ARMY RESEARCH AND DEVELOPMENT

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ILIR Reports Indicate In-House Capabilities Relevant to Missions

Basic and applied research accomplishments indicative of a high order of excellence and mission-related competence are reflected in 463 reports on the FY 1969 U.S. Army In-House Laboratory Independent Research Program, funded at $10.06 million.

Exceptionally broad diversity and depth of investigations relevant to Army operational requirements are attested by results. The ILIR Program extends into virtually all of the major scientific disciplines and most highly specialized subfields.

More than 50 in-house research and development installations participated in the FY 1969 ILIR activities. U.S. Army Materiel Command facil-

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Army Dates Symposium On Operations Research

Ninth Annual U.S. Army Operations Research Symposium participants assembled May 20–22 on the campus of Duke University, Durham, N.C., will hear addresses by high-ranking research and development leaders, some of whom will moderate panel discussions.

General Ferdinand J. Chesarek, CG of the U.S. Army Materiel Command, has accepted an invitation to present

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Army Outlines 5-Year DoD Food RDT&E Program At 85th Joint Services Medical Research Conference

Facets of a 5-year "Department of Defense Food Research, Development, Testing and Engineering Program," scheduled for implementation in July, were detailed recently at the 85th Joint Medical Research Conference in the Pentagon, Washington, D.C.

Responsibility for execution of the DoD program is assigned to the Army Materiel Command, which has assigned the task of integrating activities to the Natick (Mass.) Laboratories (NLABS). Staff monitorship is charged to the Life Sciences Division, Directorate of Army Research, Office of the Chief of Research and Development.

NLABS Deputy Commander Col William B. Levin outlined the DoD program to participants in the Joint Medical Research Conference. Since then, the impact of DoD budgetary reductions has necessitated reductions in projected funding levels in the 1971–75 FY planning. The proposed range of the program submitted to the DoD Feb. 12 is from $7 to $10 million annually.

Dr. Edwin E. Anderson, Deputy Scientific Director for the DoD Food

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BESRL Reorganized Into New R&D Center

Reorganization of the U.S. Army Behavioral Science Research Laboratory (BESRL) and redesignation as one of three laboratories in a new U.S. Army Manpower Resources Research and Development Center has been approved.

General Orders No. 3, Office of the Chief of Research and Development, states the USAMRRDC mission is to:

- Supervise and conduct R&D for the Chief of Research and Development in personnel classification, selection, utilization, training methods and techniques, morale, leadership, and human performance in military systems.
- Conduct and supervise R&D relevant to internal defense, civic action, military assistance, psychological operations, human factors of U.S. military operations in developing nations, and motivation, morale, opinion and values of the American soldier.
- Provide technical supervision for Human Resources Research Organiza-

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Army Schedules Shift Of Research to London

Permanent change of station of the U.S. Army Research and Development Group, Europe, from Frankfurt, Germany, to London, England, is scheduled for completion by June 30 to collocate with U.S. Navy and Air Force European research organizations.

In accordance with a memorandum from the Director of Defense Research and Engineering to secretaries of the Military Departments, the collocation will involve a reduction in the current level of U.S.-supported European R&D activities.

In the case of the Army, the program reduction will be in accord with about a 30 percent decrease in funding support. Under the continuing program of the U.S. Government in recent years to reduce the "dollar drain," the level support of European research has steadily declined.

The U.S. Army European Research Office, known as ERO, was established by authority of HQ DA letter dated Apr. 25, 1956, and the mission was detailed by Army Regulation 70–40 in mid-May. The goal was to broaden the

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Project THEMIS Chagas' Disease Study Pays Off

Possibilities of effective biological control of the triatomid insect vectors of Chagas' disease, devastating in certain areas of Central and South America, are raised by results of research performed under U.S. Army support of Project THEMIS.

Chagas' disease (also known as American trypanosomiasis) is primarily a hazard to field personnel in rural areas, and is transmitted by the bite of certain beetles resistant to insecticides. Myocarditis is a common complication of the disease and effective therapeutics for general use are lacking.

Heart damage caused by the disease, for which there is no known cure, is of a nature which reduces physical activity and leads to a significantly shortened life span. Conceivably, it could place a large burden on military medical resources if large numbers of troops were exposed.

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Featured in This Issue....

Army R&D Newsmagazine

Vol. 11 No. 2 • February 1970

Editor . . . . . Clarence T. Smith
Associate Editor . . . . George J. Makuta

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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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OTHER GOVERNMENT AGENCIES' requirements should be submitted directly to the Army Research Office, OCRD, Department of the Army, Washington, D.C. 20310, ATTN: Data Management Division, Publications Branch.

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Trees Viewed for Pollution Control

Army Scientist Suggests Federal Agencies' Studies

Trees planted in cities and urban areas with a scientific knowledge of their practical utility, longevity and requirement for minimal care have long been one of the highly diversified interests of U.S. Army scientist Dr. Carl Lamanna. Need for research on their uses for air pollution control is the subject of his latest publication.

Writing in the February 1970 edition of *Bioscience*, Dr. Lamanna offers three important recommendations for actions by federal agencies. During his 10-year association with the Army Research Office, Office of the Chief of Research and Development, as deputy chief and scientific adviser, Life Sciences Division, he has devoted private effort to tree planting problems.

In the *Bioscience* article, he restates many of the views he has suggested to research and development institutes and corporations "to stimulate their thinking about ways and means to identify and exploit the potentials of vegetation in the urban environment for reducing air pollution . . . ."

Working with civic groups in the Washington, D.C., area he became interested in acquiring reliable information about the best types of trees to plant for precise conditions of city or urban environment. The March 1967 edition of the *Army Research and Development Newsmagazine*, page 27, reports on some of his findings.

One of the problems ("great bottleneck") on which he comments in the *Bioscience* article, regarding potentials of using vegetation for reducing air pollution in an urban environment, is that "no government agency has any explicitly stated mission in this area of research . . . ."

The questions to be resolved, he says, include: "Might this field not represent an opportunity for the Departure of Agriculture to turn its skills and resources from an exclusive focus on food production? Might this not be an area of basic research of potential application worthy of funding by the National Science Foundation?"

Pointing out that evidence is plentiful to indicate that trees are vulnerable to damage from atmospheric contaminants, Dr. Lamanna states: this testifies to the capability of foliage to absorb pollutants.

"While the result is undesirable," he writes, "the immediate effect is removal and entrapment of noxious materials from the atmosphere. . . ."

Various species of trees, he points out, have "differing sensitivity to air pollutants. If resistance to air pollutants can be shown to be due to greater concentration of neutralizing compounds in resistant than sensitive plants, then it would be entirely reasonable to breed for enhancing this property . . . ."

Dr. Lamanna closes the *Bioscience* article with these recommendations:

- That appropriate federal agencies undertake studies to assess the potentials for reducing air pollution in the urban environment by planting of vegetation.
- That information and technical assistance be made available by a designated federal agency to local communities on the uses of vegetation to control air pollution.
- That an appropriate federal agency be designated to draw up and execute a plan of economic assistance to metropolitan areas chosen as demonstration areas for exploring and developing plantings as a means for controlling air pollution.

Army Engineers' Civil Works Tallied in FY 70-71 Budgets

Magnitude of Civil Works Program responsibilities of the U.S. Army Corps of Engineers is reflected in the FY 1970 budgetary appropriation of $1,145,773,000 and in the President's FY 1971 budgetary message to Congress requesting $1,270,073,000 for projects planned by the corps.

The FY 1971 general-heading breakdown of funding requests is: investigations, $39,597,000 (studies of proposed projects, etc.); general construction, $821,389,000; operation and maintenance, $292,600,000; general expenses, $25,800,000; flood control, Mississippi River and tributaries, $79,578,000; flood control and coastal emergencies, $7,000,000; permanent appropriations (estimated), $4,100,000.

Projects and studies in the FY 1971 75-page listing of the funding breakouts extend into 50 states. They are concerned with improvements for navigation of inland waterways, power plants and dams, harbor improvements, levee construction and other flood control measures, reservoirs, dredging, improving of river channels, water quality and waste disposal projects, construction for hurricane protection, prevention of beach erosion, control of undesirable aquatic growth, and numerous other efforts for improvements to and better utilization of the nation's water resources.

Army Outlines 5-Year DoD Food RDT&E Program at Joint Research Conference

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Program, was charged last fall with supervision of basic and applied research performed at the NLABS in support of the program.

When the program was assigned to NLABS, effective Oct. 24, about 300 scientists, engineers and food technologists became engaged in efforts to achieve the DoD goal of integrating all activities of the Armed Forces in food processing, packaging and preservation.

DoD Instruction 3200.10, issued July 12, 1968, established a policy and assigned to the Secretary of the Army the responsibility for formulating an RDT&E Food Program—and for executing the approved program in coordination with military departments and appropriate DoD components.

The program calls for "optimizing the feeding situation" for the Army, Navy, Air Force and Marine Corps. Col Levin said there is a "much higher level of commonality" among the military services in garrison-type feeding than in feeding of field troops. In the case of the Army, the latter have been the focus of the most RDT&E to meet combat needs in recent years.

DoD Directive 1338.10 (Dec. 5, 1967) established a Unified Food Service Program. Recommendations regarding the program were developed by a 20-member panel of nationally known leaders established by the National Academy of Sciences-National Research Council at the Army's request.

The NAS–NRC ad hoc group studied the over-all problem at a 2-day meeting in August 1968. An in-house 12-member working group representative of the NLABS, Air Force, Navy and Marine Corps then developed the detailed 5-year program to meet objectives proposed by the NAS–NRC experts.

Following another 2-day NAS–NRC committee review in March 1969, the final program was submitted by the commanding general of NLABS to the Army Materiel Command in April 1969.

In his presentation to the Joint Medical Research Conference, Col Levin explained that the Army's RDT&E food program has been directed primarily toward solution of problems and the development of new food and equipment items required by field troops.

Some of the Army-developed dehydrated food products have been used in the Navy's "Ration Dense" program. Marines have used some Army-type rations when operating in the field.

Col Levin stressed that requirements for further progress in feeding field troops still pose problems and that "support of the fighting men of all the services must be uppermost in our program." The DoD program, he said, includes "food service systems, material and facilities for all environments and operating conditions."

This requirement entails a substantial change in the Army RDT&E food program, which has been directed principally to the roughly 10 percent of field forces operating in a combat environment, requiring other than garrison-type food that serves needs of about 90 percent of the troops.

Some of the problems in garrison-type feeding will require that the expanded DoD program includes such areas as systems analysis, total food systems, centralized food production centers, continuous food processing equipment, facility layout, fresh and frozen food, convenience foods, etc.

Six major areas of RDT&E activity are included in the DoD program:

- Nutritional requirements and adequacy under all conditions.
- Food chemistry, microbiology, processing, preservation, packaging, stability and consumer acceptance.
- Food service systems, material and facilities for all environments and operating conditions.
- Recipes, menus, operational rations and food packets.
- Food preparation, holding, serving and handling equipment.
- Specifications for food and related packaging, equipment and systems.

Formulation of the 5-year RDT&E program was guided by that portion of the DoD instruction requiring continual upgrading of the general and specialized military feeding programs.

The instruction calls for effort "to meet feeding requirements as they change with changing modes of warfare."

A major objective is to support "the timely introduction of new and improved food items, preservation methods, packaging and new feeding systems as well as improvement of systems in use."

In substance, Col Levin said, the

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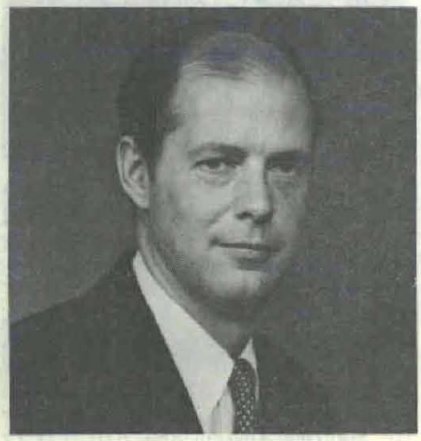
Ward Succeeds Siena As Beal's IA Deputy

David H. Ward became Deputy Under Secretary of the Army for International Affairs in Pentagon ceremonies Feb. 6 when he was sworn in by Under Secretary of the Army Thaddeus R. Beal.

He succeeds James V. Siena, who resigned recently to become general counsel of Stanford University, and will be responsible for advising and assisting the Secretary of the Army and Under Secretary on international security matters and foreign relations affecting the mission of the Army.

Included in his areas of concern are the U.S. administration of the Ryukyu Islands, the Canal Zone Government and Panama Canal Co., treaty matters concerning the Panama Canal, military history, certain security and foreign liaison matters, military support of civil defense, and various special projects.

Born May 13, 1933 in Kansas City, Mo., Ward received a BA degree from Harvard College in 1955 and a bachelor of law degree from the Harvard Law School in 1960. He has been a member of the American Bar Association since 1965, a trustee of the Art Institute of Chicago since 1968, and has practiced law with the Chicago firm of Sidley and Austen since 1961.



David H. Ward

Error Drops Deputy From Title Of Coauthor in Newsmagazine

Apologies for a seemingly careless mistake when it appears in print never adequately compensate for the error—as is regrettably the case for Col William H. Meroney, director and commandant of Walter Reed Army Institute of Research since June 1968.

Such an error was made in the title of Col E. L. Buescher in the *January edition of the Army Research and Development Newsmagazine.* Col Buescher is *deputy* to Col Meroney in both of his capacities. *Deputy* was inadvertently omitted in the biography of Col Buescher as coauthor with Dr. M. S. Artenstein of an article titled "Army Reports on Advances in Meningococcal Meningitis Control."

Army Outlines 5-Year DoD Food RDT&E Program at Joint Research Conference

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program "technically supports the current feeding systems used in all military departments but more importantly, at the same time, it will create new knowledge, techniques and data required to evolve more efficient and effective feeding systems for the future."

While it is recognized that, ideally, one standardized DoD feeding system for all conditions and situations would be desirable, Col Levin said it is the consensus that the current state-of-the-art will not support adoption of a standard system.

Consequently, activities proposed in the DoD program are addressed to solution of problems in three existing major feeding subsystems—Operational; Garrison and Shipboard; and Special.

Operational problems are related to field feeding for the Army and Marines, as well as Navy and Air Force requirements, and current development programs such as: Meal, Ready-to-eat, Individual; Meal, Uncooked, 25-man; Food Packet, Individual, Combat; Ration Dense Foods; Volume Conservation (for use in high-performance aircraft).

Garrison and Shipboard projects are concerned with fresh, dehydrated and frozen foods; also, certain thermal- and radiation-processed items used in the four military services in garrison and fixed messes and ships.

Feeding Subsystem, Special activities will emphasize production items required in limited quantities under special conditions, such as: Food Packet, in-Flight, Individual; Ration, Individual, Trail Frigid; Ration Supplement, Aid Station; and Food Packet, Survival.

In addition to these three subsystems, a fourth called Future Feeding Subsystem includes fundamental or basic research studies and exploratory development—"information, techniques and management knowledge required to create new and/or more effective feeding systems or ideally one standard system."

Inputs from a broad spectrum of scientific, technological and engineering disciplines are programed in seeking solutions to problems in the four subsystems. For simplification of structural and management activities, 10 project areas have been identified.

Systems Analysis provides for a comprehensive analysis of the total DoD food service system within the guidelines of DoD Directive 1338.10. The objective is a pattern for future DoD food service management, organizational and operational structure.

Food Processes and Products. This project is concerned with control and exploitation of food processing and preservation technology; also, application to procurement instruments for food products to meet a wide range of known and foreseen military needs.

"Soundly based quality assurance measures will be established as an inherent part of food product development."

Project THEMIS Chagas' Disease Study Pays Off

(*Continued from page 1*)

Under a Project THEMIS contract with Louisiana State University, monitored by the Army Medical R&D Command, Dr. Rodrigo Zeledón and his colleagues are conducting research at the LSU Medical Center offshore base in Costa Rica. Fundamental work has been done on the biology of the insect transmitting the disease.

More recently, they have identified a natural enemy of the beetles identified as carriers of Chagas' disease—a wasp species which might, by introduction in large numbers into a community, reduce the beetle population below the critical level for maintenance of disease transmission.

This investigative effort in seeking for biological enemies of the beetle is considered justifiable as opposed to research directed to more effective insecticides (potential environmental pollutants), against which the beetle might develop resistance.

In spite of the prolific reproductive ability in the laboratory of *Triatome dimidiate*, Latrielle 1811, the main insect vector of Chagas' disease in Costa Rica, density in houses in the endemic area of trypanosomiasis is usually not more than 10 per house. This fact suggested the presence of good biological control mechanisms—the clue to researchers.

One parasite found in the field was the microhymenopteran, *Telenomus fariai*, which grows and feeds in the eggs of *Triatoma dimidiata*. The mites have been reared in the laboratory in large numbers for field trials.

When these microhymenopteran were released inside a house, they were able to parasitize *T. dimidiate* eggs, placed in flasks on the floor and at different levels, within four hours.

In studies in which 5,000 to 7,000 *Telenomus* were released in two houses monthly, no first instars (part of the propagation process) were found since the second introduction. Natural parasitism occurred in as high as 22.6 percent of the eggs in a single household.

Experiments are in progress to determine whether the triatomid can be eliminated from a household through extension of natural biological control by this parasitic microhymenopteran by releasing several thousand of them at intervals.

A species of *Pimeliaphilus* mite is an ectoparasite of all instars of *T.dimidiata*. It sucks the body fluids of the insect and noticeably inhibits its development. Researchers say its specificity for *T.dimidiata* would contribute to its importance in areas where this species is the principal vector, but would limit its usefulness in areas where other triatomid species are major vectors.

In an earlier study, Dr. Zeledón observed the "camouflage phenomenon." Mobile stages of *T.dimidiate* camouflage themselves by "kicking" dust on their bodies to obscure themselves from the eyes of animal predators.

This phenomenon assumes great importance in areas where dirt-floored dwellings predominate. In studies supported by the THEMIS contract, this dust-covering protective measure was found in use by other species of triatominae. It negates the continued use of unfloored habitations in areas endemic for Chagas' disease.

The Project THEMIS effort under which the research is being performed by Dr. Zeledón and associates is a part of "Studies of Infectious Diseases in Persons Introduced into Tropical Areas" headed by Prof. J. Clyde Swortzwelder of the Department of Tropical Medicine and Medical Parasitology at LSU.

ARMY DEPUTY CHIEF OF R&D Maj Gen Edward L. Rowny was briefed recently on scientific and engineering projects at several Army R&D activities, including Walter Reed Army Institute of Research in Washington, D.C., and the Army Research Office, Durham, N.C. In briefings at the Harry Diamond Laboratories (HDL), also in Washington, HDL Technical Director Dr. Maurice Apstein and HDL CO Lt Col Peter A. Hexner participated.

Functional Characteristics of Food is a project to provide "guidelines and principles to assure nutritional adequacy, wholesomeness, acceptability, keeping quality and utility of Armed Forces' subsistence."

Guidelines will be sought for preventing microbial deterioration of food, through quantitative and qualitative analysis, "to assure safety to the ultimate consumer in the field, even where access to a laboratory is impracticable." Special emphasis will be on food flavor and texture.

Packaging and Container Materials, Methods and Equipment. In this project, the effort will be on rapid use or application of innovations in packaging, whether initiated or conceived in Army facilities or by industry. Exploratory development will be pursued on packaging for foods preserved by thermoprocessing, dehydration, low temperatures and irradiation.

While it is recognized that a broad industrial and commercial base exists for packaging materials and designs, Army experience is that military requirements are usually beyond those commercially necessary.

Much of the emphasis in this area will be on specific and militarily unique requirements, such as lightweight and convenient operational ration packaging; also, development of a lightweight, expendable system for combining items and packages into compact, convenient modules compatible with over-all feeding and transportation systems.

Areas of investigation will include compatibility with preservation techniques, ration breakdown, food preparation, and serving techniques; also, multiple functions such as use as a serving counter or in shelter constructions, ease of disposal, and resistance to CBR agents.

Meals and Other Food Assemblies. Activities will seek to assure that products "possess the nutritional adequacy, acceptability, utility and keeping quality required by concepts of use . . . large groups with little or no limitation on food service equipment or personnel, or individual men without any food service support and without planning resupply."

Food Preparation, Serving and Sanitation Equipment. Research in this area will encompass the needs of all the military services, including shipboard, aircraft, submarine, garrison and field operations. The approach will be to adapt commercial practice in preparation, materials handling, dispensing/serving, waste disposal and sanitation—all integrated into a military food service system.

Food Storage Equipment. Investigation in this project will cover the use of cryogenic refrigeration techniques for freezing, and refrigerated storage and shipment of food products, including the economic feasibility of cryogenic shipments.

Studies will include thermoelectric, mechanical and absorption refrigeration, insulating materials, controlled atmospheric storage equipment and processes, and water containers.

Behavioral Sciences Research in Support of Feeding Systems involves two programs: 1) Sensory and Physiological Psychology and 2) Human Factors and Engineering Psychology.

Program 1 investigations will use animal and human subjects under controlled laboratory conditions to probe problems of taste, palatability and olfaction; also, the psychobiological control system for appetite, and for food choices of soldiers.

Program 2 will focus on the human element in food preparation and handling in food service systems; the man-machine relationship in food preparation areas; and environmental effects on consumers.

Life Sciences Research in Support of Feeding Systems is programed to develop background information for solution of military feeding. Efforts will attack problems arising from more stringent military requirements for storage, transport and reduction in weight and volume of foods without loss of quality and acceptability.

Research in microbiology, entomology and mammalogy will seek more effective methods to control the destruction and contamination of foods by microorganisms, insects and rodents.

Post-harvest physiology of fruits and vegetables will be studied to develop effective methods for prolonged storage and transport.

Histology and cytology research will be concerned with structural changes in plant and animal tissue during preservation treatments.

Biochemistry investigations will deal with the fundamental structure and properties of enzymes and other proteins for application to food problems. In biophysics, theoretical analyses will be made of fundamental biological systems.

Physical Sciences Research in Support of Feeding Systems is programed to yield basic information on physical and chemical properties of foods, packaging and handling materials, and model systems in support of military feeding systems.

Objectives include the determination of characteristics of existing and new energy sources pertinent to development of improved and new processing for military rations; reaction mechanisms of foods subjected to various forms of energy, chemical and/or enzymatic treatments; synthesis and characterization of chemical additives to improve and stabilize food products or formulations of synthetic foods.

Responsibilities of the Army, Navy, Air Force and Marines regarding the DoD Food RDT&E Program are detailed in a Joint Services Regulation currently being staffed. Representatives of each service will be assigned to the Natick Laboratories.

Planning also envisions scientific and technical personnel of each of the Armed Forces working in the NLABS, particularly on unique programs. Through such joint, integrated effort, the DoD plans to meet, economically, all known and projected subsistence problems, under any operational, organizational and logistical system.

War Gaming Facility Simulates Future Battlefields at USACDC

Simulation techniques, using mathematical and computerized formulae instead of troops and guns, have advanced with the recent dedication of a War Gaming Facility at the Army Combat Development Command's Institute of Land Combat (ILC).

The battlefield at the Alexandria, Va., installation, is depicted on 8x10-foot glass panels that can be tracked by monorail from the gaming rooms to a photographic station where a record is made of a moment in the battle for later analysis.

Played by opposing Red and Blue Armies and Controllers (umpires), war gaming provides a rapid means of selecting the strengths and weaknesses of many alternatives of organizations, weapons systems and battlefield tactics.

The ILC Evaluation Directorate is using the gaming techniques as one of the primary methods of analysis in examining and ranking alternative conceptual designs for future armies. This is a phase of a larger study called Land Combat System of the 1990s, in which the institute is taking an objective look at the Army as a total system of combat capabilities.

MBT-70 Program Redesignated With Further Change Slated

Reorientation of the U.S./Federal Republic of Germany Main Battle Tank (MBT-70) development program has led to its temporary redesignation as the MBT-70/XM803.

After about a year, the "BMT-70" will be dropped and the official nomenclature will be "Tank, Combat, Full-Tracked: 152mm Gun/Launcher, XM803." When the tank is approved for production, the "X" will be dropped and it will be given a popular name. Historically, the Army names its tanks after generals, such as Sherman, Patton, Sheridan.

Initiated in 1963 as a joint U.S./FRG effort, the MBT-70 program was modified recently along unilateral concepts to reduce procurement costs, simplify operation and maintenance, and to improve reliability.

ILIR Reports Reflect In-House Capabilities for Army Requirements

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ities accounted for 338 of the total 463 work-units. Walter Reed Army Institute of Research was the individual leader with 34 work-units, followed by the Corps of Engineers Waterways Experiment Station with 32.

All ILIR projects selected must contribute toward solution of a problem which is included within the mission assigned to each of the in-house laboratories, all well organized to perform specific functions.

Creativity has been a key word in the ILIR Program since it was initiated in FY 1962 "to promote a vigorous internal research program of the highest technical caliber."

Results are reviewed annually by the Assistant Secretary of the Army (Research and Development) through an Ad Hoc Committee representative of the major commands involved in R&D. This group evaluates how well the work-units have satisfied ILIR Program criteria, and makes recommendations for funding levels for the next year.

Merits of the program have been enthusiastically attested throughout the years by the lab directors and individual researchers for whom it has opened the door of opportunity for original research in their areas of specialized competence.

Picatinny Arsenal, for example, concentrates ILIR activities largely related to its basic mission as the Army's center for explosives and propellants research. Picatinny conducted 28 ILIR work-units.

Similarly, Edgewood Arsenal engaged in 27 ILIR work-units related to its basic mission of chemical, radiological and atmospheric research. Frankford Arsenal, renowned for pioneering development of Propellant-Actuated Devices (PAD), fire control and other highly specialized investigations, had 21 ILIR work-units.

Waterways Experiment Station ILIR work-units delved deeply into problems of improved vehicular mobility under a wide variety of soil and environmental conditions, materials and techniques for reinforcing concrete structures, flood control and navigational problems, and many other areas of mission responsibilities.

Among the Army Materiel Command (AMC) independent laboratories, the Ballistic Research Laboratories, part of the Aberdeen (Md.) R&D Center, accounted for the most ILIR effort with 29 work-units. The Natick (Mass.) Laboratories and the Harry Diamond Laboratories, Washington, D.C., each with 23 work-units, were followed by the Materials and Mechanics Research Center, 10; Nuclear Defense Laboratory, 4; Human Engineering Laboratory, 3; Chemical and Coating Laboratory, 2.

Distribution of ILIR work-units among AMC's major commodity commands was: Munitions Command, 88; Electronics Command, 36; Test and Evaluation Command, 28; Missile Command, 25; Mobility Equipment Command, 24; Weapons Command, 20; Army Tank Automotive Command, 20; and Aviation Systems Command, 3.

In the Medical R&D Command, Office of The Surgeon General, the breakout was: Walter Reed Army Institute of Research, 34; Medical Research and Nutrition Laboratory, 10; Medical Equipment and Development Laboratory, 4; Aeromedical Research Laboratory, 4; Institute of Environmental Medicine, 3; Medical Research Laboratory, 3; Biomechanical Research Laboratory, 3; Institute of Surgical Research, 2; Letterman Army Institute of Research, 1.

The Office of the Chief of Engineers listed 55 ILIR work units, 32 by the Waterways Experiment Station, 16 by the Cold Regions Research and Engineering Laboratory, and 7 by the Engineer Topographic Laboratories.

Far too many of the 463 ILIR work-units in FY 1969 were consid-

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the keynote address on "The Role of Simulation in Decision-Making." Army Chief of Research and Development Lt Gen A. W. Betts will introduce him and make opening remarks.

Maj Gen John Norton, deputy director of Project MASSTER (Mobile Army Sensor System Test, Evaluation and Review), a top-priority effort under the Army Chief of Staff, will moderate a panel discussion on STANO (Surveillance, Target and Night Observation) developments.

Maj Gen Felix J. Gerace, director, Requirements and Procurement, Army Materiel Command, will moderate a panel discussion on logistics simulation.

"Scope of Simulation" is the topic for a panel discussion being organized and to be moderated by Dr. Daniel Willard, Office of the Deputy Under Secretary of the Army.

Director of Army Research Brig Gen George M. Snead Jr. is general chairman of the sessions, expected to attract about 180 invited representatives of the Department of Defense, the Army, academic scientific community and industrial firms.

Sponsored by the Chief of Research and Development, the symposium will be hosted by the Army Research Office-Durham, N.C. ARO–D Commander Lt Col Edgar G. Hickson Jr. will present the address of welcome.

Dr. Marion Bryson, technical director, Institute for Systems Analysis, Army Combat Developments Command, is technical adviser for the meeting.

One of the highlights will be an address by Prof. Ronald Shephard, head of the Ballistics and Operational Research Branch, Royal Military College of Science, United Kingdom. Dr. George B. Gerrish, director, Systems Operations, International Business Machines Federal Systems Center, is programed for the banquet address.

John Itelkofer, chief, Combat Support Division, U.S. Army Materiel System Analysis Agency, is organizing and will chair a session on "Uses of Simulation in Air Mobility."

"Uses of Simulation in Limited Warfare" is the theme of a session being organized by William Lueders, chief, Operations Research Division, Institute of Strategic and Stability Operations, Army Combat Developments Command.

Dr. Cecil Johnson, chief, Statistical Research and Analysis Division, U.S. Army Manpower Resources Research and Development Center, will moderate discussion of "Uses of Simulation in Personnel/Manpower Studies."

Col John P. Chandler, chief, Engineer Strategic Studies Group, Office of the Chief of Engineers, is arranging for and will chair a session on "Uses of Simulation in Transportation/Communication Studies."

About 10 technical presentations are planned, including a paper by a representative of the United States Military Academy. First Lt Gerald W. McLaughlin will discuss "The Application of Computer Simulation to a Three-Person Non-Zero Sum Game."

Other presentations will be made on techniques of mathematical modeling in systems planning, engineering and decision-making by representatives of the University of North Carolina, the Office of the Army Surgeon General, U.S. Army Natick (Mass.) Laboratories, U.S. Army Tank Automotive Command, Office of the Assistant Chief of Staff for Intelligence, Army Materiel Systems Analysis Agency, and Litton Scientific Support Laboratory.

ered to have produced outstanding results for a practicable effort to select 10 or even 25 considered the most significant achievements. Only passage of time will determine the value through application of the new knowledge.

In a great many instances, the potential application to military requirements is regarded as promising for near, intermediate or long-range needs. Byproduct benefits for many civilian community needs also are envisioned.

An example of the Natick Laboratories research as a center for the Department of Defense Food Research, Development, Test and Engineering Program is an ILIR work-unit to explore the potential for converting otherwise inedible waste to food.

The project was conceived as an effort to extend the basic knowledge of the kinetics and mode of enzyme production from the fungus *Trichoderma viride* and the action whereby this enzyme degrades native or crystalline cellulose to sugar. Results produced a clear syrup (12 to 14 percent W/V). Most of the enzyme and undigested cellulose are retained in the reaction vessel. The reaction continues when solid cellulose, water and a small quantity of make-up are added to the mix.

In the Human Engineering Laboratories, Aberdeen Proving Ground, an ILIR effort was directed to improved military understanding of behavioral and physiological consequences of long-term psychological stress.

Findings also might have civilian applications. Testable hypotheses were developed for design of facilities, acquisition of equipment, training of personnel, development of a psychological test battery, and the implementation of physiological and endocrinological measurement techniques.

ILIR research on human factors related to military operations also were conducted in five work-units of the Behavioral Science Research Laboratory (since redesignated the U.S. Army Manpower Resources R&D Center), Office of the Chief of R&D, HQ DA.

Another area of broad potential civilian community benefit as well as its primary military application was an Army Aeronautical Research Laboratory project to acquire more knowledge of how to measure low-velocity factors with great accuracy in operations of helicopters and V/STOL aircraft. Substantial progress is reported and investigations are continuing.

"Development and Refinement of Photo-Optical Techniques Through Application of Coherent Light Sources," the title of an ILIR effort at the Army Ballistics Research Laboratories, was evaluated as a meritorious project.

Investigations are continuing to test basic mechanical and optical principles in determining feasibility of multiple exposure with and without film transport; and, if practical, these will be applied to detonation and other flow phenomena of high-velocity shock waves, projectiles and fragmentation problems in military operations.

Harry Diamond Laboratories' investigations ranged over a variety of fuzing problems; the electronic and optical properties of hot-pressed semiconductor materials; unipolar and bipolar switching devices; an Advanced Artillery Simulator; methods of determining boresight errors; means of protecting military personnel from eye damage due to laser radiation; a Gun Aiming Radar Device; and target indicator research.

Materials and Mechanics Research Center, ILIR activities included research on problems of alloys; quantitative prediction of deformation, fracture and fatigue in materiel; new approaches to mechanics and materials engineering; and successful development of an extremely sensitive instrument to record quantitatively slight temperature changes in reactions in aqueous solution in an adiabatic reaction vessel during titration.

Many of the Natick Laboratories' ILIR work-units were concerned with problems of food, clothing, environmental protection, effects of exposure to climatic extremes, preparation of a manual of Accelerator Radiation Protection, compilation of key Russian terms in the fields of food and nutrition (531 pages), parameters that influence the production of shock waves in various liquid media by lasers, thermal stresses on visual sensitivity, design of hearing protective devices against high noise levels, and "Seasonal Changes Revealed by Time-Lapse Photography."

Twelve (one-third) of the Electronics Command ILIR projects originated with Atmospheric Sciences Laboratory investigators, indicating the high degree of interest in improving understanding of atmospheric composition and effects related to military operations.

The ECOM Communications and ADP Laboratory conducted 11 ILIR investigations, and the Electronic Components Laboratory had six projects, as did the Institute for Exploratory Research. Considered one of IER's significant projects was a study to test feasibility of various electromagnetic, seismic and acoustic detection and surveillance devices.

ECOM's Combat Surveillance, Night Vision and Target Acquisition Laboratories' ILIR efforts involved a project to improve in-house capability in the field of "eye-safe" lasers, including an assessment of erbium laser material and germanium detectors and methods of testing them. Extensive work was completed on a Target Insertion Synthesizer.

One of five ECOM Electronic Components Laboratory ILIR projects was to develop a family of temperature stable materials to satisfy requirements for reciprocal phase shifters in communications systems. Another effort was directed to developing a ceramic dielectric material sintered to high density, and capable of being used as a high-energy storage capacitor with an efficiency of 400 joules/lb. at 500 volts/mil stress.

Twenty-five ILIR projects conducted by Army Missile Command investigators included a "Theoretical Investigation of Laser Materials"; "Nuclear Spin Systems in Magnetic Materials"; analysis of cold gas static tests on the Ejectrol Control Force Concept; studies in hot gas ducting; research on photochromatic processes in the alkaline earth fluorides; work on high-temperature organometallic compounds; and aerodynamic characteristics of a ring-wing type control device for missiles.

A Missile Command ILIR effort produced a report titled "Low Noise Receivers Which Utilize Image Frequency Energy," indicating that tests of new designs have high potential as broad-band radar receivers. Progress also was reported on a study of "Clutter Rejection Techniques for Multi-Function Array Radar," linked to the Safeguard ABM defense sysem.

Mobility Equipment Command ILIR activities (24 work-units) all were conducted at the Mobility Equipment R&D Center, Fort Belvoir, Va. Evaluated among projects relevant to a current military requirement was the developmental work on a lightweight and efficient gas generation system in a hydrocarbon fuel cell to produce electric power. Results are reported in "Open MERDC Cycle Hydrocarbon-air Fuel Cell," a June 1969 technical paper by E. A. Gillis.

Other MERDC ILIR work included investigation of more efficient equipment for treatment of brackish waters having a high calcium sulfate content; improving the life cycle of zinc batteries; efforts to optimize electrolytes for high-energy density batteries; research in eutectic materials and heat exchangers to determine feasibility of a "hold-over" element for military environmental control units; research to increase knowledge of cata-

(*Continued on page 8*)

ILIR Reports Reflect In-House Mission Capabilities

(*Continued from page* 7)

lytic phenomena and preparation of catalysts with improved properties; and a project to develop an in-house liquid metal MHD generator capability.

Munitions Command ILIR efforts at Picatinny Arsenal were centered in the Feltman Research Laboratories (22 of the total of 28 at the arsenal). The Nuclear Engineering Laboratory conducted 4 work-units and the Ammunition Development and Engineering Laboratory accounted for 2.

Considered one of the arsenal's meaningful efforts (as indicated by three patent disclosures and technical presentations at several national meetings) was the work on properties of high-energy oxidizers. Results showed improved qualities by incorporating oxidizers into mixed crystals with other isomorphous constituents.

Other Picatinny ILIR projects included artillery and land mine studies; feasibility probe of external burning propulsion system to extend range of projectiles; investigation of thermodynamic properties of high-energy molecules (several technical papers resulted); study of materials and reactions for use in pyrotechnic flash and flare systems (patent application submitted); feasibility study of electrically powered sources for light signals in lieu of colored flares; and

Investigation of high-pressure (up to 200,000 psi) propellant combustion process; study of telemetry systems for obtaining in-bore and terminal ballistic data, to improve fuze design and minimize need of expensive preliminary test firing in development programs; pioneering project in conduction and electrical switching in amorphous semiconductors (results have been widely recognized); and study of reactions of gaseous systems.

Frankford Arsenal's Ammunition Development and Engineering Laboratory worked on eight ILIR investigations, including boundary-layer studies related to improving artillery shell and guided missile accuracy and range; improved propellant-actuated devices (PAD); and development of a mathematical model for predicting deflection effects on a small-caliber projectile passing through vegetation.

Frankford's Fire Control Development and Engineering Laboratory ILIR efforts included studies on intermediate and FAR infrared detection, and experimental applications of the Cook Demodulator on frequency and phase modulation, with results successful as high as 60 Meg. Hz.

The Pitman-Dunn Laboratory at Frankford Arsenal conducted 10 ILIR activities. Significant results were reported on studies of the reflection and refraction of elastic stress waves from a flat interface, an effort that included design, development or improvement, and test of equipment.

Other studies of this laboratory included organometallic materials used as burning-rate modifiers and explosive complexes; formation of the bond in explosive bonding of metals; mechanism of dealkylation of cholinesterase following inactivation by organiphosphorus compounds to obtain information about the surface of the enzyme;

Displacement reactions of organiphosphorus fluorides in nonaqueous media for application of results to nonaqueous decontamination and detection; clarification of concepts of accuracy and precision for the elemental determination of carbon and hydrogen in the 10–50 mg working range; and chemical dosimetry systems to determine their suitability for use in a nuclear reactor environment.

In the Biological Center R&D Laboratories, 12 ILIR work-units included a study of respiratory diseases of man; physical properties of microbial suspensions (in collaboration with personnel of Rensselaer Polytechnic Institute); physical and chemical characterization of toxin molecules; immunology of viruses; immunopathology and histochemistry; epidemiology of airborne diseases; identification of mammalian cell lines in culture; the role of interferon in virus aerosal infectivity; and protein synthesis by animal virus *in vitro.*

AMC Tank and Automotive Command R&D Laboratories engaged in 20 ILIR work-units concerned principally with problems relevant to improved design and development of a wide range of vehicles and components.

One TACOM study, for example, probed means for increasing the traction of vehicles in soft and slippery soils, snow, ice and water. Other efforts were directed to determination of the relationship between soil characteristics used in Civil Engineering and those in land locomotion mechanics to aid military vehicle designers; study of combination stress factors influencing fatigue (weakening) of materials in vehicles.

TACOM also delved into feasibility of using linear programing as an aid in conducting vehicle trade-off studies; means of measuring ride severity factors linked to seating arrangements and cushion types; study, design and fabrication of a 6x6 version of the Wheeled Mobility vehicle with controlled suspension; study of correlation between welding techniques and residual stresses to improve these techniques; and an effort to develop a portable soil-strength measuring instrument combining both penetration and shear-strength measurements.

AMC Test and Evaluation Command ILIR projects included 11 at Deseret Test Center (DTC), 3 at the Tropic Test Center (TTC), 10 at White Sands Missile Range (WSMR), and 4 at the Electronic Proving Ground (EPG).

DTC efforts included a study of rickettsial metabolism; exploration of

(*Continued on page* 32)

MERDC Conducts Weatherability Studies on Paper House

When Milady began wearing high-fashion throw-away paper dresses a couple of years ago, some observers believed the ultimate in use of paper technology had been reached—but now the U.S. Army is testing a paper house.

Weatherability studies of this experimental product are being conducted by the U.S. Army Mobility Equipment Research and Development Center at Fort Belvoir, Va.—as part of MERDC's continuing investigation of prefabricated structures for military use.

Fabricated from a chemically-treated corrugated 3/8-inch kraftboard, the 21 x 20-foot house is the product of Papertech Corp., Hatfield, Pa. It is claimed to be more waterproof, fire-retardant and vermin-resistant than a wood house.

Pieces of the house are identical and interchangeable except for the ends, which are tapered to fit the slope of the roof. Assembly is accomplished with staples and nails.

The experimental unit was made available for test at no cost to the government under a release agreement.

PAPER HOUSE undergoing weatherability studies at U.S. Army Mobility Equipment R&D Center, Fort Belvoir.

Fiber Optics Technology Aids Facsimile Transmission

Advanced fiber optics technology is incorporated in a new and rugged facsimile transmitter capable of scanning or reading anything that can be reproduced on paper for electrical transmission to distant points.

Two experimental prototypes were developed and built for the U.S. Army Electronics Command by IIT Research Institute, Chicago, under technical direction of ECOM's Communications-Automatic Data Processing Laboratory.

Facsimile transmission, similar to the sending of news photos over a wire, has been used by the Army since before World War II. Difficulties have been encountered, however, in a rugged machine with the capability of handling maps or drawings larger than an ordinary sheet of typewriter paper.

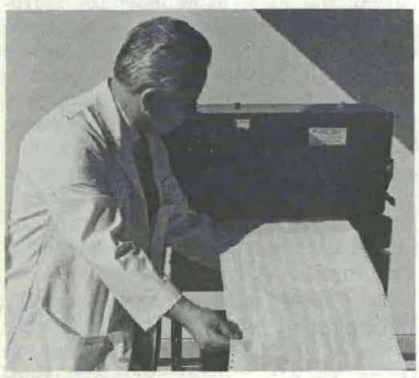
Earlier machines used mirrors or other mechanical devices to move the image being sent from the copy to a photo-detector that transforms the visual material to electrical pulses for radio or wire transmission.

Fiber optics are thin, flexible glass fibers coated with an outer layer of glass of a different composition. They can transmit light around corners or in any nonlinear path desired. They might be called "light pipes."

Use of bundles of fiber optic material in the new facsimile transmitter eliminates the need of complicated mechanical light transmission devices. A flat-bed design permits feeding of paper of unlimited length into the scanner.

Previous machines picked up light pulses from paper attached to drums, and the length of the material to be sent was limited to the circumference of the drum.

Scanning width of one of the new transmitters is 18⅝ inches, to accommodate standard weather maps, which are 18½ inches wide. The other has a scanning width of 8½ inches to take normal photos or typewriter-sized paper.



COMPUTER PRINTOUT being fed into this facsimile transmitter demonstrates the continuous scanning capability of the fiber-optics model developed for the U.S. Army Electronics Command at Fort Monmouth, N.J.

The transmitter is capable of scanning large copy at speeds as high as one and one-half inches per second, or seven and one-half feet per minute. However, scanning speed in the prototypes is reduced to about two inches per minute to be compatible with telephone line data transmission capacity.

The rate could be increased if a transmission medium with greater band width were employed, such as high-frequency coaxial cable and microwave systems. The signal generated by the transmitter is suitable for reception by the standard Army AN/GXC–5 facsimile recorder.

ECOM project engineer for the system is John A. Erhart, a supervisory electronic engineer, Comm-ADP Laboratory.

Picatinny Arsenal Develops Organization Data Bank

An organization data bank developed by the Management Office is Picatinny Arsenal's new way to find out rapidly where to go to get specific services—where the expertise is available to aid problem solution.

Under the general heading of "Technical Characteristics Listing," the master organization data bank identifies capabilities of organizations under seven topical areas: skill; class of commodity; commodity or system; material; component; technology; and function.

Each heading is stratified many times. "Skill," for example, totals 103 and "technical characteristic" has 514 listings. The system reduces Picatinny's hundreds of different organization sections to a small box of post-card-size punch cards.

In book form, the master file holds information on which punches in cards are based. Each card represents, for example, a single technical characteristic, with punches indicating the identity of an arsenal organization.

A user can browse in the data bank as he casts about for the answer to a problem. Handling the cards to identify desired information calls for only a peek-a-boo trick to find where capabilities exist to aid solution of a specific problem.

Assume, for example, you are interested in what organization can do Product Engineering on Pershing and have a relationship with Printed Circuits, Rigid. Characteristics are listed as 761, 345 and 659.

Pull these cards from the file and you learn that 85 organizations have "761 Product Engineering" capabilities, 40 have "345 Pershing" and 45 have "659 Printed Circuits" capabilities.

When the three cards are laid one over the other, only four holes show through, indicating that only four organizations have these capabilities. The holes indicate column 2, row 3; column 38, row 6; column 40, row 3; and column 54, row 3.

Identification then is simple by checking the "Organizational Location Listing," which shows the organization in numerical column and row sequence. The desired capabilities then can be found as follows:

1. Explosives Applications Section, Artillery Ammunition Laboratory, Ammunition Development Division, Ammunition Engineering Directorate.
2. Telemetry Section, Tactical Atomic Warheads Laboratory, Nuclear Weapons Development Division (NWDD), Nuclear Engineering Directorate (NED).
3. Section 3, Product and Process Engineering Laboratory, NWDD, NED.
4. Warhead and Rockets Section, Inspection Equipment Engineering Branch, Ammunition Reliability Division, Quality Assurance Directorate.

The next step is to refer to the individual four interview sheets and review them, keeping in mind that characteristics are listed as indicating a *primary effort* when they are *circled*, and only a support or secondary effort when they are *checked*.

Logically, then, the final determination should be that the organization best qualified to answer questions and give assistance is the one with the most circles. The next step is contact this organization and explain the details of the problem.

The choice of technical characteristics and the shuffling of cards in the Organization Data Bank can give almost unlimited approaches to personnel seeking information.

In the cited example, three technical characteristics were used. Suppose, however, that because of the "Printed Circuits" technology, information was desired on an electronic engineering capability. By pulling the "18 Electronic Engineering" card and laying it over the other three cards, the same four holes still will show through. But by dropping out the "345 Pershing" card, 15 holes show through because the field of technical characteristics has changed.

Field Tests Clear MUST for Type Classification

Field tested in Vietnam since October 1966, the U.S. Army's radically innovative MUST hospital system has proved its merit, undergone improvements (with others in progress), and is ready for Standard A type classification for service-wide acquisition.

MUST stands for Medical Unit, Self-contained, Transportable. The system has been under high-priority development since 1963, when the Army Medical Department "faced up" to the problem of practicing modern medicine in the field in tent hospitals.

The Office of The Surgeon General, HQ DA, announced that action for type classification will be for the MUST Shelter System and the Utility Element, major units of which have satisfied final testing. Initial development and type classification of MUST medical equipment is complete.

The 45th Surgical Hospital has remained operational in Vietnam since 1966, and has provided the base for numerous refinements in equipment being procured. Engineer and service testing of the newly developed MUST Water and Waste Management System, and the MUST Food Service, is scheduled to begin about May 1.

Water and waste management equipment includes a utility room complex consisting of showers, toilets and lavatory; water purification unit and treatment unit; and a mobile incinerator.

Recycling and reuse of all waste water except human waste is possible with the purification and treatment unit. Results in field operation to date indicate that potable water recovery should reach 90 percent, including estimated user losses, to reduce greatly the hauling problem.

Toilets of the "air-lav" type empty into a mobile incinerator (not to be confused with the small human waste incinerator) which produces temperatures from 1,400 to 1,600 degrees Fahrenheit. Odors and smoke are eliminated. About 3,000 pounds of all types of waste can be incinerated in 24 hours, without degradation of the environment.

Modifications in MUST Food Service are being made as a result of testing at the Army Natick (Mass.) Laboratories. The system includes a kitchen capable of feeding up to 400 persons daily with Type B or A rations. Air conditioning, which controls closely the environment for surgery and patient wards, extends to the dining room.

MUST has its own power source for air conditioning, heating, water pumping, lighting and other requirements. MUST is operational in temperature ranges from minus 65° to 120° F.

Recent tests in the environmental chamber at Eglin Air Force Base demonstrated that MUST hot and cold running water systems would function throughout the shelter system when ground temperatures were minus 70 degrees F.

When MUST is completely packed for transport, all equipment required is contained in the expandable shelter, the service/ward container, and the utility element. Transportation can be accomplished by 2½-ton trucks, C–130 or larger aircraft, or by a "sling load" beneath a helicopter.

Developed primarily to meet U.S. Army Medical Department requirements, elements of the MUST shelter system are suited for many other purposes. For example, a Tactical Air Control Center using a MUST inflatable shelter has been developed by the Marine Corps.

Numerous similar uses for the shelter units are envisioned. Agencies are encouraged to consider the complete shelter system, ease of mobility, and efficient environmental controls for application to requirements.

Col Milard C. Monnen, MSC, U.S. Army Medical Research and Development Command, is MUST project officer.

Medical Unit, Self-contained, Transportable Complex

Army Schedules Shift of Research to London

(*Continued from page 1*)

base of acquisition of new scientific knowledge relevant to U.S. Army requirements by exploiting the capabilities of top European scientists.

Contractual support of R&D activities, principally basic research to acquire new knowledge applicable to the Army's advanced technology needs, extended at the high point of operations to all 14 NATO nations. Funding of the program ranged from $1.5 to nearly $2 million for several years.

One of the stated objectives, along with "uniting the scientific talent of the Free World and stimulating the flow of new scientific knowledge," was to "create and maintain a maximum capability for the exploitation of any scientific breakthrough that might enhance mutual military defense."

Toward achievement of this goal, the U.S. Air Force and Navy also supported European R&D programs. Tri-Service Coordination Group meetings were held at regular intervals to minimize duplication of activities by close coordination and integration of effort.

When the pinch of an unfavorable balance of payments became increasingly evident in recent years, the policy guidance provided by the U.S. Congress House Committee on Government Operations carefully prescribed constraints on funding European research.

Funding limitations now imposed on the three U.S. Military Departments, under the collocation plan of operations in Keysign House, will further curtail the scope of support for European research scientists. In the case of the Army, it is expected fewer branches of science will be explored.

Col Robert L. Bennett, who has headed the U.S. Army R&D Group, Europe, will complete his 3-year tour of duty and be returned to an assignment with the Office of the Chief of R&D, HQ DA, in June. He completed an OCRD tour prior to his present assignment.

Col Benedict L. Freund, deputy chief of the Physical and Engineering Sciences Division, Army Research Office, OCRD, will succeed Col Bennett when the move is made from Frankfurt to London. Only one officer and two civilian scientists will move. Reassignments from the U.S. will provide a staff of four officers, one enlisted man and four civilian employees.

BESRL Reorganized Into New R&D Center

(*Continued from page 1*)

tion (HumRRO), Center for Research in Social Systems (CRESS), and other contractors as required.

Initially, the USAMRRDC will be located in the Commonwealth Building in the Rosslyn Circle area of Arlington, Va., where BESRL has been operational since October 1968. The authorized staffing is 110 civilian and 15 military personnel.

Assigned to the Behavioral Sciences Division, U.S. Army Research Office since October 1969, Lt Col Pennel J. Hickey is director of the new center. Army Chief Psychologist Dr. Lynn E. Baker of the Army Research Office staff is detailed as acting deputy and scientific director.

Elements of the center are a Management Division, headed by Lt Col Leonard J. Greeley, formerly with the Social Sciences Branch, Behavioral Sciences Division, Army Research Office; an Administrative Support Office; Motivation Research Laboratory; Training Research Laboratory; and Behavior and Systems Research Laboratory (formerly BESRL).

Brig Gen George M. Snead, Director of Army Research, exercises staff supervision of the center through the Behavioral Sciences Division, Army Research Office, Office of the Chief of Research and Development.

Operational benefits envisioned for the center include an expanded ability to support research requirements, and increased competency in management of contractor research, such as performed by HumRRO and by CRESS.

The Behavior and Systems Research Laboratory, as shown on the center's organizational chart, will be initially the largest element. Although redesignated, it will retain the BESRL acronym. It is currently staffed with 105 civilian and military personnel, about 15 of whom are detailed to the other elements of the center. BESRL's new authorization is 87 personnel.

Col Hickey said that BESRL will continue to function in its traditional scientific specialty areas of R&D in predicting individual human performance effectiveness, evaluating and selecting personnel management policies through operations research modeling, and improving human performance in manned systems.

The Motivation Research Laboratory is responsible for programs relevant to internal defense, civic action, military assistance, psychological operations, human factors of U.S. military operations in developing nations, and motivation, morale, opinions and values of the American soldiers.

The Training Research Laboratory supervises and conducts programs to improve efficiency of training and operational performance of military personnel; develops means for efficient acquisition of required military knowledges and skills, procedures to insure retention of required knowledges and skills, and ways to maximize acquired knowledges and skills in performing military duties.

Graduated from the United States Military Academy at West Point in 1949, Lt Col Pennel J. Hickey served there (1966–68) as an associate professor. He has a master's degree in industrial relations from Purdue University (1965) and is a 1959 graduate of the U.S. Army Command and General Staff College.

Upon his return from a tour of duty in Vietnam, where he served with the 4th Infantry Division and the 1st Logistical Command, he was assigned in September 1969 to the Behavioral Sciences Division, U.S. Army Research Office, Office of the Chief of Research and Development.

* * *

Lt Col Pennel J. Hickey
USAMRRDC Commander

THE VIETNAMIZATION PROGRAM recently accounted for turnover of Lai Khe headquarters and base camp from the 1st Infantry Division (Big Red One) to the 5th Army Republic of Vietnam (ARVN). The Big Red One will deploy to the United States by Apr. 15. The U.S. and Republic of Vietnam flags that had flown side by side for four years were lowered and replaced by a single Vietnam flag to symbolize Vietnamization of the defense of Binh Duong Province.

Maj Gen Nguyen Van Hieu, 5th ARVN Division CG, and Maj Gen A. E. Milloy, 1st Infantry Division CG, attributed much of the credit for making the turnover possible to the Dong Tien (Progress Together) Program that links U.S. and Vietnamese troops in combined operations and fire bases.

Lt Gen Do Cao Tri, in a press conference after the ceremony, said the action "represents not only changing a U.S. base to a Vietnamese base, but the turning over of responsibility for the war effort from U.S. to Vietnamese troops." General Tri is commanding general of III Corps Tactical Zone.

About $2 million worth of facilities at the $3.3 million Lai Khe base will have been given to the ARVN by the time the 1st Infantry Division redeploys. Table of Organization property and equipment will be redistributed in Vietnam or returned to the United States.

Surgical Research Institute Enters 25th Year of Burns Research

Hope for formerly hopelessly burned patients is ingrained in the success story of the U.S. Army Institute of Surgical Research, which has achieved worldwide renown during a quarter century of R&D progress in structuring unique capabilities for treatment.

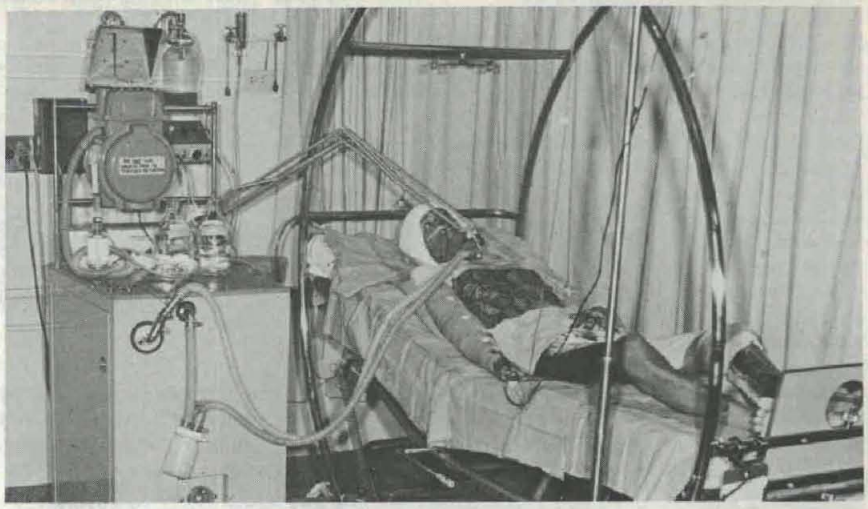
Within the U.S. Armed Forces, all of which it serves impartially, the ISR is the only institution of its kind. Militarily, that distinction may extend throughout the world.

Located at Brooke Army Medical Center, Fort Sam Houston, Tex., the ISR is a Class II Activity of the Army Medical Research and Development Command, Office of The Surgeon General.

In addition to treating burn casualties for the U.S. military services, the ISR conducts basic and clinical research into problems of mechanical and thermal injuries. In the management of burn casualties, instruction and training are given to other physicians, military and civilian.

Established in 1945 at Halloran General Hospital on Staten Island, N.Y., to investigate the use of antibiotics in treatment of infection resulting from war wounds, the ISR was moved to the newly established Brooke Army Medical Center in 1947. Two years later it was given additional responsibility for investigating and evolving better methods for burn treatment.

Translated into more meaningful language, that mission involves research and development to minimize the effects of crippling or disfiguring burns that have been among man's afflictions for centuries—and to save thousands who formerly would have died.



PATIENT WITH A LARGE BURN is susceptible to a host of potential complications, as shown here in patient with impaired respiratory and gastrointestinal tract functions. Mechanical ventilatory assistance, gastrointestinal drainage, intravenous alimentation and fluid replacement, and wound care exemplified by the homograft on this patient's chest, necessitate application of a wide spectrum of sophisticated, intensive care for prolonged periods by ISR specialists.

SEVERELY BURNED PATIENT care involves efforts of a multidisciplinary team. Occupational and physical therapists contribute to the maintenance of useful motion and the ultimate functional restoration of burned extremities. Positioning and splinting devices are fabricated to meet specific needs.

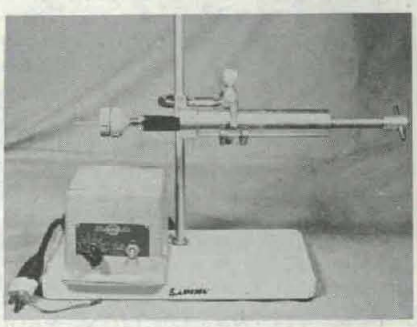
When a military member or dependent is severely burned at a post anywhere in the United States, the attending medical officer will normally seek advice by telephone from the ISR. Since most military hospitals are neither manned nor equipped to handle serious burn cases, transfer of such a case is usually recommended or requested.

Teams of burn specialists at the unit are ready around-the-clock to fly to the bedside of serious burn cases. Composed of a medical officer, a technician and often a nurse, with special medical equipment, the team goes by special air-evacuation plane from Kelly AFB to the scene and returns to Brooke within a few hours.

Since the outbreak of the Vietnam War, teams are flown to Japan about every two weeks to pick up burn patients from the 106th General Hospital and accompany them back to the unit.

The ISR pioneered such techniques as exposure treatment, replacement of body fluids, use of homografting of skin, and the now famous "burn butter," sulfamylon, in prevention of massive infection.

Lt Col Basil A. Pruitt Jr., commanding officer and director of the research unit, reports that sulfamylon has proven most effective in preventing infection in second- and third-degree burns covering up to 60 percent of the body. In cases where the burns cover a larger area, appreciable reduction of the death rate is still an objective.



NEW ULTRAFILTRATION DEVICE, designed and developed by the Chemistry Section of the ISR, can produce an ultrafiltrate 15 times more rapidly than other standard methods. Such devices enable speedier and improved treatment of burn patients and have other potential medical applications.

Sulfamylon itself is not new, but this use of it is. An antibacterial agent of the sulfa drug family, it was developed before World War II and tested by German scientists. Later, U.S. Army researchers tested it. After extensive laboratory study, investigators at the institute came up with the drug in a water-soluble white cream which is applied topically to the burned area.

Lt Col Pruitt says current statistics

show sulfamylon reduces the bacteria count in the burn wound far more effectively than any other known and tested surface application. The ISR is handling 250 to 300 severe burn cases a year, about double the load before the fighting in Vietnam.

About half of the cases from Vietnam are the result of hostile action; others result from noncombat accidents and injuries. Most of the combat cases are chemical, flash and flame burns.

One of the most favorable factors in saving the burn cases from Vietnam and other overseas areas is the capability of the U.S. Armed Forces, working together, to move the patients rapidly.

From Vietnam the patients are flown to Japan to the 106th General Hospital, then through Travis Air Force Base in California, and on to Brooke. Most are treated in the burn ward within days after injury. One was flown in from Spain less than 18 hours after injury.

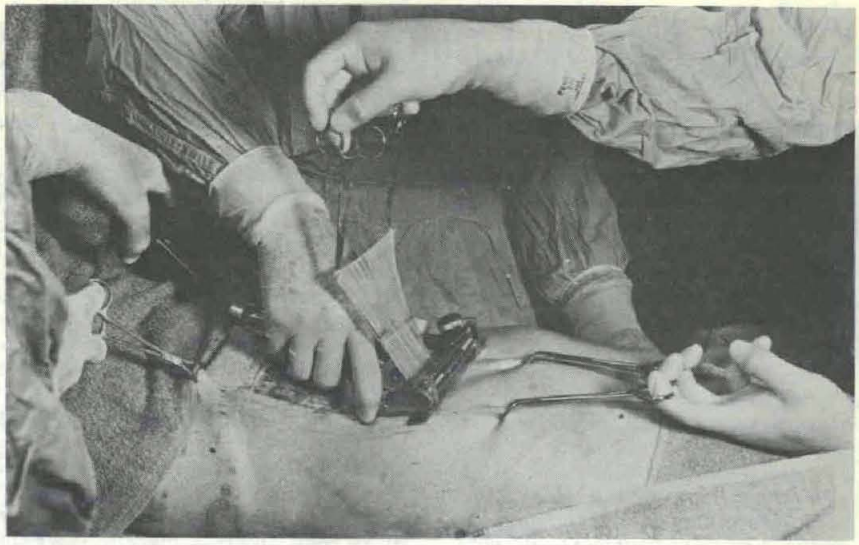
The ISR Clinical Division, directly responsible for care and treatment of patients, has a professional staff of 9 physicians (surgeons and anesthesiologists), 13 Army nurses, 12 civilian registered nurses, a dietitian, 2 occupational therapists, and 2 physical therapists.

Enlisted technicians assist in the ward care of patients and accompany medical officers on air-evacuation missions. All of the medical officers requested assignment to the unit and most of the other military personnel volunteered for the duty. As the only burn treatment unit serving the U.S. Armed Forces, the ISR Clinical Division conducts a continuing program of in-service training.

Current clinical investigations include: 1) Hemodynamics of Early Postburn Period; 2) Pulmonary Function in Burns; 3) Metabolic Effects of Therapy; 4) Energy Balance in Burns; 5) Skin Substitutes; 6) Bacteriology of Burns; 7) Studies on Hyperalimentation; 8) Fungal and Viral Infections of Burns; 9) Metabolic Changes in Anesthesia; and 10) Coagulation Factors in Burns.

The institute's other major element is the Laboratory Division, which provides highly specialized medical support for patient care and gathers research data for developing and evaluating treatment techniques.

Laboratory investigations in progress are: 1) Renal Physiology; 2) Studies of Acute Renal Failure; 3) Intestinal Anatomotic Healing; 4) Studies of Pulmonary Ultrastructure; 5) Synthesis of Chemotherapeutic Agents; 6) Protein Metabolism; 7) Chemotherapy of Infection in Burns; 8) Phage Typing of Bacteria; 9) Immunology of Burns; and 10) Bioengineering Studies.



FINAL COVERAGE of full-thickness burn wounds is achieved by autograft skin obtained at surgery by means of a dermatome. In this case, such a graft is removed from abdominal wall of a patient at Institute of Surgical Research.

One recent laboratory division project which could have far-reaching effects is the development of a low-cost gel support pad for the prevention of decubitus ulcers or "bed sores." The gel pad that has been developed costs 1/30th as much as the nonstandard pad previously used. Physical properties of this pad in initial tests exceed all those of the commercial pad.

The Laboratory Division staff includes 48 professional and technical personnel—3 Medical Corps officers, 2 Medical Service Corps officers, 14 enlisted laboratory specialists and 29 civilians qualified as microbiologists, electronic engineers, research chemists and biologists, and research scientists in other fields.

CONTROL of bacterial population and prevention of infection of burned tissue is maintained by use of topical Sulfamylon burn cream, applied here to upper and lower limbs. Viable cutaneous homografts have been applied.

The flow of information from the ISR to field units, and from these units to the ISR, regarding new knowledge acquired through research or practical experience, is continuous within the U.S. and overseas. ISR specialists travel from unit to unit to present new ideas and techniques, as well as to discuss problems.

Dissemination of information on treatment of severe-burn patients is continuous also to numerous civilian burn centers throughout the United States. ISR specialists present numerous technical papers, participate in seminars, author publications in professional journals, and speak at medical symposiums throughout the world.

Former ISR staff members and trainees have formed the nucleus of the staff of other burn centers throughout the United States.

Requests for information about the Institute's achievements are indicative of its fame in its field. More than 100 requests for information are received monthly from within the United States, plus about 45 from foreign sources.

Institute of Surgical Research specialists are devoting primary efforts these days to coping with the heavy inflow of patients from combat areas in Southeast Asia and from other U.S. Armed Forces theaters of operation.

Still the search for improved methods of treatment and care of those who are severely burned is continuous —research dedicated to the goal of making possible a full and productive life, of building new hope and faith for many who might otherwise despair.

USAMRL Program Encompasses Broad Range of Scientific Disciplines

How can human blood be stored longer? What kinds of biological damage are caused by lasers? What is the mechanism of stereo vision? What causes blood transfusion reactions? How can we protect the soldier's hearing?

Answers to questions such as these are of prime interest as part of the mission of the U.S. Army Medical Research Laboratory (USAMRL), Fort Knox, Ky.; they are indicative of the broad range of scientific disciplines encompassed by USAMRL research.

Established in 1942 as the Armored Medical Research Laboratory, its purpose was to examine the medical problems specifically related to the soldier in the Armor environment. Responsibility for operating the laboratory was transferred after World War II to The Surgeon General, and the research mission was expanded to include matters of Army-wide interest.

Scattered among some 30 barracks-type buildings at Fort Knox, with an outpost at Frankford Arsenal, Pa., the USAMRL has about 45 professional investigators working in five divisions — Biochemistry, Biophysics, Blood Transfusion, Expermental Psychology and Pathology.

Laser Hazards. Two areas of major research effort are directed to evaluating and defining the medical hazards of exposure to coherent light. Basic investigations at the Fort Knox facility are concerned primarily with ruby and CO_2 laser sources.

Critical to continuing laser research is the development of instruments and techniques that permit accurate measurements of laser energy output. Considerable effort to stabilize the output of the CO_2 laser has sought to achieve a beam of highly uniform power density for relatively long periods.

USAMRL technician closes door of behavioral cubicle used in on-going Army research to assess the effects of laser radiation on visual acuity of animals.

Another group of USAMRL scientists is developing mathematical models applicable to laser-induced tissue damage; also, fitting these models to measurements of skin burns and other injuries. Objectively, a capability of predicting the degree of injury likely to occur in any adequately described tissue will lead to designation of safe levels of radiation.

To understand some of the disturbances that may take place in laser tissues and the factors that must be considered in devising models of damage, other USAMRL researchers are studying resultant biochemical changes.

Effects of small increases in temperature on the capacity of cells to take up and metabolize sugars are being measured in various ways. Changes in proteins of the eye caused by laser irradiations are being characterized by immunological and electrophoretic techniques. These studies are important in providing a basis of factual knowledge essential for describing possible injuries and for interpreting hazard potentialities.

A highly dangerous aspect of laser exposure involves damage to the eye. Several USAMRL projects are concerned with visual impairment evaluation, using a variety of techniques. One recently completed correlative study of the effects of pulsed ruby laser radiation on the retina established that injury, as demonstrated by microscopic examination of the retinal pigment epithelium, occurs at dosage levels considerably lower than can be detected by clinical observations.

Other investigations are using behavioral techniques and nonhuman primates to evaluate critically the degree of *functional* disturbance in visual ability that may result from laser exposure. Electrophysiological changes are being monitored to assess their potential as a means for evaluating retinal injuries.

A complementary laser research program is being conducted at Frankford Arsenal, Pa., by a Laser Safety Team staffed and funded jointly by the Army Medical Department and Army Materiel Command. The team is charged with responsibility for evaluating the hazards associated with existing and proposed laser systems, for providing safety guidance to system developing agencies, and for evaluating protection devices.

Damage probability data, based upon clinically detectable retinal lesions, have been developed for the pulsed ruby and erbium lasers and for the continuous wave argon laser. Clinical lesions are being characterized in terms of the pathologic changes at various energy levels.

Blood Research. The Army has long been dealing with problems associated with the collection, processing, storage, shipment and transfusion of blood and blood products. These problems come sharply into focus during times of conflict when the demand for blood increases precipitously.

One of the most critical needs is to extend the storage life of whole blood beyond the 21-day limit acceptable at present. Increased shelf life expands the supply available since fewer units need be discarded.

Japanese scientists discovered a few years ago that blood drawn into a receptacle containing adenine could be stored for as long as 42 days with minimal red cell mortality. USAMRL researchers have been evaluating possible side effects related to infusion of adenine blood. Preliminary trials with clinical use of adenine stored blood in combat casualties in Vietnam have revealed no signs of toxicity.

The Army immunization program has been a subject of scrutiny inasmuch as certain immunizing agents have been known to exert an adverse effect in blood from the Universal blood donor (Group O).

USAMRL research has determined that several vaccines contain blood-group-related substances capable of stimulating antibodies against the common human blood groups, thereby limiting the value of group O blood for urgent transfusion requirements.

For example, it was found that the culture medium used to prepare the plague vaccine contained extracts of meats capable of binding blood group A substance; this was obviated by modifying the growth medium. The determination led to the practice of obtaining blood from recruits prior to administration of vaccines.

Another line of investigation concerns the role of the erythrocyte membrane in preserving the ability of the red cell to carry oxygen under storage conditions. One discovery was that female blood can withstand storage for longer periods than male blood; also, that this difference may be related to the presence of certain female sex hormones that, in some way not yet understood, interact with compounds in the cell surface to maintain

its integrity to carry out essential functions.

Several investigators are engaged in research projects which are more developmental and evaluative in nature. In this category are logistic and procedural aspects of blood banking. New methods for packaging and delivering blood have been evaluated, including free-fall air delivery.

Considerable time has been devoted to evaluating accuracy and cost effectiveness of automated blood grouping equipment. It has proved highly accurate and, for large blood bank operations, economically feasible.

The blood research program is an essential counterpart of the large operating blood donor and processing center operated by the laboratory. This center, one of the Army's largest, collects, processes and distributes blood for worldwide operational requirement; it provides a testing ground for the research program.

Each week the center ships 600 units of blood and blood products. It also operates a year-long fellowship training program for blood bank officers open to all military services. A blood reference laboratory evaluates and catalogs rare blood types, and provides quality assurance testing of blood grouping reagents for all new lots purchased by the Defense Personnel Support Center.

Psychophysiological Research. The third major area of research at USAMRL is psychologically oriented and is subdivided into areas of vision, audition and ergonomics. The latter effort is concerned with the multifarious factors that influence man's ability to work effectively. The vision research is attempting to determine how the human eye works in conjunction with the brain. Answers to such basic questions as how we perceive color, and how stereoscopic vision works, will enable the Army to design optical devices to make optimum use of the soldier's visual acuity.

For example, comparative studies of color vision sensitivity between humans and nonhuman primates indicate that red-green color-deficient individuals will be handicapped in a night-vision situation in which red illumination is used to maintain dark adaption.

Other studies have shown that the central nervous system can and does suppress vision at predictable intervals. An understanding of this mechanism, as it relates to binocular vision, may have a direct impact on the design and use of stereoscopic devices, such as rangefinders.

USAMRL audition research is oriented toward minimizing noise-induced hearing loss. Both impulse and continuous noise play a large part in the soldier's environment. Determination of the most damaging types of noise will provide guidance to system developing agencies and, in some cases, contribue to new protective devices.

The Acoustic Reflex Ear Defender System (AREDS) for example was developed several years ago to protect the hearing of tank crewmen. AREDS takes advantage of the ear's own protective device, the acoustic reflex. A harmless sound is generated a fraction of a second prior to firing the main gun, causing the middle ear muscles to contract and give a significant degree of protection.

Ergonomics research is concerned with man and his work. USAMRL investigators are studying tasks ranging from simple isometric (static) muscle contractions to complex motor skills.

Studies of heavy work in static and dynamic tasks have demonstrated that individuals can reliably gauge the amount of effort required at any moment by a task, or the reserve capacity remaining to complete the task! It seems that, at least in heavy work situations, the limiting factor on endurance is the ability to tolerate the pain or discomfort produced by activity.

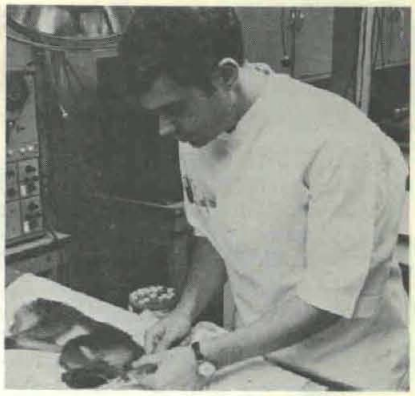
Other research, utilizing a subject-paced treadmill to impose a physical load on the subject, has demonstrated an interaction between personality variables and the degree to which performance is influenced by the social situation in which the work is done.

Complex skills associated with truck driving and the effect of fatigue on driver performance are being studied. Test subjects drove a ¾-ton truck on a 2½-mile loop of secondary road for nine hours without meal or rest breaks. Performance tests of tracking, jockeying and problem-solving abilities indicate little, if any, decrement in performance after nine hours of driving.

Wide-ranging research activities of the laboratory are supported by a technical staff equally broad-based in capabilities. The vivarium is responsible for maintaining approximately 15 species of laboratory animals ranging from baboons to chinchillas.

The staff is concerned with identifying and treating of sporadic diseases found in laboratory animals and also in an animal preventive medicine program; also, with determining normal physiological parameters for the various animal species and collaborates in many of the research projects involving the use of animals.

Other vital functions are conducted by the Research Support Division, consisting of four elements: Supply, Engineering and Services, Photography and Illustration, and Technical Library.



Sp/5 John F. Mouw is shown withdrawing blood from "Javas" monkey in conjunction with USAMRL studies on the effects of hemoglobin solutions.

The Supply Branch manages a stock record account on equipment valued in excess of $3.2 million, and annually expends approximately $800,000 for supplies, services and new equipment.

The primary function of the Engineering and Services Branch, in which the staff is representative of 17 crafts, is to design and fabricate or modify special items of equipment required for biomedical research projects.

Personnel of the Photograph and Illustration Branch are specialists in medical photography and illustration. As members of the various research teams, they advise and assist senior research investigators in planning and executing research projects.

The Technical Library maintains a very modern 11,000-volume medical collection for use by the staff.

Scientific Calendar

Physical Electronics Conference, Milwaukee, Wis., Mar. 30-Apr. 1.

1970 Army Numerical Analysis Conference, sponsored by ARO-D, Fort Belvoir, Va., Apr. 2-3.

3d Communications Satellite Systems Conference, sponsored by AIAA, Los Angeles, Calif., Apr. 6-8.

Thermophysical Properties of Solids at High Temperatures, Risley, Warrington, England, Apr. 7-10.

Symposium on Snow Removal and Ice Control Research on Roads and Runways, sponsored by OCE, NAS and Highway Research Board, Hanover, N.H., Apr. 8-10.

2d Annual Meeting on Geoscience Electronics Symposium, sponsored by IEEE, Washington, D.C., Apr. 12-17.

Annual Meeting of Research and Development Associates for Military Food and Packaging Systems, Inc., Feeding Systems in the Space Age, Chicago, Ill., Apr. 13-16.

Conference on Automatic Test Systems, sponsored by IEEE (U.K. and Republic of Ireland Sections), Birmingham, Warwickshire, England, Apr. 14-15.

Joint Conference on the Influence of Electric and Magnetic Fields on Chemical Engineering, sponsored by IEE, London, England, Apr. 14-16.

International Geoscience Electronics Symposium, sponsored by IEEE, Washington, D.C., Apr. 14-17.

OCRD Announces 4 Officer Assignments

Assignments of four Office of the Chief of Research and Development staff officers were announced in February.

LT COL JACK A. NEUBERGER is with the Operations Office, U.S. Army Advanced Ballistic Missile Defense Agency, following service with the 1st Battalion, 42d Artillery and the 4th Missile Command in Korea.

A 1953 graduate of the U.S. Military Academy, he earned an MS degree in aerospace-mechanical engineering from the University of Arizona in May 1965 and completed the Command and General Staff College (C&GSC) in 1966. He then was assigned as an ABM systems specialist with the Foreign Science and Technology Center, U.S. Army Materiel Command, Washington, D.C.

Among his citations and decorations are the Army Commendation Medal (ARCOM) with Oak Leaf Cluster (OLC), National Defense Service Medal, Army Occupation Medal (Germany), and the Armed Forces Expeditionary Medal.

LT COL CHARLES A. FULP, staff officer with the General Materiel Branch, Combat Division, recently completed a tour of duty in Vietnam, initially as executive officer for the Assistant Chief of Staff G–4, HQ USARV and then as commander, 266th Supply and Service Battalion.

He was a personnel management officer with the Office of Personnel Operations, Officer Personnel Directorate, HQ DA (1966–68), following three years as chief, Stock Accounting and Services Branch and then as chief, Hague Field Office, U.S. Army Supply Control Agency, HQ U.S. Army Europe (USAREUR).

Col Fulp earned a BS degree in agronomy from North Carolina State University (1954) and an MS degree in business management from Cornell University (1962).

His military schooling includes the C&GSC (1965), Quartermaster Advanced Course (1961), and Artillery Battery Officer Course (1958). He has been awarded the Legion of Merit and the ARCOM with OLC.

LT COL ANDREW M. NELSON was assigned to the OCRD Chemical-Biological Branch, Nuclear, Chemical and Biological Division after graduating from Armed Forces Staff College.

He served as personnel management officer, Office of Personnel Operations, Washington, D.C. (1966–69) after a tour in Vietnam as chemical adviser with the III Corps. From January 1964 to June 1965, he was chemical officer, 1st Brigade, 4th Infantry Division, Fort Lewis, Wash. (1964–65).

Col Nelson has a BS degree in bacteriology from Utah State University (1955). His decorations include the Bronze Star Medal (BSM), Air Medal, and ARCOM.

CAPT JAMES W. MORRIN completed the Adjutant General Officer's (AGO) Course at Fort Benjamin Harrison, Ind., prior to assignment to the U.S. Army Manpower Resources Research and Development Center, Arlington, Va.

He served a year with the 22d Replacement Battalion in Vietnam following tours of duty at the U.S. Army Personnel Center, Fort Lewis, Wash., and with the STRATCOM Long Lines Battalion in Korea.

Capt Morrin received the ARCOM for 1960–64 service with the 21st Replacement Battalion, USAREUR and also wears the BSM.

KEEP YOUR EYES ON THE SIGN she's holding if you want to get the real message of this picture, which shows the change in name from U.S. Army Limited War Laboratory to U.S. Army Land Warfare Laboratory. She's Mrs. Mark Langlais, a secretary in the Materiel Readiness Branch of the LWL at Aberdeen (Md.) Proving Ground.

Some 150 civilians, many of them almost uniquely qualified scientists and engineers, and about 20 military personnel with extensive combat experience are assigned to the LWL. Established seven years ago to meet emergency or high-priority materiel requirements in Southeast Asia (SEA), the LWL assumed added functions with its recent change in designation.

Col Rudolph A. Axelson, LWL CO, explained: "We hope to make it known to the R&D community, civilian contractors and our Armed Forces, that we are ready to serve in whatever way possible in any area of the world and not just in Vietnam."

Key words at the LWL are Imagination, Initiative and Innovation in meeting selective materiel requirements on a rapid-response basis. Under a Generation of New Ideas (GNI) Program, an LWL scientist or engineer may receive $2,000 if approved by his branch chief, to explore an original idea to meet a specific need. GNI has paid off in 40 of 130 new items sent to SEA by the LWL.

DoD Announces Appointment Of DSB Chairman, Members

Composition of the Defense Science Board changed in mid-February when the Department of Defense announced appointment of a new chairman and four new (replacement) members.

Dr. Gerald F. Tape, president of Associated Universities, Inc., Washington, D.C., will become a member and the new chairman Apr. 1, succeeding Dr. Robert L. Sproull, vice president and provost at the University of Rochester.

New members are J. Fred Bucy, group vice president of Texas Instruments, Inc., Dallas, Tex.; Dr. Anthony R. Curreri, MD, director, Division of Clinical Oncology and professor of surgery at the University of Wisconsin Hospitals, Madison; Dr. Alexander H. Flax, president, Institute for Defense Analyses, Arlington, Va.; and Fred A. Payne, vice president for technical operations, Martin-Marietta Corp., Orlando, Fla.

Dr. Tape's appointment is for four years, including two years as chairman. Dr. Curreri's term is for two years while Bucy, Dr. Flax and Payne are appointed for four years. Effective dates are Bucy, Curreri and Payne, all Jan. 1, and Flax, Jan. 21.

The Defense Science Board is chartered as the senior technical advisory body in the Department of Defense. Composed of members appointed from civilian life and of ex-officio members representing major federal agencies, the board advises the Secretary of Defense, through the Director of Defense Research and Engineering, on scientific and technical matters.

USAETL Selects Winners of Scientific, Leadership Achievement Awards

Distinction of being the first winners of the Scientific and Leadership Achievement Awards at the U.S. Army Engineer Topographic Laboratories (USAETL), Fort Belvoir, Va., has been conferred upon Kenneth D. Robertson and William Howard Carr.

USAETL Commander Col John R. Oswalt Jr., presented the Commanders Awards during recent ceremonies. Consisting of a plaque and certificate, the awards recognize the most outstanding individual scientific/technological achievement during the year, and the supervisor displaying the most outstanding leadership.

William Howard Carr (left) and Kenneth D. Robertson pose with Col John R. Oswalt Jr., CO of the U.S. Army Engineer Topographic Laboratories, following ceremonies at Fort Belvoir, Va., where they received USAETL Commanding Officer's Scientific/Technological, and Leadership Achievement Awards.

Robertson, a research physicist, received the Scientific and Technological Achievement Award for his work in development of highly advanced surveying instruments and techniques that give promise of radical changes in present geodetic surveying practices.

Specifically, he wrote specifications for and monitored development of what is reputed to be the most precise distance measuring instrument in the world. Capabilities of the instrument for "unparalleled precision" were reported in the May 1968 issue of the *Army R&D Newsmagazine*, p. 36.

The laser device is described as having such precision, stability and resolution that it should detect any "apparent change" of less than one-tenth of one foot caused by minute fluctuations of the earth's atmosphere, within the distance to a "corner reflector" target 30 miles away.

Robertson received a BS degree in physics from Indiana University in 1951. He served in the Army from December 1952 to September 1954 with the U.S. Army Engineer R&D Laboratories (now the U.S. Army Mobility Equipment R&D Center) at Fort Belvoir in the enlisted Scientific and Engineering Assistants Program.

When honorably discharged from the Army, he became a civilian employe in Army mapping and geodesy agencies preceding the establishment of the USAETL. His work has earned him Outstanding, Sustained Superior Performance and Special Act or Service Awards.

Carr is chief of the Automated Cartography Branch in the Automated Mapping Division. He received the Leadership Award for exceptional performance in planning and directing a program for development of a Semi-automatic Cartographic System.

Starting with newly acquired and relatively inexperienced personnel in the field of conventional cartography —and even more inexperienced to the ideas and concepts being applied to automate the cartographic function— he instituted an intensive training program that has resulted in a highly motivated and efficient team.

Carr received a BS degree in mechanical engineering from West Virginia University in February 1952. He then served with the Army in Korea 18 months until April 1954, when he became a civilian employe of the Engineer R&D Laboratories at Fort Belvoir. He has been presented numerous Oustanding, Sustained Superior Performance, and Special Act or Service Awards.

MOCOM Appoints Renier, Zwick to Advisory Group

Appointment of Dr. James J. Renier and Eugene B. Zwick to the Scientific Advisory Group of the U.S. Army Mobility Command, St. Louis, and its Mobility Equipment R&D Center at Fort Belvoir, Va., increases the group to seven specialty members.

Effective early in March, the appointments add to the group Dr. Renier's capabilities as vice president and general manager, Data Systems Division, Minneapolis Honeywell, Inc., and Zwick's broad experience as a consulting engineer in power and propulsion problems.

Formed to advise the CG of the Mobility Equipment Command on scientific and technical matters, the Scientific Advisory Group is headed by G. E. Burke, a construction engineer.

Other members are Fred Muller Jr., a specialist in transportation; Dr. T. J. Wang, known for his capabilities in mathematics and the physical sciences; Dr. L. M. Goldsmith, mechanical engineer; and Dr. H. A. Peterson, electrical engineer.

Dr. Renier is a native of Minnesota and was graduated from the College of St. Thomas in 1951 with a BS degree in chemistry. He earned a doctorate in physical chemistry from Iowa State University in 1955.

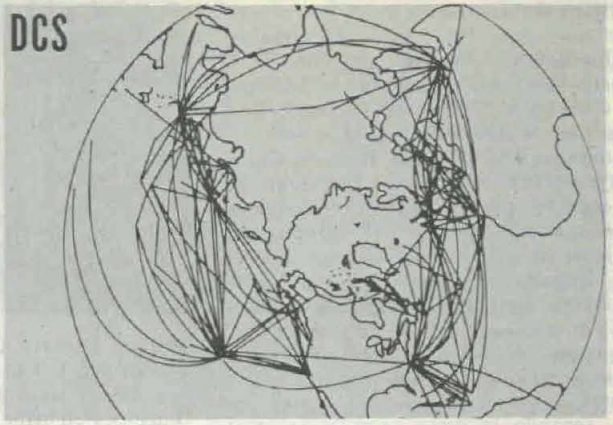
His career includes service as a research assistant with Ames Laboratories of the Atomic Energy Commission; scientist, Technical Services Division, ESSO Corp.; senior research scientist, Corporate Research Center, Honeywell Inc., 1956; and progressively responsible positions climaxed by appointment to his present position Jan. 1, 1970.

Zwick received a BS degree in physics from California Institute of Technology in 1948 and pursued graduate studies at the University of California at Los Angeles. Registered as a professional engineer in California, he has served numerous major industrial organizations as a consultant. While with the Institute for Defense Analysis as a consultant, he served as an adviser to the Secretary of Defense.

Dr. James J. Renier

Eugene B. Zwick

Defense Communications Agency Spans 80 Countries in Decade



ARMY, NAVY, AIR FORCE personnel man the Defense Communication Agency's (DCA) Operation Center on a 24-hour basis in Washington, D.C. The facility is the national center through which the DCA director can exercise operational control of the worldwide Defense Communications System (DCS), the network of which is depicted at right.

Strategic communications capabilities serving the U.S. Armed Forces in 80 countries, as managed through the Defense Communications Agency, involving assets valued at about $3 billion, have increased from 3,000 to more than 60,000 common-user circuits in 10 years.

Created May 12, 1960, as one of five agencies charged with centralized management and direction of special services used by the Army, Navy and Air Force, the DCA has expanded its functions and services worldwide through the Defense Communications System (DCS).

Other organizations charged with missions similar in scope to that of the DCA, in their respective specialty areas, are the Defense Atomic Support Agency (DASA); Defense Intelligence Agency (DIA); Defense Supply Agency (DSA); and the Defense Contract Audit Agency (DCAA).

Organized initially to integrate the long-haul, point-to-point communications assets of the Armed Forces, the DCA has consolidated various capabilities that were duplicative as regards common-user geographical coverage.

Individualized services of the Army, Navy and Air Force, as established to satisfy their particular communications requirements, are still functioning apart from the Defense Communications System controlled by the DCA. They contribute to and augment the DCS; in their respective areas, they are responsible for procurement of equipment, installation, operation, and maintenance of systems, as well as training of personnel.

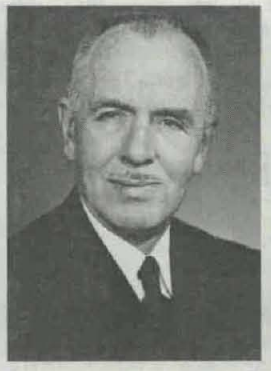
From an initial authorized strength of 212 personnel, HQ DCA has increased to about 800 military and civilian employes. DCA field units, strategically located around the world, are staffed with about 2,300 military and civilian personnel. Altogether, about 36,500 employes carry on Defense Communications Systems operations.

One of DCA's major functions involves that part of the worldwide National Military Command and Control System (NMCS) designed specifically for use by the National Command Authorities, and their authorized alternates, in the exercise of strategic direction of U.S. Armed Forces. These include the President, Secretary of Defense, and the Joint Chiefs of Staff.

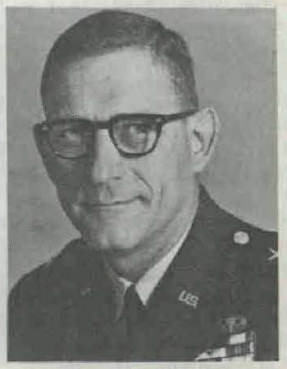
The NMCS operates a communications facility in the Pentagon called the National Military Command Center (NMCC), together with alternate facilities for focalizing the management and controlling the exchange of command and control data.

Aided by the Pentagon NMCS Sup-

Lt Gen Richard P. Klocko
Director, DCA



Rear Adm R. H. Weeks
Vice Director, DCA



Brig Gen Robert D. Terry
Deputy Director, NMCS.

Brig Gen Herbert A. Schulke Jr.
Deputy Director, Operations

Rear Adm John L. Boyes
Deputy Director, DCA Plans

Brig Gen Floyd H. Trogdon
Deputy Director, DCA Programs

port Center (NMCSSC), a DCA field activity, the NMCC collects, displays, evaluates and relays to the proper authorities (major Army commanders and heads of U.S. Government agencies) important military and political information. If attacked, the U.S. could retaliate almost instantaneously.

To insure that the centralization of command and control data would survive a nuclear attack, alternate facilities are operational underground, on the sea, and in the air.

Three EC–135J airplanes constitute the National Emergency Airborne Command Post (NEACP). One aircraft is constantly on duty, on a rotating basis, so that command can be maintained for response to any situation.

A second responsibility, passed to the DCA in 1962, was the mission of integrating space, ground and seagoing elements of military communications satellite systems handled by the Army, Navy and Air Force.

The concept is that a string of orbiting satellites properly designed and deployed provides a communications reliability approaching 99 percent by furnishing an added measure of immunity to disruption and outage that could be caused by enemy action. Satellite systems also enlarge the peacetime DCS capacity by furnishing extra communications channels.

The Initial Defense Communications Satellite Project (IDCSP) was designed to research, develop, test and evaluate the operational capability of orbiting communications satellites, employing ground-based and shipborne communications terminals separated by distances of 3,500 miles.

Implemented in 1969, the IDCSP involved 36 earth terminals and 24 satellites. The space portion of the IDCSP got under way on June 16, 1966, when a TITAN IIIC launched seven communications satellites into orbit, ringing the earth at a distance of about 21,000 statute miles out.

Another launch in January 1967 added eight satellites. Three were orbited in July 1967 and eight more in June 1968, making 26 in all (24 operationally useful).

Magnitude of activities under DCA control and direction is reflected in current annual expenditures of about $750 million for research and development on advanced systems, procurement, operation and maintenance.

Indicative of the scope of activities in late 1969 was DCA's responsibility for direction of some 115 relay stations, about 2,000 tributary stations and 102 high-frequency stations.

Initially, DCA assumed operational direction of more than 10 million circuit miles of long-haul communications. Now 64,000 circuits and 124,000 channels provide 45 million 2-way, voice and teletypewriter (TTY) channel miles of service.

In addition, DCA has large-scale responsibilities for leased commercial circuits and for engineering services. Effective Dec. 31, 1962, the Defense Commercial Communications Office (DECCO) was created as a field activity of DCA at Scott Air Force Base, Ill. DECCO became the successor to the former Air Force Office of Commercial Communications Management.

DCS customers were then using millions of miles of leased landlines, particularly in the Continental United States, and the objective was to achieve the lowest practical rates.

DECCO centralized for Department of Defense and non-DoD users the leasing of, and the account for, commercial circuits employed by DCS and non-DCS users. Currently, DECCO administers some 40,000 leased facilities accounts, and has effected major economies.

In 1963, the Defense Communications Engineering Office (DCEO) was added as a DCA field activity, collocated with HQ DCA at Eighth Street and South Courthouse Road, Arlington, Va. 22204.

DCEO was organized to convert approved plans into workable projects for improving, expanding and modernizing the Defense Communications System, and directing implementation of projects.

Another progressive move was made in 1968 when a DCA Systems Engineering Facility (SEF) was authorized. SEF will be located in a building to be constructed at Reston, Va. When operational early next year, it will contain the instrumentation and staff for performing test-bed evaluations required to satisfy DCS system engineering goals.

Simultaneously with consolidation of DCS installations, and of DCA business responsibilities and engineering tasks, DCA modernized DCS communication systems, chiefly through automation of manual and semiautomatic switched networks.

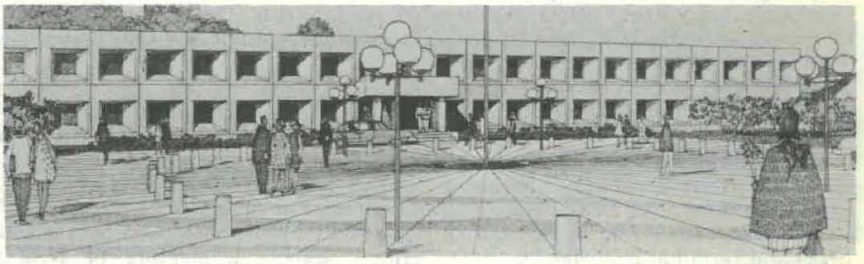
Two programs in particular were emphasized: AUTOVON (Automatic Voice Network) and AUTODIN (Automatic Digital Network). These are perhaps the best known of DCA achievements.

Established in 1963 with the approval of the Secretary of Defense, the AUTODIN is capable of handling top secret traffic on a worldwide basis. It has a self-contained storage and forwarding system, enabling low-precedence traffic, during periods of peak loads, to be stored temporarily at the switch for later release after priority messages have been sent.

AUTODIN accepts and relays traffic between various dissimilar types of subscriber terminals that may contain digital computers, punched card readers and teletypewriters, and magnetic tape terminals. AUTOVON circuits can be "called up" as needed by AUTODIN to handle peak loads or go around failed circuits.

Nine AUTODIN Switching Centers were programed for the Continental U.S. and 11 overseas, and all were installed by mid-1969. Switches are computer-driven, capable of receiving messages at rates from 100 to 3,000 words a minute and transmitting them at up to 3,000 words a minute.

(Continued on page 20)



DEFENSE COMMUNICATION AGENCY major elements, the relatively new Systems Engineering Facility, and the Defense Communications Engineering Office (DCEO), will be collocated in a 97,500-square foot complex scheduled for completion early in 1971. Under a lease agreement, the complex is being constructed in the Industrial Park at Reston, Va., by Gulf Reston, Inc. and eventually will house about 400 DCA employes. The Systems Engineering Facility is charged with over-all DCA system engineering and instrumentation for test and evaluation to achieve system engineering objectives. Included are the AUTOVON and AUTODIN worldwide networks; also, in the future, the AUTOSEVOCOM (Automatic Secure Voice Communications) and the DSSCS (Defense Special Security Communication System). The DCEO is primarily responsible for engineering subsystems over which the DCA provides management control and operational direction.

Defense Communications Agency Spans 20 Countries in Decade

(*Continued from page 19*)

The speed-of-service goals are less than 10 minutes for Flash; 20 minutes to one hour for Intermediate Precedence; one to six hours for Priority; and three to 18 hours for Routine. DCA is close to attaining these goals.

To realize similar improvements in handling voice traffic, DCA is replacing the manual voice switchboards with AEVS (Automatic Electronic Voice Switches). AEVSs are capable of instantly finding an open-circuit path, differentiating between high- and low-priority subscribers, and giving precedence to high-priority users.

AUTOVON operates 56 leased switches. To enhance survivability in the event of an attack, and to improve service, DCA plans to install 65 switches in the U.S. that will be linked with nine identical switches in Canada. An additional 20 switches are progra.ned for service overseas in three years.

Users seem to be harmonious in viewing the progress of DCA toward many of the original goals as remarkable during the first decade, such as, for example, establishment and operation of its vast organization structure.

Integration of resources, one of the prime initial goals, is evidenced in a tightly-knit complex embracing seven Regional Control Centers and four Area Control Centers, all linked to the DCS Operations Center (DCSOC).

Regional centers are in Japan, the Philippine Islands, South Vietnam, Korea, the United Kingdom, Spain and Turkey. Four field offices at HQ U.S. STRIKE Command (McDill Air Force Base, Fla.), Puerto Rico, the Panama Canal Zone and Canada report to the four Area Control Centers in Hawaii, Alaska, Germany and the U.S. (Colorado), which report to the DCSOC.

DCA's basic missions are to direct the Defense Communications System; to plan and implement support for the National Military Control System; and to integrate the ground and space-borne elements of the Defense Communications Satellite System into the DCS. The DCA develops plans for DCS modifications after the Secretary of Defense has approved such plans.

HQ DCA is staffed with administrators representative of the Armed Forces. Lt Gen Richard Phillip Klocko, Air Force, has directed the DCA since Nov. 15, 1967. Rear Adm Robert H. Weeks is vice director.

Brig Gen Robert D. Terry, with the Office of the Chief of Research and Development, HQ DA (1956–58) heads the National Military Command System and also the Technical Support Directorate. Other deputy directors are Brig Gen Floyd H. Trogdon, Programs, Air Force; Rear Adm John L. Boyes, Plans, Navy; and Brig Gen Herbert A. Schulke Jr., Operations, Army.

Consolidation, modernization, growth and intensive effort to meet the objectives envisioned when it was created have been key words in DCA operation of the Defense Communications System during its first decade. Along with continued progress, they likely will remain key words in the discharge of over-all DCS management responsibilities in the 1970s.

SATCOM Terminals Demonstrated at NATO Meeting

Two-way communication between a U.S. Army UH–1D helicopter hovering in the U.S. and participants in a NATO Communications-Electronics Board meeting in Belgium, via ground stations and a satellite 22,000 miles above the earth, was recently demonstrated successfully.

Set up by the U.S. Army Satellite Communications (SATCOM) Agency at Fort Monmouth, N.J., the test demonstrated the potential for long-distance tactical communications between airborne or ground stations via orbiting satellites.

Messages were transmitted through the Air Force/Lincoln Laboratory LES–6 satellite, the SATCOM field station in Lakehurst, N.J., and a SATCOM terminal in Brussels.

The airborne AN/ARC–146 terminal used in the demonstration is one of six configurations developed in the Tactical Satellite Communications (TACSATCOM) Program, a cooperative R&D effort of the Army, Navy, Air Force and Marine Corps. Other versions are the team-pack, jeep-mounted, shelter installation, a broadcast warning receiver, and shipborne terminals.

A feature of the helicopter installation is the mounting of an antenna above the helicopter rotor to avoid the "chopping effect" on communications signals caused by the whirling rotor blades. This crossed dipole antenna is used for operation with satellites at high elevation angles. A single vertical monopole antenna is mounted on the fuselage for use when the satellite is near the horizon.

The ultra-high frequency AN/ARC–146 can receive and transmit both voice and teletype traffic while in flight. The electronics are packaged in a unitized console inside the aircraft. Only one operator is required.

The AN/TRC–156 terminal set up in Belgium belongs to the team-pack family, so-called because it breaks down into three packages for transit. Last July, the team-pack was used as part of an Army station in Hawaii for Apollo 11 spacecraft joint recovery communications.

Rollin Keyes of the Army SATCOM Agency and Lt Col John Steinke of the Tactical Satellite Management Office, OCRD, represented the United States in Belgium during presentations of the NATO Tactical Satellite Communications Program. Maj John Anderson, Sp/6 Lance Gromme and Sp/4 Gary Troutman of the agency's field station at Lakehurst demonstrated the team-pack terminal in Brussels.

SATELLITE Communications terminals, AN/TRC–156 "team-pack" (shown at right) and the Army's new helicopter-mounted AN/ARC-146 (below), were used to demonstrate the potential of satellite communications for tactical forces during a meeting of NATO Communications Electronics Board.

AMC Seeks to Stabilize Project/Product Manager Tours

Stabilized tours of duty for its 45 project/product managers concerned with implementing PROMAP–70 (Program for the Refinement of the Materiel Acquisition Process) are an objective of the U.S. Army Materiel Command.

Standards for selection of project/product managers have been drawn to insure exceptionally well-qualified officers in these positions. Maj Gen Paul A. Feyereisen, AMC Deputy CG for Materiel Acquisition, explained:

"In Army project managership, we identify a single individual, arm him with full line authority and charge him with full responsibility for accomplishing the objectives of a particular program. The objectives are well defined in a project manager charter.

"The funds and resources to accomplish this mission are provided directly to him for his further allocation to contractors, supporting government agencies or other organizations. His entire effort is focused on the accomplishment of his program objectives and his attention is not divided among a host of tasks and programs."

In view of rising costs linked to the inflationary trends, while Department of Defense funding and manpower resources are being decreased, General Feyereisen said, "We face the pain, but more positively, the opportunity to make significant reforms. . . ."

More and more, he said, it is essential to fix responsibility and authority for action on key individuals, as is "fundamental to the project management theme." In recognition of this requirement, the Materiel Command initiated action for a study approved by the Army Vice Chief of Staff in December 1969.

Determinations of the study included that, although officers with top qualifications were being selected for project/product manager assignments, about 75 percent of them did not complete a 3-year tour of duty.

Several administrative actions taken by the AMC are directed to stabilizing tours of duty of PMs. For example, a request was submitted for an exception to the general policy which provided tours of duty of adequate duration for field grade, warrant officers and enlisted personnel, but excluded company grade officers.

A selective list of company grade officers serving on PM staffs has been submitted to HQ DA requesting a stabilized 2-year tour of duty. Future personnel requisitions will be annotated with the specific requirements of the PM staff position. Policy guidance on this subject has been provided.

To inform and attract highly qualified officers to the PM field, the Materiel Command has initiated a program that calls for knowledgeable officers and perhaps former PMs to visit the service schools and colleges to explain the PM field to students.

PMs will serve a full 3-year tour or for the duration of the project, if completed earlier, provided the AMC recommendation is approved. The 1969 study also detailed essential selection criteria. Examples of standards intended to assure selection of officers in the top 10 percent based on qualifications include:

- A PM candidate must possess a degree in engineering, or one of the sciences, and a graduate degree in business or related technical field.
- He must be a senior service college graduate and have commanded a troop unit commensurate with grade.
- He must have demonstrated outstanding performance and leadership, and possess high potential for advancement to general officer rank.

CH–54A Flying Crane, one of the U.S. Army Materiel Command's 45 project product management materiel items, has proved its capability in Vietnam.

- He must have a service obligation as a result of some other personnel action and not be within three years of mandatory retirement.
- He must have received training in the field of materiel acquisition.

MICOM Consolidates Data Processing Activities

Consolidation of all data processing activities of HQ U.S. Army Missile Command is achieved in a new Management Information Systems Directorate to be operational in March.

Headed by Willie N. Calcote, chief of the Management Science and Data Systems Office, as acting director, the new directorate combines eight former organizations at an estimated annual savings exceeding $1 million.

Patterned after Army Materiel Command recommendations for a "Standard Commodity Command Structure," the MICOM MIS Directorate is viewed as a major step toward a National Automatic Data Processing Program for Logistics Management (NAPALM).

This program proposes standardization of computers, information systems and procedures at all AMC subordinate commands. Ultimately, the NAPALM program envisions a network of computers and information systems throughout AMC, interconnected, with hardware and data information made available to all commands under a standard method of communications and control.

The NAPALM program has been directed toward business-type use of computers and information systems. A MICOM innovation will be a third-generation "scientific" computer to provide direct on-site support to the Research and Engineering Directorate, as one of the most advanced simulation capabilities in the U.S.

With these facilities, MICOM officials state, an entire weapon system can be simulated, and proven, by computer, resulting in more effective design, greater product reliability, and decreased development and production costs for weapon systems.

Using remote terminal devices, these same facilities can provide on-line computation service to scientists and engineers in the R&E Laboratory or other MICOM elements.

DCA Announces Completion Of Overseas AUTOVON Units

Completion of the overseas portion of the Department of Defense AUTOVON (Automatic Voice Network) was announced recently when the last five of 17 overseas electronic switching centers of the Defense Communications System became operational.

The Defense Communications Agency (DCA) announced that the centers—at Coltano, Italy; Athens, Greece; Fuchu, Japan; Grass Mountain, Taiwan; and Futema, Okinawa—are interconnected with the worldwide network, giving military leaders the capability of completing global telephone calls in seconds.

The announcement said AUTOVON provides the Department of Defense (DoD) "with a worldwide system for handling both voice and graphic communications on an automatically-switched basis. Besides the 17 overseas switching centers, the global system links 53 centers in the Continental United States and nine in Canada with some 2,000 military facilities."

RDT&E, Procurement Contracts Dip Below $217 Million

U.S. Army research, development, test, evaluation (RDT&E) and procurement contracts from Jan. 1 to Feb. 10, in the $1 million or more each category, totaled $216,947,602.

Army R&D Newsmagazine listings for nine years indicate that this total is an all-time low for a corresponding period, reflecting the Department of Defense drive to save more than $3 billion in FY 1970.

Bowen-McLaughlin-York Co. will receive $18,709,229 (two contracts) for armor plates for 2½-ton and 5-ton trucks, M–110 self-propelled 8-inch howitzers, M–107 self-propelled 175mm guns, and M–572 recovery vehicles.

Olin Mathieson Chemical Corp. gained five contracts totaling $17,399,874 for propellants, projectiles and cartridges, and for loading, assembling and packing services. Uniroyal, Inc., was issued a $13,684,011 contract for support services and production of explosives.

AVCO Corp. will be paid $12,542,535 (six contracts) for parts for projectiles and fuzes, and for helicopter engines overhaul, repair and product improvement services. Chamberlain Manufacturing Corp. was awarded $10,504,960 (two contracts) for projectile parts.

Contracts under $10 million. Dynelectron Corp., $9,532,071 and Lear Siegler, Inc., $8,223,799 for maintenance support and crash/battle damage repairs on aircraft; Raytheon Co., $8,600,379 for Improved Hawk conversion test equipment; and

Chrysler Outboard Corp., $7,435,993 for military standard engines; R. G. LeTourneau, Inc., $6,322,864 for 750-pound bomb parts; Hamilton Watch Co., $6,097,009 for radio sets and receiver transmitters; American Machine & Foundry Co., $5,611,936 for bomb parts; and

Honeywell, Inc., $5,200,667 (two contracts) for bomb fuzes; Gulf Western Industries, Inc., $5,041,311 for parts for fuzes.

Contracts under $5 million. General Motors Corp., $4,843,277 (two contracts) for ¼-ton trucks and ambulances, and for M–60 tank transmissions; Pace Corp., $4,644,677 (two contracts) for flares and parachute signals; Levinson Steel Co., $4,372,010 for 105mm high explosive projectile parts; and

Philco-Ford Corp., $3,729,885 (two contracts) for development and improvement of the XM140 30mm automatic weapon for aircraft systems, and for design and control of spare parts of classified equipment; Resdel Engineering Corp., Arcadia, Calif., $3,718,325 for electronic components for a classified system; and

Bell Aerospace Corp., $3,343,481 (two contracts) for heater kits for aircraft, and for repair of crash/damaged aircraft; Device and Components Co., $3,154,752 for support packing for 105M1 artillery shells; and

International Telephone and Telegraph Corp., $2,948,501 for repair parts for radio sets; Institute for Defense Analysis, $2,941,000 for studies for the Advance Research Projects Agency and the Director for Defense Research and Engineering; and

Allied Materials and Equipment Co., $2,651,940 for cylinder assemblies for M60 tank engines; Bulova Watch Co., Inc., $2,612,539 for parts for fuzes; Lockheed Aircraft Corp., $2,416,370 for maintenance support and crash/battle damage repairs on aircraft; and

Emco Porcelain Enamel Co., Inc., $2,214,675 for metal ammunition boxes; Heckethorn Manufacturing Co., $2,185,307 for projectile parts; Bauer Ordnance Co., Warren, Mich., $2,139,110 for conversion kits for the 20mm weapon system.

Contracts under $2 million. Pacific Car and Foundry Co., $1,987,157 for amphibious cargo carriers and assault vehicles; Ralph M. Parsons Co., $1,783,128 for standard design radar site and site adaptation to the first Safeguard site at Grand Forks, N.D.; and

Ammann and Whitney, $1,759,000 for design of Perimeter Acquisition Radar and site adaptation of this design for the Safeguard site at Grand Forks; Ridge Instrument Co., Inc., Huntsville, Ala., $1,657,322 for calibration sets used for testing test equipment; and

Wire and Metal Specialties Corp., Warren, Pa., $1,645,200 for 5.56mm cartridges; Kings Point Manufacturing Co., $1,611,115 for 5.56mm ammunition bandoliers; Northrop Corp., $1,533,652 for flechette warheads; Chrysler Corp., $1,529,630 for conversion kits for the 20mm weapon system; Associated Spring Corp., $1,506,700 for 5.56mm cartridge clips for M–16 rifles; and

Chrysler Motor Corp., $1,472,932 for cargo trucks and ambulances; IBM Corp., $1,349,627 for preliminary ballistic missile defense software development program; Teledyne Industries, Inc., $1,327,950 for cylinder assemblies for M48 tank engines; and

Bell and Howell Co., $1,315,378 for fuze parts; Scovill Manufacturing Co., $1,308,852 for grenade fuzes; Galion-Amco, Inc., $1,257,051 for fuze parts; Eastern Tool and Manufacturing Co., $1,253,700 for projectile parts; and

Aerojet General Corp., $1,240,000 to modify forward-looking, infrared, airborne target acquisition and fire control systems; Federal Laboratories, Inc., $1,181,537 for riot-control hand grenades; Union Carbide Corp., $1,172,664 for reserve power supplies for fuzes; and

Stanford Research Institute, $1,119,418 for research and scientific studies in air defense and ballistic missile defense areas; Control Data Corp., $1,091,136 for a data processing feasibility study; Goodyear Tire and Rubber Co., $1,072,710 for pneumatic tires; and

Action Manufacturing Co., $1,043,756 for metal parts for fuzes; Marathon Battery Co., $1,003,500 for dry batteries, engineering samples and high- and low-temperature production testing equipment; and Texas Instrument, Inc., $1,000,000 for classified electronic equipment.

Youngest Picatinny Arsenal PhD Researcher Assigned to FRL

Twenty-seven-year-old 1st Lt Ron McCauley is Picatinny Arsenal's youngest doctor backed by industrial research experience.

Working under Dr. Harry Fair at the Army's Dover, N.J., ammunition explosives and propellants research center, he is investigating qualities of explosives in the solid-state branch of Feltman Research Laboratories.

1st Lt Ron McCauley

Graduated in 1964 with a BS degree from the University of Missouri, and commissioned in the U.S. Army Corps of Engineers, Lt McCauley continued graduate studies at Penn State University for five years to earn MS and PhD degrees, specializing in ceramic science.

While engaged in undergraduate studies at the University of Missouri, and after getting his degree, he worked on research in explosives for DuPont de Nemours in Gibbstown, Mo.

While attending universities he won two varsity letters as a member of rifle teams. His honorary society memberships include Keramos (ceramic society), Sigma Xi, and Sigma Gamma Epsilon (earth science group).

Nabors Succeeds Hall as AMCA CO, Deputy Director

Duties of commander and deputy director of the Army Materiel Concepts Agency (AMCA) were assumed by Col George A. Nabors prior to the retirement of Col Norman L. Hall effective Mar. 1.

Col Hall was at first detailed to those duties from the Directorate of Development and Engineering, Army Materiel Command, when AMCA was activated early in 1968 and later was given both assignments. A career officer in the U.S. Army Corps of Engineers, he retired with more than 28 years of military service.

Col Nabors and Col Hall served tours of duty with the U.S. Army Research Office soon after its establishment in March 1958. Until stepped up to his new duties, Col Nabors was acting chief, Concepts Synthesis Division of AMCA, following a tour as commander of the U.S. Army Arctic Test Center, Fort Greely, Alaska.

Other key assignments for Col Nabors in recent years have included military adviser to the Operations Research Office (since reorganized as the Research Analysis Corp.); adviser to the Chinese Nationalist Army Armor School in Taiwan; and operations and training officer in the G–3 Section, HQ Sixth U.S. Army.

Col Nabors is a graduate of San Diego State College, the Armored Officers Advanced Course, and Army Command and General Staff College.

AMCA's mission is concerned primarily with generating alternative systems and concepts of materiel that will impact upon future U.S. Army Combat effectiveness—generally in the time frame of 20 to 30 years in advance. Major functions are detailed in Army Materiel Command Regulation 10–82, dated July 17, 1968.

In the discharge of its responsibilities, AMCA has a "troika" working relationship with the Institute of Land Combat of the U.S. Army Combat Developments Command and the Intelligence Threat Analysis Group of the Assistant Chief of Staff for Intelligence. AMCA's mission involves close working relationships with representatives of Army in-house laboratories.

As spelled out in a memorandum of agreement with the Institute of Land Combat and the Intelligence Threat Analysis Group, AMCA will "stimulate production of materiel concepts by exploiting the potential of science and technology unrestrained by current doctrine."

Col George A. Nabors

Army Schedules 3 MOB DES R&D Symposia

Three research and development symposiums intended primarily for members of R&D Mobilization Designation (MOB DES) Detachments are scheduled this summer.

Other U.S. Army Reserve or active duty Army, Navy or Air Force personnel may attend on a space-available basis, subject to approval by their proponent agency or headquarters.

The symposiums are:

July 5–17—"Reliability and Quality Control," sponsored by the 1677th MOB DES Detachment, School of Business Administration, University of Connecticut at Storrs. Col Richard M. Story commands the 1677th.

July 26–Aug. 8—"The Army's R&D Requirements 1970–80 Time Frame," 621st MOB DES Detachment, Oregon State University at Corvallis. The 621st is commanded by Col Milton H. Mater.

Aug. 2–15—"Research and Development in Army Heavy Equipment Requirements." 1664th MOB DES Detachment, headed by Col Adolph H. Humphreys, U.S. Army Mobility Equipment R&D Center, Fort Belvoir, Va.

Persons desiring to attend any of these symposiums should submit DA Form 1058 through their proponent agency (for MOB DES officers) or through appropriate headquarters to Lt Col William D. Guinn Jr., assistant executive for administration, Office of the Chief of Research and Development (OCRD). Active duty personnel should submit their requests through the appropriate headquarters.

Lt Col Allbertson Selected For Fellowship in AAAS

Lt Col John N. Albertson was recently elected a Fellow of the American Association for the Advancement of Science (AAAS) in recognition of his research and administrative contributions to science.

Assigned in July 1968 as a staff officer in the Life Sciences Division, Army Research Office, Office of the Chief of Research and Development, he has been serving since June 1969 as chief of the Medical and Biological Sciences Branch.

From July 1964 to August 1967, he was chief, Bacteriology Division and Virology Division, 1st Army Medical Laboratory, Fort Meade, Md. He was a research associate at Hahnemann Medical College in Philadelphia, Pa., from August 1962 to June 1965, when he received an MS degree. Lt Col Albertson has a BS degree in chemistry and bacteriology from the University of Connecticut. He completed the residence course at the Command and General Staff College in 1968 and is a 1966 graduate of the Army Medical Service Career Officers Course at Fort Sam Houston, Tex.

Griffin Commands WSMR Safeguard Evaluation Agency

Command of the Safeguard System Evaluation Agency (SAFSEA) at White Sands (N. Mex.) Missile Range was assumed by Col Bobbie A. Griffin following retirement of Col Frank J. Wasson Jr. after a 35-year career.

Col Griffin is a 1943 graduate from the United States Military Academy and since 1960, when he became chief of the Nike-Zeus Test Branch of the Army Air Defense Board, has been almost continuously associated with R&D of ballistic missile defense systems.

Col Bobbie A. Griffin

While assigned to the Office of the Chief of Research and Development, HQ DA (1965–66), he served as chief, Nike X Branch, later as chief of the Nike X and Space Division of the Missiles and Space Directorate, and then as assistant manager, Nike X System Office.

In 1960 he received a master's degree in mechanical engineering from the University of Southern California. He is a graduate from the Army Command and General Staff College, Fort Leavenworth, Kans., and Industrial College of the Armed Forces, Fort McNair, Washington, D.C.

During World War II, he served in the European Theater of Operations as executive officer and as commander of a Field Artillery Battalion, 11th Armored Division.

WSMR Collecting Information Linked to Nuclear Effects Problems

How much radiation does your body receive in a lifetime? Is it harmful? Who measures ionizing or nuclear radiation and how is it done?

Answers to such questions may be found in a textbook published by the U.S. Public Health Service. More clearly definitive information relative to operational problems associated with nuclear effects is an objective of a relatively new facility at White Sands (N. Mex.) Missile Range.

In case your interest was piqued by the introductory questions, a person living to age 70 will receive, on the average, about nine rads (Roentgens Absorbed Dose) of whole body radiation from all sources.

The body suffers no ill effects from this amount of radiation spread over a lifetime, the PHS textbook states, since humans have always been exposed to ionizing radiation of cosmic origin in varying degrees.

In the modern environment, however, the cosmic background is only one of many potentially harmful sources. Radiation-generating machines and radioactive materials are present in many environments.

X-ray machines, fluoroscopes, diffraction units, nuclear reactors, particle accelerators, radionuclides, and static eliminators employing radioactive sources are used widely every day, in medicine, dentistry, industry, scientific research and defense activities.

When properly used, these sources offer little or no exposure to ionizing radiation for the average person, but thousands are exposed occupationally, through use of the devices or close-proximity employment.

Extremely rapid development and use of radiation technology for many purposes are associated with the "atomic age." White Sands Missile Range has contributed to these advancements and, because of the nature of its work, is directly affected.

WSMR facilities such as the Nuclear Effects Directorate, with its fast-burst reactor, high-energy accelerator and complex of instrumentation and radioactive sources, have been designed and built for testing and research.

Other WSMR activities such as mobilization plans (Civil Defense), environmental health and health physics groups, radiography services, medical and dental service, missile testing and recovery, use radiation-measuring instruments and radioactive sources.

The WSMR Radiation Protection Committee is responsible for radiological health and safety. The Calibration Directorate, an element of Logistics, assures the accuracy of radiation measurements.

In accordance with established policy, radiation measurements must be included in test programs for all items which may produce radioactive emanations. Calibration of the rapidly growing numbers of electromechanical instruments being employed has become a critical requirement.

Referred to as nucleonics equipment, radiation detecting and measuring devices are of many designs and capabilities with a common purpose—to provide a "sixth sense" with which man can detect, observe and study or measure radiation, with the goal of adequate protective procedures.

Means of maintaining the accuracy of nucleonics instruments became pronounced at WSMR during a 1964–67 period of great expansion and modernization of instrumentation for tracking and reentry studies of missiles and other test vehicles.

A limited nucleonics calibration capability was established in 1965 by the Calibration Directorate, headed by Glenn C. Wright, and the Nuclear Effects Directorate Army Missile Test and Evaluation (ARMTE), under Glenn E. Elder.

NSF Lists Science Technology, Public Policy Sources

Science Technology and Public Policy (A Selected and Annotated Bibliography II), prepared for the National Science Foundation by the Program of Advanced Studies in Science, Technology and Society, Department of Government, Indiana University, is a new publication.

Edited by Lynton K. Caldwell, with the assistance of William B. DeVille and Gertrude W. Lindesmith, this 544-page document lists and annotates, where necessary, some 2,700 articles selected from 50 periodicals. A similar Volume I was published in English for 1945 through 1967.

The preface explains that the new bibliography "represents an effort to provide, as rapidly and economically as possible, a survey of the more generally accessible literature in this emergent field of study."

Six areas of difficulties encountered in preparation of the documents are listed to explain to prospective users the limitations of the intended service. ". . . The editors, supported by the National Science Foundation, have sought to provide a respectable coverage of the literature that would have immediate, practical utility. . . ."

The amount of material available for Volume II "greatly exceeded the space available. . . . The editors have tried to give priority to articles of continuing relevance over those largely limited in importance to a given place and time. They have also avoided extensive coverage of topics treated in other bibliographies."

Henderson Succeeds Franz as Edgewood Labs Chief

Assignment of Lt Col William J. Henderson as director of the Defense Development and Engineering Laboratories at Edgewood (Md.) Arsenal, to succeed Lt Col Robert F. Franz Jr., reassigned to Vietnam, was announced in mid-February.

Col Franz had served as director since June 1969, after a 4-year tour of duty with the Office of the Chief of Research and Development, HQ DA, the last two years as chief, Chemical-Biological Branch. He is now with the U.S. Army Element, MACV.

Col Henderson served more than two years in the Nuclear, Chemical and Biological Division, Office of the Chief of R&D, HQ DA, prior to assuming his present duties. He was G3 operations officer and chemical officer with the 4th Infantry Division in Vietnam until assigned to the Office, Chief of Research and Development.

Stationed at Ent Air Force Base, Colo. as chemical officer with the Army Air Defense Command (1965–66), he has served as project officer with the Special Warfare Agency, Combat Developments Command, Fort Bragg, N.C., and S3 with the 518th Chemical Battalion, Fort McClellan, Ala.

Lt Col Henderson has a BS degree in botany and plant pathology from Colorado State University (1952), MS degree from the University of California at Davis (1954), and has completed the Command and General Staff College.

Lt Col W. J. Henderson

Much of the work necessarily had to be sent to off-post facilities, which entailed the possibility of instruments that had been freshly calibrated being jarred out of adjustment during the return trip to WSMR.

An inventory in 1967 showed 959 nucleonics instruments at WSMR, requiring annually more than 2,700 calibrations, with the workload increasing more than 10 percent each year.

Development of the Nucleonics Calibration Facility (NCF) was initiated and this facility is responding to a requirement for about 5,000 calibrations annually on 2,000 instruments.

Robert E. Sleever, an electronics technician in the Electrical Standards Division of the Calibration Directorate, proposed the NCF and was assigned responsibility for coordinating its development. Doyle G. Quillin, experienced in radiation technology and nuclear reactor work, assisted in putting the NCF into operation.

Sleever's plan called for adaption of long-vacant Building 23108, used only for storage but constructed originally at a cost of $943,000 for the Land-Based Talos Project in the 1950s.

Built of high-density reinforced concrete for blast containment and protection during Talos missile firings, Building 23108 also had the advantage of being in a remote area. Consequently, essential modifications were done at minimal cost.

Safety fences and special locks were installed. Alarm systems consisting of flashing lights and audible signals were added, along with controlled access procedures. Dosimeters and protective devices were installed.

Calibrated radionuclides (sources) and devices producing alpha, beta, gamma and neutron radiations are used in the NCF. Most important is a U.S. Government-issue item, the AN/UDM-1A Cesium Beam Gamma Calibrator. Locked when not in use, it serves to calibrate Geiger counters, ionization chambers, scintillation detectors, dosimeters and other gear.

The NCF uses a 300-kilovolt Automatic X-ray Calibrator, a locally modified version of a commercial item, to calibrate X-ray detection devices and for energy-response studies. Local modification saved thousands of dollars, WSMR officials stated.

Other NCF includes a Condenser R-meter, with associated wide-energy spectrum chambers, used in measurements of gamma and X-radiation.

Planned for installation in the near future is a precision Free-Air Ionization Chamber, which will provide a capability that will eliminate reliance solely on the National Bureau of Standards Center for Radiation Research at Gaithersburg, Md.

Although the NBS center develops and maintains basic standards for all U.S. radiation measurement facilities, it cannot perform all of the actual measurements required, such as the mounting workload for WSMR.

WSMR also is planning a Cobalt-Gamma Irradiation Pool, again by using an existing structure that is ideal for the purpose and thereby permits substantial savings. An existing concrete pool, used formerly for absorption and dispersion of initial blast effects of Talos missile firings, will require minor modifications to meet NCF requirements.

CDC Plans MAN, GAN Land Navigation Systems Tests

MAN and GAN land navigation systems are scheduled for pilot tests in mid-March, preliminary to intensive field evaluation tests by the Combat Developments Command, Continental Army Command, and Army Materiel Command, at Fort Carson, Colo.

Test plans and criteria were developed by the Combat Developments Command (CDC), whose Armor Agency at Fort Knox, Ky., is the proponent for the Canadian-built systems. CDC's final report on the tests will be made to the Department of the Army late this summer.

The MAN (Magnetic Automatic Navigation) system, mounted on a jeep, was demonstrated at Pikes Peak and Cheyenne Mountain in Colorado earlier this year, during a briefing for General James K. Woolnough, CG of the Continental Army Command (CONARC).

Maj Gen Bernard W. Rodgers heads a new directorate formed at Fort Carson to conduct the tests. Deputy director Col J. R. Loome explained the systems, saying:

"MAN works on the principle of relating magnetic north to the distance and direction the vehicle has traveled from a known point. Because it relies on magnetic north, heavily armored vehicles, such as the tank, cannot use MAN. Therefore, GAN (Gyro-Compass Automatic Navigation), which substitutes the Magnetic North-seeking compass with a True-North seeker, is also begin tested by CDC.

"Both systems use common pieces of equipment: North-seeking sensing devices, a computer, a vehicular power convertor, and a map board. Each can pinpoint both direction and location on the map board, as well as supply map coordinates within an accuracy of less than two percent."

In MAN-GAN, a North-seeking sensor relates itself to the direction of travel and distance traveled. Regardless of which direction the vehicle turns, its relationship to north is constantly known. In addition, an onboard computer cross-checks the direction with the distance traveled and displays an 8-digit map coordinate readout of the vehicle's position. At the same time, the vehicle is visually tracked on a map board.

Prior to leaving the starting point, the commander relates the known location and vehicle attitude to the computer and map board. An illuminated dot on the map board represents the vehicle location and an illuminated arrow the direction.

As the vehicle moves over the terrain, regardless of whether it is rough or flat, the dot and arrow move accordingly. Thus, the commander is not only supplied with a digital map coordinate of where he is, but he can also see, on the map board, his exact location.

The field evaluation of both devices will examine tactical performance of combat elements in tank, infantry, self-propelled artillery and armored cavalry units. MAN is intended for installation in most types of wheeled vehicles and thin-skinned armored vehicles. GAN is designed for use in tanks and tank retrievers.

The evaluation will consist of three 48-hour field exercises for each type unit. Repetitive tests are necessary to assure validity of the evaluation results. Specially trained crews of the Army Materiel Command will assist in instructing more than 250 personnel in use of the equipment. CDC personnel will monitor evaluation procedures.

TROOPS will subject Map Position and Heading Plotters to field evaluation tests at Fort Carson, Colo. Arrow indicates Heading Indicator in jeep.

Deputy CRD Rowny Discusses R&D Problems, Policies, Budgetary Challenge

Pruning skill comparable to the precision of a surgeon's scalpel is required in adjusting research and development programs within constraints of budgetary cutbacks, and accepting the challenge to get the "most from the R&D dollar."

Deputy Chief of Research and Development Maj Gen Edward L. Rowny expressed that viewpoint to personnel of the Combat Service Support Group at Fort Lee, Va., in discussing the need to produce quality materiel and equipment with less R&D money.

Invited to Fort Lee by Brig Gen Ross R. Condit Jr., CG of the Combat Service Support Group, General Rowny presented his views on programs, policies and current R&D trends. Prudent fiscal trimming and reorienting of projects, he stressed, must ensure that essential goals are sustained.

Under examination are such policies as the desirability of stockpiling inventory, the innovative versus product improvement dilemma, the reorientation to basic rather than production research, and the whole spectrum of the weapons acquisition process.

General Rowny said the innovation versus product improvement question is especially difficult and ambiguous because there are no clear criteria with which to decide when a product should be improved or when it should be discarded for a more innovative one.

In stressing the need for competent, dedicated personnel in the R&D programs, he said he would initiate the "corporate vice president" concept whereby each project officer is given increased responsibility to enhance professional satisfaction. High integrity and willingness to follow up intensely their ideas must be among prime assets, he stated.

Although Army R&D is "machine-oriented" necessarily, he emphasized that technology is subordinate to the human factor and that the focus must constantly be also on human goals.

One of the sticky dilemmas in R&D, in his view, is that of risks involved which precent guarantees of perfection, and "avoiding creation of needs when the intention of R&D is to fulfill needs of a quality Army."

General Rowny predicted some trends future R&D would follow, including greater emphasis on effective ways of testing so as to insure the efficiency of a product; also, efforts to reduce the "gestation period" from concept of a new idea to fruition in a finished R&D product.

For an invigorating environment in research, he suggested a special R&D Sixth Commandment: "Thou shalt steal!" This dictum, he said, means that all new and fresh ideas should be used to improve the Army R&D program.

3 Nations Exchange Views On 155mm Standardization

Representatives from the United Kingdom, Federal Republic of Germany and the United States convened Feb. 10–12 to discuss programs and planning related to standardizing 155mm weapons and ammunition.

Substantial progress was reported toward attaining the ultimate objective of producing cannons and ammunition which will permit any complete (fuze, propellant, projectile) round of one nation to be fired safely and effectively from any new 155mm weapons of the nations concerned.

Present for the first meeting of its kind ever held at Picatinny Arsenal, Dover, N.J., were representatives from the U.S. Army Combat Developments Command, HQ U.S. Army Materiel Command, Army Munitions Command, and the arsenal.

Brigadiers Geoffrey Burch and Fred Ward were the senior delegates from the United Kingdom; in the same role for the FRG were Col Otto Wohlfeil and Otto Seehaus. Frank Grossman, deputy project manager, Close Support Weapons, Rock Island (Ill.) Arsenal, was presiding chairman. Joseph Caporaso, 155mm commodity manager, was principal Army Materiel Command and Picatinny Arsenal representative.

AMMRA Picks SRI Scientist as New Director

Director of the Army Materials and Mechanics Research Center, Watertown, Mass., is the new title of Dr. Alvin E. Gorum, who has been director, Materials Science Division, Stanford Research Institute since 1961.

Army Chief of Research and Development Lt Gen Austin W. Betts announced the appointment of Dr. Gorum, who has distinguished himself as a teacher and as a research scientist. With AMMRC he will direct about 650 employes, one-third of them scientists and engineers.

While studying for his doctorate in materials sciences at the University of California at Berkeley (1956–59), he served as an associate research engineer. He was in charge of a group concerned primarily with investigating mechanical properties of ionic solids.

Graduated from the University of Arizona with a BS degree in metallurgy in 1950, he served as an instructor in physics and metallurgy while studying there for his master's degree (1951–54). The next two years he was a staff member with the Los Alamos Scientific Laboratory.

Prior to accepting an appointment with Stanford Research Institute, he was director of materials research with Rheem Semiconductor Corp. (1959–61). He has specialized in the mechanical and electronic properties of materials, dislocation phenomena, and high-temperature materials.

While studying at the University of California, he was in charge of a group doing research on the mechanical character of ionic solids. At the Los Alamos Scientific Laboratory, he was responsible for reactor fuel alloy development and fabrication.

Dr. Gorum is a member of the American Society for Metals, the American Ceramic Society, Tau Beta Pi and Sigma Xi.

DIRECTOR of Army Materials and Mechanics Research Center, Dr. Alvin E. Gorum, is sworn in by Frederick J. Boyd, chief, AMMRC Personnel Div.

CHIEF OF R&D Lt Gen A. W. Betts and Dr. Robert B. Dillaway, Deputy for Laboratories, U.S. Army Materiel Command, visited the Army Materials and Mechanics Research Center (AMMRC), Watertown, Mass., to welcome Dr. Alvin E. Gorum, new director, and to observe and discuss AMMRC programs. Examining test specimens in the Beryllium Laboratory are (from left) Col George Nabors, director of the AMC Advanced Materiel Concepts Agency, who accompanied General Betts; Dr. Gorum; Lt Col Joseph B. Mason, AMMRC deputy director and CO; General Betts; Dr. Dillaway; Dr. L. A. Shepard, F. J. Rizzitano and E. M. Shebeck, all members of the AMMRC scientific and engineering staff.

3 U.S. Armed Forces Emissaries Participate in Japan Student Science Awards

International good will at the "grass roots" level of exceptionally talented teenage scientists was stimulated successfully by three U.S. Armed Forces representatives during "Operation Cherry Blossom" visits to the 13th Annual Japan Student Science Awards in Tokyo, Jan. 13–23.

Prince and Princess Hitachi were among numerous high-ranking Japanese officials, scientists and educators at activities where Marilyn Sue Miles, William J. Synhorst and Jean C. Lauricella turned on the charm that, with their research exhibits, made them youthful good-will emissaries.

The Army selected Miss Miles, the Air Force chose Miss Lauricella and the Navy picked Synhorst for research exhibits and the personality they demonstrated at the 20th International Science Fair in May 1969. They were chosen from 391 young researchers at Fort Worth, Tex.

In the Japan Student Science Awards, however, the American trio did not compete for prizes. Their purpose was to demonstrate to visitors to the exhibit the high caliber of research by U.S. high school students, and to manifest sincere good will in the process.

"Operation Cherry Blossom" was initiated by the U.S. Armed Forces when they selected representatives to attend the Japan Student Science Awards for the first time in 1963. The awards are sponsored by the *Yomiuri Shimbun*, Japan's second largest newspaper (circulation 4,500,000) and the All Japan Science Education Promotion Committee.

The remarkable success of that first venture, as evidenced by the warmhearted response of Japanese science students and adults to the visit, laid a firm foundation upon which to build a steadily stronger structure of mutual respect and esteem with each succeeding year of the effort.

Judged by the enthusiastic response to this year's representatives, as reported by U.S. Army escort officer Jack B. Fenn, they may have achieved a new peak of American student popularity among the Japanese. The Army and Navy rotate each year in providing escort officers, while the Air Force carries continuing responsibility for on-site planning in Tokyo.

Joyous spontaneity to the challenge of changing situations during a jampacked schedule of activities was the keynote of the American trio. For example, eating raw fish dipped in soy sauce was experienced for the first time with outward grace and indication of delight.

ARMED FORCES REPRESENTATIVES at Japan Student Science Awards visit HQ U.S. Army Japan (USARJ) Command. From left are Maj Gen John A. Goshorn, USARJ CG; Jean C. Lauricella, representing the U.S. Air Force; William J. Synhorst, U.S. Navy; Marilyn Sue Miles, U.S. Army; and Col Bryce C. Walton, Commander, U.S. Army Research and Development Group, Far East.

"Science is fun" exclaimed one of the trio as the fish was consumed with gusto. It became the byword and a source of mutual laughter as they adjusted to Japanese customs in overnight visits to homes and in other activities.

The program arranged for them by the *Yomiuri Shimbun* included visits to the Tokyo Museum, the Sony (radio, TV and electronics) Factory, Yomiuri Land (the Japanese version of Disneyland), the beautiful Hakone National Park, and a Japanese high school.

Dohjun Hashimoto was the key man in promoting the Japan Student Science Awards for the *Yomiuri Shimbun* in his dual capacity as executive director and also director of the newspaper's Cultural Promotion Division. The American students visited his office.

The remainder of their itinerary, arranged by the U.S. Air Force, included visits with Maj Gen Louis E. Coira, deputy CG of the U.S. Forces Japan; David L. Osborn, minister-counsellor, U.S. Embassy in Tokyo; Maj Gen John A. Goshorn, CG of the U.S. Army Japan, and Capt Arthur R. Hawkins, CO, Atsugi Naval Air Station. They also visited the *Pacific Stars and Stripes*, U.S. Armed Forces newspaper, and the Far East Network of U.S. Armed Forces Radio Service.

One of the friendships they formed may be resumed in personal associations at the 1970 International Science Fair, May 10–15, in Baltimore, Md., when Miss Yuko Enaka, 17, and Junichi Yasumoto, 18, will be Japan's representatives sponsored by the *Yomiuri Shimbun*.

Miss Enaka, a student at Tokyo Metropolitan Hakou High School, was chosen for her exhibit titled "Influence of Metal Ions on the Formation of Nickel Ammine Complex Salt." Yasumoto, of Shizuoka High School, exhibited "A Study on the Relation of Mountain Form and Plain Form of *Neope Menetries*."

Exhibits displayed by the American trio attracted a great deal of attention from both juvenile and adult visitors to the Japan Student Science Awards. Marilyn Sue Miles explained her research project on "The Golden Section in Nature—An Application of the Fibonacci Sequence to Nature," which established the growth factors in leaf structure. She is now a student at West Liberty (W. Va.) State College.

Synhorst, now a freshman at Iowa State University of Science and Technology at Ames, displayed a computer and robot experiment, "Associative Learning from Relative Environmental Data." The robot, "Alfred," demonstrates a form of trial and error machine learning.

The Japanese were intrigued as "Alfred" showed his capability of moving along a horizontal path, learning to avoid objects in the way, and picking up small objects with his "arms." Without doubt, "Alfred" was an outstanding attaction.

Miss Lauricella, a freshman at Caldwell (N.J.) College for Women, showed her project titled "Osteoid Demineralization of the Chick Embryo Skeletal Structure by Five Cycline Compounds." Completed over a 2-year research effort, the project proved that cycline drugs, if taken by a female during the initial stages of pregnancy, could have an adverse effect on the tooth and bone structure of the developing fetus.

The good will that developed among the American students and several of their Japanese counterparts may lead to enduring friendships through promises of maintaining correspondence. Memories of the "Science is fun" laughs they shared undoubtedly will be cherished for many years.

Kudos

MERITORIOUS CIVILIAN SERVICE. *Frank Shanty*, Edgewood (Md.) Arsenal, received the MCS Award for "providing leadership in the programs to develop detectors for chemical agents and for concealed enemy personnel."

The chief of the Detection and Warning Laboratory of the Defense Development and Engineering Laboratories was cited for efforts that "resulted in molding the chemical detection and warning program for the United States into a model of excellence, totally responsive to modern Army concepts of research and development and end item life cycle control."

Shanty earned BS and master's degrees in chemical engineering from Johns Hopkins University (1943 and 1953), and has a master's degree in hygiene from the University of Pittsburg (1960). He has been employed by the Army since 1950.

Luther C. Marsalis Jr. received the MCSA for outstanding managerial and supervisory abilities at the Waterways Experiment Station (WES), Vicksburg, Miss., where he has served 23 years as civlian personnel officer.

The award citation states that due to his "highly competent supervision, the specific needs have been consistently met, many times in the face of great hardships, such as manpower restrictions, nonavailability of technically trained and qualified personnel, and a lack of interest in Government employment." He was instrumental in the establishment of the Vicksburg Center, a branch for graduate study of Mississippi State University.

OUTSTANDING SERVICE. *Dr. W. Paul Havens Jr.* received the Outstanding Civilian Service Award from Lt Gen Hal B. Jennings Jr., The Army Surgeon General, during the February meeting of the Armed Forces Epidemiological Board (AFEB).

Dr. Havens has served since 1947 on the AFEB Commission on Viral Infections (formerly the Commission on Viral and Rickettsial Diseases) and the Commission on Liver Diseases.

His interest and research on the epidemiology of hepatitis began while in military service in Egypt and Germany during and following World War II. Subsequently, he was a consultant to the chief surgeon, European Command.

Dr. Havens is professor of clinical microbiology and medicine at Jefferson Medical College in Philadelphia, Pa. He is a 1936 graduate of Harvard Medical School and was Board Certified in medicine in 1944.

MEDITORIOUS SERVICE MEDAL. *Lt Col Howard B. Blanchard Jr.* received the MSM for service as deputy project manager of FLAT-TOP at U.S. Army Materiel Command headquarters.

The citation states in part: "Col Blanchard was instrumental in the conceptual planning, studies, programs and organization of resources, and training for Floating Army Maintenance Facilities for contingency support of U.S. Army Forces overseas.

"His vision, tireless efforts . . . were key factors in the development of an outstanding program for the future as well as providing, through USNS Corpus Christi Bay, vital means for support of Army aviation in Vietnam."

The award was presented by Col Arthur T. Surkamp, project manager, Night Vision, Fort Belvoir, Va., where Col Blanchard is deputy project manager for night vision.

ARMY COMMENDATION MEDAL. *Col Edwin S. Stenberg Jr.* received the ARCOM for service with the U.S. Army Hospital at Landstuhl, Germany, 1966 to 1969.

Since last summer he has been assigned as chief, Professional Inquiries Office, Office of The Surgeon General, U.S. Army, and commanding officer, U.S. Army Dispensary at the Forrestal Building in Washington, D.C.

Col Stenberg interned at the California Hospital in Los Angeles following graduation from Temple University Medical School. His residency in internal medicine was served at Fitzsimons General Hospital in Denver, Colo. He became a Diplomate of the American Board of Internal Medicine in 1957.

COMMENDATIONS. Office of the Chief of R&D, HQ DA, certificates for Outstanding Performance Ratings were awarded recently as follows:

Technical and Industrial Liaison Office. Marsha J. Rotosky, Walter Willis and Leslie S. Davis. Willis and Davis also received Certificates of Achievement.

Office of the Executive for Administration. Nora L. Comer (with salary Quality Increase), Cathleen R. Durkin, Mildred N. Kern, Mary Elizabeth Heinbuch and Marvin R. Wren.

Director of Plans and Programs.

USAETL Chemist Earns Award From Belvoir Branch of RESA

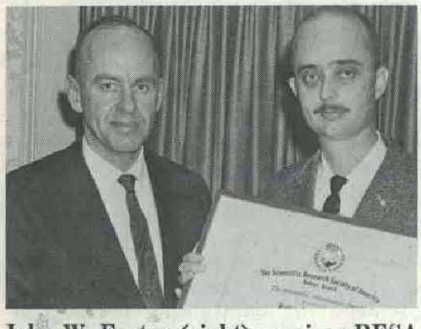
Innovative research on effects of molecular structure on basicities of nitroaromic amines has earned John W. Eastes the 1969 Scientific Achievement Award from the Fort Belvoir (Va.) Branch of the Scientific Research Society of America (RESA).

Eastes is a chemist in the Topographic Engineering Division of the U.S. Army Engineer Topographic Laboratories (USAETL) at Fort Belvoir. He specializes in the research and development of new material, methods and techniques in the fields of mapping and surveying.

The award, consisting of a hand-scripted certificate and a technical book, or books (of the recipient's choice) valued up to $25, was presented by Lt Col David T. Baker of the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir.

Eastes entered Civil Service in 1963 and was employed at the Ames Research Center, National Aeronautics and Space Administration, until he transferred to the USAETL in 1964.

He received BA and BS degrees from Texas University in 1963 and earned a master's degree in chemistry from American University in 1969.



John W. Eastes (right) receives RESA 1969 Scientific Achievement Award from Lt Col David T. Baker, MERDC.

NATIONAL SAFETY COUNCIL Award of Honor is presented to the U.S. Army Electronics Command (ECOM) for the second consecutive year, with ECOM CG Maj Gen Walter E. Lotz Jr. receiving the plaque from NSC regional representative George Grotz. ECOM safety officer Bernard M. Savaiko participates as observer.

Beatrice Newkirk (with Sustained Superior Performance Award).

Director of Developments. Evelyn L. Vincent (with Sustained Superior Performance Award).

Director of Missiles and Space. Joan M. Smith and Mildred Wagnon (both with Sustained Superior Performance Awards).

Army Research Office. Dr. Ivan R. Hershner Jr., Dr. Francis W. Morthland, Dr. Eugene M. Sporn, Dr. Robert B. Watson, Dr. Valentine E. Zadnik, Frances L. Whedon, Patricia A. Vermette (with Sustained Superior Performance Award), Ruthe I. Vaughn, Sylvia S. Gladsden, Margaret R. England, Harriet B. Doyle, Vera B. Brown and Lura H. Ferrone (with Sustained Superior Performance Award).

Information Systems Office. Robert Chaillet, David Nemore and Ann G. Taylor.

AATT Awards 1970 Bronze Medal To Natick Labs Clothing Director

Dr. Stephen J. Kennedy, director of the Clothing and Personal Life Support Equipment Laboratory, U.S. Army Natick (Mass.) Labs, is the recipient of the 1970 Bronze Medal of the American Association for Textile Technology.

Dr. Kennedy was honored with the award at AATT's 10th annual conference, Feb. 4, in New York City. He is the first Army employe among seven recipients to be recognized for outstanding service to the association and to the textile industry over a long period of time.

For the past quarter century, Dr. Kennedy has served as head of the Army's research and development program on military uniforms, protective clothing, handwear and footwear, personal equipment and leather and textiles. His responsibility has extended to development of body armor and helmets, and research and development on Armed Forces common-use items.

ASM Appoints 3 Army Medics to New Periodical Board

Three U.S. Army medical investigators known for scientific achievements and publications are recent appointees to the editorial board of *Infection and Immunity*, an American Society for Microbiology periodical which made its first appearance in January.

Dr. Fred E. Hahn is chief, Department of Molecular Biology, Walter Reed Army Institute of Research, Washington, D.C. Dr. Carl Lamanna has served nearly 10 years as deputy chief, Life Sciences Division, Army Research Office, Office of the Chief of Research and Development, HQ DA. Dr. George G. Wright is in the Directorate of Medical Investigation, Biological Laboratories, Fort Detrick, Md.

Established as the successor to a corresponding section of the *Journal of Bacteriology*, in recognition of the rapid increase in the number of investigators in this field, *Infection and Immunity* is devoted to the advancement and dissemination of fundamental knowledge concerning:

- Pathogenic microorganisms, particularly, but not exclusively, bacteria and fungi.
- Infection and its pathogenesis as well as host factors.
- Antimicrobial agents and chemotherapy.
- Immunity, humoral and cellular.

Ottoson Heads Picatinny Tech Services Directorate

Picatinny Arsenal, Dover, N.J., has established a Technical Services Directorate, comprised of more than 500 personnel under the direction of Karl Ottoson, to consolidate engineering-type services.

Another stated objective is to provide more efficient utilization of Picatinny Arsenal elements and give prompt support to research and engineering activities. The TSD is responsible for testing and evaluation, and preparation of engineering documentation, design and drawing information.

TSD's mission also includes design of telemetry components and systems to provide information on the performance of missiles and conventional ammunition during the evaluation process.

The directorate absorbed certain activities which were under other directorates, notably the technical information library and the museum of the Feltman Research Laboratory, and the Engineering Services Division and the telemetry section of the Nuclear Engineering Directorate.

TSD Director Ottoson is a graduate of Upsala College with a degree in chemistry and has been employed at the Arsenal since July 1941, except for duty as an Army officer in the Chemical Warfare Service during World War II.

Ottoson is credited with inventing a plastic explosive known as "C–4" used as a standard demolition by the Armed Forces. He has been awarded patents for several inventions.

Karl Ottoson

Almost Like Science Fiction

Dr. Zahl's Tales of Army Scientist Market Broadens

Retirement after 35 years of pioneering research and development in the field of communications and electronics, leading to international renown and numerous honorary distinctions, might be the avenue to a life of ease for most U.S. Army scientists.

Dr. Harold A. Zahl, however, is finding an increasingly wide market for fascinating accounts of his experiences as an Army scientist. When he retired in January 1966 because of ill health, the former director of research at the U.S. Army Electronics Command Laboratories actually did lead the easy life—for a few months.

Since the publication of his robustly humorous book, *Electrons Away or Tales of a Government Scientist*, he is burgeoning big as an author in *Signal* magazine and other periodicals.

Signal has carried seven of his articles during the past year: "Bombs, Bullets and Electrons," February 1969; "Truth Takes a Holiday," April; "Nights and the Daze of Las Vegas," July; "Ohm's Law, a Foolish Regulation," September; "Line-of-Sight Shiboleth," November; "Now Less Seriously," December; "Invention of the R&D Contract," February.

Frequency Technology published his "That Fourth Dimension" in April, 1969, and *Physics Today*, in the same month, carried "Of Highest Order." Scheduled for early publication are "1937—A New Device to Detect Aircraft"; "The Baptism of Bixby's Baby"; and "The Secret Everyone Knew."

Awaiting decision of prospective publishers are "A Gift From Hell's Angels"; "History Hung in the Balance"; and "The Saga of the VT–127." In preparation is "The Innovation of a Secret Tube," giving the background for the so-called "Zahl Tube" during the early days of radar development.

That envisioned life of ease in retirement is still that to Dr. Zahl! Perhaps he is mindful of the saying popular among many scientists seeking acclaim, "Publish or Perish."

TACOM System Promises Improved Armored Vehicles Vision

By Donald W. Rees

Chemical, biological and radiological effects could be far more disastrous to unprotected troops on tomorrow's battlefield than the casualties caused by conventional weapons. Far beyond the range of direct damage, and perhaps miles from the enemy, precautions must be taken to minimize these possible effects, which hopefully never will materialize.

In this type of environment, a sealed combat vehicle provides a ready refuge, and tanks with CBR protective capabilities will play an important combat role. Sealing the crew compartment precludes the use of open-hatch viewing by the tank commander, however, and an alternate vision system must be provided if combat effectiveness is to be maintained.

Designers of tomorrow's vehicles are, therefore, faced with the problem of providing the crew a wide field of view of the area surrounding a vehicle through relatively small sealed openings in the vehicle armor.

A new panoramic viewing device developed at the Physical Sciences Laboratory, U.S. Army Tank Automotive Command (TACOM) offers an experimental solution to this problem. This innovation produces a distortion-free image over a 60-degree vertical and 360-degree horizontal field of view, and requires only a small hole in the vehicle armor.

The device has demonstrated distinct advantages over conventional, fixed-field and gimbaled camera-monitor systems. In its panoramic viewer, a single camera and monitor provide coverage of the entire field of view required for vehicle operation. Well protected, the commander and crew may view the terrain projected completely around them, or any special area, just as if they were perched atop the turret.

The wide field of sight also provides the operator with the peripheral vision necessary for depth perception. Addition of a phase-reversal circuit in the monitor-deflection electronics enables the operator to reverse the scene image inside the viewing screen by simply depressing a switch; he can see directly behind him, much as he might by using a rear-view mirror.

Moreover, the viewer inherently incorporates night vision, nuclear and laser flash-blindness protection, and range and azimuth determination capabilities.

The concept for the device resulted from consideration of the geometrical relationship between the hyperbola and the ellipse. In its simplest form, the relationship can be explained by reference to Figure 1. Here the two conic sections share a common axis, and the external focus of the hyperbola is coincident with the external focus of the ellipse.

A ray passing through the inner focus of the hyperbola will strike the hyperbolic surface at a given point and a given angle of incidence. A ray constructed from that point at an equal angle of reflection will pass through the coincident outer focus and strike the elliptical surface at an incidence angle. If the figures have reciprocal eccentricities, the reflected ray intercepts the inner focus of the ellipse.

Careful examination of the figure reveals that the ray approaching the inner focus of the hyperbola at a given angle to the common axis makes the same angle to that axis at the inner focus of the ellipse, but it is rotated 180 degrees on the common axis from the original direction.

If the geometrical model is replaced by reflecting hyperboloidal and ellipsoidal surfaces, and an aperture stop is placed at the coincident focal point, a ray of light from a detected object in the field directed toward the inner focus of the hyperbolic mirror is reflected through the aperture stop. It is then re-reflected into the inner focus of the ellipsoid.

An observer located at this exit pupil views an exact duplication of the original scene surrounding the entrance pupil at the inner focus of the hyperbola.

The insertion of light amplification into the viewer (Figure 2) is required to allow relative displacement between the hyperboloidal image collector and

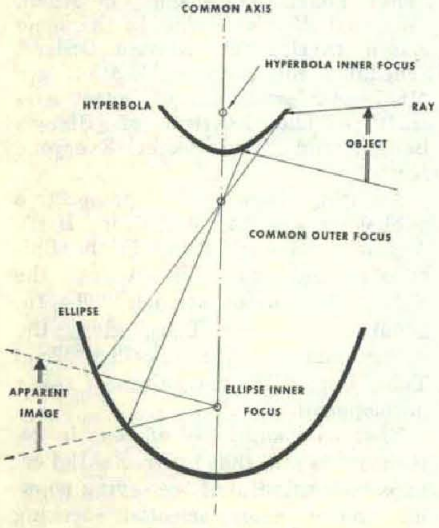


Figure 1

DONALD W. REES, researcher in the Physical Sciences Laboratory, U.S. Army Tank Automotive Command, Warren, Mich., specializes in optics and acoustics. He earned a BS degree in electrical engineering (1958) and an MS degree in physics (1958) from Wayne State University in Detroit.

the ellipsoidal screen, and to overcome the depletion of scene brightness caused by light losses. These losses are due to the insertion of aperture stops in the camera and projector lenses, and the relative difference in size between the image-former and viewing screen.

The elliptical viewing screen surface was modified to produce an exit pupil of sufficient size to include both of the observer's eyes. This modification caused additional losses of image brightness, further necessitating the need for light amplification.

Motion picture equipment provided the needed amplification in the first model constructed for feasibility determination. Because of the need for real-time image reproduction, it has been replaced by a closed-circuit, high-resolution, projection-type television system.

This system, with the image-former,

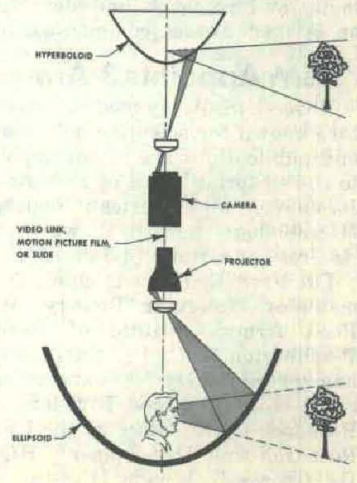


Figure 2

the viewing screen and the required optics (Figure 3), has been installed on a modified M–151 ¼–ton truck chassis for testing and evaluation as an aid to vehicle operation and close order surveillance.

If current tests indicate that the viewer meets the necessary requirements, a development program will be undertaken to reduce the size and weight of the electronic package; also, to investigate a viewing screen occupying less volume than the present one and the incorporation of target acquisition capability. Preliminary studies indicate these goals may be readily accomplished.

Potential applications for the panoramic viewer reach far beyond armored vehicles, such as an on-board helicopter viewing system to aid the pilot in station keeping, landing and air rescue. Another suggestion is a remote-area surveillance system to provide visual monitoring of a large area. Under study is the possibility of using a similar device in a flight training simulator, in cinemagraphic entertainment, and as an aid to unmanned space exploration.

Figure 3

Tests performed on the M151-installed system are providing valuable data input to advance these envisioned applications.

Army Research Office Library Lists 3 New Publications

New books added recently to the Army Research Office library through publisher's submissions of review copies to the *Army R&D Newsmagazine* include: *Ion-Selective Electrodes; World War II, A Compact History*; and *Great Weapons of World War I.* The library is in the Highland Building, 3045 Columbia Pike, Arlington, Va.

Ion-Selective Electrodes, Special Publication 314 of the National Bureau of Standards, U.S. Department of Commerce, is the proceedings report of a symposium held at HQ of the NBS in Gaithersburg, Md., Jan. 30–31, 1969. More than 450 scientists representing a broad spectrum of industrial, governmental and educational institutions attended the symposium, which provided a critical state of-the-art evaluation on ion-selective electrodes.

The foreword states, in part, that "Those interested in recent innovations in the area of quantitative electroanalytical chemical will find this book on the non-glass ion-selective electrodes to be a very comprehensive source of information."

Richard A. Durst, NBS Institute for Materials Research, edited the proceedings, available at the Library of Congress, Catalog Card No. 79–601302. The document is on sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Order by SD Catalog No. C13.10:314), price $3.50.

World War II, A Compact History is the work of Col R. Ernest Dupuy, an eminent military historian and professional soldier, in presenting new facts about the politics of this war. The book provides a detailed discussion of Operation Bodyguard, the plan designed to delude the Germans about the Allied invasion of the European continent.

Published by Hawthorn Books, Inc., 70 Fifth Avenue, New York, N.Y. 10011 (price $6.95), this review of history-making events also includes an account of the near-panic in the United States caused by a veil of secrecy during the Battle of the Bulge.

Col Dupuy served in both World Wars and was General Eisenhower's public relations chief at Supreme Headquarters Allied Expeditionary Forces in France. He has authored or coauthored 18 books.

Great Weapons of World War I, is authored by William G. Dooly Jr. and published by Walker & Co. for the Army Times Publishing Co. (price $14.50). Although not intended to depict or describe all the weapons used in this conflict, the book is hailed as the most comprehensive work to date. It is a companion volume to Walker's *Great Weapons of World War II.*

Illustrated are important weapons and system developments in World War I, from hand guns to aircraft through artillery, machineguns, grenades, poison-gas cylinders, tanks, trench defenses, battleships and submarines.

Atomic Energy Officer Program Hailed as Rewarding

Strong endorsement of the U.S. Army Atomic Energy Officer Program comes from a recent brigadier general designee, Col Alvin C. Isaacs, who enrolled in the program in 1953.

In a recent letter to the chairman of the Atomic Energy Officer Program Consultant Board, Col Isaacs commented:

"Atomic energy specialization gave me a series of extremely rewarding assignments during the 1953–1961 period. I believe my specialization gave the initial impetus toward the series of increasingly responsible assignments since then. I wholeheartedly recommend it to qualified officers."

Currently assigned as deputy commander, U.S. Army Tank Automotive Command, Col Isaacs started his Army career in 1942 with the Chemical Warfare Service. During World War II, he served in North Africa and Italy.

Assignments have included duty as an instructor in the maintenance and employment of atomic weapons at Sandia Base, N. Mex.; Ordnance staff officer, HQ Eighth U.S. Army; R&D duty with the Office, Chief of Ordnance; and chief, Operations Division, Watervliet (N.Y.) Arsenal.

Col Alvin C. Isaacs

In 1966–67 he was chief, G4 Plans and Operations Division, U.S. Army Vietnam and subsequently served 2½ years as Army Project Manager-Rifles. He was responsible for design, production and distribution of the M16 rifle and related small arms.

Col Isaacs is a graduate from the University of Kentucky (1941); Ordnance Officer Career Course (1951); Command and General taff College (1957); Army War College (1966).

While enrolled in the Executive Program of the Chicago Graduate School of Business, from which he was graduated in 1963 with a master's degree in business administration, he worked two years with five major Chicago corporations for indoctrination on industrial management methods.

ILIR Reports Reflect In-House Mission Capabilities

(*Continued from page 8*)

the possibilities of using a laser source for spectrochemical analysis; a project to rear guinea pigs free of antibodies to the psittacosis group of microorganisms; and studies resulting in a number of classified reports on antigen-antibody reactions.

Tropical Test Center studies of personnel detection devices to improve jungle combat capabilities included accumulation of data on auditory thresholds in various conditions of jungle canopy; and measurements of personnel for human engineering of materiel and equipment.

WSMR investigated reactions of energetic electrons produced by the Gamma LINAC with matter in the nuclear, atomic and aggregate states; orientation of a target through high-range resolution radar cross-section measurements; new techniques for determining the neutron spectrum, neutron dose, gamma spectrum and gamma dose from the Fast Burst Reactor, Gamma LINAC, and Neutron Generators; and

Methods of correcting tropospheric refractor error in trajectory measurements; investigating range instrumentation problems to which methods of numerical analysis can be adapted or for which new numerical methods are needed; and developing a working knowledge of basic lens design and of the computer techniques and programs used in design and analysis of optical components and systems.

Electronic Proving Ground ILIR investigators qualitatively identified human factors in various environments as correlated to reliability and maintenance of VRC–12 and PRC–25 radio sets.

Other EPG efforts were directed to improved optical measurement methodology, and advancing the state-of-the-art knowledge of propagation phenomena; evaluation and development of techniques for measurement of laser lines; and interface mounts for the laser-modulator-polarizer-collimator components (mounts have been designed and fabricated).

AMC Weapons Command listed 16 ILIR work-units at the Benet Research and Engineering Laboratories, and four at Rock Island Arsenal. One of the Benet projects, in collaboration with Dr. G. A. Miller of Bethlehem Steel Homer Research Labs, was a study of fatigue crack initiation, rate of propagation, and critical size functions of cyclic life, stress level and material properties.

Other Benet ILIR research probed the effect of stress-aging on tensile properties of two titanium alloys; the validity of the vacancy mechanism for self-diffusion in metals, and techniques for making diffusion measurements; vaporization and condensation behavior of materials (metal and compounds) at high temperatures (up to 10,000° C); and effects of surface and interfacial energies on mechanical behavior of dispersion-strengthened alloys.

In the Rock Island Arsenal laboratories, one ILIR study was concerned with conductive heat transfer resistance of compound barrel interfaces in weapons. Another task attempted to apply laser holographic techniques to artillery and small arms problems associated with wear, vibration and stress. A report was prepared on a project to develop instrumentation and techniques for remotely measuring operational temperatures of stationary and moving gun barrels.

Army Corps of Engineers ILIR projects at the Cold Regions R&D Laboratory, 15 in all, were concerned principally with studies of rock mechanics, frozen ground and ice conditions as pertinent to military operations; freezing and thawing phenomena in lakes; stability of rock slopes and certain geological and mechanical conditions; defining a wide variety of maintenance problems encountered in the cold regions; and

An effort to provide a more valid basis for estimating temporal variation of stream runoff and flood frequency for streams in interior Alaksa; and a study to determine natural laws governing chemical reactivity of soil mineral surfaces as they relate to adhesion, surface catalysis, corrosion, adsorption and degradation of various chemical species of military significance, including reaction kinetics at soil-water interfaces.

Other CRREL projects supported with ILIR funds included an effort to obtain reliable test data suitable for development of new methods of foundation construction for U.S. Army, Navy and Air Force facilities in cold regions; also, a project to develop design methods and criteria for underground rooms in permafrost for storage of materials and for protection and occupancy of personnel and equipment of U.S. Army, Air Force and Navy for military purposes in arctic and subarctic areas.

In the Engineer Topographic Laboratories, the ILIR efforts included a project to improve reliability of barometric methods of ground control survey; research to design and develop a laser gravimeter; and improving mapping technology as relevant to planning for lines of communication, specifically highway foundations, such that the map units will have quantitative significance in terms of engineering properties.

The Waterways Experiment Station (WES) extremely wide-ranging ILIR program (32 work-units) literally "covered the water front"—as relevant to the Corps of Engineers military and U.S. Government Civil Works Program responsibilities for improving and maintaining capabilities for efficient use of the nation's water resources (rivers, coastlines, harbors, etc.).

WES studies, however, ranged deeply into other Corps of Engineers mission-oriented areas including construction problems (such as better protection from the hazards of radiation), reinforced concrete technology, soil stress and dynamics studies relevant to military mobility and construction requirements; and

Mathematics modeling related to hydraulic problems; studies of strain in various mixes of concrete during the hardening process, to improve quality through more knowledgeable precise blending of controlling admixtures for a wide range of requirements; and

A project to develop capability through use of the WES Calcomp plotter to automatically plot topographic contours, stress contours, and contours of complicated mathematical functions; and a project to develop computer programs that can be used to solve differential equations application to WES studies.

In the Medical R&D Command, Office of The Surgeon General, the Walter Reed Army Institute of Research was responsible for the "lion's share" of ILIR effort. WRAIR investigations included animal studies of effects of chronic nutritional deficiency (related to man) of metallic trace elements, with emphasis on detection of long-term degenerative processes; and

A project to obtain definitive information on biologic characteristics of various types of antiviral antibody so as to determine their significance in immunity in man; investigation of genetic and metabolic alterations in cell populations surviving injury; efforts to determine effects of physiological and psychological stress upon infection and disease; and

A project to characterize the intestinal lesions of tropical sprue and infectious hepatitis, and to attempt to identify the virus particles in specimens from patients with these diseases; a study of quantitative aspects of growth of malaria parasites in terms of rate of synthesis of protein, lipids and nucleic acids; and

A project for antigenic analysis of

dengue viruses, with particular reference to the classification of wild viruses recovered in various parts of the world; detailed epidemiologic studies in Thailand of certain traits, including various hemoglobins and blood enzymes, as they may relate to susceptibility or resistance to selected epidemic diseases; and

A study of retrieval of biological research information as support for laboratory investigations and to provide, in a readily accessible form, all data contained in the Tropical Diseases Bulletin, Voumes 1 through 63; an effort to determine the role of migrating animals in the transport of diseases; and

A project to develop a computer system to create, maintain and index the abstracts from the Tropical Disease Bulletin; an effort to define, study, diagnose and control known and potential infectious diseases of military dogs in Southeast Asia; a related study of these dogs during procurement, training and utilization; and a project to adapt newly developed surgical procedures to the combat situation, and to develop additional surgical techniques and procedures as required.

ILIR activities engaged in by the Behavioral Science Research Laboratory (BESRL), now a part of the new U.S. Army Manpower Resources R&D Center, included projects concerned with exploring experimentally the promise of indirect measures of aptitude, and developing techniques for indirect measures for operational use; and

An effort to extend classical theory in psychometrics to free response situations in which the concepts of reliability, validity, and inter-rater agreement are applicable, but with additional complexity in the model; a project to integrate classical theory in psychometrics with theory and techniques derived from mathematical statistics, operations research and computer science—objectively for optimal design for simulation (and war gaming) experiment; and

A project to explore experimentally the promise of unconventional techniques of test programing (equipment has been selected and assembled, special circuitry developed, and software completed); and an effort to determine how and to what extent covert response systems can be employed usefully and reliably to enhance human performance, particularly in military operations.

Lance, Chaparral Meet Test Objectives at ATC

In temperatures dipping to 44 degrees below zero, the Army's highly mobile Lance and Chaparral missile systems recently passed advanced development test objectives at the Arctic Test Center (ATC), Fort Greely, Alaska.

The 20-foot-long, 3,300-pound Lance missile is designed as a rugged, mobile weapon system intended to replace the Honest John and possibly the Sergeant missiles.

Lance firings at the ATC were conducted by personnel from the Artillery Board, Fort Sill, Okla., and the U.S. Army Missile Command, Redstone Arsenal, Ala. Mobility tests and simulated firings also were conducted after the missile had been "cold-soaked" as low as 35 degrees below zero.

The Lance has a simplified guidance and control system and is the first Army missile to use prepackaged liquid propellants. This eliminates fueling of the missile in the field. Six men can quickly prepare the missile for ground-to-ground firing.

The Arctic Test Center provided logistical support for the Lance tests, supported by representatives from White Sands (N. Mex.) Missile Range, Picatinny Arsenal, Dover, N.J., and Aberdeen (Md.) Proving Ground.

In Chaparral firing tests, a 12-foot drone was a target for the infrared, air-to-air Sidewinder missiles modified for a surface-to-air role.

Chaparral was put through maintenance and serviceability tests. The tracked vehicle, firing unit and missiles were road-tested over more than 1,250 miles.

Designed to destroy high-speed, low-altitude enemy aircraft or missiles that may threaten forward Army elements, the Chaparral is intended to augment the Hawk and Nike Hercules missile systems.

In a combat situation, Chaparral is as mobile as a tank and can be set up within minutes for a preoperational check. Seated in a plexiglass bubble between four mounted missiles, the gunner is complemented by four crewmen serving as spotters. Eight unmounted missiles are carried.

The U.S. Army Test and Evaluation Command has been evaluating Chaparral capabilities since 1965, including operation last summer at the Tropical Test Center in the Panama Canal Zone. Military potential tests followed at China Lake, Calif., and at Fort Bliss, Tex.

Preparations are under way to move Chaparral air-defense equipment and test crews to White Sands (N. Mex.) Missile Range for desert tests. Before Chaparral is approved for production, the effects of arctic and tropical environments on the total system will be evaluated by the Army Air Defense Board, Fort Bliss, Tex.

Picatinny Names Barnett Chief of Industrial Services

Eighteen years of progressively responsible assignments in Picatinny (N.J.) Arsenal's Industrial Services Directorate climaxed recently for Louis S. Barnett when he became head of the directorate.

Barnett began as an engineer in the Methods Engineering Division (then called the Production Engineering Branch, Industrial Division), and headed the Project Engineering Branch when it was formed to perform in-house engineering studies in conjunction with the Ammunition Engineering Directorate. His next promotion was deputy chief of Methods Engineering and after a 5-year span he became chief.

Barnett now heads the Arsenal's largest and most diversified directorate (nearly 2,000 employes) as successor to Otto V. Freund who recently retired after serving as director since September 1968.

The ISD provides fabrication and processing support to the Arsenal's R&D agencies in accomplishment of the national development, industrial engineering, maintenance engineering and special missions. His responsibilities include support essential to preparation of technical data packages as they evolve from preproduction and pilot evaluation of materiel.

Barnett earned a BS degree from Newark College of Engineering and an MS degree in chemical engineering from Stevens Institute of Technology.

Louis S. Barnett

Concept of 'Unzippable' Polymer Studied for Chemical Detector Devices

By Dr. Edward J. Poziomek

National defense research by the Army includes investigations of catalytic and chain reactions for use in highly sensitive detector devices. Theoretical considerations in microchemical detection of aerosols and gases indicate that improved detection reaction is essential for achievement of optimum simplicity and sensitivity.

For example, if the chemical to be detected promotes a chain reaction at each point of contact with the detector surface, or if it catalyzes the reaction that occurs in the detector, then sampling and concentration procedures could be minimized or even eliminated. Reliance on a chemical reaction for amplification avoids requirements for elaborate electronic and optical apparatus that might limit the usefulness of the method.

This report deals with Army-supported research on the concept of using an "unzippable" polymer for detection of chemicals. The type of polymer required is one that is stable under normal environmental conditions but will rapidly depolymerize by an unzipping mechanism in the presence of the material to be detected. Such a polymer may be denoted by A-Z-Z-Z-Z-Z-Z-Z-etc., where A is an end or capping group on the polymer and Z is the monomer unit.

The A cap stabilizes the polymer under normal conditions; if the chain is broken at any point, however, the polymer decomposes. The decomposition of the polymer by the chemical to be detected (B) may be represented as:

$$\text{A-Z-Z-Z-Z-Z-Z-Z-etc.} \xrightarrow{B} \text{A-(Z)}_n\text{-B} + \text{Z-Z-Z-Z-etc.}$$

$$\text{Z-Z-Z-Z-etc.} \longrightarrow \text{Z} + \text{Z-Z-Z-etc.}$$

$$\text{Z-Z-Z-etc.} \longrightarrow \text{Z} + \text{Z-Z-etc.}$$

The over-all detection reaction:

$$\text{A-Z-Z-Z-Z-Z-Z-Z-etc.} \xrightarrow{B} \text{A-(Z)}_n\text{-B} + \text{many molecules of Z.}$$

Since a polymer chain can contain a great number of monomer units, one molecule of the chemical to be detected can theoretically initiate a reaction that will result in the production of a sufficient amount of monomer detectable by simple means. If the monomer is a colorless liquid, it could be used to dissolve a dye.

To be practical for use in detection, the polymer must be readily cleaved at some point by the chemical pollutant, must be stable under conditions of use and storage, and must not be affected by materials normally present in the atmosphere. The cleaved or uncapped polymer must decompose rapidly at normal temperatures by an unzipping chain mechanism

A polymer property of great interest to this work is the ceiling temperature—the minimum at which depolymerization can occur spontaneously or, conversely, the maximum at which a polymer can be formed spontaneously from the monomer.

A polymer does not necessarily unzip spontaneously, however, simply because the ceiling temperature is exceeded. A larger amount of energy may be required to initiate the process or there may be competitive processes of degradation.

A general review of the thermodynamics of polymerization and depolymerization, and of kinetics information, led to the conclusion that polyaldehydes, polyacetone and polysulfones might be useful for detection purposes. Major research emphasis has been on investigation of polyaldehydes, e.g., those derived from chloroacetaldehydes.

Polyaldehydes have an acetal structure and are prepared easily from a base-catalyzed polymerization of monomer as illustrated in a simplified equation with chloral, as shown above.

$$\mathrm{Cl_3CC(H)=O} \xrightarrow{\text{base}} \text{—C(H)(CCl}_3\text{)—O—}_n$$

Poly(chloroacetaldehydes) are unstable at room temperature unless capped, for example, with an anhydride, as shown below.

$$\text{—C(H)(CCl}_3\text{)—O—}_n + \text{R-C(=O)-O-C(=O)-R} \longrightarrow \text{R-C(=O)-O—C(H)(CCl}_3\text{)—O—}_n\text{—C(=O)-R}$$

These capped poly(chloroacetaldehydes) are very susceptible to unzipping with amines. A preliminary report of the detection of amines by using a trifluoroacetate-capped chloral-dichloroacetaldehyde copolymer appeared in the November 1969 issue of *Analytical Letters*. Examples were given of the detection of microgram quantities of diethylamine and triethylamine in water.

The test was performed by injecting an aqueous solution of the amine into a detector tube containing a mixture of copolymer and fluorescent dye. The detection signal was based on observing a marked increase in fluorescence caused by dissolution of the dye by the liberated monomer. The test has been extended to detection of amine vapors and amines in organic solutions.

While more research is needed on aspects of surface molecular interactions, and the initiation of unzipping, before broad practical applications can be realized, it has been shown that polymer unzipping is a promising means for the amplification of a molecular event.

The Army has a number of approaches in the research area of chemical amplification. These will be discussed in later reports. Obviously, the increasing interest by people, industry and government in pollution and ecology makes this research in detection especially relevant to current national concerns.

DR. EDWARD J. POZIOMEK began his Army career in 1956 as an enlisted research chemist at Edgewood (Md.) Arsenal under the Army Scientific and Engineering Assistant's Program. Released from Army service in 1958, he returned to the arsenal as a civilian.

He earned an MS degree in 1960 and a PhD in 1961 from the University of Delaware, and has a 1954 BS degree in chemistry from Rensselaer Polytechnic Institute.

While employed at the U.S. Army Chemical R&D Laboratories at Edgewood, Dr. Poziomek was awarded a Secretary of the Army Research and Study Fellowship in 1963 at the State University of New York, and in 1965 won a research grant for studies at the University of Leiden in Holland.

Army R&D Newsmagazine Enters 10th Year, Invites Suggestions

"Why don't you give the *Army R&D Newsmagazine* a face-lifting, you know, doll it up with fancy window-dressing, gawdy it with color like those new uniforms the White House guards put on recently for special occasions?"

In one form or another, that question has been directed to the editor of the *Army R&D Newsmagazine* many times since the publication was launched in December 1960, with the modest expectation that it might be appealing to about 10,000 readers in the Army research and development community. Going into its tenth year, the magazine is distributed nearly 60,000 copies each month, in accordance with certified demands of readers (DA Form 12–4).

In March 1962, the results of the first reader survey were published. Virtually all comments from Army R&D activities were highly laudatory. None of the agencies contacted had any adverse criticism except that quite a bit of small 6-point type was being used then, in an effort to cram in as much news from as many sources as possible, with consideration also for the broad diversity of the scientific interests of our readers. Soon thereafter, authorization was granted to expand the magazine to 36 pages.

One critic, however, said that while the publication was "extremely interesting," its range of subject material was too broad . . . "it tries to be all things to all people." Conversely, many of those who praised the magazine suggested that it "could be improved by adding. . . ." Much merit unquestionably supports such suggestions, but limits of space and the editorial staff (2 people at present) inhibit drastic changes.

Nevertheless, along with top Army R&D leaders, the editorial staff is desirous of stimulating another objective appraisal of the *Army R&D Newsmagazine* from readers, with a view to considering what improvements are feasible within current limitations of space and manpower.

In that regard, it is necessary to restate one of the basic operational principles: "News and feature material will be written in simple, readable layman's language, with a minimum of technical terms, so as to be easily understandable. In no way is the publication intended to substitute for, or compete with, the professional scientific and engineering journals, each of which usually is designed to appeal to readers in a specific scientific discipline or field of interest."

Likewise, it is necessary to restate some of the philosophy that was applied in designing the *Army R&D Newsmagazine* to serve all of the then existing seven Technical Services of the Army, and the Army R&D community at large. *First, the magazine was designed to provide the maximum of stimulating ideas and communication between Army R&D activities at minimum cost.*

That basic consideration ruled out some of the suggestions for improvement our readers may have to offer, such as use of several contrasting and changing color schemes each month to give the publication more eye appeal. It banished thought of a fancy and continuously changing front cover design each month, as well as the use of large display-type headlines, and setting off articles in intricate designs based on liberal use of white space; also, use of larger body type size, such as 9 on 10 point or 10 on 11 point instead of the 8 on 9 point type used since the beginning.

The primary consideration of minimum cost of production that spiked the high cost of using a variety of color combinations also dictated against a top quality "slick" cover stock and high-grade paper, such as serves to achieve excellent reproduction in pictorial presentations.

Another factor that was long and carefully weighed was the use of a distinctively different but reasonably sedate color combination for the cover that would serve to identify the publication unmistakably the moment it reached a reader—and thereafter when it had to be found in a stack of documents. The salmon-colored cover stock and the brown ink on the cover were unique among more than 2,000 periodicals and scientific reports surveyed at the time the *Army R&D Newsmagazine* was being established.

With that explanation of some of the reasoning that went into the founding of the *Army R&D Newsmagazine*, we now leave to our readers the options they might like to suggest for feasible improvements. Primarily, we are interested in expressions of your "druthers"—what should, perhaps, be dropped and what should be substituted to achieve our continuing objective of making the publication "improve the R&D message to the field," that is, making it more interesting and valuable to our readers.

In this tenth year of what we like to consider the *Army R&D Newsmagazine's* continuing improvement, it would be an inexcusable oversight of the editorial staff if we were to pass up this opportunity to express heartfelt thanks to the many hundreds of persons who have had various roles in our growth—and progress.

Once more, one of the heartiest "Thank you!" acknowledgements goes to William J. Donohoe, the long-time chief of the Office of Freedom of Information, HQ DA, and to Eugene F. Hart, special assistant for public affairs, Defense Supply Agency, who recently assumed supervisory responsibility for the *Defense Industry Bulletin*. They helped in setting up channels for the flow of information and its clearance for publication.

Information officers and their staff writers throughout the U.S. Army Materiel Command, the Combat Developments Command, Continental Army Command, Office of The Surgeon General, Office of the Chief of Engineers and various miscellaneous activities keep newsworthy or human interest material flowing into our office. They rate a "Pat on the Back."

Certainly not to be overlooked for appreciation are scientists, engineers, administrators, scientifc or technical directors, technicians and many others who have contributed feature articles to the *Army R&D Newsmagazine*, with no compensation other than a by-line and biographical sketch. In our opinion, they have earned a special kind of kudos.

Finally, gratitude is acknowledged to those numerous individuals in the long line of coordination and reviewing authorities whose diligence in scrutinizing every word of copy pertinent to their areas of specialty has often saved us from possible embarrassment because of inaccurate or improperly cleared material. In fact, in a moment of rather rare humility, we cast aside thoughts of vexatious nit-picking and late "Kills" requiring new copy and costly page proof revisions.

Suggestions for improvements may be addressed to: Editor, *Army Research and Development Newsmagazine*, U.S. Army Research Office, Office of the Chief of R&D, HQ Department of the Army, Washington, D.C. 20315.

CRESS Moves to Kensington, Md.

Relocation of the Center for Research in Social Systems (CRESS), which recently severed its long association with the American University to become an affiliate of American Institutes for Research, was announced effective Mar. 1.

CRESS is now located at 10605 Concord Street, Kensington, Md. 20795. Following its alignment with the American Institutes for Research, CRESS remained temporarily in offices it had occupied for several years at 5010 Wisconsin Ave., N.W., Washington, D.C.

3 U.S. Researchers Participate in Japan Student Science Awards

(See story on p. 27)

13th ANNUAL JSSA winners, Miss Yuko Enaka and Junichi Yasumoto, pose with United States Army and Air Force representatives during "Operation Cherry Blossom" activities.

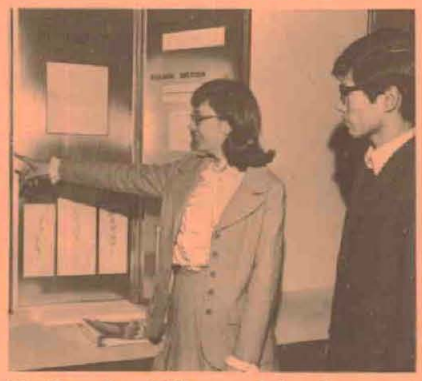
WARMTH OF FRIENDSHIP flowed freely when three young scientists representing the U.S. Armed Forces visited overnight in Japanese homes during a 10-day tour as participants in the 13th Annual Japan Student Science Awards (JSSA) in Tokyo. Most Japanese homes use only portable room heaters to offset the chill of winter, however, and the Americans wore their coats for comfort. *Left to right*, unidentified Japanese student, Marilyn Sue Miles (Army), Jean C. Lauricella (Air Force) and William J. Lynhorst (Navy) with Katsunori J. Kobuta, chairman, liaison section, Nippon Finalist Club, Student Science Awards.

U.S. ARMED FORCES "Operation Cherry Blossom" representatives included visit to Japanese high school.

U.S. ARMY ESCORT officer Jack B. Fenn presents replica of Apollo 11 moon-landing plaque to Ryozo Funayama, principal of the Tokyo Metropolitan Suginami Technical High School.

SCIENCE SERVICE coordinator Howard Weibrod chats with Miss Michiko Hemmi and Denutsu Sudo, a JSSA finalist in the 1969 International Science Fair held at Fort Worth, Tex.

William Synhorst has "Alfred" shake hands with Miss Michiko Hemmi, former chief of International Department, Japan National Student Association.



Marilyn Sue Miles explains her project, "The Golden Section in Nature."

Jean Lauricella shows research project to Japanese student at the 13th JSSA.

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