were members of the Cumberland Chorale at Fort Bragg, NC, and Harford Choral Society at Aberdeen Proving Ground, MD.

Currently they are on the Board of Directors of the Huntsville Community Chorus. Additionally, he is chairman and financial secretary while she is on the educational committee which provides musical information to Madison County schools.

Summing up their activities, the Ailles said: "We both like to sing and dance and we can enjoy the activities together. We do it for fun."

Striving for Perfection . . .
Safeguard Hobbyist Delights in 'Gilding the Lilly'

Advanced technology in color photography is not good enough for Frank Hiserodt of the U.S. Army Safeguard System Command, Huntsville, AL, in pursuing his hobby of depicting the floral beauties of nature. You might say he delights in "gilding the lilly."

Perfectionist is a word that applies properly to Hiserodt, and no less to his wife Nancy who shares with him in enjoyment of his avocation. Their idea of happy hours is to pack a lunch, the camera equipment, and spend weekends and holidays hiking the woods to look for rare and exotic wild flowers—or nature scenes in still unpolluted areas.

Utilizing special lenses and close-up techniques, Hiserodt gets enlargements of wild flowers, many of them so small in their natural environment they go unobserved by casual walkers.

Fastidious care is involved in achieving the optimum camera set-up and Frank credits Nancy with her part in his success, saying: "She has a knack for picking the right angles that best show the colors of the flowers to advantage . . . I rely on her judgment!"

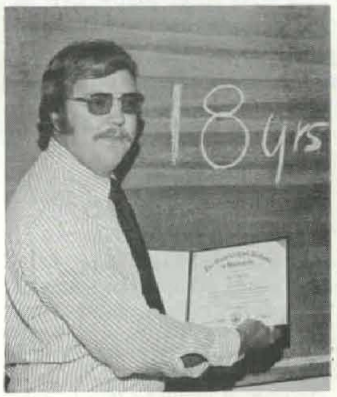
The quest for perfection does not end with taking the pictures. Hiserodt develops his pictures at home and pictures that many photographers would gladly accept are rejected because they lack the realism he demands.

The real artist's touch is given to those selected. Delicate oil color hand tinting, a vanishing art in today's high-speed world, comes next. To achieve exact shades and blends for the realism of the flower in its natural setting, he sometimes spends weeks of painstaking effort.

Many of his photographic embellishments are displayed in private homes around the Huntsville area, but he says he never equates the cost of a picture with the time and effort he expends in its production.

To him, the quotation, "Perfection is its own reward," is meaningful.

Degree Rewards 18-Year Persistent Effort



Patient persistence personified is a properly merited description of Victor D. Puckett's 18-year-long successful effort to add a college degree to his qualifications as an aerospace engineer with the Ballistic Missile Defense Systems Command.

During the process he accumulated 175 semester hours of successfully completed university courses. That is 47 hours more than normally required for a bachelor's degree, but he found in his travels that one institution would not accredit courses offered by another.

The coveted degree came by way of studies at Kansas State University, Wichita State, Oklahoma City University, San Bernardino Valley College, the University of Oklahoma and, finally, the University of Alabama. The Huntsville, AL, institution has a cooperative educational program worked out with HQ U.S. Army Missile Command.

Now that he can list among his professional qualifications a BS degree in the behavioral sciences, Puckett is planning to proceed toward another career objective, an MS degree—but this time it isn't going to take 18 years or anything like that, he vows.

BMD Officer Finds Pleasure in Ocean Depths

Hobbyists find their fun in hundreds of fascinating fields but few profess to being more completely absorbed in their avocations than MAJ Rick Waldrop, a staff officer with the Ballistic Missile Defense Systems Command.

Since he was 13, and had his first experience with the thrills of scuba diving, MAJ Waldrop has become progressively more enthusiastic about the fascination of exploring the depths of the sea. Initially he was content with being an observer of marine life and the many other beautiful sights.

Now an accomplished and certified instructor in the art of scuba diving, he has a continuing interest in persuading others to share the pleasure his hobby gives him. He also has expanded his interests to underwater photography and the collection of specimens of tropical fish and other exotic sea life. He has amassed hundreds of color slides, and continually restocks his aquarium.

MAJ Waldrop, on rare occasions, even ventures on treasure dives. During one such outing, he and some fellow enthusiasts charted more than 12 shipwrecks off the Florida coast. Their oldest find was a 3-masted schooner once used to haul lumber in the late 1800s.

They brought up an old anchor and lots of dishes and bottles, but little treasure. Many of the items, including some ship's remains, were later donated to local museums.

MAJ Waldrop recalls that one of his greatest thrills occurred when he was stationed in Vietnam. While diving in the South China Sea, he encountered some of the most dazzling undersea life imaginable, including the largest lobsters he had ever seen. Samples of sea shells and unusual coral formations that abound in these unexplored tropical waters are in the rewarding collection he is continuing to amass.

Personnel Actions...

AMC Names Pezdirtz Deputy for Logistics Support

MG Joseph W. Pezdirtz is the new deputy commander for Logistics Support, HQ U.S. Army Materiel Command, after serving since April 1973 as chief of staff, HQ AMC. BG Robert L. Kirwan is his successor.

MG Joseph W. Pezdirtz

MG Pezdirtz was commander, Korea Support Command, Eighth U.S. Army during 1972 following a tour as chief, U.S. Army Advisory Group, Korea, and (later) special assistant to the commander, U.S. Forces, Europe.

He began his military career with an Army Reserve commission upon graduation from the University of Michigan in 1942. He is a graduate of the Army Command and General Staff College, Armed Forces Staff College, and the Naval War College. Among his military honors are the Silver Star, Legion of Merit with 22 Oak Leaf Clusters, Bronze Star with three Oak Leaf Clusters, and the Army Commendation Medal.

BG Robert L. Kirwan

BG Kirwan has served since 1972 as director, Personnel, Training and Force Development, HQ AMC. In 1971 he became assistant division commander, 3d Armored Division, U.S. Army Europe (USAREUR) after serving during 1969 as chief, Plans and Operations Division, Office Deputy Chief of Staff for Personnel, USAREUR.

Other key assignments have included commander, 1st Brigade, 4th Infantry Division, U.S. Army, Pacific, Vietnam; chief, Reassignment Section, Office, Personnel Operations, Washington, DC; commander, HQ, 2d Bn., 87th Inf., USAREUR; assistant chief of staff, G-3, later special assistant chief of staff, HQ and HQ Co., 4th Infantry Division, U.S. Army, Pacific, Vietnam; deputy brigade commander, HQ and HQ Co., 3d Brigade, 8th Infantry Division, USAREUR; and secretary, General Staff, HQ, V Corps, USAREUR.

His military honors include the Silver Star, Legion of Merit with Oak Leaf Cluster (OLC), Distinguished Flying Cross, Bronze Star Medal, Air Medal with "V" device and nine OLC, and Army Commendation Medal with two OLC.

Graduated from the U.S. Military Academy in 1948, BG Kirwan has completed the Army Command and General Staff College, Army War College, Armor School Advanced Course, U.S. Army Infantry School, and the Ground General School.

Griffith Succeeds Meyer as AMC RD&E Director

MG Stewart C. Meyer is the new Commander of MASSTER (Modern Army Selected Systems Test, Evaluation and Review), Fort Hood, TX, after serving 35 months as director, Research, Development and Engineering, HQ U.S. Army Materiel Command, Alexandria, VA.

BG Harry A. Griffith reported at HQ AMC as his successor July 31 following duty since 1973 as division engineer, Southwestern Army Engineer Division, Dallas, TX, and a 3-year stint as head of the U.S. Army Engineer District at Mobile, AL. He commanded the 35th Engineer Group (Construction), U.S. Army Pacific-Vietnam (1969–70) after serving as chief, Nike-X and Space Division, Office of the Chief of Research and Development, Washington, DC.

BG Harry A. Griffith

Other key assignments have included commander and assistant director, U.S. Army Advanced Ballistics Missile Defense Agency, Washington, DC; project manager, R&D, Advanced Research Projects Agency, Office, Secretary of Defense, Washington, DC; Office of Personnel Operations, HQ DA; and commander, 27th Engineer Battalion (Combat), Fort Campbell, KY.

A graduate of the U.S. Military Academy, he has a master's degree in civil engineering from California Institute of Technology. He is a graduate from the Armed Forces Staff College and the National War College. His military honors include the Legion of Merit with Oak Leaf Cluster (OLC), Bronze Star Medal, Air Medal (two awards), and the Army Commendation Medal with OLC.

Gansler Named DASD for Materiel Acquisition

Secretary of Defense James R. Schlesinger recently appointed Jacques S. Gansler to succeed VAdm Eli Reich as Deputy Assistant Secretary of Defense for Materiel Acquisition (Installations and Logistics).

Jacques S. Gansler

Gansler became the first civilian named to this position after serving as Assistant Director of Defense Research and Engineering, Office, Secretary of Defense, and earlier as Assistant Director for Electronics. Until he joined the DDR&E staff he was president and director of Business Development, Avionics Div., International Telephone and Telegraph.

Currently completing studies for a PhD in political economy at American University, Gansler has a bachelor's degree from Yale University and a master's degree from Northeastern University, both in electrical engineering, and a master's degree in political economy from the New School for Social Research, Boston, MA.

Proudfoot Commands White Sands Missile Range

MG Robert J. Proudfoot

MG Robert J. Proudfoot, former deputy for Materiel Acquisition, Office of the Assistant Secretary of the Army (Installations and Logistics), has been named commander, White Sands (NM) Missile Range, succeeding MG Arthur H. Sweeney.

During 1968–73 MG Proudfoot served at Redstone Arsenal, AL, as project manager of the Shillelagh and Lance weapon systems. Earlier he was a deputy project manager with the U.S. Army Materiel Command. Prior to a one-year tour of duty in Vietnam, he served as a special weapons and guided missile officer with the U.S. Army, Pacific, Fort Shafter, HI.

MG Proudfoot has a 1958 bachelor's degree from the University of Maryland and a master's degree in business administration from Babson Institute. He has also completed the Army Command and General Staff College and the Industrial College of the Armed Forces.

Included among his military honors are the Legion of Merit, Bronze Star Medal, Air Medal with Oak Leaf Cluster (OLC) and the Army Commendation Medal.

Merrill Takes ADPA Industrial Preparedness Post

Roger L. Merrill, Battelle Memorial Institute's corporate director for National Security, Space, and Transportation Research, has been appointed deputy chairman of the Industrial Preparedness Division of the American Defense Preparedness Association (ADPA).

One of his initial responsibilities in this capacity will be to plan, coordinate and chair the National Industrial Preparedness Conference planned during the spring of 1975 (date undecided).

The division is one of the major components through which ADPA provides defense and other government agencies with the assistance of private industry on matters relating to national defense preparedness.

Since joining Battelle in 1949, Merrill has served in a number of research and administrative posts including director of Battelle's Columbus Laboratories, associate director, assistant director for Technical Development, and as manager of one of the major research departments at Battelle-Columbus.

Awards . . .

Abraham Golub, 5 Others Receive DCS Award For Scientific and Technical Accomplishments

Former Assistant Deputy Under Secretary of the Army for Operations Research Abraham Golub, now technical adviser to Army Deputy Chief of Staff for Operations LTG Donald W. Cowles, is a recent recipient of the Department of Defense Distinguished Civilian Service Award.

Abraham Golub

Deputy Secretary of Defense William P. Clements presented the award to Golub and five other outstanding employes in a ceremony at the Pentagon. Honored Posthumously was Dr. Elvio H. Sadun, formerly a long-time chief of the Department of Medical Zoology, Walter Reed Army Institute of Research.

Cited also for scientific and technical accomplishments was Lynwood A. Cosby, internationally known for his contributions to electronic warfare technology during the past 15 years as a U.S. Navy employe.

Until assigned to his present duties May 20, 1974, Golub was scientific adviser to the Army Assistant Chief of Staff for Force Development (ACSFOR), and in 1972 was the keynote speaker at the Eleventh Annual Army Operations Research Symposium.

Dr. Elvio H. Sadun

Golub's long association with the U.S. Army Ballistic Research Laboratories, Aberdeen (MD) Proving Ground, terminated in 1964 when he accepted an appointment with the Secretary of the Army. His award citation credits him with outstanding leadership during the past 32 years in the development of advanced and innovative techniques for the solution of complex military problems.

Specifically, he was recognized for exceptional achievement as scientific adviser to the ACSFOR, but the citation also acclaimed him as a pioneer in the practice of operations research and systems analysis—one of the most knowledgeable and highly respected analysts in the field of weapons systems evaluation.

DR. SADUN's citation stated that under his leadership the Department of Medical Zoology, Walter Reed Army Institute of Research, became known worldwide as a center of excellence in the study of helminthic and protozoan infections. It added that "Dr. Sadun has served with great distinction as a teacher, administrator, and professional adviser. His outstanding contributions to the scientific community and Department of Defense warrant the highest recognition this Department can bestow."

Fort Campbell Cited for Resource Conservation

The 1973 Defense Natural Resources Conservation Award was presented recently to Fort Campbell, KY, home of the 101st Airborne Division, by Secretary of Defense (Installations and Logistics) Arthur I. Mendolia.

Fort Campbell was selected following competition among military installations throughout the country, encompassing more than 19 million acres of the 25.8 million acres of DoD-controlled land.

The annual award is presented in recognition of the greatest contributions in applying natural resource conservation principles in line with environmental and ecological objectives. The potential for maximum multiple recreational use of military property, consistent with the military mission of the installation, is also of key importance.

Cowinners in this year's runner-up category are Eglin Air Force Base, FL, and the Naval Ammunition Depot, Crane, IN. Honorable mention citations were presented to Fort Knox, KY; Marine Corps Air Station, Kaneohe Bay, HI; and Vandenberg Air Force Base, CA.

Fort Sill Wins 1973 Environmental Quality Award

Innovative leadership in environmental management has made Fort Sill, OK, home of the U.S. Army Artillery Center and School, the winner of the 1973 Secretary of Defense Environmental Quality Award.

Secretary of Defense James R. Schlesinger announced that an advisory committee of nationally known environmentalists had cited Fort Sill for "outstanding leadership and achievement in the conduct of environmental quality programs in consonance with DoD objectives and the national effort to improve and protect the quality of life of its citizens."

Meritorious achievements in planning and carrying out environmental protection and quality responsibilities earned honors for the U.S. Air Force Academy, Colorado Springs, CO; the Naval Civil Engineering Laboratory, Port Hueneme, CA; and the Marine Corps Air Station, Kaneohe Bay, HI.

RARELY, VERY VERY RARELY does a 2-star British general pin the insignia of promotion on the shoulder of a U.S. Army officer—in fact, this ceremony is believed the first of its kind since World War II. MG J. M. Sawers, Signal Officer-in-Chief of the British Army, is pinning the Eagles on COL Llewellyn P. Rose, commander and senior representative, U.S. Army Standardization Group (United Kingdom) in a ceremony in London, England. COL Rose is a graduate of the University of Nebraska, the Army Command and General Staff College, and is currently enrolled in the Army War College non-resident course.

Combat ADP Support System Expanded Armywide

Extension of the Combat Service Support System (CS_3) to all Active Army Divisions—termed a "major milestone" in the Army's automatic data processing systems—has been approved by the Assistant Secretary of the Army for Financial Management, the U.S. Army Computer Systems Command announced Aug. 14.

Currently, three divisions—the 1st Cavalry Division and the 2d Bomber Division at Fort Hood, TX, and the 101st Airborne Division, Fort Campbell, KY—are operating the CS_3 system. Extension to other Active Army divisions will commence in the spring of 1975.

Each division will control and operate its own computer complex, a Division Data Center (DDC), to process the Standard Installation/Division Personnel System (SIDPERS); Division Logistics System (DLOGS); and Maintenance Reporting and Management (MRM).

Using the van-mounted IBM 360/30, the CS_3 system will move with field tactical units, thereby providing rapid responsive support.

The CS_3 system is being developed and project managed by the Computer Systems Command (USACSC), Fort Belvoir, VA.

TAMA Standardizes Army Audiovisual Devices

Standardization of audiovisual formats for slides, transparencies, filmstrips, motion pictures, and audio and video tapes has been announced by the U.S. Army's Training Aids Management Agency.

Primary purpose of the move is to reduce incompatibility and increase interchangeability of software. Other areas of standardization include the maintenance of Army-owned and operated educational support materiel, and the establishment of uniform quality control technical engineering standards for each system used to support educational technology applications.

Controlled Environmental Storage

By LTC David C. Davenport

Lack of a simple, inexpensive, efficient, labor-saving method for controlled environmental protection of equipment is a serious deficiency in the U.S. Army logistical system. Personnel who were involved in support of Exercise Reforger, or units in Southeast Asia, know well the costs and difficulty of this problem.

The U.S. Army has tried three approaches to date: design materiel to withstand storage and environmental stresses; devote hours and large numbers of personnel for maintenance duties to insure operational readiness; transport and store materiel in costly containers and buildings to provide a controlled environment.

All of these solutions are expensive. Moreover, they do not assist the Active Army, Reserve or National Guard commander who, because of mission, logistical constraints or personnel shortages, must maintain quantities of equipment in administrative storage.

Solutions using the latter two of these methods are not always practicable. For example, they do not help personnel required to maintain a division's operational readiness float. Similarly, a depot commander in the U.S. Army Pacific can hardly hope for a sufficient number of controlled environmental warehouses in which to store the contingency stocks for which he is responsible.

Armies throughout the world have the same difficulties and their solutions, for the most part, have paralleled U.S. Army practices.

British Forces, however, have discovered a solution that merits our consideration—a controlled environmental storage and shipping system which is lightweight, mobile, labor-efficient and inexpensive.

Developed by the British firm of Driclad Ltd., the equipment provides environmental protection by maintaining a suitable level of humidity within a flexible lightweight cover which encloses the item requiring protection.

Acceptable humidity levels are maintained by the use of Silica Gel or an electrical dehumidifier. Periodic visual inspections of internal indicators through a transparent window in the cover reveal when the acceptable parameters have been exceeded.

Access to the interior is provided by a continuous loop "zipper like" air-lock device that permits personnel to enter the cover for periodic inspections, or exercise components.

Advantages of such an approach are readily apparent. A controlled environment may be provided to equipment and/or materiel whenever desired; the number of personnel required to inspect the equipment is small; and the time required to return this equipment to operational readiness is minimal.

The system has had limited use within NATO, Middle Eastern, and Southeast Asia armed forces. It has proved extremely cost-effective—less than two percent of the acquisition cost of the equipment being protected. The cost of maintenance, in manpower and parts, has been reduced by more than 75 percent.

Eighty British tanks stored within such covers by the British Army of the Rhine area have remained in storage for over five years, with no decrease in operational readiness. Three individuals have performed all required daily maintenance and inspection.

The system was used to transport a British "Lightning" jet fighter as deck cargo from Singapore to England in 1971. The ship was en route for 37 days during the monsoon season, and the aircraft was operational after preflight inspection and servicing.

The concept also has been tested in the United Kingdom for conversion of existing warehouse and hanger facilities. Using this approach, it is possible to adapt existing buildings for controlled environmental storage of any materiel.

The Driclad system has been tested by the British Forces in both hot/wet and cold/dry environments. An acceptable controlled environment for stored materiel has been provided in both of these extremes. Similarly, U.S. Army tests of the system have proved its feasibility.

Tests in the Theater Army Support Command (TASCOM) Europe in 1972 and 1973 showed that the concept provides excellent environmental protection for a wide range of equipment from small communications-electronic items to armored vehicles.

The Aviation Systems Command (AVSCOM) tested the system for storage of UH-1 helicopters in 1972 and has procured additional systems for test. The TASCOM equipment is being shipped to the U.S. Army Pacific and to the Army Materiel Command's Tank-Automotive Command for additional use and evaluation.

Most of the applications of the Driclad system have concerned high-dollar-value materiel, stored statically in fitted covers. However, the concept is equally efficient and even more cost-effective when used in general-purpose configurations compatible with international standard shipping containers and pallets.

Equipment such as batteries, communications-electronic repair parts, major engine components and medical supplies can be stored and shipped in general-purpose covers reuseable numerous times as containers.

With advances in environmental storage such as this, it appears that a solution to the environmental storage problems of U.S. Active Army, Reserve and National Guard commanders and logisticians may be forthcoming.

PHOTO SEQUENCE shows Driclad cover fitted to a helicopter 120 minutes after arrival from the factory. The helicopter remains in the cover, untouched for 33 weeks and is unveiled in 13 minutes. Two hours after removal of the cover, the helicopter is ready for flight.

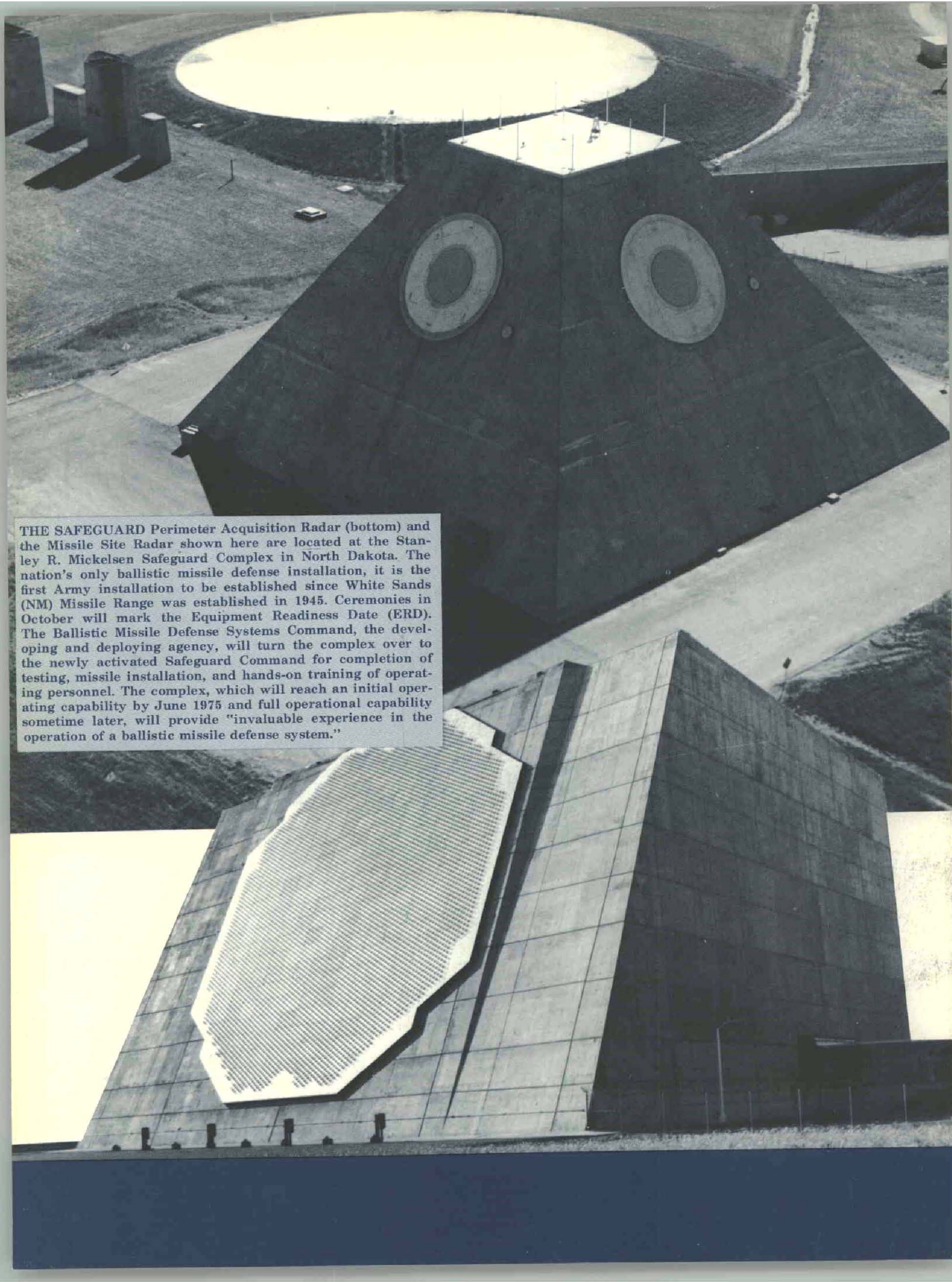
MG Marshall Takes Over as BMD PM

MG Robert C. Marshall has succeeded LTG W. P. Leber, now retired, as Ballistic Missile Defense Program Manager, the Army recently announced.

Stationed in the Pentagon, Washington, D.C., MG Marshall has responsibility for all Army organization involved in ballistic missile defense, including the Ballistic Missile Defense Systems Command, formerly the U.S. Army Safeguard System Command, as well as the Ballistic Missile Defense Advanced Technology Center, formerly the Advanced Ballistic Missile Defense Agency. The BMDATC and the BMDSC are located in the Huntsville, AL, Milton H. Cummings Research Park.

LTC DAVID C. DAVENPORT, a member of the R&D Officer Program, is the general/chemical representative for the U.S. Army Standardization Group, United Kingdom, a field activity of the Office of the Chief of Research, Development and Acquisition, HQ Dept. of the Army.

Graduated in 1957 from the Virginia Military Institute with a bachelor's degree, he has an MA degree in contemporary history from the University of Missouri. He attended the Army Command and Staff College in 1970–71, was executive officer and commander of the Saigon Logistical Support Activity in 1969 and during 1965–66 was S-4, Operational Detachment C-1, 5th Special Forces Group, Vietnam. He has served with the CDC Maintenance Agency and the Institute for Strategic and Stability Operations.



THE SAFEGUARD Perimeter Acquisition Radar (bottom) and the Missile Site Radar shown here are located at the Stanley R. Mickelsen Safeguard Complex in North Dakota. The nation's only ballistic missile defense installation, it is the first Army installation to be established since White Sands (NM) Missile Range was established in 1945. Ceremonies in October will mark the Equipment Readiness Date (ERD). The Ballistic Missile Defense Systems Command, the developing and deploying agency, will turn the complex over to the newly activated Safeguard Command for completion of testing, missile installation, and hands-on training of operating personnel. The complex, which will reach an initial operating capability by June 1975 and full operational capability sometime later, will provide "invaluable experience in the operation of a ballistic missile defense system."