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## ASAP Schedules Meet At Natick to Consider Combat Soldier Problems

"Helping the Soldier Function More Effectively in Combat" is the theme of the Army Scientific Advisory Panel (ASAP) meeting, Feb. 27–28, at the U.S. Army Natick (Mass.) Laboratories. Brig Gen William M. Mantz, CG, will host the sessions.

While at the Natick Labs, the 26 panel members and senior consultants and approximately 30 other dignitaries from the R&D community will review the advances and problems resulting from research on battlefield environments of the future.

Of major interest in this connection are man's inherent capabilities and

(*Continued on page 3*)

## Report on Project Hindsight Details Findings On Study of Research Leading to New Materiel

Findings of Project Hindsight, a Department of Defense 2½-year study of research and exploratory development (RXD) patterns in weapon systems, are detailed in an interim report issued by the Office of the Director of Defense Research and Engineering (ODDRE).

The continuing DoD and Military Departments study was directed by Dr. Chalmers W. Sherwin, former Deputy DDRE for Research and Technology, who has joined the U.S. Department of Commerce. Current Project Hindsight director is Dr. Donald MacArthur, Dr. Sherwin's successor in ODDRE, assisted by Col Raymond S. Isenson.

Dr. Richard A. Weiss, Deputy and Scientific Director of Army Research, Office of the Chief of Research and Development, represents the Army on the Project Hindsight steering group. Col Harvey E. Sheppard is the Army Materiel Command coordinator.

Information for the report was compiled by teams of in-house scientists and engineers of DoD and the three Services working with the voluntary assistance of defense contractors. It is estimated that about 40 professional man-years were required to col-

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## Featured in This Issue . . .



## Ostrom Succeeds Kimball as Army Research Director

Director of Army Research Col Robert E. Kimball retired from 25 years active military service Dec. 31 to accept a position in private industry.

Chief of Research and Development Lt Gen A. W. Betts announced that Col Charles D.Y. Ostrom, Jr., has been selected to report for duty Feb. 1 as successor to Col Kimball.

Col Ostrom is commanding officer of the U.S. Army Ballistic Research Laboratories, U.S. Army Human Engineering Laboratories and the U.S. Army Coating and Chemical Laboratory, Aberdeen Proving Ground, Md., where he has served since August 1963. He commanded the U.S. Army R&D Group at Frankfurt, Germany, from 1960 to 1963.

Backed by 25 years service in the Army Ordnance Corps, Col Ostrom has a BS degree from the University of California, an MS degree in engineering from Harvard University, and an MS in mechanical engineering from Massachusetts Institute of Technology. He was graduated from the Command and General Staff College in 1955 and the Industrial College of the Armed Forces in 1960.

During World War II, he served as an ammunition officer with the Ninth U.S. Army in the United Kingdom,

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**Col Charles D.Y. Ostrom, Jr.**

**Col Robert E. Kimball**

## HQ STRATCOM Slates Move to Fort Huachuca

Announcement of the move of Headquarters, U.S. Army Strategic Communications Command from scattered offices in the Washington, D.C., area to consolidated facilities at Fort Huachuca, Ariz., came as a week-before-Christmas surprise.

Installation and construction personnel have begun work at Fort Huachuca and the first elements of the headquarters staff of about 600 civilian and 200 military personnel are expected to leave Washington in March. The move is being phased over a period of months to be completed by mid-1967.

Commanded by Maj Gen Richard J. Meyer, STRATCOM directs the Army's long-range strategic network portion of the worldwide Defense communications system. In announcing the move, General Meyer called employees together to explain the

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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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# The Army Activities In Satellite Communications

By Col Mitchel Goldenthal

Military interest in satellite communications rests on their unique ability to solve two extremely pressing military problems: communicating over global distances and communicating in underdeveloped areas.

The first problem is caused by the unreliability and lack of capacity of conventional means. The second is self-evident, and its solution is of paramount importance to our national defense posture and future deployment of the U.S. military forces.

For these reasons, the Army has played a basic and impressive role in space communications, beginning as long ago as 1946, when the Signal Corps at Fort Monmouth, N.J., first made contact with the moon by radar in Project DIANA.

With the acceleration of space efforts, the Army continued in the forefront, producing SCORE in 1958, the world's first communications satellite, and COURIER in 1960, an advanced communications satellite. The ADVENT Program, managed by the Army, was intended by the Department of Defense to satisfy, ahead of its time, all the foreseeable communications requirements of the Armed Forces.

Army participation in major DoD satellite communications projects involves: first, the now operational SYNCOM Satellite Communications System; second, the Defense Communications Satellite Program to fulfill military needs for global strategic communications, consisting of the initial Defense Communications Satellite Project (IDCSP), which is to be followed by an operational system. The third project is the Tactical Satellite Communications Program (TACSATCOM), which aims to provide reliable, flexible communications for combat.

For the Defense Communications Satellite Program, each of the military services carries specific responsibilities under the direction of the Defense Communications Agency (DCA). The Air Force develops and launches the communications satellites; the Navy develops shipboard terminals; and the Army develops the ground terminals and conducts the technical test program.

These Army responsibilities are carried by my command, the U.S. Army Satellite Communications (SATCOM) Agency. To accomplish this mission, I am the SATCOM project manager as well as the Agency commander. As project manager, I report directly to General Besson, the commanding general of the Army Materiel Command, and I exercise full line authority in all planning, direction and control of tasks and resources involved in providing the U.S. Army systems and equipments for effecting communications with satellites.

Included are all phases of research, development (including R&D system emplacement and testing), procurement, production, distribution, installation, new equipment training and logistical support for satellite communications systems and equipments.

A precursor to the present Defense Communications Satellite Program was the SYNCOM Project, started in 1960 as an industrial contractor's in-house effort. It was adopted by the National Aeronautics and Space Administration (NASA) in 1961 and military participation began in 1962.

The U.S. Army Satellite Communications Agency was assigned by the Department of Defense in 1962 to support NASA in the SYNCOM satellite program. SATCOM terminals, developed for the ADVENT program, made up the experimental SYNCOM

(*Continued on page 16*)

*Col Mitchel Goldenthal has commanded and served as project manager of the Army Satellite Communications (SATCOM) Agency at Fort Monmouth, N.J., since Oct. 1, 1965. He previously served as SATCOM deputy commander after duty as deputy commander and chief of the Program Management Division, U.S. Army Electronic R&D activity, Fort Huachuca, Ariz.*

*The colonel is a graduate of the U.S. Military Academy (1943), the Army War College (1965), and the Command and General Staff College. He holds an MS degree in engineering from Texas A&M and a master's in international affairs from George Washington Univ.*

# Stanwix-Hay Succeeds Riley as Deputy to Ignatius

Maj Gen A. T. Stanwix-Hay, special assistant to Assistant Secretary of Defense (I&L) Paul R. Ignatius since March 1966, last month became Deputy Assistant Secretary (Materiel).

In his new position, one of several changes within the Office of Installations and Logistics announced by Mr. Ignatius, General Stanwix-Hay assumed responsibility for the functions of the Weapons Analysis and Readiness component formerly under the supervision of Deputy Assistant Secretary Paul H. Riley.

The reassignment in Mr. Ignatius' office coincided with the Dec. 19, 1966, departure of Robert C. Moot, deputy assistant secretary of Defense (Logistic Services), who was appointed deputy administrator of the Small Business Administration.

Transportation and Warehousing, Telecommunications, Cost Reduction and Food Service responsibilities formerly directed by Mr. Moot were assigned to Mr. Riley as well as the responsibility for Technical Data and Standardization. Mr. Riley continues to be responsible for Supply Management activities.

Mr. Moot's Contract Support Services were assigned to Deputy Assistant Secretary Glenn V. Gibson, who directs all administrative activities of Assistant Secretary Ignatius as well as being responsible for International Programs functions.

Eckhard Bennewitz, former director of Weapons Analysis and Readiness, succeeded General Stanwix-Hay as special assistant.

The general was appointed in July 1964 by Secretary of Defense Robert S. McNamara as director of the new Office of Technical Data and Standardization Policy. At that time, he was director of the Defense Contract Administration pilot office in Philadelphia.

He was responsible for policies and Defense procedures in the field of technical logistics data acquisition and utilization, including storage and retrieval systems. He also administered the Department of Defense-wide standardization program. Prof. O'Neill is associate dean, School of Engineering and Applied Science and director, Electronic Research Laboratories, Columbia University.

Maj Gen A. T. Stanwix-Hay

General Stanwix-Hay's long experience in logistics included a year as commander of the Army Electronic Materiel Agency in Philadelphia before assignment to the Defense contract office.

He is a graduate of the University of Florida, the Armed Forces Staff College and the Industrial College of the Armed Forces. During World War II, he served in Africa and Europe.

He has served extensively with the Army Signal Corps, beginning with an assignment in 1948 to the headquarters of the Army Electronics Command, Fort Monmouth, N.J. In 1951, he was assigned to the Office of the Chief Signal Officer in Washington, D.C., later he joined the staff of the Deputy Chief of Staff for Logistics. In September 1963, he became Deputy Chief Signal Officer.

## ASAP Schedules Natick Meet On Combat Soldiers' Problems

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novel methods for enhancing them, which will be emphasized in discussions by the U.S. Army Medical Research and Development Command's Institute of Environmental Medicine (ARIEM).

Serving to provide perspective for the briefings, the U.S. Army Combat Developments Command will introduce the program with a presentation on Long Range Goals and Objectives. Experts in their related fields will outline concepts and programs on Lightening the Individual Combat Load, Food for High Performance and Protective Systems for the Combat Soldier in a Hostile Environment. The interaction between man and machine will be discussed as well as problems of man on the battlefield.

During the Panel's regular business session, Prof. Lawrence H. O'Neill, chairman, ad hoc group on Army Tactical Air Defense, will discuss results of his study. Conclusions and recommendations will take into consideration SAM-D activity and Advanced Forward Area Air Defense Systems.

Those on the Panel Executive Committee who will attend the meeting include Assistant Secretary of the Army (R&D) Dr. Russell D. O'Neal; chairman and vice chairman of the Panel respectively, Dr. Harold M. Agnew and Dean Ralph E. Fadum; General Frank S. Besson, Jr., CG of the U.S. Army Materiel Command; Lt Gen Ben Harrell, CG of the Army Combat Developments Command; Lt Gen A. W. Betts, Army Chief of Research and Development, and Lt Col Joseph E. Fix, III, Panel executive secretary.

## DoD STINFO Courses Offered At Wright-Patterson AFB, Ohio

STINFO (375), a Department of Defense course in scientific and technical information, will be given at the School of Systems and Logistics, Wright-Patterson (Ohio) Air Force Base, Mar. 13–24 and May 15–26.

The course is considered appropriate for STINFO officers, liaison officers, technical librarians, and others working with scientific and technical information.

It covers the nature of scientific and technical information and the means for its identification, acquisition, storage, retrieval and dissemination.

It also aims to acquaint developers and users of scientific and technical information with their responsibilities for identification, abstracting, key word use, and the maintaining of a publication philosophy providing for ease and economy of retrieval.

Those engaged in scientific and technical information on their own or by contract may participate, but a secret security clearance is required.

## HQ STRATCOM Slates Move to Fort Huachuca

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many climatic and geographic advantages supporting the decision.

Fort Huachuca, a communications-electronics post since 1953 and home of the Electronics Research and Development Activity of the Army Electronics Command, provides an environment, in addition to the consolidation of facilities, that is expected to enhance the capability of HQ STRATCOM to perform its mission.

Assistance in finding employment in the Washington, D.C., area for those civilians who do not wish to transfer with their positions to Fort Huachuca has been offered by STRATCOM in cooperation with the U.S. Civil Service Commission and State Employment Services.

# Hindsight Report Details Research Findings

(*Continued from page 1*)

lect and analyze the data reported.

The first 18 months were devoted to developing pilot studies and establishing the techniques of analysis. The analysis includes these steps:

- A recent weapon system or "end item" equipment which is either already in or is committed to the inventory is selected for study;
- Five to 10 scientists and engineers, selected for their expertise in the system area, are appointed to serve as a team;
- The team dissects the system into subsystems and components to assure systematic analysis and then identifies each contribution from recent science and technology which is clearly important either to increased system performance or to reduced cost, compared to a predecessor system when such can be identified. Each identified contribution is called an "event."

Of the 20 systems included in the reports, six are representative of the Department of the Army.

Technological history of the Lance missile was studied by a team from the Army Missile Command, Redstone Arsenal, Ala., under Lewis L. Gober.

The Starlight Scope (night-vision system) team was headed by Benjamin Goldberg, now director of the Night Vision Laboratory, Fort Belvoir, Va., of the Army Electronics Command.

The Rounds of Ammunition (XM–409, 152mm HEAT MP) team was led by Joseph Dubin, Picatinny Arsenal, Dover, N.J., and the FADAC (Field Artillery Digital and Analog Computer) group by Raymond Brachman of Frankford Arsenal, Philadelphia, Pa. These two systems were analyzed with the assistance of members of the Ballistic Research Laboratories (BRL), Aberdeen (Md.) Proving Ground.

Contractors conducted the pilot studies on the Sergeant missile and the 105mm Howitzer systems.

Fifteen of the 20 systems involved 638 events, 82 of which were identifiable through more than one system. The report states that the remaining 556 distinct events were performed by approximately 300 organizations and more than 1,000 individuals as principal contributors.

A further task of Project Hindsight is "to identify and firmly establish management factors for research and technology programs which have been associated with the utilization of the results produced by these programs."

The principal management team leaders are Dr. Paul S. Strauss, Picatinny Arsenal and Harry B. Black, Redstone Arsenal. Among the industrial participants in the Army's study are Morgan L. Dring, representing Ling Temco Vought (Lance contractor), and Shepard M. Arkin and George E. Malone of Raytheon Co.

Analysts of the available information thus far in Project Hindsight came to the following conclusions:

- Successful engineering design of advanced weapon systems primarily consists of skillfully selecting and integrating many elements from diverse technologies to produce the high performance demanded.
- At least in the systems studied, the contribution from recent (post–1945) research efforts in science and technology were greatest when those efforts were oriented toward Defense needs.
- Production of scientific and technical information utilized in weapon systems has been substantially more efficient when research efforts were funded and managed by DoD or Defense industry for Defense purposes than when funded and managed by the non-Defense sector of Government or industry, without specific concern for defense needs.
- For the systems studied, approximately two-thirds of the innovations essential to the successful development of those systems were available at the time engineering design was initiated.
- The DoD investment in science and technology has had a demonstrably large payoff in terms of the resultant weapon system cost-effectiveness.
- The productivity of the Department in-house (Government) laboratory is comparable to that of the Defense industries.

The Project Hindsight report is available through the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va.

YOUR CIVIL SERVANT

By Rube Weiss

## VICTOR LINDNER

...THE MAN BEHIND THE GUN! WIDELY KNOWN IN THE ARMED FORCES AS "MR. CONVENTIONAL AMMUNITION" CIVILIAN CHIEF OF THE AMMUNITION ENGINEERING DIRECTORATE AT THE ARMY'S PICATINNY ARSENAL, DOVER, N.J., HE SUPERVISES ENGINEERS & SCIENTISTS ENGAGED IN THE DESIGN AND ENGINEERING OF A WIDE VARIETY OF MUNITIONS AND AMMUNITION SYSTEMS.

...RESPONSIBLE FOR ALMOST ALL OF THE NEW CONVENTIONAL AMMO THE ARMY WILL USE... FROM GRENADES TO GUIDED MISSILE WARHEADS...PLAYED A KEY ROLE IN ESTABLISHING THE ARMY'S NEW LIMITED WAR LABORATORY.

# Electronic Planimeter Speeds Ammunition Testing

Measurements of projectile dispersion for evaluating high-explosive ammunition can be made in three seconds with an electronic planimeter developed recently at Picatinny Arsenal, Dover, N.J.

The planimeter replaces the tedious "oil drop" technique for obtaining average cross-sectional areas of the many fragments produced when a projectile detonates.

Measurement is accomplished simply by dropping a shell fragment into a chute and pressing a button. The fragment ejects automatically three seconds later and the average cross-sectional area of the fragment in square inches is shown on an electronic counter.

The oil-drop method, involving a calibrated tube of oil into which a fragment is dropped and timed to determine the measure of area-to-mass ratio, requires eight hours for each hundred fragments. The planimeter can measure a hundred fragments in five minutes.

A closed-circuit television camera and electron beam scanning of the shell fragment, convertible to the length-to-time ratio of the constant velocity of the scan, provide the operational principle.

The electronic planimeter may be operated under varying atmospheric conditions, unlike the oil-drop technique which must be conducted in a controlled atmosphere.

Based on an original idea by William Griffel of the Ammunition Development Division of Picatinny, the electronic device was designed and built by Douglas Morlock, Wilhelm Lohninger, Richard Satz, William Conway and Thomas Slack, all of the Ammunition Development Div.

# Ostrom Succeeds Kimball as Army Research Director

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France, the Netherlands and Germany. From July 1948 to June 1950, he was executive officer of BRL's Ballistic Measurements Laboratory at Aberdeen Proving Ground.

Following a tour of duty as ammunition officer with the Eighth U.S. Army during the Korean War, he was assigned to Picatinny Arsenal, Dover, N.J., as executive officer, R&D Division (Samuel Feltman Laboratories) from June 1952 to July 1954. Later he became chief of the Research Branch, R&D Division, Office of the Chief of Ordnance, Washington, D.C.

COL KIMBALL was awarded the Legion of Merit (Third Oak Leaf Cluster) upon his retirement to join the Hazelton Laboratories, Falls Church, Va., as an engineering physicist. General Betts made the presentation.

The accompanying citation recognized a long list of achievements during Col Kimball's 14-month tenure as Director of Army Research. Further accolades came in large measure from R&D leaders and associates in the Office of the Chief of Research and Development at a farewell party in the Arlington Hall (Va.) Officers Club.

After enumerating notable accomplishments in shaping Army research programs, including innovations to achieve a better interface for the coupling of R&D activities, the citation states:

"Colonel Kimball fostered an atmosphere of trust, unity of purpose, confidence in the future, and imagination in resolution of problems which permeated the entire Army organization for research. The results speak for themselves in terms of a multitude of applications of research to current military problems and strategy worldwide. This award marks the conclusion of over 25 years of distinguished service to the United States Army, and research and development in particular."

Col Kimball became Director of Army Research after serving in Viet Nam as assistant chief of staff J-6 (Communications and Electronics) on the staff of General William C. Westmoreland. As DAR he succeeded Brig Gen Walter E. Lotz, Jr. (later promoted to 2-star rank), who in turn filled the J-6 position vacated by Col Kimball.

Army senior scientists paid tribute to Col Kimball as a scientist and research leader of professional stature, based upon contributions to advances in military electronics, as well as in the physical sciences.

Experience gained by Col Kimball in Viet Nam enabled him to apply first-hand knowledge and understanding as well as the depth of his scientific training to solution of problems of producing urgently needed items of specialized materiel on a greatly accelerated basis.

Influence of his understanding of the overall problem of relating basic research activities more closely to exploratory development for new military materiel also was felt strongly in the deliberations of The Army Research Council (TARC) in revising the Army Research Plan.

Reorientation of the Army overseas research program, in line with suggestions from President Johnson, also was achieved under his leadership. The program of the Army Research Office-Durham (N.C.) was expanded with establishment of an Environmental Sciences Division.

The Army Junior Science and Humanities Symposia Program was supported strongly by Col Kimball.

First assigned to the U.S. Army Research Office in June 1958, about four months after it was established, he served as deputy chief of the Physical Sciences Division and later as Assistant Director of Army Research, OCRD.

Col Kimball has a bachelor of electrical engineering degree from Johns Hopkins University (1939), an MS degree in the same field from Massachusetts Institute of Technology (1948) and a PhD degree in physics from the University of Virginia (1957). He is a graduate of the Command and General Staff College and the U.S. Army War College.

# AVLABS Test 'Closed Circuit' Refueling System

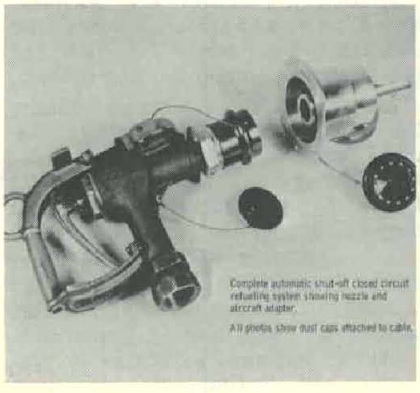
"Closed circuit" refueling of the UH–1A helicopter with a new device developed at the Army Aviation Materiel Laboratories (AVLABS), Fort Eustis, Va., reportedly reduces refueling time by 50 percent.

Evaluation of the automatic shut-off closed-circuit system was conducted under an AVLABS in-house research program from February to April 1966. Further testing to determine the military potential is in process at the U.S. Army Aviation Test Board, Fort Rucker, Ala.

Francis V. Limandri, aircraft equipment specialist at AVLABS, found during the Fort Eustis Evaluation of 39 refueling operations that the closed-circuit system eliminates certain disadvantages of the conventional gravity-feed type of refueling.

Major improvements include:

- Aircraft can be refueled while engine and rotors are running;
- From 15 to 30 gallons of additional fuel can be carried in UH–1 model helicopter tanks;
- Fuel contamination susceptibility is lessened;
- Need for an electrical grounding cable is eliminated;
- Battery wear, which eventually leads to a "hot start" condition, is reduced; and
- Fueling time is reduced an average of 50 percent.



Complete automatic shut-off closed circuit refueling system showing nozzle and aircraft adapter.

All photos show dust caps attached to cable.

The closed-circuit system provides a continuous airtight flow of fuel. It consists of an automatic shut-off nipple mated with an adapter flange to make up the automatic shut-off aircraft filler unit. It also contains an automatic shut-off nozzle modified to accept the closed-circuit filler unit.

A quick-disconnect fitting in the system allows more fuel to be loaded into aircraft tanks because the tank opening is automatically sealed when the nozzle is removed. This feature also allows quick takeoff in emergency.

Development of the closed-circuit system was prompted by the inherent disadvantages of the conventional fueling method.

The conventional nozzle-to-tank method requires helicopter shutdown to prevent contamination of fuel by dust generated by the rotors, and a 20-minute waiting period is required before restart.

The AVLABS developers foresee less maintenance, longer engine life, extended battery use and less flying time loss if the closed-circuit system is adopted. Although the UH–1A helicopter was used for evaluation, AVLABS contend the system can be adapted to other types of helicopters, airplanes and ground vehicles.

# Self-Contained Portable Dental Lab Provides Complete Field Care

The newest component of the MUST (medical unit, self-contained, transportable) hospital systems is a 2-chair dental clinic and laboratory.

Brig Gen Colin F. Vorder Bruegge, MC, CG of the U.S. Army Medical Research and Development Command, termed the self-contained dental unit "a major advance for total dental service in the field . . . a blending of modern engineering technology and dental research advances to manage the increasingly heavy requirement to provide complete oral and maxillofacial care during troop operations in the field."

The dental clinic-laboratory, designed by the Ritter Co. and the Garrett Corp. under contract with the Medical R&D Command, consists of an expandable shelter and a ward-type inflatable unit. The rigid sides of the expandable shelter fold to form its own shipping container. When folded, the shelter carries all of the clinical and laboratory equipment and the inflatable element. It can be transported by truck, trailer, in transport aircraft or by helicopter.

The expanded shelter serves as the 2-chair operatory and is equipped to provide complete definitive dental care. The inflatable element houses the laboratory and also serves as a patient waiting area. Utilities and environmental control are provided by the MUST utility (power) unit.

The first of four of this "limited production" unit will arrive in South Viet Nam in the summer. During this year, the Army Medical Service will receive a second field dental clinic and the Navy will get two units.

The Medical R&D Command is hopeful that MUST and its dental element will be classified as "Standard A" by Fiscal Year 1969 and placed in the Department of Defense system.

**MUST HOSPITAL DENTAL CLINIC showing inflatable unit in foreground.**

**INTERIOR of expandable unit demonstrating two dental operatories complete with all utilities, high-speed operative instrumentation, ultrasonic peridontic instrumentation, and X-ray.**

## Computerized Inventory Aids Maintenance

Maintenance of Army equipment in Southeast Asia is being improved by computerized inventory of more than 10,000 repair parts, using nine systems shipped recently as part of 18 systems scheduled for delivery.

Designed to accompany major military units, the systems enable logistics personnel to insure that repair stocks are maintained at the proper level. Under contract with the Army Materiel Command, the project utilizes the National Cash Register Co. series 500 computer.

Project management responsibility is assigned to the Interim Systems Division of the Automatic Data Field Systems Division, Automatic Data Field Systems Command (ADFSC), Fort Belvoir, Va. ADFSC is commanded by Brig Gen Roger M. Lilly.

Each system requires two 9-by-22-foot standard M–146, 6-ton Army shop vans. One houses the computer's central processor and certain peripheral data processing units. The other provides card and ledger storage and desk space for supply clerks. Each system has mobile generator units for electrical power.

In addition to having special wiring and shock mounting for the computer equipment, the vans are insulated and air-conditioned to provide controlled environmental conditions. Each system includes a one-year stockage of repair parts.

Military personnel are being trained by the manufacturer to maintain the computer equipment. The U.S. Army Quartermaster School is training military supply personnel to operate the equipment. Maintenance and supply personnel are assigned to the units designated to receive the systems prior to arrival of the equipment.

## STRATCOM Activates New Facility to Serve Korean Forces

Activated at Taegu, U.S. Army Strategic Communications Command (STRATCOM) Facility-Korea, is the newest member of the worldwide communications network to serve the Armed Forces.

Mission of STRATCOM Facility-Korea is to administer, operate and maintain the Army portion of the Defense Communications System.

On Nov. 14 the tape relay station, Camp Walker; the transmitter station, Song-So; and the receiver station Kyong-San, now operated by Eighth Army, become an operational responsibility of the new element.

A complement of personnel from other STRATCOM facilities in the Western Pacific and the United States is on temporary duty in Korea now, providing technical assistance in preparing and testing communications equipment in the facilities for operational requirements.

Maj Raymond A. Jones, Signal Corps, assumed command of the new organization last October, officially establishing the STRATCOM Facility-Korea as a subordinate command of USA STRATCOM-Pacific, Schofield Barracks, Hawaii.

## Holmes Directs MICOM P&P

Col Sterling C. Holmes, former chief of the U.S.-NATO Hawk Liaison Office in Paris, is the new head of the Army Missile Command's Procurement and Production Directorate.

He succeeded Col Eugene J. McGinnis, who recently completed a second tour of duty at Redstone Arsenal, Ala., and was assigned as chief of War Plans (J–4), HQ, U.S. European Command, Stuttgart, Germany.

# Reactor Plant in Antarctica Breaks Record

Army-trained navy men operating the nuclear power plant in the Antarctic recently broke the record for the longest run of a military reactor with 3,390 uninterrupted service hours.

Manned by a crew of 24, the PM–3A plant is the Navy's first land-based power reactor and the fourth plant "on the line" of the Army Nuclear Power Program (ANPP), which has cognizance of five military plants operated by the Army, Navy and Air Force.

Since construction in 1962 the PM–3A plant at remote McMurdo Station has produced more than 24 million kilowatt hours of electricity. McMurdo Station is the Navy's key support base for "Operation Deep Freeze," the name given to U.S. scientific explorations at the bottom of the world.

Because of the station's inaccessibility, the plant was built as the prime power source instead of relying on shipment of the large quantities of fuel oil which otherwise would be required. The PM–3A also is used to provide steam for the first U.S. land-based nuclear desalinization plant.

Commanded by Navy Lt Thomas L. Boennighausen, the record-breaking crew consists of Seabees (Navy Construction Battalion) and Navy hospital corpsmen, all graduates of nuclear power training conducted by the Nuclear Power Field Office (NPFO) of the U.S. Army Engineer Reactor Group at Fort Belvoir, Va.

Plant operators are rotated every 13 months at McMurdo, which is shut off from the world by the Antarctic winter from March to October.

Pace-setter for military power plant endurance records was the PM–2A at Camp Century—the "City Under the Ice"—in Greenland. The record established early in 1964 was 2,502 continuous hours of operation and in August 1966 the Greenland plant topped all previous records with 3,355 hours.

The SM–1A at Fort Greely, Alaska, the largest of the ANPP plants, beat the Greenland reactor's first running time with 2,750 continuous hours ending in August 1964. It also topped the PM–1, Air Force-manned power plant at Sundance Air Force Base, Wyo., which ended 2,630 uninterrupted hours in April 1964, the start of record-breaking among the ANPP plants.

The Wyoming plant began a power run on Sept. 9, 1966 that, at press time, is expected to end in February 1967, breaking all military and civilian reactor endurance records. The present private industry reactor endurance record is held by the Yankee Atomic Power Plant in Boston, Mass., with 3,750 hours.

The nuclear power training course for the three Military Services began in 1957 at the NPFO, Fort Belvoir, using the SM–1 plant. Since then, 520 students have been graduated including 305 Army, 143 Navy, 65 Air Force and 7 civilians. The present class includes 17 Army, 18 Navy and 13 Air Force personnel.

The NPFO course is in three phases:

- Academic—mathematics, modern physics, health physics, electrical, mechanical and nuclear engineering;
- Operations—training on the SM–1 Nuclear Power Plant simulator and then on the plant itself; and
- Specialist development of students in one of the four maintenance categories—mechanical, electrical, instrument and process control (chemistry and health physics)—to insure the availability of crew members to perform the highest echelons of power plant maintenance.

The NPFO is represented by graduates at other reactors throughout the nation in addition to those under the ANPP. The sites include:

Walter Reed Army Institute of Research, Washington, D.C., Aberdeen Proving Ground, Md., where a reactor is being installed; White Sands Missile Range, N. Mex.; the Nuclear Engineering Test Facility, Wright-Patterson Air Force Base, Dayton, Ohio; and the Nuclear Reactor Test Station, Idaho.

In addition to the three Services' land-based nuclear power plants, NPFO-trained crew members serve in *Sturgis*, the MH–1A floating nuclear power plant still undergoing tests in the Potomac River at Fort Belvoir.

The Army Nuclear Power Program actually began in 1952 as a Department of Defense study conducted by the Office of the Chief of Engineers. (The first U.S. nuclear weapons had been developed under the Manhattan District of the Corps of Engineers.)

In February 1954, based on recommendations of the Joint Chiefs of Staff, the Secretary of Defense assigned responsibility for land-based nuclear power plant development to the U.S. Army which delegated it to the Chief of Engineers. COE established the Army Engineer Reactor Group in 1958, as the basic Army organizational unit for the ANPP.

The ANPP serves the military interest in nuclear power plants and in research and development through close liaison with the Department of Defense and U.S. Atomic Energy Commission.

# ECOM Develops Improved 6-Foot Radio Antenna

Novel electronic techniques are incorporated in an improved high-frequency radio antenna developed by the U.S. Army Electronics Command (ECOM), Fort Monmouth, N.J.

A full-scale working model of the 6-foot antenna has demonstrated "spectacular improvement" in efficiency over conventional antennas of equal size.

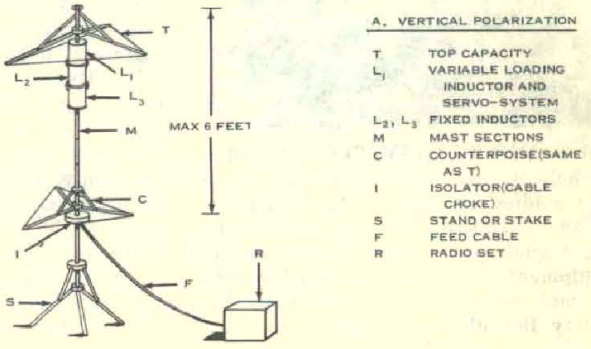
Dr. Helmut L. Brueckmann of ECOM's Institute for Exploratory Research reports that the gain of the antenna in a vertical position at 2.8 megaHertz (MHz) was found to be 11 decibels greater than that of a 40-foot vertical wire excited at the base against a radial ground system tuned by a conventional antenna coupler.

Tests showed that the compact antenna can handle more than 100 watts of radio-frequency power. Dr. Brueckmann said that the antenna system is potentially applicable to portable, vehicular and airborne HF communications.

Unofficially designated the "Universal Tactical Antenna" by ECOM engineers, the ferrite-loaded device can be tuned continuously from 2 to 30 MHz and incorporates the following innovations:

- Optimal distribution of the integrated inductive loading over antenna length rather than uniform distribution.
- Continuous permeability tuning instead of sliding contacts. Top feeding instead of base feeding. Isolation of antenna and counterpoise from ground and feed cable.

BASIC INSTALLATIONS OF UNIVERSAL TACTICAL ANTENNA



# Instrumented Course Tests Troops in Combat Situations

Testing of infantrymen and weapons under the most thoroughly realistic conditions possible short of the battlefield is being studied at Fort Benning, Ga., with a experimental instrumented attack course.

Established by the U.S. Army Infantry Board, the developmental test facility is the initial result of a broader study of small arms testing to determine feasibility of gathering man/weapon data in a simulated tactical environment.

Range instrumentation is built around a system of data-gathering devices that provide electrically recorded information on 95 percent of the rounds fired. The system detects and times each round fired, registers target hits and senses the location of near misses. Heretofore, on ranges where only hits could be counted accurately, sensings have been possible about six percent of the time.

Approximately 550 meters in length, the course has 16 rows of plotted firing positions at intervals of about 20 meters. Consisting of logs, stumps and shell holes, the same firing points are used in each trial.

Action on the range, including control of artillery and small arms simuators, is handled from a camouflaged observation and control bunker adjacent to the line of departure.

Test soldiers move through the course under command of an Infantry Board noncomissioned officer who provides a continuous commentary on the actions of each participant to the control bunker by means of a lightweight transmitter attached to his helmet.

**FM RADIO TRANSMITTER, mounted on helmet, picks up muzzle blast when test soldier's weapon is fired. Relayed to an instrumentation van, the resulting signal is fed into data-recording equipment to provide a timed record of each round fired on the Army Infantry Board's instrumented course.**

**"IMPASSIVE ENEMY" with a prodigious memory is equipped with small arms simulators and an elaborate electrical system for reporting and recording hits and sensing misses on the instrumented attack course at Fort Benning, Ga. Shots striking within 20 feet of his post are detected by two rows of 8-inch, hit-sensitive witness panels concealed in ground before him.**

Artificial controls, such as flags, range poles or marked safety lanes, are unneeded. Devices spotted throughout the test area to enhance an already realistic combat atmosphere range from dummy casualties and wire obstacles to agressor emplacement and wrecked equipment.

One portion of the system is activated by small FM transmitters attached to the test soldiers' helmets. When an individual weapon is fired, the muzzle blast is relayed to an instrumentation van, where the signal is fed into data-recording equipment.

Other information is transmitted electrically to the instrumentation van from the objective or target area.

Hits on lifelike, 3-dimensional targets, located on the military crest of the objective and on camouflaged witness panels, appear on the recorder adjacent to the record of each round fired. The hit-sensitive material used in the targets and witness panels is made up of two layers of aluminum foil separated by a latex-foam insulator. Bullets passing through the skin cause a momentary short-circuit which generates the signal sent to the recording equipment.

If a round passes over or to the side of a target, the distance and direction of the miss is sensed by microphones near the target. These pick up the shock wave created by a passing bullet and measure the distance by the magnitude of the sound.

Use of timing mechanisms on the recorders provides continuous information on the rate of fire, rate of movement, magazine change time and other data essential in evaluating results of service tests.

Instrumented quick-fire and defense courses to complement the existing attack course are planned. They are expected to incorporate the same type instrumentation plus more advanced electronic devices as suitable equipment is perfected. Use of automatic data-processing facilities to speed recording, processing and storage of test data is of special interest.

### Shillelagh System Undergoing Engineering-Service Tests

The U.S. Army's tank-launched Shillelagh guided missile system, having successfully passed all other tests and evaluations demonstrating its effectiveness, is undergoing engineering-service tests at Fort Greely, Alaska.

In addition to being the main armament for the Sheridan tank, the Shillelagh weapon system is being adapted to the United States-Federal Republic of Germany Main Battle Tank under development for the 1970s.

## DoD Establishes Rotating Manpower Research Post

Dr. Edmunnd E. Dudek, technical director of the Naval Personnel Research Activity, San Diego, Calif., has been appointed to a newly created position as Military Manpower Research Coordinator, Office of the Assistant Secretary of Defense (Manpower).

Dr. Dudek will serve for a period of one year in the position, which will be filled on an annual rotating basis from the top professional staffs of the Army, Navy and Air Force personnel research laboratories. His staff also will be drawn from the Armed Forces. Dr. Dudek is on leave of absence from his Navy position.

As research coordinator, Dr. Dudek will furnish staff support to the Manpower Management Planning Board composed of the Deputy Director, Defense Research and Engineering, and the Deputy Under Secretaries (Manpower) of the Departments of the Army, Navy and Air Force. The Assistant Secretary of Defense (Manpower) is chairman.

The mission of the Planning Board is to review and recommend policy guidance on Defense-wide manpower research programs.

Born at Clarkson, Neb., Nov. 20, 1914, Dr. Dudek holds AB and MA degrees from the Unversity of Nebraska, and received his PhD degree in psychology from Purdue University.

# Wiswesser System Considered for CIDS

Chemists and technical information specialists reviewed the Wiswesser Line Notation (WLN) System for potential application to the Army Chemical Information Data System (CIDS) experimental program at a recent 2-day meeting at Edgewood Arsenal, Md.

Dr. Howard T. Bonnett, an official of G. D. Searle and Co. and president of the Wiswesser Users Association, presented the keynote address. The WLN System is a mechanized chemical structure description approach to enable computers to handle the tedious organizing and searching of large chemical information files.

Considered as possible applications of WLN to the CIDS were used as an input media, for registration of compounds, for whole structure and substructure search, for indexing and file organization, as screens, as a compact machine language, and as an output (natural) language.

Currently CIDS is an exploratory development project intended to provide the basis for a network to collect, process, store and retrieve chemical data in support of on-going Army work. The possible use of WLN is based on recommendations presented in 1964 at a National Academy of Sciences conference.

Technical papers on possibilities of adapting the WLN to CIDS were presented at the Edgewood meeting by Dr. Carlos Bowman, Dow Chemical Co., "Automatic Checkout and Classification," and Ernest Hyde, Canadian Industries, Ltd., "Notation to Connection Tables."

A report also was given on WLN work being done in list structure and substructure searching by George Fraction of Eli Lilly and Co. and Justin Walker of the U.S. National Bureau of Standards.

The WLN System uses letters, numbers and standard symbols on unmodified typewriter or punch-card keyboards to represent chemical symbols or significal chemical units, i.e., steroid structures.

WLN connection tables are coded to portray relationships of a given compound in a computer word. Tables are used as the unique entity of the chemical structure to relate it to such data as atomic number, bond value and number of atoms in the compound.

The goal of the studies reported at the meeting is to convert the WLN, using the standard characters, into the code used in the connecting tables and, conversely, to generate the WLN from the tables. The 2-way translation capability would permit the WLN input notation to be converted into the appropriate fields of a computer word associated with the table.

William J. Wisewesser, originator of the system, was among the group of 40 chemical information experts from the Government, private industry and the academic community who assembled at Edgewood to review the technical status of the program. He has been employed at Edgewood since 1963.

Peppino N. Vlannes, deputy chief of the Scientific and Technical Information Division, U.S. Army Research Office, represented the Office of the Chief of Research and Development at the meeting.

One of the highlights was the presentation of a Certificate of Achievement to Charles Granito of the Diamond Alkali Co. for significant contributions to automation of files in the Industry Liaison Office at Edgewood Arsenal. The award was presented by Edmund H. Schwanke on behalf of the commanding officer to recognize the cooperative working relationship between industry and the Army in the CIDS program.

### Teflon Used as Coating to Ease Friction on Howitzer Mechanism

Teflon, the wonder plastic material developed in the early 1950's to save homemakers' time and effort cleaning household utensils, is now saving work for artillerymen of the First Cavalry Division in Viet Nam.

The heavy-duty coating underwent tests at Aberdeen (Md.) Proving Ground, Development and Proof Services, in 1962, and is now being used to cover the recoil mechanism of the 105mm, M–102 howitzer.

The fluro-carbon plastic allows the gun tube to slide freely during recoil, thereby reducing friction and lessening wear and damage to parts.

To artillerymen, it means better operation over a longer period of time, with considerably less maintenance.

# Gudaitis Moves to MICOM Electromagnetics Lab

The Research and Development Directorate of the U.S. Army Missile Command recently announced the appointment of William V. Gudaitis as acting deputy director of the Electromagnetics Laboratory.

Gudaitis previously was deputy director of the Army Inertial Guidance and Control Laboratory, another of the eight Laboratories in the Directorate at Redstone Arsenal, Ala.

He replaces Robert C. Haraway, who is now heading a task group engaged in advanced radar research in the Electromagnetics Laboratory. Filling his old position is John P. Leonard, former chief, Systems Analysis Branch of the Inertial Guidance and Control Lab.

GUDAITIS has worked for the Army since 1960, and during the past year was a participant in the Alfred P. Sloan Fellowship program at the Massachusetts Institute of Technology. He did undergraduate work at the University of Detroit (BS degree in physics), and graduate work in physics at Harvard and MIT.

For more than seven years before joining the Army agency, he worked closely with the Army Ballistics Missile Agency at the Arsenal in developing the Redstone and Jupiter missile systems while heading the Control Design Department of the Chrysler Corp. Missile Division in Huntsville.

**William V. Gudaitis**

LEONARD has been at the Arsenal working in guidance areas since 1956 while working for Ford Instrument Co. on the Jupiter guidance and control system. He remained at Redstone with Ford until 1960, working on the Redstone, Jupiter C, Juno II and Pershing programs.

He joined the Army agency in 1960 as chief of the Dynamics Analysis Section, Guidance Control and Aeroballistics Laboratory. In 1962 he became chief of the Systems Analysis Branch.

The 32-year-old electrical engineer holds a BS degree from Manhattan (N.Y.) College, and has done graduate work at the University of Alabama. He has authored and coauthored a number of publications on missile guidance and control.

**John P. Leonard**

## U.S. Students Win Acclaim At Japanese Science Awards

Three outstanding American high school science students gained the esteem and admiration of thousands of Japanese as participants in the Tenth Annual Japan Student Science Awards in Tokyo, Nov. 2–9.

Kenneth L. Hurst, Felice Rose Tillman and Letantia Jankowski represented the U.S. Army, Navy and Air Force by displaying results of their research studies. Their exhibits were the same as they showed at the 17th International Science Fair (ISF) last May in Dallas, Tex., where they were selected by judges representing the three Services.

The Japan Student Science Awards are sponsored by the *Yomiuri Shimbun*, one of the world's largest newspapers, which also sponsors participation of Japanese students each year in the ISF.

Army's representative, 17-year-old Kenneth Hurst from Ephrata, Pa., displayed "Artificial Photo-Reduction," which proved that oxygen evolved by plants comes from chloroplasts, and that light rays affect the rate of photosynthesis.

A student with an exceptionally strong desire to excel, Kenneth was permitted to waive his senior year at Ephrata Union High School to enter Messiah College in Grantham, Pa. With a nearly perfect "A" average in high school studies, he has a dual goal of a doctorate in medicine, followed by a PhD degree in psychiatry.

Navy selectee Felice Rose Tillman's exhibit showed survival characteristics at 40 Gs between hypothermic and normothermic mice. She is a student at Denver (Colo.) University.

Air Force representative Letantia Jankowski, enrolled at the University of Southern California as a biochemistry major, displayed "Radioprotection and Immunosuppression."

The rigorous 9-day schedule also included visits to Japanese high schools, major industrial facilities, and the Imperial Palace. As guests of Japanese families, the trio also found time to absorb a smattering of Japanese culture and customs.

**TRI-SERVICE REPRESENTATIVES to Tenth Annual Japan Student Science Awards chat with Col Charles W. Cook, commanding officer, U.S. Army R&D Group, Far East. From left are Kenneth L. Hurst (Army), Felice Rose Tillman (Navy), and Letantia Jankowski (Air Force).**

## DoD Library Tech Report Deals With Automation

*Study of Mechanization in DoD Libraries and Information Centers* is now available to Federal organizations, industry and the public.

The recently published technical report consolidates information on efforts to automate DoD technical libraries and for current and long-range improvements in the Defense Department's interchange of scientific and technical information.

Included in the basic report are presentations and evaluations on thesaurus building, file structure, input processing, serial control, selective dissemination of information, circulation control and equipments being used.

Recommendations are given on information retrieval systems, as are observations on organization, operation and application, and summaries on mechanization status, scope and size of collections.

Individual in-depth reports, which were generated at 35 of 76 facilities involved in the study, are included as Appendix C.

The report evolved from a contract study recently completed by Booze, Allen Applied Research Inc., Bethesda, Md., under direction of Walter M. Carlson, Director of Technical Information, Office of the Director of Defense Research and Engineering.

It reflects a need for improved communication between librarians and computer personnel and also greater concern about cost versus usefulness and value of the systems. A better understanding of user needs also is presented as a goal in future efforts to improve the Defense interchange of scientific and technical data.

Results of the study will be used to develop greater uniformity, common practices, and improved systems for all the facilities involved.

Report AD 640 100 is available to Federal organizations and contractors registered with the Defense Documentation Center or to the general public from the Clearinghouse for Federal Scientific and Technical Information, 5285 Port Royal Road, Springfield, Va. 22151. Cost from the Clearinghouse is $7.00 for full-size copies and $1.75 for microfiche copies.

**JAPANESE HOSPITALITY is extended to Kenneth L. Hurst as guest in Tokyo.**

***McCORMACK'S THEOREM: If an experiment works, you could be using the wrong equipment.***

***GORACKE'S CONSTANT: Any number which when added, subtracted, multiplied, or divided into the answer, produces the required result.***

***ABEL'S AXIOM: When all else fails, read the instructions!***

# Brig Gen Shira Heads WRAMC Dental Activities

Former chief of oral surgery at Walter Reed General Hospital, Robert B. Shira recently returned to Washington, D.C., as a brigadier general and director of dental activities at the Medical Center.

Brig Gen Shira gained that rank last October in Germany, where he was assigned to U.S. Army Europe as dental surgeon. At WRAMC he succeeded Brig Gen Oscar J. Ogren, who retired from active military service.

Prominent in dental circles for many years, General Shira has appeared as clinician and essayist for more than 30 dental meetings and has conducted postgraduate courses in oral surgery at several dental schools. He is immediate past president of the American Society of Oral Surgeons.

After graduating from Kansas City Western Dental College in 1932, General Shira practiced dentistry in his hometown of Dewey, Okla., then transferred his practice to Pawhuska, Okla. He entered the Regular Army Dental Corps in 1938.

Brig Gen Robert B. Shira

From 1941 to 1947 he was stationed at Gorgas Hospital, Canal Zone, where he was in complete charge of all dental clinics operated by the Canal Zone Administration.

The author of over 30 articles on oral surgery and related subjects, General Shira's outstanding work with the Pennsylvania Division of the American Cancer Society won him the "Sword of Hope Award" in 1961. The University of Missouri named him "Man of the Year" in 1962, and the Dental Society of the State of New York awarded him the Jarvie-Burkhart Medal in 1966.

During his 28-year military career, General Shira has also presented clinics and essays at numerous international meetings in Canada, The Dominican Republic, Cuba, Chile, Peru, Panama, Argentina, Venezuela and Costa Rica. In addition he has presented papers at the First International Conference in Oral Surgery in London, The American Dental Society in Europe, and the F.D.I. in Cologne, Germany.

He is a member of the American Dental Association, American Society or Oral Surgeons, American Academy of Oral Pathology, Fellow of the American College of Dentists and a Diplomate of the American Board of Oral Surgery.

# 500-Year Time Capsule Includes Natick's Space Foods

In *2466 A.D.*, when a time capsule is raised at the Robert Hutchings Goddard Library, Clark University at Worcester, Mass., observers will find among 100 encapsulated items a variety of space foods, all produced by the U.S. Army Natick (Mass.) Laboratories.

The contents, by then sealed for five centuries, will include actual and microfilmed materials drawn from four categories: materials representative of space science pioneer Dr. Robert Goddard, the Space Age, Clark University, and contemporary life.

Alongside a can of irradiated bacon, barbecued beef slices and chicken a la king in experimental flexible packages, viewers of the future will find (as representative of our current culture) a Beatles record and a miniskirt. The items were selected by a 55-member committee.

The Natick-developed foods have historical significance in their own right. The irradiated bacon is from the Free World's first commerical production of foods preserved by ionizing atomic energy.

Ration components are thermally processed and the flexible packages are being evaluated as lightweight containers for minimizing reliance on conventional cans. The foods are identical to those used aboard the Gemini flights.

The artifacts of today's Army are contained in a time capsule designed as a replica of a rocket built in 1940 by the late Dr. Goddard. It will be lowered into the ground when current construction of the memorial library permits permanent placement.

The 300-pound container is constructed of stainless steel and aluminum. It is 10 feet, 4 inches long, with a diameter of 12 inches. Nitrogen is used to preserve the materials for inspection 500 years from now.

## Maj Walter Reed Monument Dedicated at WRAMC

**A BRONZE AND MARBLE memorial to Maj Walter Reed, conqueror of yellow fever, was unveiled Nov. 21 on the grounds of the Walter Reed Army Medical Center (WRAMC), Washington, D.C., further immortalizing the Army doctor who died in 1902. Guests of honor at the ceremony were former President (General of the Army) and Mrs. Dwight D. Eisenhower, seated at the base of the monument with Maj Gen Douglas B. Kendrick, Jr., CG of WRAMC. Principal speaker was retired Brig Gen (Dr.) Stanhope Bayne-Jones (lower left). Behind him is Mrs. Daisy Reed Royce, granddaughter of Maj Reed. The bust, by American sculptor Felix de Weldon, and the edifice are a gift of the Walter Reed Memorial Association.**

# HumRRO Announces Work Program for Fiscal Year 1967

Six work units, six exploratory studies and two basic research projects have been added to 35 other projects listed in the Fiscal Year 1967 work program of the Human Resources Research Office (HumRRO).

HumRRO is a George Washington University organization now in its 16th year as an Army contract research and development agency. Headquartered in Alexandria, Va., and with six operating divisions elsewhere, it serves to discover, develop and apply human factors and social science principles and techniques to improve Army training and operational performance. Upon request, it provides technical advisory service.

The FY 1967 work program comprises 30 work units, 15 exploratory studies, and 4 basic research projects. Work units are full-scale research efforts intended to produce information and products aimed directly at helping to solve Army problems or improving Army operations. The six new work units are:

*Computer-Assisted Training (COM AT)*. Division No. 1 (Systems Operations), Alexandria, Va., is assessing the feasibility of using Computer-Assisted Instruction—the latest technological development in education and training. Researchers are studying existing capabilities developed by educational institutions, industry and governmental agencies in assessing the state-of-the-art. They also are preparing materials for computer presentation in subsequent stages of this work unit.

*Determination of Performance Capabilities and Training Requirements for Manual Command and Control Function of the Nike-X Weapon System (MANICON)*. In direct support of the Nike-X Engineering/Services Test and Evaluation Program, Division No. 5 (Air Defense), Fort Bliss, Tex., is performing research to identify and evaluate human performance capabilities and training requirements for command and control functions within the Nike-X system. Researchers will expand, verify and update command and control position analyses and will conduct human capabilities research on specific individual tasks.

*Training Guidelines for the US/FRG Main Battle Tank (MBT)*. Division No. 2 (Armor), Fort Knox, Ky., will study job and training demands the new tank developed jointly by the United States and the Federal Republic of Germany will create in order to:

- Determine tank-crew skill and knowledge requirements.
- Devise appropriate training methods for imparting these skills and knowledges.
- Identify materials necessary for developing a timely training program for the tank crewmen.

*Long-Term Memory of Motor Skills (STRANGER)*. Scientists at Division No. 3 (Recruit Training), Monterey, Calif., will study how well soldiers remember military skills they learned in basic combat training if they use these skills only occasionally. They also will study "long-term memory" as a function of various possible training methods.

This is an effort to help the Army select training methods that will increase a soldier's proficiency and retention of learned skills, while using training time and resources more efficiently.

*Improving Aviation Maintenance Training Through Task and Instructional Analysis (UPGRADE)*. Division No. 6 (Aviation), Fort Rucker, Ala., will develop a model system in aviation maintenance training for relating the U.S. Army Aviation School's instructional objectives to the actual, on-the-job performance of Army aircraft mechanics.

Researchers will apply this model system to the development of training for maintenance personnel who work on the UH–1 series of helicopters, the prime rotary-wing aircraft now in use in Viet Nam. They also will develop methods and procedures for employing the system in other aviation maintenance training courses.

*Army Training Center (ATC) System Analysis (OVERVIEW)*. Division No. 3 (Recruit Training), Monterey, Calif. will examine interrelationships of various aspects of ATC training, and the ways in which the many specific aspects relate to the overall military objective.

Key elements of the system are personnel input, flow and output; subject-matter knowledge and skills to be learned; instructional techniques; evaluation procedures; instructors; and facilities.

This analysis is intended to help the Army integrate information it has obtained from numerous individual studies of isolated elements of the ATC system. From this effort should also come guidelines for assigning priorities to future ATC research activities.

Exploratory Studies are problem-defining activities undertaken in response to a particular military requirement. In such studies, HumRRO scientists evaluate the feasibility of engaging in a major research activ-

# Richey Heads Air-Mobile 11th Signal 'Fire Brigade'

Col Thomas B. Richey has been selected to command the 11th Signal Group, the Army's only air-mobile emergency communications unit, which transferred recently from Fort Lewis, Wash., to Fort Huachuca, Ariz.

Known as the "Fire Brigade," the 11th Signal Group is an element of the U.S. Army Strategic Communications Command's (STRATCOM) Continental United States (CONUS) subcommand, headquarters at Suitland, Md.

Col Richey recently returned from Viet Nam, where he served with the U.S. Army Concept Team. During a 25-year Army career, he has attended the Army Cavalry, Signal, and Aviation Schools, the Command and General Staff College, and the Air War College. He earned a BS degree at Texas A&M University (1941) and an MA degree in international affairs from George Washington University (1965).

Col Richey served in the Asiatic Pacific Theater during World War II and later in Korea. Assignments to Signal Plans and Operations Division, Office of the Chief Signal Officer of the Army, and as project officer at the Signal Engineering Laboratories, Fort Monmouth, N.J., followed his return from Korea.

He also served as an aviation staff officer at Continental Army Command Headquarters, Fort Monroe, Va., and on the staff of the Director, Communications-Electronics, Joint Chiefs of Staff.

Col Thomas B. Richey

With the Legion of Merit received for outstanding performance in Viet Nam, Col Richey wears the Combat Infantryman's Badge, the Bronze Star with two Oak Leaf Clusters, the Air Medal with Oak Leaf Cluster, and the Joint Services Commendation Medal.

He also has been awarded the U.S. Army Presidential Unit Citation with Oak Leaf Cluster, the Meritorious Unit Citation, and both the Philippine and Republic of Korea Presidental Unit Citations.

ity on a specific Army problem. The new Exploratory Studies are:

*Control in Small Infantry Units (ES–52).* Division No. 4 (Infantry, Fort Benning, Ga.) will study factors that influence "controllability" of small Infantry units in combat situations. Scientists will analyze input variables that determine how much close supervision a small unit requires in combat. They also will analyze the moderating variables that may relieve the small-unit leader of some of his control requirements (such as the degree of prior unit training and the use of subordinate leaders).

*Human Performance Degradation (ES–54).* Researchers at Division No. 5 (Air Defense, Fort Bliss, Tex.) will study the types of human factors that have a degrading influence on the effectiveness of radar-controlled air defense systems.

Quantitative measurement of human performance under actual combat conditions is extremely difficult, expensive and sometimes impossible. Researchers will study techniques for simulating adverse influences on human ability to detect and engage the enemy and maintain radar units.

*Environmental Engineering for Foreign Language Learning (ES–55).* Division No. 7 (Language and Area Training, Alexandria, Va.) will explore training environmental factors in which two major determiners of foreign language learning achievement (student aptitude and motivational factors) are utilized as effectively as possible.

The approach will explore the feasibility of combining new programed instruction techniques with simultation of non-American cultural settings so that foreign language learning will have meaningful benefits for students.

*U.S. Overseas Military Posts and Communities (ES–56).* U.S. Military personnel assigned to overseas missions often live in relatively self-contained American communities in the foreign countries. Division No. 7 will seek a better understanding of the characteristics of such communities in order to help the Army assess the implications of such arrangements on morale and mission accomplishment.

*Training for Logistics Functions (ES–57).* Division No. 1 will study cross-training for officers serving logistics functions. Scientists will explore the feasibility of research on methods, timing and content of training to improve the Army's capability to meet modern-day logistics needs.

*Factors Affecting ROTC Curriculum Improvements (ES–53).* HumRRO research on Work Unit ROCOM has identified the range of initial duty assignments for new ROTC graduates and has analyzed these assignments to identify the common core of branch-immaterial knowledges and skills required of these newly commissioned officers. The new study, to be conducted by Division No. 4, will explore areas in which further research would be of greatest benefit to the ROTC program.

Basic Research Studies deal with selected problems in the psychological and social sciences in which an increase in knowledge would apply to the human factors problems that exist in a military environment, and contribute to the present body of facts and principles bearing on training. The new basic research studies are:

*Prompting and Guidance in Training (BR–14).* Objective of this study by Division No. 2 is to identify principles and practices of guiding performance during training that would be useful over a wide range of military training programs.

Researchers will explore various forms of step-by-step prompting and guidance and will conduct pilot experimental comparisons of aspects that appear to be critical—such as frequency of prompting, the nature or content of prompting, and styles of prompting.

*Types of Small Units (BR–15).* HumRRO scientists at Division No. 4 will attempt to develop a system for categorizing small units (work groups) in terms of their tasks, structures and interdependencies.

It is expected that out of this study, and subsequent research, will come a model that will distinguish between types of small units. Such distinctions have implications for different kinds of unit training for various kinds of units.

Work Units account for approximately 65 percent of the total FY 67 program, Exploratory Studies for 22 percent, and Basic Research for 5 percent. In addition to these programed research efforts, HumRRO has allocated the remaining 8 percent of its FY 67 resources to a fourth, unprogramed category of effort—Technical Advisory Service (TAS). HumRRO responds to about 100 requests for TAS assistance each year.

## SCIENTIFIC CALENDAR

American Society for Testing and Materials National Symposium on Adhesion of Materials in Space Environments, Toronto, Canada, Feb. 5-6.

American Society for Testing and Materials Winter Meeting, Detroit, Mich., Feb. 5-10.

Middle Atlantic Meeting of the American Chemical Society, N.Y.C., Feb. 6-7.

Flight Test, Simulation and Support Conference, sponsored by AIAA, Cocoa Beach, Fla., Feb. 6-8.

6th Annual Lectures on Aerospace Medicine, sponsored by USAF School of Aerospace Medicine, Brook AFB, Tex., Feb. 6-9.

Winter Convention on Aerospace and Electronic Systems, sponsored by IEEE, Los Angeles, Calif., Feb. 7-9.

International Solid State Circuits Conference, sponsored by IEEE and the University of Pennsylvania, Philadelphia, Pa., Feb. 15-17.

Meeting of the American Institute of Chemical Engineers, New Orleans, La., Feb. 19-20.

Seminar on Airborne Photo-Optical Instrumentation, sponsored by the Society of Photo-Optical Instrumentation Engineers and USAF Eastern Test Range, Cocoa Beach, Fla., Feb. 20-21.

Meeting of the Biophysical Society, Houston, Tex., Feb. 22-24.

National Air Meeting on Collision Avoidance, sponsored by the Institute of Navigation/Flight Safety Foundation, Dayton, Ohio, Feb. 23-24.

2nd Toronto Symposium on Thermoanalysis, sponsored by The Chemical Institute of Canada, Toronto, Canada, Feb. 27.

Sounding Rocket Vehicle Technology Meeting, sponsored by AIAA, Williamsburg, Va., Feb. 27-Mar 1.

Conference on Membrane Structure and Function, sponsored by The Chemical Institute of Canada and the Canadian Biochemical Society, Marguerite, Quebec, Feb. 27-Mar. 3.

### Delivery Set on UH–1 Fuel Controls

Production and delivery of fuel controls for the Army UH–1 Iroquois helicopter are scheduled to be completed this month by Chandler Evans, Inc., W. Hartford, Conn. The $507,727 contract was awarded last November by the U.S. Army Aviation Materiel Command, St. Louis, Mo.

## Quadripartite Working Group Studies 1980s Combat Concept

The Quadripartite Standing Working Group on Combat Developments recently held a 6-day conference at the U.S. Army Combat Developments Command Experimentation Command (CDCEC) to develop the scope and framework for the ABCA Operational Concept Post 1980.

The 25-man team from the United States, Britain, Canada and Australia meets periodically to insure the fullest cooperation among the four armies in the field of concepts, doctrine and other combat development matters of concern to the four armies. Efforts of the group address the achievement of nonmateriel standardization and interoperability among the armies.

The CDCEC at Fort Ord, Calif., was selected as the conference site because the group desired information on CDCEC operations and its part in the defense picture of the future. Experimentation in action was observed on the Hunter Liggett Military Reservation. Brig Gen George L. Mabry, Jr., commanding general, welcomed the group.

Presentations on current operational research tasks were made by Dr. Wilbur Payne, special assistant to the Under Secretary of the U.S. Army; Lt Col J. C. Mears, U.S. Army Office of the Chief of Research and Development; A. Grimes of the United Kingdom; and Dr. J. W. Mayne and M. W. B. Snarr, Canada.

# Army RDT&E, Procurement Contracts Total $450 Million

Army contracts totaling more than $450 million have been awarded for research, development, test, evaluation and materiel since last reported in this publication.

Bell Aerospace Corp. received eight contracts totaling $47,146,513 for UH–1E and AH–1G helicopters and components such as rotor hub assemblies, rotor blades and various other assemblies for the AH–1G and UH–1 aircraft.

Boeing Co. was given $45,025,949 in modification of a CH–47B model helicopter contract and for preproduction planning, procurement and production of long lead-time materials for additional CH–47Bs; rotor wing blades for CH–47 (Chinook) were included.

Modification to a contract for artillery ammunition charges of $32,467,-993 was awarded to Olin Mathieson Chemical Corp. AVCO Corp. is receiving $23,695,425 for T–53–L–13 and T–53–L–11A engines for UH–1 aircraft.

A contract for artillery projectiles, related components and for operation and maintenance activities was modified with an additional $22,203,465 going to Day and Zimmerman, Inc., Philadelphia, Pa.

Hercules, Inc., Wilmington, Del., is receiving $20,630,639 in contracts for propellants and explosives for the Nike booster and 2.75-inch rockets. Harvey Aluminum, Inc., is getting $16,579,719 for 20mm cartridge components and certain classified items.

Atlas Chemical Industries, Inc., received a $15,764,868 contract modification for TNT. Page Communications Engineers, Washington, D.C., is getting $15,298,653 for expansion and services for the Integrated Wide Band Communication System (IWCS) facilities at Fort Monmouth, N.J., and in Southeast Asia.

Philco Corp. and Philco-Ford Corp. have been awarded contracts totaling $12,051,654 for R&D, data and control sets for Shillelagh missile system, and expansion of the IWCS.

A contract modification of $11,033,-262 goes to Mason and Hanger, Silas Mason Co., Inc., N.Y.C., for warheads and ammunition components and operation and maintenance activities.

General Motors Corp. received $10,-879,989 for diesel engines for the M113A1 vehicles, starter assemblies for 2½- and 5-ton trucks, M551 diesel engines, 12-volt batteries for ¼-ton and ¾-ton trucks, and for 20-ton capacity dump trucks.

Machlett Laboratories, Inc., Springdale, Conn., is getting a $10 million definitization of a previous contract for Image Intensifier Assemblies. Goodyear Tire and Rubber Co. was awarded $9,358,151 for combat tank components.

Honeywell, Inc., won contracts totaling $7,786,292 to produce 40mm cartridge fuzes, bomb components and bomb fuzes. Firestone Tire and Rubber Co., is receiving $6,488,746 for combat tank components. Norris Thermador Corp., Everett, Mass., will produce 66mm high explosive antitank rocket launchers for $6,117,140.

Chamberlain Corp., Waterloo, Iowa, was awarded $5,087,400 for 2.75-inch rockets and 105mm cartridge cases. Ford Motor Co. is receiving $4,965,-235 for 2½-ton utility trucks (M151-A1) and General Time Corp. won two contracts totaling $4,849,081 for 105-mm and 2.75-inch rocket fuzes.

Canadian Commercial Corp., Ottawa, is getting $4 million for radio sets (AN/GRC–103/VI) and ancillary items. Illuminating ground signals and smoke canisters are being purchased from Pace Corp., Memphis Tenn., for $3,504,354.

Research and development in electronic warfare will be done by Sylvania Electric Products, Inc., under a contract for $3,300,000. Gyroscopes for Nike Hercules missiles will be produced for $3,049,000 by Western Electric Co.

McDonnell Aircraft Corp. is receiving $3 million for continued engineering development of the medium antitank assault weapon (MAW).

Four firms received contracts for 20mm cartridges: Galion (Ohio) Amco, Inc., $1,901,696; Supreme Products Corp., Chicago, $2,411,475; Newal, Inc., Waltham, Mass., $1,176,-100; Z-D Products, El Segundo, Calif., $3,523,000.

Mansfield Tire and Rubber Co. was awarded $3,117,303 and Mohawk Rubber Co., $4,222,405 for tires for 1½-ton trailers and 2½-ton trucks; General Electric Co., is receiving a total of $2,804,628 for armament spare parts, ground equipment and for additional effort on the ARPA Project Glow research program.

United Aircraft Corp. was awarded $2,774,561 for CH–54 gear box assemblies and JFTD 12A–4A helicopter engines. A $2,530,284 contract modification goes to Kaiser Jeep Corp. for M606 ¼-ton utility trucks.

Minnesota Mining and Manufacturing Co. received a $2,349,121 modification to a contract for periscopes and mounts for the General Sheridan assault vehicle and Chrysler Corp. was

**EDGEWOOD ARSENAL has contracted for manufacture of more than 1,600,000 M17A1 protective masks that enable the fighting man to drink water and to administer resuscitation while wearing the mask. The M17A1's (shown at right) will be manufactured by Mine Safety Appliances Co., Pittsburgh, Pa., under a multi-year contract totaling over $28,000,000. Below, Col William W. Stone, Jr., CO of the Arsenal and Eugene Merry, president of the Pittsburgh company, observe as William Huss, contracting officer, signs pact.**

issued $2,735,121 for engine assemblies.

Pacific Car and Foundry Co., Renton, Wash., is receiving $2,435,500 for engineering services for M107 and M110 vehicles and fabrication of test hardware sets, a contract modification.

M1A1, M2 and M3 30-caliber carbine parts are being bought from High Standard Manufacturing Corp., Hamden, Conn., for $2,334,255. FMC Corp. was awarded $2,573,314 for Hawk missile equipment carriers.

American Bosch Arma Corp., Springfield, Mass., is being issued $2,239,487 for fuel pumps for trucks; Holt Brothers, Stockton, Calif., $2,269,268 for generator sets; Albion (Mich.) Malleable Iron Co., $2,368,800 for 2.75-inch rocket metal parts.

Industrial tractors are being bought from Caterpillar Tractor Co. for $2,313,664. M. C. Ricciardi Co., Alpha, N.J., was awarded $2,169,845 for fiber containers for ammunition and Kollsman Instrument Corp., Elmhurst, N.Y. is receiving $2,142,000 for booster assemblies and metal parts for 75mm and 155mm shells.

A contract for $2,115,000 for 20mm projectiles was awarded to Amron Corp., Waukesha, Wis., and $2 million to the Ratheon Co., for Multiplexers and ancillary items.

Other contracts awarded include: $1,964,539 to Eureka Williams Co. for mechanical time fuze parts; AVCO Corp., $1,973,611 additional for further production of T-53 series engines and UH-1 aircraft parts; Consolidated Box Co., Inc., $1,914,792 for ammunition containers;

Also, Ingraham Co., $1,960,000 for metal parts for 4.2-inch mortar rounds; General Dynamics Corp., $1,823,409 for components of radio sets (MD-522/GRC and MT-3140/GRC-106); Servel Co., $1,765,450 for radio batteries; North American Aviation, Inc., $1,700,000 for Condor missiles;

Also, General Instrument Corp., $1,505,750 for 750-pound bomb fuzes; TRW Inc., $1,500,000 for electronics gear; Hughes Tool Co., $1,426,000 for TH-55A helicopters; FMC Corp., $1,612,976 for metal parts for 4.2-inch cartridges; Federal Laboratories, Inc., $1,453,332 for hand grenades;

Also, Lehigh, Inc., $1,695,792 for 2.75-inch rocket warheads; Plymouth Industrial Products, Inc., $1,512,800 for M105A2 ammunition container assemblies; Norris Thermador Corp., $1,361,250 to refurbish ordnance production equipment; Atlantic Research Corp., $1,361,008 for bomb fuzes;

Also, Booz, Allen Applied Research, Inc., $1,253,167 for scientific and technical support of the Army Combat Development Institute of Combined Arms and Support; Gibbs Manufacturing and Research Corp., $1,381,380 for 2.75-inch rocket fuzes; Canadian Commercial Corp., Washington, D.C., $1,334,517 for portable telephone sets (TA312);

Also, Sperry Rand Corp., $1,444,000 for gyro magnetic compass sets and ancillary items; Bell Helicopter Co., $1,241,009 for UH-1 aircraft scissor and sleeve assemblies; Electrospace Corp., $1,254,730 for central office telephones;

Also, Hanson Machinery Co., $1,224,871 for truck-mounted cranes; Rohm and Haas Co., $1,150,000 for propulsion research; Union Carbide Corp., $1,132,032 for portable radio set batteries; Paper Tubes, Inc., $1,084,612 for ammunition containers; Stewart Warner Corp., $1,113,080 for 60m projectile metal parts;

Also, Firestone Tire and Rubber Co., $1,117,377 for shoe assemblies for armored personnel carriers; Gar-Let Manufacturing Co., $1,139,464 for telephone cable assemblies; Chamberlain Corp., $1,178,635 for 2.75-inch rocket parts; Kisco Co., Inc., $1,197,490 for 20mm cartridge containers, shipping and storage; and Brunswick Corp., $1,059,187 for 155mm projectile parts.

# AVLABS Evaluating 2 Aircraft Check-out Systems

In an effort to minimize aircraft crashes due to mechanical failures, the U.S. Army Aviation Materiel Laboratories (AVLABS), Fort Eustis, Va., are conducting an intensive program to develop diagnostic sensing systems to indicate go or no-go readiness.

Two types of systems have proved workable in investigations to date, AVLABS reported recently. One is the Automatic Light Aircraft Readiness Monitor (ALARM), built and subjected to limited testing by the Bendix Corp. under contract. Devices to sense temperature, pressure and vibration automatically establish an aircraft's mechanical and structural condition for flight.

Another system in which the Army Aviation Materiel Command installation is interested is a more recent development, known as the Sonic Analyzer, designed and built by Curtiss-Wright Corp. This system is based on the principle that almost all rotating components produce sounds having discrete frequencies which can be determined acoustically.

The concept is that by calculating where these frequencies should appear in the sound spectrum for each component, and establishing a base line from which deviation in the spectral characteristics of the component can be measured, it is possible to detect defects in the condition of rotating components.

In pursuance of study of the feasibility of the sonic analyzer and detector, the AVLABS recently awarded a contract to the Curtiss-Wright Corp. to build a prototype for evaluation on the power trains of several helicopters of the same type.

The ultimate goal is a push-button system that will enable the operator to determine automatically the condition of each rotating component in the engine or power train. If a malfunction is detected, the analyzer automatically will shut down. The operator then can determine at which point the component is malfunctioning.

Analysis time is expected to be under five minutes for each aircraft, assuming no malfunctions. Simply by changing a plug-in adapter device, the sonic analyzer will be converted to perform on a wide variety of engines and/or power trains.

AVLABS researchers stress that although the ALARM and Sonic Analyzer programs have attested the functional feasibility of monitoring systems to indicate the flight readiness of aircraft, much effort is still required before they can be made ready for operational use.

In the limited testing conducted to date, every malfunction detected by these systems was found to be a true malfunction. When ALARM sensors indicated a defect in the tail section of a UH-1A helicopter, although repeated visual checkouts could uncover no fault, a detailed tear-down inspection of the tail boom showed a cracked mounting frame that verified findings of the sensor.

Advantages of diagnostic sensing systems from the viewpoint of the AVLABS and contract agency researches are obvious—in respect to the reduction of aircraft crashes due to engine or structural failures, in the economy of maintenance inspection manhours, and in assurance to the crew and passengers that an aircraft is fully ready for service.

The AVLABS research programs have been conducted under the guidance of Leonard M. Bartone, chief of the Mechanical Systems Branch, Aircraft Systems and Equipment Division, and Meyer B. Salomonsky, aerospace engineer.

# Army Activities in Satellite Communications

(*Continued from page 2*)

network. The SATCOM Agency conducted the test program from its Test Operations Center at Fort Monmouth, first for NASA, and later for the Department of Defense when the two SYNCOM satellites were transferred by NASA to DoD.

In providing the surface environment for the SYNCOM satellite communications system, the Army developed and deployed fixed, transportable and shipboard terminals, had responsibility for their continual redeployment to meet constantly changing requirements, and directed and evaluated the R&D communications testing.

As the SYNCOM program progressed, this surface complex evolved into a network of terminals varying in size and complexity. Terminals which originally were planned for ADVENT were modified: the AN/FSC–9 fixed stations with 60-foot antennas, located at Fort Dix, N.J., and Camp Roberts, Calif., and the *USNS Kingsport* shipboard terminal which carried a 30-foot antenna under its radome.

The transportable AN/MSC–44 terminal with its 30-foot antenna was specifically designed for SYNCOM, as were the two experimental 15-foot antenna highly transportable terminals, the Mark IV (X) and the AN/TSC–55.

Finally, the Army deployed for SYNCOM the AN/MSC–45, also a 30-foot transportable terminal, initially built for Air Force use with Telstar.

During the R&D test phase, with the SATCOM Agency serving as a technical advisory agency, first to NASA and then to the Defense Communication Agency, the various SYNCOM circuits were synthesized into systems which, in turn, were combined into an operational network and integrated into the Defense Communication Systems.

The location of SYNCOM II over the Indian Ocean and SYNCOM III west of the International Date Line provides dependable communications relay points in an area previously devoid of such a capability. The ground terminals were, of course, also located for the best communications in the Pacific/Asia area.

Today, the SYNCOM system provides a limited alternate route for passing DCS traffic, having progressed from the R&D portion of the program to an operational status on July 1, 1966.

Effort in the Defense Communications Satellite Program now concerns technical testing of the Initial Defense Communications Project, which will be followed by an operational system.

Testing for the IDCSP started June 16, 1966, when the Air Force launched eight 100-pound satellites (seven communications satellites, and one gravity gradient experient) aboard a single TITAN IIIC. This was the first of a series of three launches scheduled for 1966–1967 and designed to place a total of 22 communications satellites into a random, equatorial, near-synchronous (18,200 nautical miles) orbit.

The second launch of the series, on Aug. 26, 1966, failed when the TITAN IIIC exploded shortly after lift-off. Another launch is planned early this year.

Each launch begins with the initial "lift-off" in the usual, nominal 30° inclined orbit, from Cape Kennedy. As the launch sequence proceeds, the TITAN III boosts the trans-stage to a near-synchronous altitude of 18,200 nautical miles and orients the trans-stage along the equator. The satellites are then ejected in a time sequence and with a velocity differential to insure their eventual spreading, in a random sequence, above the equator.

The near-synchronous orbit combines the advantages of a synchronous system with those of a random, uncontrolled system. This is accomplished by the slow drift of near-synchronous satellites, in the orbits specified, into and out of the mutual field of view of each pair of ground terminals.

The long time in view minimizes the tracking and handover problems and simplifies the system control concept. The satellites contain no control mechanism or circuitry and are immune from deliberate enemy tampering with their positioning.

Once the satellites have separated, each one, in turn, is used as a repeater for a series of communications experiments. These experiments have been devised to fully test the capabilities of the satellite communications system, the interface between the ground terminal and the satellites, and the interface between the ground terminal and the conventional communication system.

One of the first requirements in establishing the IDCSP network was the selection of suitable overseas terminal sites. The location of each terminal was determined by the Defense Communications Agency, based on the results of surveys by SATCOM agency site-engineering personnel. These highly trained specialists have developed a capability which is unique because of the newness of the entire field and the absence of previous experience in the selection of sites for satellite communications terminals.

In developing the surface environment for the initial project, the Army has drawn upon the experience gained in the development of the SYNCOM terminals and in the operation of the SYNCOM technical test program. The IDCSP surface complex is a mix of fixed and transportable terminals with planned future augmentation by a new, smaller transportable design.

The specific terminals included in this initial project are the AN/FSC–9 fixed stations at Fort Dix and Camp Roberts, the air-transportable AN/MSC–46s and the lighter weight AN/TSC–54.

The Fort Dix and Camp Roberts fixed stations serve as the principal entry points for the satellite communications links from the Pacific and Europe. Both stations are veterans of military space communications research. Originally built for the ADVENT Program, they were modified first for SYNCOM and again for the IDCSP. The most recent modification insures compatibility with the AN/MSC–46 and enables operation in the IDCSP mode while retaining a SYNCOM capability.

The AN/MSC–46, developed for overseas deployment, incorporates engineering advances resulting from earlier efforts and is the first to be specifically designed for military satellite communications. A single terminal consists of a 40-foot diameter parabolic antenna (usually housed to protect it from the elements in a 58-foot dual-wall inflatable radome), three 30-foot vans (an operations control van, a cargo van, and a maintenance van), and three 100-kva diesel generators.

Delivery of the terminals began late in 1965 with a total of seven terminals delivered to date and seven more to come. Of the seven already delivered, six have been installed overseas—in Hawaii, Ethiopia, Philippines, West Germany and two in Viet Nam. One has been allocated to the Signal School at Fort Monmouth for personnel training.

Three of the seven terminals still in production will be shipped to add to the current stations in Hawaii, West Germany and Ethiopia. One will be deployed to Okinawa. Three are earmarked for the Air Force.

An essential portion of the overall IDCSP is the Satellite Communications Control Facility (SCCF), the central point for the operational control of the system. Installed in the DCA Operations Center in Arlington,

Va., the SCCF schedules and allocates satellite time for use by ground terminals located across the globe.

In the course of the Army's experience with satellite communications for military use, system applications have evolved from point-to-point, long-haul usage to the more flexible, lighterweight terminal. Since this trend is expected to continue, the Army has under development a small terminal, the AN/TSC–54. It will be a highly mobile, quick reaction, lightweight terminal specifically designed to meet Air Force and Navy, as well as Army, rapid deployment requirements.

The AN/TSC–54 will consist of an antenna and operations shelter mounted on separate trailers, with a generator attached on the antenna trailer. The antenna will be a Cassegrain type with four parabolas in a "cloverleaf" configuration. The estimated terminal weight in transport configuration including fuel for 72 hours operation is about 10½ tons.

Each terminal, including support materiel and six operating personnel, will be transportable in a single C–130 aircraft. Without the two trailers, the terminal will be transportable in helicopters. Setup will require less than two hours, and only minimum site preparation will be needed. The 13 terminals currently under contract will be used to augment the IDCSP system.

To fulfill the requirement for system evaluation in the IDCSP, the SATCOM Agency has employed a combination of automated and manually operated automated data reduction facilities. Known as DAPS (Data Acquisition and Processing System), these facilities are integrated into the fixed terminals at Fort Dix and Camp Roberts and, installed in vans, are deployed with the AN/MSC–46s.

The Satellite Communications Test Operations Center (SCTOC), located at the SATCOM Agency at Fort Monmouth, is linked with the satellite communications stations in the United States and overseas. Maps, orbital display and data panels on the walls present up-to-date information, while television monitors show teletype data and test planning information.

Testing which began in June with the first IDCSP launch is scheduled to run about nine months. The first phase of the test program has been dedicated to determining the characteristics and capabilities of the satellites. Later phases involve the investigation of the terminals and the evaluation of the complete system.

Findings resulting from this program are being applied to the technology of the next phase, the follow-on operational system. In performing these R&D functions, we are well aware of the importance of providing operational capabilities. In fact, we expect to use the terminals in the Pacific-Southeast Asia area for this purpose early in the program.

The next phase will insure continuity of space communications services, since it is an outgrowth or follow-on project to the IDCSP. The Army, as part of a DCA tri-service study team, has formulated concepts for the ADCSP terminal development, defining in detail a family of terminals which will represent the exploitation of advanced electronic techniques.

The success of the highly transportable Mark IV-type terminals in the SYNCOM system also furnishes the opportunity to confirm SATCOM Agency's confidence in the suitability of satellite communications for tactical military applications, particularly in underdeveloped regions without indigenous communications.

This belief led to Army planning for development of a tactical system with SATCOM Agency assigned the Army's action responsibility in the new tri-Service TACSATCOM or Tactical Satellite Communications Program.

For the TACSATCOM R&D stage, responsibilities have been assigned to the Army for land terminals, to the Navy for shipboard equipment, and to the Air Force for airborne communications equipment as well as for the spacecraft and booster.

The Army's in-house TACSATCOM program is known as "Quick Fix," which very clearly describes our joint SATCOM-ECOM effort of fabricating and assembling experimental tactical terminals by modifying existing radio equipment and vehicles. Included are ¼-ton and ¾-ton truck installations and one 26-foot van.

In parallel with the preceding effort, a more advanced program is underway to develop a family of UHF and SHF (superhigh frequency) specifically designed to operate with tactical satellites. Each family will consist of both UHF and SHF terminals in team pack designs, ¼-ton installations, ¾-ton trucks, 2½-ton trucks and alert receivers. Airborne terminals, both rotary- and fixed-wing installations, will be developed by the Air Force and tested by the Army.

As the source for systems engineering in the field of satellite communications, the Army has the task of continually advancing the design of the ground environment pointing toward the optimum in military satellite communications. Usable new concepts and techniques have been evolved through an intensive exploratory development program and a strong program of in-house technological studies.

Currently under investigation are such diverse critical areas as high-efficiency antennas, advanced amplifiers, weather effects on satellite communications, small fuel-cell power supplies, multichannel adaptive complexes, optical synchronizers, communications in motion, and the survivability of link terminals.

With the ever-increasing technological progress, studies and experiments now being carried out and planned for the future can be expected to exploit the potential of military space communications to the fullest.

### Project SPARTA Begins Firings

A modified "Old Reliable" Redstone missile was used in recent tests, reentering the earth's atmosphere at ICBM reentry velocities, high above the Woomera Test Range in Australia.

The tests are the first of a series of planned launchings known as Project SPARTA (Special Antimissile Research Tests in Australia), a cooperative program of the United States, Great Britain and Australia, managed by the U.S. Army Missile Command, Redstone Arsenal, Ala.

## Johnson Rejoins Army Weapons Command as Deputy CG

Col C. H. Johnson

Col Chester H. Johnson assumed duties this past month as deputy to Brig Gen William J. Durrenberger, commanding general, Army Weapons Command (AWC), Rock Island, Ill.

Listed for promotion to brigadier general, Col Johnson served as AWC director of Procurement and Production from September 1960 to May 1965, then as chief of the Army Section of the Military Assistance Advisory Group in the Netherlands.

His 25 years of duty have been spent principally in ordnance and procurement assignments. From June 1948 to December 1950 he was an adviser to the Imperial Iranian Army. In 1959, he was chief of the distribution branch with the Eighth Army in Korea.

Col Johnson received a BS degree in civil engineering from Kansas State University in 1938. His awards include the Legion of Merit and the Army Commendation Medal.

# Army Environmental Research Broadens Combat Capability

By Dr. David E. Bass

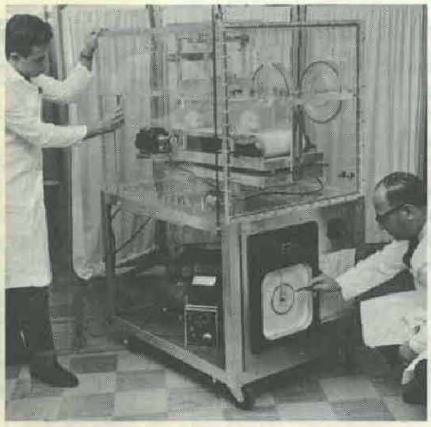
*This is the sixth in a series of articles on U.S. Army Medical Service laboratories research. Published in 1966, the first five explained missions of the U.S. Army Institute of Dental Research, Washington, D.C. (June); U.S. Army Medical Unit, Fort Detrick, Md. (September); U.S. Army Medical Research Laboratory, Fort Knox, Ky. (October); U.S. Army Surgical Research Unit, Brooke Army Medical Center, Fort Sam Houston, Tex. (November); and U.S. Army Medical Research and Nutrition Laboratory at Fitzsimons General Hospital, Denver, Colo. (December).*

An important factor in the waging of wars is the effect of climate and weather on the soldier. So overwhelming was this factor in earlier centuries that poor weather occasionally required postponement of "scheduled" battles (frequently by agreement between opposing field commanders!).

Modern warfare permits no such amenities. Our troops must be prepared to fight, not only in all natural climatic extremes, but also in environmental stresses artificially superimposed, for example, by use of protective clothing against chemical-biological weapons.

Consequently, the Army has a requirement to ensure that the combat effectiveness of the soldier is not unduly hindered by environmental extremes. This responsibility can best be discharged by providing:

- Rational doctrine for training and tactics in environmental extremes.
- Protective clothing and equipment that will take into account the physiological requirements and limitations of the soldier without imposing undue encumbrance or other stress.
- The best possible medical treatment for injuries or disabilities associated with environmental stress.



**ALTITUDE CHAMBER, with treadmill for chronic exposure of rats to simulated altitudes, is used for environmental studies at USARIEM.**

***Lt Col James E. Hansen***
***USARIEM Commanding Officer & Scientific-Technical Director***

The U.S. Army Research Institute of Environmental Medicine (USARIEM) at Natick, Mass., is importantly involved in the discharge of this responsibility. This Institute was activated in October 1961 as a Class II Installation of the Medical Research and Development Command on the grounds of the U.S. Army Natick Laboratories (NLABS).

USARIEM has yet to attain its full growth but it inherited from its precursors a distinguished lineage. It was fashioned from the Climatic Research Laboratory, originally in Lawrence, Mass., (later the Environmental Protection Research Division of the then Quartermaster Research and Engineering Command), and elements of the Medical Field Research Laboratory at Fort Knox, Ky. Both these laboratories performed important research on the effects of heat and cold on the soldier, particularly as they affected performance in environmental extremes and in tanks.

The mission statement of USARIEM is:

- "To understand the complex effects of climatic stresses on the human body and its defenses and to ascertain the techniques, procedures and equipment best able to make the soldier operationally effective with respect to optimal climatic protection.
- "To conduct basic and applied research to determine how heat, cold, high terrestrial altitude, and work affect the soldier's life processes, performance and health—and report and advise the Army and the scientific community, as appropriate."

Research conducted by USARIEM is related to the four major problem areas of Heat, Cold, High Terrestrial Altitude and Work Performance. Approaches to possible solutions include: (1) Clinical studies associated with disabilities due to environmental extremes; (2) studies of performance of the soldier; (3) supporting basic research; and (4) providing consultations, end-item tests, and studies of an *ad hoc* nature in response to specific requests from other elements of the military establishment that require the expertise peculiar to USARIEM's multidisciplinary professional staff. Basic research is conducted *in vivo* and *in vitro* to provide new information for the solution of present and future military problems.

USARIEM is commanded by Lt Col James E. Hansen, MC. The present staff consists of 69 civilians and 38 military personnel. Approximately 35 at the doctoral level (MD and PhD) are representative of the disciplines of physiology, biochemistry, pharmacology, psychology, anthropology, histology, pathology, medicine, physics and veterinary medicine.

The Institute is operating in temporary facilities consisting of 16,515 square feet of laboratory and office space on the grounds of the NLABS, and 5,776 square feet in a rented building about two miles away. A new building with about 76,000 square feet is scheduled to be ready for occupancy during the summer of 1968.

In addition to the most modern laboratory facilities for supporting research in the disciplines mentioned, the new facility will have numerous climatic chambers suitable for studying the effects of heat, cold and altitude on both humans and animals. Tropical and arctic chambers used at NLABS since 1954 will continue to be available to the professional staff of USARIEM, expected to grow to about 160 civilians and 50 military personnel. Between 50-60 investigators at the doctoral level will be required.

The Institute presently consists of a Support Division and five research divisions: Physiology-Medicine, Biochemistry-Pharmacology, Behavioral Sciences, Military Ergonomics and Pathology-Animal Care.

The regularly budgeted research program is supported by three projects. These, together with the percentage of current effort, are: Military Environmental Medicine (53 percent); Research in Biomedical Sciences (40 percent); In-House Laboratory Independent Research (7 percent).

Some idea of the broad spectrum of research activities within this project structure is afforded by the titles of the work units into which they are divided. Within Military Environmental Medicine are work units in Environmentally Induced Disabilities, Military Performance, Human Adaptations to Climatic and Related Stresses, Biological Considerations in the Design of Engineered Environments, Pathophysiology of Diseases Caused by Extreme Climates, and Pharmacology of Extreme Climates.

Within Research in Biomedical Sciences are tasks in Environmental Biochemistry, Environmental Psychophysiology, and Environmental Physiology. In-House Laboratory Independent Research tasks include Basic Research in Physiology, Basic Research in Biochemistry, and Basic Research in Psychophysiology.

From these titles, it can be seen that research in Military Environmental Medicine, results of which have the broadest application of these project areas, has a multidisciplinary flavor. Conversely, Research in Biomedical Sciences and In-House Laboratory Independent Research, both of which are more basic, are largely discipline-oriented in their approach.

In recent years, extra emphasis and budget support have been placed on problems of military operations at high terrestrial altitude. A large part of this expanded effort is funded separately by the Advanced Research Project Agency (ARPA).

The mission of USARIEM requires a broad spectrum of research activities, ranging from the most highly applied field studies to basic, and at times esoteric, animal and *in vitro* experiments. This is exemplified by descriptions of recent and ongoing research.

On the applied side, a study was completed recently on the effects of high terrestrial altitude on the ability of unacclimatized troops to perform military maneuvers. Approximately 180 Special Forces personnel conducted maneuvers at sea level and at altitude between 13,000 and 14,000 feet in Colorado.

The performance of a 120-man unacclimatized, tactical group was evaluated by Special Forces umpires and by USARIEM observers. In addition, the effect of a drug (acetazoleamide) on the adverse effects of acute altitude exposure was studied on the advance party of aggressors and umpires.

Two other field studies completed during the past year were: "The effects of high altitude on the thermoregulatory responses of man to cold," performed by a USARIEM team in the mountains of Peru, and "The pattern of cold acclimatization on a tropical population," performed in Puerto Rico on inhabitants who had not experienced cold and whose forebears for several generations had not been exposed to cold.

Test subjects did not show successful acclimatization to cold by criteria which have been used successfully in groups who have experienced cold at some earlier period of their lives. This has encouraged the design of a second study which will test the occurrence of acclimatization to cold in genetically similar test subjects who have been reared or brought up in colder latitudes of the United States.

Many studies have been performed on volunteer test subjects in the climatic chambers at Natick. These studies have been directed toward such diverse goals as determining the effects of drugs, e.g., aldosterone, salicylates, on man's ability to work in the heat; also, the relationship between psychological responses to stress and certain physiological and biochemical responses, with emphasis on catecholamines.

In the realm of the biophysics of clothing, many studies have probed physical factors affecting heat transfer from the body to the environment. These studies have involved the use of human test subjects, copper manikins, and flat-plate evaluations of insulation.

Theoretical research has been aimed at predicting physiologic responses to wearing protective clothing. A moisture permeability index for characterizing heat transfer through clothing has been devised and improved. A telemetry system has been developed for use on human test subjects during field maneuvers.

In the area of pathophysiology of diseases caused by extreme climates, ongoing work seeks to develop an experimental model for heat stroke and for high-altitude pulmonary edema. Studies on the effects of environmental extremes on drug action are being performed, using animals. Among other basic research efforts are studies on the physiology of hypothermia and hibernation.

In biochemistry, enzymatic adaptations to environmental stress are being studied at tissue levels. A significant effort involves studies of factors affecting mobilization and metabolism of fat depots, being made on humans, animals and *in vitro*.

Among other problems under attack by USARIEM psychologists are: The use of techniques of operant-conditioned behavior in studying behavioral thermoregulation in small animals; a search for predictors of altitude-induced disability; military physical performance and its relationship to other variables such as motivation, heat, cold, hypoxia, etc.; and the effects of hypoxia on sensory-perceptual performance.

USARIEM is fortunately situated with regard both to proximity to the scientific community and excellent professional relationships between members of the professional staff and this community.

Although there is no official affiliation, USARIEM staff members hold appointments in Boston University, Harvard University, Massachusetts

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Dr. David E. Bass has been deputy scientific director and chief civilian scientist of USARIEM since May 17, 1964, when he was appointed to PL–313 status. He received his first Civil Service appointment in 1942. During World War II, he served nearly three years in the Army.

He reentered Civil Service early in 1947 as a biochemist at the Quartermaster Climatic Research Laboratory, Lawrence, Mass., and has served as chief, Biochemistry Unit; chief, Physiology Branch, Quartermaster R&E Center, Natick, Mass.; director, Division of Heat and Work Research, USARIEM.

Dr. Bass was honored by The Quartermaster General in 1953 when he was awarded the QM Research Director's Award. In 1959 when he was awarded a Secretary of the Army Research and Study Fellowship.

He has published over 50 papers in the field of environmental physiology, with emphasis on human responses to heat and cold. Dr. Bass is a member of the American Physiological Society and several professional societies. He holds professorial appointments at the Boston University School of Medicine and at the University of Rhode Island.

A graduate of Brown University (AB, 1932), Dr. Bass spent a post-graduate year studying physiology with the late Prof. Walter B. Cannon at Harvard. After serving in World War II, he received MA and PhD degrees from Boston University School of Medicine, where he majored in medical sciences with emphasis on physiology.

# USARIEM Research Broadens Combat Capability

(*Continued from page 19*)

Institute of Technology, Northeastern University, Peter Bent Brigham Hospital and the University of Rhode Island. All these appointments, with the exception of that at the Peter Bent Brigham Hospital, require teaching at the undergraduate, graduate and medical school level.

An equally important advantage of the interaction between USARIEM and the academic community is the collaborative research, performed in-house at USARIEM between full-time staff members of USARIEM and consultants from the Boston area.

Collaborative ongoing research also involves USARIEM and the Harvard Medical School, Massachusetts Institute of Technology (Division of Life Sciences), Boston City Hospital, Boston University Medical School and Peter Bent Brigham Hospital.

It is, of course, axiomatic that the wellspring of applied research knowledge would soon dry up without a constant flow of new information that will provide the basis for solving the *ad hoc* military problems of the future. A continuing concern of the research staff of USARIEM is to steer a militarily effective course between the Scylla of too much *ad hoc*, applied research and the Charybdis of too much basic research that solves no clear and immediate military problem.

The research policy at USARIEM has been formulated with the hope that this Institute will:

- Perform such basic and applied research in environmental medicine as will solve present problems and anticipate problems of the future.
- Serve as consultants and a reposity of expertise in the field of environmental medicine for The Surgeon General and all Army elements.
- Provide guidance for rational doctrine in training and maintaining effectiveness of troops under all adverse climatic conditions.

## National Directory Lists Water Resource Researchers

Organizations doing research on U.S. water resources are described in a directory published recently by the National Referral Center for Science and Technology, Library of Congress.

The 248-page book, "A Directory of Information Resources in the United States: Water," was prompted by growing concern over the conservation, use and quality of the Nation's water resources. The directory includes Federal, State and municipal government offices, academic research groups, professional societies, water commissions and committees, national associations and other organizations.

The National Referral Center, established in 1963, is supported by the National Science Foundation. In addition to publishing directories of information sources, the Center has a free referral service.

The directory on water information resources, the third scientific resource directory published by the Center, may be purchased at $1.50 a copy from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The other directories listed information resources for the physical and biological sciences and engineering, and for social sciences.

## Edgewood Offers Course In Defense Negotiations

Edgewood (Md.) Arsenal is bringing the university to the student in a course backed jointly by the Graduate Extension Program of Rensselaer Polytechnic Institution and Harbridge House.

The Arsenal's Training and Development Division initiated the course in "Defense Negotiation Technique" (worth two college credit hours) to develop negotiation skills of the students, mostly from the Procurement and Production Directorate.

Col Clifton O. Duty, head of the P&E Directorate, reports that holding the graduate-level course at the Arsenal saves money when compared to the cost of sending the students to school and creates a superior learning atmosphere by enabling regular working associates to study together.

# ERDL Elevates 3 Civilians to Key Posts

Internal reorganization at the U.S. Army Engineer Research and Development Laboratories (USAERDL) has accounted for elevation of three civilians to fill key positions at Fort Belvoir, Va.

TERENCE G. KIRKLAND heads a new Power Equipment Laboratory formed to handle USAERDL responsibilities for design, development and evaluation of portable and mobile power generation equipment.

A graduate of the Montana School of Mines and the University of Wisconsin, Kirkland was with Allis-Chalmers before joining the USA ERDL) fuel cell development program in 1964.

RALPH E. HOPKINS is chief of the new Power Technology Laboratory which performs applied research and exploratory development on advanced power generation, conversion and transmission methods, and electromagnetic energy storage.

Employed at the Laboratories since graduation from Ohio University in 1950, Hopkins has received many awards including the Commanding Officer's Technology Medal, the Army Research and Development Achievement Medal, and the Exceptional Civilian Service Award.

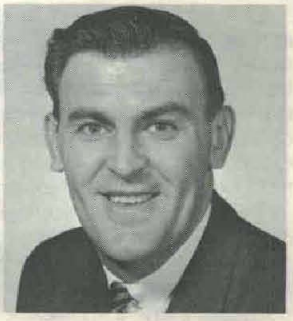
W. CARTER HALL was promoted to chief of the Procurement Office which is responsible for the annual award of millions of dollars in contracts at the Laboratories and tenant organizations located at Fort Belvoir.

Hall, who has been serving chief of the Office for several months, worked as a purchasing agent at Fort Belvoir before joining the Laboratories in 1956.

He has attended Benjamin Franklin University, Strayer College and Rensselaer Polytechnic Institute. While in military service (1950–54) he attended the Air Force Finance School and also served in French Morocco and Korea.

Terence G. Kirkland

Ralph E. Hopkins



W. Carter Hall

# Kudos

Exceptional Civilian Service Awards presented recently by General Frank S. Besson, Jr., CG of the U.S. Army Materiel Command, recognized the management achievements of Dr. Frank W. Howard and Alex Smallberg.

Dr. Howard retired from Federal Government service in June 1966 after a 35-year military and civilian career. He was cited for "creative and productive management" as technical director of the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., for the past 10 years. Currently, he is director of the Engineering Experiment Station, University of Arizona.

Accomplishments of the Laboratories for which Dr. Howard was recognized include development of a fuel cell program, development and standardization of an engine-generator family, an electric propulsion program, a nuclear electromagnetic pulse effects facility, and development of advanced night-vision devices.

Dr. Alex Smallberg

Dr. G. Howard & General Besson

Smallberg was decorated for exceptional performance of duty as director of materiel, U.S. Army Biological Laboratories, Fort Detrick, Md., and special assistant to the program manager, U.S./Federal Republic of Germany Main Battle Tank (MBT) Development Program. He also was called upon to act as contracting officer to the MBT Parametric Design/Cost Effectiveness study.

"Due to his leadership efforts and outstanding capabilities," the citation states, "the contract was executed in time to meet critical schedules and in a manner to insure qualitative, economic and timely performance. His utilization of incentive features in this contract drew wide attention and acclaim from Government and industry."

LEGION OF MERIT. Col George H. McBride received the Legion of Merit from Maj Gen John G. Zierdt, CG, U.S. Army Missile Command, for exceptionally meritorious service as project manager of the Hawk air defense missile system the past 27 months. Col McBride was nominated recently for the rank of brigadier general.

Lt Col (USA, Ret.) Frank D. Penas was awarded the Legion of Merit for his role in developing a firm foundation for the progress of the military research and development program in communications for the U.S. Army Electronics Command.

Retired from the Army since last February, Penas served in successive R&D positions as chief of the Requirement Division; Lab executive officer; and executive officer of the ECOM R&D Directorate since July 1963. He is now employed at Fort Monmouth, N.J., as executive special assistant to the director of the command's Combat Surveillance and Target Acquisition Laboratory.

Col William W. Stone, Jr., commanding officer at Edgewood (Md.) Arsenal, recently received the Legion of Merit at ceremonies involving the Arsenal Honor Guard and more than 100 senior officials.

Maj Gen Floyd A. Hansen, CG, U.S. Army Munitions Command, Dover, N.J., presented the award for exceptionally meritorious service as director of the Research, Development and Engineering Directorate from December 1965 to October 1966.

The Legion of Merit and Distinguished Flying Cross were awarded to Maj William E. Dismore, Jr., of the Edgewood (Md.) Arsenal Weapons Development and Engineering Laboratories.

The Legion of Merit Award cited his exceptional "chemical support" contributions while serving with the 1st Infantry Division in Viet Nam between January 1965 and August 1966. The Distinguished Flying Cross was awarded for his heroism while participating in aerial bombing operations.

ARMY COMMENDATION MEDAL. The first Oak Leaf Cluster to the Army Commendation Medal was awarded recently to Col Lewis E. Browning, deputy director, Operations and Administration, Armed Forces Radiobiology Research Institute (AFRRI), Bethesda, Md.

Col Browning was cited for "exceptionally meritorious service" while serving as nuclear medical officer at the U.S. Army Combat Developments Command Medical Service Agency, Fort Sam Houston, Tex. He held that post from August 1963 until July 1966, when he joined AFRRI.

CW2 William G. Hubacek of the Nuclear Power Field Office, Fort Belvoir, Va., received the Army Commendation Medal for meritorious service from July 1963 to July 1966 as superintendent of the SM–1A Nuclear Power Plant, Fort Greely, Alaska.

The award recognized outstanding initiative, technical ability, and supervisory skills in development of a temperature control system to detect potential failure before breakdown.

**ARMY R&D ACHIEVEMENT award winner Milton Cutler accepts bronze wall plaque from Chief of R&D Lt Gen A. W. Betts for his contributions to the effectiveness of quick-reaction research and development in providing new devices or materiel for delivery to Southeast Asia. As chief of the advanced Development Division, U.S. Army Limited War Laboratory, Aberdeen Proving Ground, Md., Cutler was credited with planning and supervision development of the acoustic bullet detector for low-flying aircraft, the integral smoke generator, the chemiluminiscent panel, a position locator, a runway marking system, lightweight purification unit, and ultrasonic sniffer for ambush detection.**

# Army R&D Advancing Combat Capability in Environmental Extremes

By Dr. F. P. dePercin, Dr. Leo Alpert, Donald C. Hilton

With the U.S. Army's current global commitments, entailing rapid movement of forces, the soldier may find himself fighting in the humid tropics today, and the desert or cold regions tomorrow. These three regions comprise approximately 57 percent of the earth's land surface and the 4 percent of the sea surface that is ice-covered.

Because of the rigorous environment, special consideration must be given to the problems associated with the development of a capability to operate and survive in such areas. Although military operations have taken place in humid tropical and desert areas over the centuries, much remains to be learned of the problems involved.

New materials, weapons and techniques have made today's military problems in such areas more numerous and complex than those faced by the warrior of bygone days.

In the world's cold regions, in particular the arctic and polar portions, a different situation has prevailed. For the most part, military strategists and tacticians have steered clear of such areas. Severity of the environment is one reason; also, in the old days these areas were isolated from the rest of the world.

With the advent of the airplane and nuclear submarine, one capable of cruising over and the other under the arctic ice pack, military leaders have taken a new look at polar potentialities. Now it is recognized that the northern cold regions regions offer the shortest route between many strategic areas.

Outer fringes of the cold regions were used in World War II for the location of airfields and aircraft ferry routes. Not until the early 1950s, however, was serious effort initiated by this country to exploit strategic advantages of these regions.

Research and development activities in the humid tropics and deserts are but a continuation of work begun centuries ago. Similar ventures in the cold regions are a relatively new endeavor for the Army.

The humid tropics, comprising about 20 percent of the world's land area, present a challenge to the soldier because of the debilitating heat and humidity, tropical diseases and unsanitary conditions to which he has little or no built-in immunity.

Compounding the problem of operations are the dense evergreen rain forests with which most military men are unfamiliar, and in which target acquisition, movement and communications are problems.

Another weighty factor is the strange people, with different languages, customs and religions, we may have to fight or support as allies. Finally, these people in the humid tropics often are the focus of insurgency activities conspired by Communist agents.

To improve the soldier's ability to function in humid tropical environment, improved jungle boots, tropical clothing and sleeping systems, and special tropical rations are being developed.

In addition, research is under way on the many health and sanitation problems of the humid tropics. The current problem of malaria among troops operating in Southeast Asia was anticipated in 1960, when it was recognized that certain strains of malaria found in Southeast Asia and other areas of the tropics were resistant to available drugs.

Consequently, a major search was launched for new drugs to treat malaria and much more effective drugs are now being provided. Continued studies are dealing with the nature of the plasmodium that causes the disease, and of the mosquito that is the vector of the disease.

Research also is aimed at improvement of communications in the dense jungle, in recognition of the marked attenuation of radio waves by the dense foliage, and development is well advanced on a new family of specially designed radios.

Target acquisition, surveillance and ambush detection are getting considerable attention. A wide range of sensors are being investigated for target acquisition from both the ground and air.

Improved techniques to identify the ground conditions in forested areas where the dense canopy hides the ground from the air also are the objective of intensive R&D. Penetrating the dense tropical vegetation is the major problem. Related to this work is the development of more rapid means of building helicopter clearings or landing pads in the forest.

Progress also is being made in R&D to provide the soldier with means of augmenting his visual and auditory senses. Ambient-light levels are extremely low under the dense jungle growth at night.

Deterioration of materials and equipment in the humid tropics caused by solar radiation, ozone, atmospheric contaminants, frequent rainfall, heat and high humidity, dew, termites and fungal growth is a major problem. Considerable effort is being expended on improved methods of corrosion prevention.

Some 12,000 samples of various metals, paints, organic and inorganic coatings, plastics, textiles, leather, rubber, electronic components, lenses, etc., are exposed or stored in the at-

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*DR. LEO ALPERT, tropical regional specialist since October 1961 . . . BS, education, State College, Mass. . . . MA and PhD, Clark University, Mass. . . . weather officer, U.S. Air Weather Service, WWII . . . research geographer, 1946–1951 . . . climatologist, Air Force Cambridge Research Laboratories, 1952 . . . Engineer Intelligence specialist, Corps of Engineers, 1953–1961 . . . chief scientist, U.S. Army Tropic Test Center, Canal Zone, 1963–1965.*

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*DONALD C. HILTON, polar regional specialist, Environmental Sciences Division, USARO since 1962 . . . CE degree, Rensselaer Polytechnic Institute . . . member, Arctic and Antarctic expeditions . . . construction engineer, Middle East and South America . . . Civil Engineer Corps, Navy, WWII . . . polar research engineer, Bureau of Yards and Docks, U.S. Navy.*

mosphere and under ground at the U.S. Army Tropic Test Center in the Canal Zone. The goal is development of improved materials and components that will stand up under long periods of storage and use. Termite and fungal-proof fenceposts, sandbags, wire insulation and building materials are among items being tested and evaluated.

Ways of increasing mobility through rice paddies and canal complexes and the slippery-sticky lateritic soils of the humid tropics also are being studied intensively. The suitability of several different types of experimental vehicles for operations in this environment is being evaluated.

Influence of the tropical rain forest on the dispersion, movement, concentration and dissipation of insecticides, herbicides, screening and signaling smokes, and other materials released from the ground or from aircraft is another important area of research.

Low clouds, fog and rain hamper air-ground operations in the humid tropics. Techniques for dissipating these conditions are being studied.

For the purpose of this article, a desert may be defined as a region of low rainfall and high evaporation in which plant growth is scanty or lacking. Desert areas comprise approximately 19 per cent of the earth's land surface. Another 15 percent is semiarid. Air temperatures in the desert can reach 135° F. and often they fall below freezing.

Much remains to be learned about the desert environment. Improved knowledge is needed for tactical and strategic planning, and for development of clothing, equipment and food for use in such regions to develop an effective desert fighting man.

Since World War II, Army equipment intended for use in the desert has been tested at Yuma Proving Ground, near Yuma, Ariz. Detailed studies have been made of the Yuma climate and terrain to assist test planners and design engineers. It is not sufficient to know only what the environment is at the test site. It is equally important to know how analogous environmental conditions at the test site are to similar regions throughout the world.

To answer this question, Army scientists at the U.S. Army Engineers Waterways Experiment Station, Vicksburg, Miss., and the U.S. Army Natick (Mass.) Laboratories have prepared reports comparing the environment of Yuma with other world desert areas.

Results show that in some respects Yuma climate and terrain are very much like those of other deserts. But there are important differences. For example, it was found that in the deserts of Northeast Africa only relatively small areas are similar to the Yuma desert with respect to precipitation and cloudiness. Temperatures of the Russian deserts of Middle Asia are not as extreme.

In most deserts, summer heat causes impairment of man's ability to work and increases his water requirements. It is essential for the Army to know how hard a soldier can work in this extreme environment, how much water he needs, and how long he can go on reduced amounts without losing his efficiency or becoming a casualty.

Dust and sand obscure visibility, erode mechanical parts of equipment and make life generally miserable for troops. Sand storms may cause operations to halt completely and it is important to know where these storms occur, how often they occur, and how long they last.

Vehicles also raise dust when moving in the desert. Under such conditions, it is obvious that men suffer and lose efficiency. Abrasion of mechanical parts is extremely rapid, and concealment of movement is impossible.

Micrometeorological measurements show that soldiers in the desert may be subjected to a considerable range in temperature. During the day for example, a soldier's feet (and boots) may be exposed to temperatures of 150° to 160° F., while his head and shoulders (about the height where standard temperature measurements are made) are exposed to temperatures of 110° F.

This type of information is important when designing clothing as well as equipment. Material used in uniforms should provide protection against burns when soldiers lie or crawl on the ground, but must be light enough to be cool in an environment with very high temperatures and strong solar radiation.

These are but a few examples of how research and development strive to attain a more effective operational capability in the desert regions.

Cold regions are subdivided into subarctic and polar areas, comprising about 18 percent of the land area of the world and 4 percent of the sea area. Temperatures in the subarctic fall as low as −65° F. on occasions and in the polar areas occasionally reach −80° F. to −90° F. Extreme temperatures in the arctic normally fall somewhere between these extremes. In the south polar areas, where military operations are forbidden by treaty except those in support of science, temperatures have fallen to −127° F.!

Obviously, low temperature alone creates many problems in developing effective fighting men, equipment and techniques for deployment in such regions. In addition to the cold, mobility, communications, ordnance and construction problems are associated with the deep snow, ice, frozen ground, summer swamps, atmospheric disturbances, darkness and remoteness found in the cold regions.

Cold weather clothing has been developed to keep the soldier warm. However, the current problem is how to reduce the weight and bulk of such clothing so that he can fight and work more effectively. This is being done by developing auxiliary heating devices, which depend upon development of lightweight power packs.

Keeping the soldier protected physically from the environment is only part of the problem. He also must be protected or developed psychologically. He *should* have a healthy respect for this severe environment but he *should not* be overawed by it.

The U.S. Army attempts to accomplish this by building up self-confidence and competence, primarily by extensive and intensive training in the region, although such things as personnel selectivity and psychological screening are important factors also.

Next in importance to developing an effective soldier for operations in cold regions is the development of

(*Continued on page 24*)

**MOST BACKYARD PONDS have been "deactivated" until spring, but the outdoor pool at the U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, N.H., has been filled for winter research. USA CRREL engineers check the 30-foot-square, 4-foot-deep pool for studies such as effect of ice on piling, crack patterns, ice reinforcement, and blast results.**

# Army R&D Advancing Combat Capability

(*Continued from page 23*)

equipment that will operate effectively. Standard Army ground vehicles do not, in most cases, perform effectively. They bog down in the winter snows and summer swamps. Communications equipment operates spasmodically due to frequent electro-magnetic disturbances in the upper atmosphere.

Ordnance materiel malfunctions frequently—fuses fail to fire upon impact, particularly in deep snow; powder ignites at a slower rate; chemical clouds form and disperse in peculiar ways. Normal construction techniques result in foundation failure, structural collapse and excessive cost.

How are these problems being solved? In the case of mobility, vehicles with lower ground pressures, larger tire diameters, articulation features, and swimming capability are being developed.

The communications problem is being attacked by studying how to predict the occurrence of electromagnetic atmospheric disturbances, as well as ascertaining the relationship between such disturbances and the effectiveness of the various wave frequencies involved. Attention is being given to the creation of artificial radio wave reflective clouds that are not affected, as is the ionosphere, by such atmospheric disturbances.

Ordnance problems are being solved by concentrating on development of more sensitive impact fuses, improvement in proximity fuses, and compilation of accurate firing tables. Research is pointed to more complete understanding of the effects of meteorological conditions on CBR warfare under low-temperature conditions.

Construction problems are being solved by utilizing native materials, such as snow, ice and frozen ground for airfields, shelters, fortifications, etc., to the greatest extent possible in place of conventional concrete, wood and steel; and by understanding more thoroughly the process of heat flow into the underlying frozen foundation materials.

U.S. Army environmental research recognizes no insurmountable obstacles to achieving capability for U.S. Army operations in any extreme of terrain and climatic environment.

These are some of the problems associated with operations in the extreme regions of the world. None appears to be so difficult that it cannot be solved by a determined and knowledgeable research and development attack.

# STRATCOM Announces Assignments to Key Posts

The U.S. Army Strategic Communications Command in Washington, D.C., recently announced assignment of Col William Minton as deputy chief of staff for Operations, and Col E. J. Quashnock as director of the Communications Engineering Department.

Col Minton fills the position vacated by Brig Gen J. B. James when he recently was designated STRATCOM deputy commanding general. Until reassigned, Col Minton was deputy chief of the Defense Communications Agency Engineering Office.

Now in his 24th year of service, he participated in five campaigns in World War II and served with a communications group with General Eisenhower in London. Later he served in Tokyo at U.S. Army general headquarters. Other overseas duty has been in Asmara, Naples and Korea.

COL QUASHNOCK is a graduate of Carnegie Institute of Technology and holds a master's degree in electrical engineering from the University of Wisconsin. His military education includes the Command and General Staff College and the Armed Forces Staff College.

During 26 years of service, he served with the Joint Military Mission in Greece (1950–53) and was a Signal representative with the Standardization Group in Ottawa, Canada (1960–63). In World War II, he served in the China Theater, holding important Signal Division assignments in Chungking and Shanghai.

**Col W. Minton**

**Col E. J. Quashnock**

## U.S. Army Units Completing Move From France to Germany

Relocation of the last major U.S. Army headquarters from France into existing U.S. facilities in Germany recently was announced by the Department of Defense.

Headquarters of the U.S. Army Communication Zone, Europe (COMZ) now at Orleans, will move to Worms, Germany. The U.S. Army Supply and Maintenance Agency, a major component of headquarters, COMZ, now located at Verdun and Maison Fort, will go to Zweibrucken.

The locations were selected after consultation with the Federal Republic of Germany.

This is the third major step in the current program of rearranging the U.S. Military Command Structure in Europe, brought on by the necessity of relocating U.S. military forces now in France. The Department has previously announced that the headquarters of the U.S. European Command will move from Paris to Stuttgart in early 1967, and that the headquarters of the Seventh Army at Stuttgart, was combined with the headquarters of the U.S. Army, Europe, at Heidelberg, during 1966.

The moves begin as soon as possible, with both units expected to be operational at new locations by Mar. 31.

## U.S., Germany Select Firms To Build VTOL/STOL Aircraft

The prototype definition phase in the joint U.S.-Federal Republic of Germany (FRG) development of vertical takeoff landing/short takeoff landing (VTOL/STOL) aircraft has been assigned to one firm in each country.

Republic Aviation Division of Fairchild Hiller, Farmingdale, N.Y., and Entwicklungsring-SUD of Munich, Germany, were selected by their governments to continue studies of the past year leading to the definition of prototype fighter aircraft which will be procured for test and evaluation.

The two firms will work together under direction of the System Program Office, manned jointly by U.S. and FRG personnel.

## Japan Unit Guards Troops' Health

**U.S. Army troops in Japan are assured of safe drinking water and nutritious food, free from harmful bacteria, through the efforts of the Army Food Analysis Branch, Department of Veterinary Medicine, 406th Medical Laboratory.**

**To carry out this mission, the Branch analyzes each month more than 1,000 food samples sent for examination, requiring approximately 100,000 individual analysis tests.**

# Army, PHS Battle Carrier of Yellow Fever

A joint Army-U.S. Public Health Service program to eradicate *Aedes aegypti*, the mosquito vector of urban yellow fever and dengue fever, from Army posts in the United States and its territories is in its second year of operation.

The Army operations are a part of the national eradication program being conducted in cooperation with the local governments of 10 southeastern states, Hawaii, Puerto Rico and the Virgin Islands.

The presence of the mosquito, *Aedes aegypti* in these areas make them receptive to the introduction of both yellow fever and dengue, diseases that in the past have occurred in epidemic form in some of these locations.

Because the environmental conditions and other factors contributing to *Aedes aegypti* infestations may vary from base to base, the detailed operation conducted at each Army installation is developed by the local base staff with the assistance and guidance of military entomologists and technical personnel of the U.S. Public Health Service.

Each base program is carefully coordinated with that of the surrounding civilian community to insure that the activities of the military and civilian agencies will be compatible and effective and that neither area serves as a source of reinfestation for the other.

Although details may vary at each installation, the military programs begin with a survey conducted at each base by qualified mosquito control specialists to determine if *Aedes aegypti* infestations exist or potential breeding areas are present. This survey includes all premises, and grounds surrounding warehouses, mess halls and other buildings.

Special attention is given to the inspection of salvage depots or other areas used for the storage of containers that might hold water suitable for mosquito breeding. Wherever possible, actual or potential breeding sites are eliminated during this survey.

Following the survey, the remaining breeding sites are plotted on a map, then sprayed with insecticide and subsequently checked for the effectiveness of the insecticide treatment. At a later date, each site is again examined for possible reinfestation.

The frequency of the survey-spray cycle varies according to the environmental conditions at each base but is continued until no further infestations can be found on the base. At this time a program of surveillance is begun to verify the continued absence of this mosquito with inspections usually being made annually.

Verification of the successful eradication requires that a minimum of three negative successive basewide inspections, at one year intervals, be made during the peak of the mosquito season. Following the third negative inspection, the base is designated as being free of *Aedes aegypti*.

According to a recent news release from the Office of The Surgeon General, U.S. Army, the eradication of this mosquito from such a large geographical area is an ambitious undertaking and will require a continuous highly efficient effort by all participants, both military and civilian.

Experience thus far has shown that the distribution of *Aedes aegypti* is much more widespread than was originally anticipated and that preventing the introduction or reintroduction of this mosquito into clear areas may be difficult.

Although the results achieved thus far in the program have been promising, the complete eradication of this disease vector from the United States and its territories will be possible only through the continued enthusiastic cooperation of military and civilian communities involved in this program.

# A Kudo for Simplicius

If you were to ask the average individual when the first theory on atomic structure was stated, undoubtedly the reply would credit this philosophical pioneering to a twentieth century scientist. Because of the rapid pace of technological development since 1900, there is a tendency, even on the part of researchers, to become ensconced in modern scientific discovery and thought without giving due credit to early philosophical logic.

Simplicius, a greek philosopher of the 6th Century A.D., made the following comment on atomic theory:

"They (atoms) move in the void and catching each other up jostle together, and some recoil in any direction that may chance, and others become entangled with one another in various degrees according to the symmetry of their shapes and sizes and positions and order, and they remain together and thus the coming into being of composite things is effected."

The clarity and profoundness of this statement by Simplicius serves to prove that scientific reasoning was well advanced even at that early point in time. Many other examples of scientific thought, many predating the age of Simplicius, prove the rich legacy of scientific knowledge upon which the modern scientific theories are based.

Are we giving Simplicius and other early thinkers sufficient credit for the present state-of-the-art? Hats off to Simplicius!

*EDITOR'S NOTE: Army Research Office Adjutant Capt Robert L. Dilworth finds time to peruse Bartlett's Familiar Quotations and similar documents in search of tidbits of thinking to enliven the ARO bulletin boards, so that perchance, occasionally, busy scientists will pause for a fleeting glance at announcements. This item is a sample.*

# 200-Mission Viet Nam Veteran Joins ECOM Staff

Decorated recently with the Legion of Merit and 4th, 5th and 6th Oak Leaf Clusters to the Air Medal for service in Viet Nam, Col James L. Burke is the new assistant to Brig Gen Kenneth M. Gonseth, deputy CG for Operations, U.S. Army Electronics Command, Fort Monmouth, N.J.

The Legion of Merit citation describes his outstanding service as chief of the Logistics/Communications Division of the Army Concept Team in Viet Nam (ACTIV). The Clusters recognize participation in more than 200 aerial missions over hostile territory in support of counterinsurgency operations.

Col Burke was associated in Viet Nam with new developments in combat surveillance, night vision, aviation electronics, and psychological warfare areas. Included is the design of a high-magnification camera system, which he test-flew in Viet Nam and which is now being considered for a patent application.

His 27-year career has included two assignments with the Office of the Chief Signal Officer, Washington, D.C.; signal officer with Allied Land Forces, Denmark; laboratory processing officer, Fort Monmouth, N.J.; and signal officer in the Pacific Theater during and after World War II.

Col James L. Burke

He directed a professional summer study group at Fort Huachuca, Ariz., in 1964, under sponsorship of the Army Research Office, Durham, N.C., and he has taken special interest in the cooperative exchange of scientists and engineers between the Government and academic institutions of the Southwest.

His Army training includes Command and General Staff College (1944), Armed Forces Staff College (1955), Army Flight Training School, Army Rotary Wing Training School and Advanced Signal School.

# U.S.-Canada Defense Development-Sharing

By Donn R. Grand Pre

Never in the written history of man have two countries shared so much as Canada and the United States: the continent of North America; a common heritage built on immigration, hard work and free enterprise; and the sweat, blood and tears of two major wars, plus the Korean affair.

When discussing this commonalty of background, the inevitable question is raised: Why don't the two countries unite?

The vast territories of the north country, second only to Soviet Russia in size, and the still untapped wealth of natural resources could combine to make the industrial complex and the population, including the investment capital of the United States, equal to ten times that of Canada.

A U. S. industrialist recently stated: "It must be clear that the Canadian problem, even more than ours, is not one of national identity but of economic survival." Edward Lamb of Toledo, Ohio, who controls 26 U. S. and Canadian companies, pointed out that Canada has been the major supplier of materials for U. S. industry for more than 100 years.

Economic integration of the two countries has been building up until 70 percent of many Canadian industries are U. S.-owned and 80 percent of foreign investment comes from the United States.

Economic integration would increase markets 10 times for Canadian producers, according to Lamb, and would do it much more efficiently than the over-the-border method; it would make available to Canadian consumers more U. S. products at lower prices and would increase the flow of capital for Canadian development.

For the most part, the 20 million persons living in Canada not only like being Canadians but are somewhat leery of being engulfed by the 200 millions "south of the border." Anti-Americanism is not what it once was, but there is a strong current of nationalism "up north."

Dr. Mason Wade, head of the history department at Middlesex College, Ontario, commented: "Since 1963, there have been abundant signs that we are emerging from that unhappy period when it appeared to be every Canadian's patriotic duty to kick Uncle Sam smartly in the shins once a week.

"Along with the instinctive traditional tendency to resist Americanization, there has been a growing recognition that whether Canadians like it or not, Canada's destiny is now bound up with that of the United States, and that the north-south continental relationship has become more significant than the traditional trans-Atlantic ones.

"Interdependence is a two-way thing," he stressed. "Americans must learn to accept that fact of Canada's determination to maintain its national identity and to pursue its national interest, which may not always be identical with that of the U. S."

It may be that the best relationship is the present one. Whether ultimately united into a single country or not, Canada and the United States will continue to be the world's best business and trading partners.

The United States-Canadian Defense Development-Sharing Program provides good evidence of this partnership. It has proven in the past, and will continue to show, the benefits of a common defense market. Its present success, however, was no overnight achievement.

One of the most important papers which helped shape the Program is the "Statement of Principles for Economic Cooperation," signed by the Prime Minister of Canada and the President of the United States on Sept. 20, 1950. It states:

"The United States and Canada have achieved a high degree of cooperation in the field of industrial mobilization during and since World War II through the operation of the principles embodied in the Hyde Park Agreement of 1941, through the extension of its concepts in the postwar period, and more recently through the work of the Joint Industrial Mobilization Planning Committee.

"In the interests of mutual security, and to assist both Governments to discharge their obligations under the United Nations Charter and the North Atlantic Treaty, it is believed that this field of common action should be further extended.

"It is agreed, therefore, that our two Governments shall cooperate in all respects practicable, and to the extent of their respective executive powers, to the end that the economic efforts of the two countries be coordinated for the common defense and that the production and resources of both countries be used for the best combined results. . . ."

Remove the high-sounding phraseology and we have two countries agreeing to greater economic cooperation. In order to accomplish the objective, certain principles were established that were designed:

- To control emergency-type materials and supplies;
- Facilitate production by a free exchange of technical knowledge and productive skills;
- Removal of trade barriers; and
- Develop a coordinated program of requirements, production and procurement.

Time, tide and governments move, however slowly, and despite the good intentions embodied in the Principles, it wasn't until Aug. 8, 1958, that an effective Defense Production-Sharing Program was established between the two countries.

Canada, at the time, was developing a high-performance jet fighter, dubbed the Avro Arrow. Millions of dollars were poured into the development, in the vain hope that the U. S., as well as other nations would procure the finished product.

The Arrow, along with the millions, went down the drain. The Canadian Government was forced into a decision to use U. S.-developed weapons systems. She could no longer afford to develop and produce these systems for her own exclusive use.

The decision was based on agree-

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*Donn R. Grand Pré, presently on the staff of the Deputy Assistant Secretary of Defense for International Logistics Negotiations, Mr. Henry J. Kuss, Jr., served as a deputy branch chief in the International Office, OCRD, from November 1958 to April 1966. During that time, he was responsible for cooperative research and development with Britain, Canada and Australia.*

*A senior parachutist and combat infantryman, Grand Pré served in the Burma campaigns in World War II and with the 27th "Wolfhound" Regiment in the Korean War until wounded near Wa Chon, Korea, in early 1953. He holds several decorations for valor and meritorious service and is presently a lieutenant colonel in the 310th Logistical Command, a Reserve unit in the Washington, D.C., area.*

*Grand Pré has a BS degree from Dickinson State College, a master's degree from George Washington University and is presently completing work toward a doctorate in government and politics at the University of Maryland.*

ments reached between the heads of government at a meeting in July 1958 that Canadian industry, and with it, her balance of trade, depended on her being able to share in future development and production of equipment for the U. S. defense forces. It was determined at that meeting that the use of facilities of both countries would bring about the best defense at the lowest cost.

Canadian production-sharing placed in the U. S. doubled that placed in Canada from the U. S. during the period 1958–1960, despite the fact that the overall goal of the program was to procure in Canada sufficient equipment to maintain Canadian industry at the same level as would have been the case had Canada elected to continue an independent development and production program.

About the close of this rather undramatic era, the seeds of development-sharing were planted. Canadian and U. S. officials agreed that the only hope for a successful long-range program was to set up a system whereby Canada could share in the research and development effort which is designed to enhance later production-sharing opportunities for Canadian industry.

Recognizing the importance to Canadian industry of sharing in U. S. research and development, and the value to U. S. defense of Canada underwriting the cost, the U. S. Army and the Canadian Department of Defence Production (CDDP) set up a Development-Sharing Agreement on Sept. 14, 1960. A month later, Canada accepted the first U. S. projects to be financed by its government.

A twofold shot in the arm greatly enhanced the Program during the 1962–63 period. When the U. S. Army reorganized in 1962, major research and development efforts were concentrated in the Army Materiel Command. "Getting the word" to the responsible personnel was vastly more simplified, as were programing and budgetary procedures, all of which assisted in bringing about a better understanding of the development-sharing agreement.

At about the same time, the U. S. Secretary of Defense added the prestige of his office to the Program. With Charles M. Drury, Canadian Minister of Defence Production, Secretary Robert S. McNamara, in November 1963, signed a Memorandum of Understanding in the Field of Cooperative Development Between the U. S. Department of Defense and the Canadian Department of Defence Production.

Its objectives were to assist in maintaining the Defense Production-Sharing Program at a high level by making it possible for Canadian firms to perform research and development to meet the requirements of the entire Defense Department; to make better use of both countries' scientific and technical resources; and to make possible the standardization and interchangeability of common equipment.

One of the major changes in policy from that of the previous U. S. Army-Canada agreement was that the U. S. would now fund at least 25 percent of research and development costs undertaken by Canada to fulfill U. S. requirements.

It was further agreed that the procurement of supplies in Canada for the Department of Defense should not be affected by the balance of payments considerations. To implement this policy, DoD issued a memorandum on June 26, 1963 which modified the "Buy American Act" of August 1962, to the extent that Canada is exempt from the provisions of the Act.

Among the most vital unclassified projects being pursued under the Program are the following:

*Tactical Transport Aircraft, CV7A, BUFFALO.* This is a follow-on to the durable and popular Caribou transport built by DeHavilland of Canada. The Buffalo is a larger turboprop version, with increased payload and performance characteristics. The cost of development was shared equally by the company, CDDP, and the U. S. Army.

An interesting factor is that if the procurement of this aircraft is approved, approximately 60 percent of the components of each aircraft, including the engines, will be bought in the U. S.

*Utility Carrier, XM571.* This is an articulated, full-tracked, amphibious vehicle of one-ton payload capacity, designed to provide all-season, off-road movement over various types of difficult terrain under extreme climatic conditions. Canadair Limited designed and developed this remarkable and versatile rig.

*Lightweight Radio Relay Set, AN/GRC 103.* A lightweight, portable, general-purpose radio relay intended for service in a tactical communications system at Division level, this set is being developed by Canadian Marconi at no cost to the U. S. Type classification as Standard A is predicted in August 1967, following completion of service testing.

*Meteorological Rockets.* Canada accepted these projects for development-sharing in 1965. The first meteorological rocket is for tactical operations to be used by the field army to collect upper-wind and air-density information from 100,000 feet. The second meteorological rocket will be used for upper atmospheric research studies up to an altitude of approximately 250,000 feet. Canada will fund 75 percent of the total costs.

*Lightweight Launcher for LANCE Missile.* The cost of the overall launcher design, development and fabrication was assumed by the Canadian Government in 1963 and work at Hawker-Siddeley has progressed generally on schedule. Delivery of 11 tactical prototype launchers to Ling Temco Vought (Lance prime contractor) was completed in July 1966.

All is not roses in the Program, however. There are still individuals in all branches of the Government, as well as in U. S. industry, who do not know that the goal of the Program is maintenance of a long-term balance of trade between the two countries.

There are bound to be times when individual companies in the U. S. will lose out to Canadian firms, either because a Canadian firm can do the job more economically, or because it has agreed, along with the Canadian Government, to fund the development of a particular piece of hardware to meet a U. S. Department of Defense need.

While this does not guarantee the Canadian firm the production rights, it does place it in an advantageous position when bidding for the production contract.

Although the natural result of the U. S.-Canada Defense Development-Sharing Program is the procurement in Canada of equipment to meet the needs of the Defense Department, the Canadian military forces buy more from U. S. industry than from their own sources.

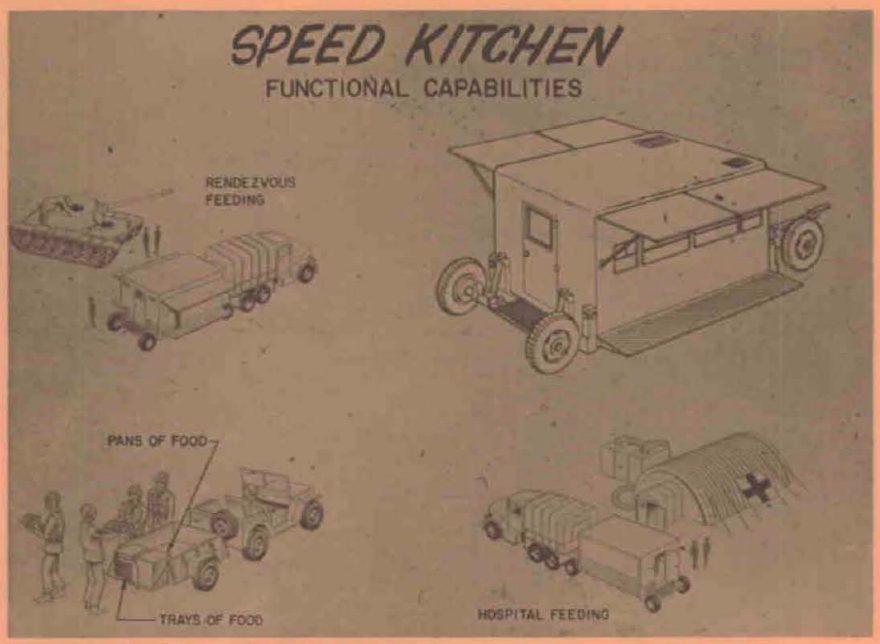
To cite just a few recent Canadian purchases, more than $30 million has been committed for the U. S.-built M113 armored personnel carrier, Canadian Forces have also purchased over $3 million worth of vehicular radio sets.

Other recent purchases, amounting to millions of dollars, include CH–113 helicopters, MG–13 fire control systems, and navigation equipment for the CF–104D aircraft.

Of potentially greater significance than these buys was Canadian Defence Minister Hellyer's stated intention, some months ago, to boost the "hardware" share of his budget up from 13 percent to 25 percent and—with luck—even higher.

According to a Canadian newspaper, *The Globe and Mail*, present government plans call for $4 billion to be spent on military equipment during the next 10 years.

If past practices are indicative of future trends, a substantial portion of this amount will be spent in the United States.




# Army Orders SPEED Kitchens for July Delivery

Prototype units of a mobile kitchen and a field bakery designed to provide ultrarapid and simple preparation and serving of meals and pastries to soldiers under field conditions are scheduled for delivery and Army evaluation in July.

Designated SPEED (Subsistence Preparation by Electronic Energy Diffusion), the concept was conceived by food technologists at the U.S. Army Materiel Commands Natick (Mass.) Laboratories.

Fresh, frozen, thermally processed, irradiated, or freeze-dried foods can be prepared at the rate of 200 hot meals an hour by one cook and an assistant. The cooks will work with two microwave ovens, oven-toaster, a grill and refrigerator. A sink with a water conservation unit will be provided for washing plastic utensils and an incinerator disposes of waste.

The familiar stainless steel mess trays will be replaced by a plastic tray with a disposable thin plastic or paper liner to hold the food. The tray can be cleaned by a sanitizing dip in the sink and the liner is fed into the incinerator.

The SPEED bakeries consist of a bread and pastry van operated by two bakers. High-speed mixers will permit preparation of 30 pounds of cake mix in about 45 seconds, and 30 pounds of bread dough in less than 2 minutes.

The mixers can prepare a yeast dough of high quality that proofs in about half the time of regular doughs, as well as the conventional wheat, rye and yeast doughs.

Other equipment planned for the bakery units include a small proofing oven, a continuous microwave oven that bakes bread and pastry in 2 to 3¼ minutes, a bread-browning element, and product storage shelves.

Each SPEED unit is powered by an internally mounted 60-kilowatt turbine electric generator. Waste heat of the generator is used for heating water, to power an emergency water supply purification unit for the kitchen, and to vent and evaporate waste water from the sink.

Each unit, including equipment, will weigh less than 5,000 pounds. Of standard military size, the units are air transportable, and can be mounted on the bed of a 2½-ton truck or towed by their own wheels.

The contract to design and build the prototypes for the Army was awarded to AiResearch Manufacturing Co., a division of the Garrett Corp.

## 300 Attend HDL Forum On 'Timers for Ordnance'

More than 300 scientists, engineers and ranking military officers heard 33 technical papers at the recent "Timers for Ordnance" symposium sponsored by the Harry Diamond Laboratories (HDL), Washington, D.C.

Maj Gen Floyd A. Hansen, CG of the U.S. Army Munitions Command, Dover, N.J., keynoted the 2-day forum where industry and military research and development interests were represented.

Areas covered in the papers included electronic and mechanical components; electronic techniques; fluid, pyrotechnic and mechanical devices; electronic and mechanical systems. Represented were HDL; Picatinny, Frankford and Edgewood Arsenals; the Naval Ordnance Laboratory and industrial organizations.

Moderators of technical sessions included Dr. Maurice Apstein, HDL associate technical director; Dr. W. Y. Pan, Radio Corp. of America; Dr. F. H. Carter, HQ Army Materiel Command; Donald Caverly, General Time Corp.; Dr. R. E. Bowles, Bowles Corp.; Dr. H. P. Kalmus, HDL chief scientist and John H. Armstrong of the Naval Ordnance Laboratory.

**PRINCIPAL PARTICIPANTS in an Army Materiel Command Conference on the Continuing Education of Engineer, Scientific and Technical Personnel at the U.S. Army Logistics Management Center (ALMC), Fort Lee, Va., included (l. to r.) Norman Brandt, chief, Civilian Personnel Division, AMC; Charles F. Mullaly, Director of Civilian Personnel, Department of the Army; Dr. J. Tol Thomas, Deputy for Research and Laboratories, AMC; Maj Gen Victor J. MacLaughlin, CG, U.S. Army Quartermaster Center and Fort Lee; Lt Gen William B. Bunker, Deputy CG, AMC. The 3-day meeting was devoted to six working group and forum discussions involving about 80 Army scientific personnel.**