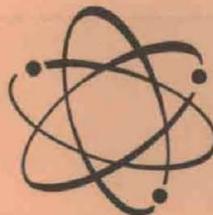




ARMY RESEARCH AND DEVELOPMENT



MONTHLY NEWSMAGAZINE OF THE OFFICE OF THE CHIEF, RESEARCH AND DEVELOPMENT
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R&D Personnel Earn 6 of 9 Secretary of Army Annual Awards

President Directs Policy On R&D Work in Colleges

Department of Defense policy is being formulated in response to President Johnson's directive that Government research funding to colleges and universities be more equitably distributed geographically.

High-level DoD leaders have held a series of meetings to consider the Presidential policy, which came Sept. 13 in the form of a memorandum to the heads of all departments and agencies. It was titled "Strengthening Academic Capability for Science Throughout the Country."

In observing that "a strong and vital educational system is an essential part of the Great Society," President Johnson pointed out that \$1.3 billion, or about 9 percent of the \$15 billion the Federal Government is spending in research and development activities this fiscal year, goes to universities.

The \$1.3 billion, including only Federal research grants and contracts, accounts for two-thirds of the
(Continued on page 6)

4 Exceptional Service Medals All Recognize Research

Achievements in research and development dominated the Ninth Annual Secretary of the Army Awards Ceremony Oct. 7 for the fourth consecutive year, accounting for six of the nine honors, including all four Decorations for Exceptional Civilian Service.

In 1964, also, four Decorations for Exceptional Civilian Service were presented and all rewarded contributions to research and development.

Five of the seven 1964 awards honored R&D employees.

Secretary of the Army Stanley R. Resor made the presentations to award winners at the Pentagon in Washington, D.C., assisted by Deputy Under Secretary of the Army for Personnel Management Roy K. Davenport.

Army Chief of Staff General Harold K. Johnson congratulated the winners and commented on the status of the Army Incentive Awards Program.

(Continued on page 3)

Army Chief of Staff Keynotes Human Factors Meeting

Chief of Staff General Harold K. Johnson was the featured speaker at the 11th Annual Army Human Factors Research and Development Conference, Oct. 3-6, at the U.S. Army John F. Kennedy Center for Special Warfare, Fort Bragg, N.C.

Introduced by Chief of Research and Development Lt Gen William W. Dick, Jr., who sponsored the conference, General Johnson spoke on "The U.S. Army—A Force for Stability," the theme of the meeting.

Participants included more than 200 psychologists, scientists, engineers and top management personnel, representing the U.S. Army, industry and not-for-profit research organizations. Representatives of the U.S. Navy, Air Force, Marine Corps and Quadripartite nations attended.

The Special Warfare Center, commanded by Brig Gen Joseph W. Stillwell, was host and the XVIII Airborne Corps, commanded by Lt Gen Bruce Palmer, was cohost of the con-
(Continued on page 4)

Four Top DoD Civilians Sworn Into Office



SECRETARY OF DEFENSE Robert S. McNamara (right) administers oath of office to (left to right) Under Secretary of the Air Force Norman S. Paul, Assistant Secretary of Defense for Manpower Thomas D. Morris, Director of Defense Research and Engineering (DDRE) Dr. John S. Foster, Jr., and Secretary of the Air Force Harold Brown, until recently the DDRE. *(See story on page 7)*

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CRD Stresses Need for Optical Research

Relevance of greatly increased "seeing" capability to prime requirements of the Army for continued improvement of firepower, mobility and communications was described to the Optical Manufacturing Association in a major address in New York City.

Appearing on behalf of Army Chief of Staff General Harold K. Johnson, who was unable to accept an invitation, Chief of Research and Development Lt Gen William W. Dick, Jr., discussed "The Army's Accent on Seeing."

The American optical industry research program, he acknowledged, has made significant contributions to the defense effort in a wide area—"not only ophthalmological, but in such other areas as new materials and in the new field of Laser optics.

"Of course, there is the very obvious field of fire control instruments without which our weapons would be quite ineffective. Still another area of contribution is that of combat surveillance and target acquisition—from vastly improved photographic lenses to totally new types of night-vision devices. And, with the maturity of nuclear weapons, there is the future requirement for protective devices for the eyes of tomorrow's military man."

General Dick explained that in recent years the Army has been teaching that there are three basic elements to successful combat operations: To shoot, to move, and to communicate. General Johnson, shortly after becoming Chief of Staff, directed the Army staff to add "seeing" to the other three functions.

Seeing, under all conditions of climate and terrain, at night almost as well as during the day, it was emphasized, is "the *sine qua non* of ability to be an effective soldier . . . Any impairment in his ability to see—no matter what the degree or how long the length of time—degrades the soldier's effectiveness."

In pointing out the critical importance of major advances in optics technology to success in combat operations, General Dick said that over one-third of the men in today's active Army wear prescription eyeglasses, and that of this number almost 40 percent require annual replacement.

During a recent 6-month period, reports at the U.S. Army Hospital at Fort Hood, Tex., home of the combat-ready 1st and 2nd Armored Divisions, revealed that 800 sets of eyeglasses per month had to be repaired, aside from replacement needs.

Because a soldier who loses both sets of glasses has to be evacuated from the combat area as a temporary *de facto* casualty, General Dick cited the Army's need for "a device or system which will provide a rapid automatic means for fabricating eyeglasses."

What the Army ultimately would like to have, it was explained, is a unit capable of quickly fabricating (in about 10 minutes) any desired lens from a single, nonsegmented, non-foci, source of optical material—hopefully, a unit of size and weight capable of being moved in a ¼-ton truck bed.

Another area of priority research to meet Army optics requirements is concerned with the problem of how to protect soldiers from temporary or permanent flash blindness resulting from nuclear explosions.

General Dick explained that the Army is following two avenues of approach to this problem. One entails use of a protective system or device, such as glasses or goggles. The other involves modifying the eye's response by pharmacological means or by human engineering design of instruments to obviate or mitigate visual impairment. Five years of Army effort, he said, still leaves many vexing problems to be surmounted in this area.

Army progress in research and development to increase tactical mobility is indicated to a great extent through use of aerial vehicles, such as "over 430 aircraft—most of them helicopters" assigned to the 1st Air Mobile Division, and "proved out" in Viet Nam.

One of the problems being experienced by helicopter pilots in Viet Nam, however, is suspected of being caused by the scintillation of rotor blades, General Dick reported. The result is termed "extreme electroencephalographic photic action," that is, the pilot becomes dizzy, nauseous and disoriented.

Some means of protecting the eyes of pilots from the intermittent light flashes of the rotor blades may be needed, he said, along with improvement of the material in the clear plastic face shield used to provide protection against flying fragments from small arms fire. The present material develops numerous small scratches that may obstruct the visual field of the pilot.

Because of the Army's increasing demand for aviation personnel, studies are being made of the possi-

(Continued on page 39)

R&D Personnel Earn 6 SA Annual Awards

(Continued from page 1)

Present for the ceremony was an impressive gathering of top military leaders and other Federal Government dignitaries.

The Decoration for Exceptional Civilian Service was conferred posthumously upon Dr. Arthur J. Dziemian. Until he succumbed of a heart attack May 9, 1965, he was supervisory physiologist and chief of the Biophysics Division, U. S. Army Chemical Research and Development Laboratories, Edgewood Arsenal, Md.

Other winners of the Department of the Army's highest decoration for civilian employees are Billy M. Horton, technical director of the Harry Diamond Laboratories, Washington, D.C.; Albert L. Nowicki, supervisory cartographer, U.S. Army Map Service, Washington, D.C.; and Benjamin D. Pile, mechanical engineer, U.S. Army Medical Equipment Research and Development Laboratory, Fort Totten, N.Y.

The citation accompanying the award to Dr. Dziemian, who died while returning from a trip to Europe on Army business, recognized his outstanding biophysics-wound ballistics studies.

Findings reported in his technical papers, it was stated, contributed significantly to the development of ammunition and weapons, body armor, footwear to protect soldiers from anti-personnel mines, and more shatter-resistant lenses for spectacles.

Albert Nowicki received his award for devising and developing new techniques and special purpose devices and for carrying out responsibility for preparation of the first lunar map by photogrammetric techniques. This map was used for planning the Ranger moon shots. He is recognized internationally as an outstanding cartographer and geodesist.

Benjamin Pile was cited for conceiving the basic design and taking a lead role in developing a rugged, lightweight, portable, battery-operated field X-ray, which is serving a critical need of field armies.

Billy Horton and Raymond W. Warren were decorated for a breakthrough in development of basic principles of pure fluid amplification which has a major impact upon the control industry. Horton invented a pure fluid amplifier; Warren participated in the exploitation of the original patent and made several important improvements. Warren received the Meritorious Civilian Service Award for his part in the development program.

Fluid amplification controls are now used in the Army's experimental heart pump, missile guidance, and in a broad variety of military and civilian applications.

The Meritorious Civilian Service Award was presented to Charles E. Leadman, an electrician with the Army Corps of Engineers, and Miss Priscilla Alden, chief, Current Year Section, Programs Branch, Technical Service Division, Research and Development Directorate, U.S. Army Materiel Command.

Leadman was decorated for rescuing a fellow worker from an electric high-tension-line pole. The citation stated that the other employee had come in contact with an energized 7,200-volt line and received a shock. The commendation said Leadman undoubtedly saved the life of the co-worker.

Miss Alden was cited for directing the formulation and preparing the justification for the annual research and development budget at the Army Materiel Command, approximating

\$1.3 billion. In FY 1965, she was able to reprogram \$20 million for high priority projects.

Richard L. Peck, director of Flight Operations, Hiller Aircraft Co., Palo Alto, Calif., received the Distinguished Civilian Service Award. As the leader of a flight of U.S. Army helicopters, the citation stated, Peck, at the risk of his own life and in the most hazardous weather conditions, flew successive rescue and relief missions into the floodstricken areas of California during the period of Dec. 22-28, 1964. He was personally responsible for rescuing several persons from certain death, the commendation read.

Eugene L. Simpson, chief, Ammunition Division, Sierra Army Depot, Herlong, Calif., received the Outstanding Suggestion Award and \$3,060 cash for his idea of reworking and reusing demilitarized 90mm. brass HE-T Cartridge Cases for the new 90mm. target practice round with tracer. First-year savings totaled \$2,008,793 and savings through FY 1969 are expected to exceed \$12 million, according to the citation.

Brig Gen Latta Spans 27 Years as New ECOM CG

Twenty-seven years after his first assignment at Fort Monmouth, N.J., following graduation from the U.S. Military Academy, Brig Gen William B. Latta has returned as CG of the Army Electronics Command.

General Latta's first assignment as an officer was with the 51st Signal Battalion at Fort Monmouth. Until recently he was deputy chief of staff for communications and electronics, North American Air Defense Command and Continental Air Defense Command.

Other assignments at Fort Monmouth were as acting director and assistant director of the Army Signal School Officer Candidate Department, and as a student in the wire, com-

pany, and advanced officers' courses.

Born in El Pasa, Tex., he entered the Army in 1933, won a competitive appointment to the U.S. Military Academy, and graduated in 1938.

In World War II, he made the D-Day landings at Casablanca with the Western Task Force. Subsequently, he took command of the First Armored Signal Battalion which provided communications for Headquarters, Seventh Army, in Sicily and Southern France D-Day landings.

In February 1945, he became Chief of the Communications Division, Seventh Army, for the Rhineland and Central European campaigns. Returned to the United States in September 1945, he served at Fort Bragg and with the General Staff in Washington, D.C.

Assigned to the Graduate School of Business Administration at Harvard, in September 1948, he was graduated with a master of business administration degree.

General Latta's oversea assignments since World War II include duty in Taiwan as chief signal adviser to the chief of the Military Assistance Advisory Group, and a tour as signal officer, Headquarters, Seventh Army, Stuttgart, Germany. His decorations include the Legion of Merit, the Army Commendation Ribbon with Medal Pendant, and the French Croix de Guerre with Palms.



Brig Gen William B. Latta

Army Chief of Staff Keynotes Annual Human Factors Meeting

(Continued from page 1)

ference. Both generals extended welcoming remarks.

General Johnson stressed the importance of understanding not only the military and political aspects of war but the psychological undercurrents, particularly in the case of insurgencies. He emphasized that the study of insurgency in its various forms and related human psychology is of direct benefit to maintenance of stability operations.

In addition to defending U.S. security at home, he said the U.S. Army has been called upon increasingly for over 100 years to help keep peace and defend freedom in areas remote and vastly different from the continental United States.

The Chief of Staff explained that the purpose of a stability operations is not to maintain the status quo;

rather, it is to help restore a political and economic climate in which free people may decide their own future through peaceful political processes.

By understanding the nature of an armed insurgency captured by communist elements early in its precipitation, General Johnson said, it may be possible to prevent it from reaching the scale now being experienced in Viet Nam.

He reviewed the contributions of behavioral science research on improved performance in the Army through training, selection, classification and use of Army personnel and the impact of human factors engineering on weapons and equipment.

Looking to the future, General Johnson pointed out the potential of social science research in determining the role of the Army in stability

operations. Reliable data on the causes and symptoms of instability would lead to a better understanding of the events which precipitate instability, he stated.

U.S. Army advisory personnel could function even more effectively, he said, if they were trained not only in language but in the best methods of communicating with indigenous peoples; the nature and characteristics of population social groupings; sources of popular discontent; the needs and aspiration of the people they would help and the manner in which confidence in democratic government can best be built.

General Johnson concluded with the challenge that "there is a compelling need for fresh ideas from the research and academic communities of our country, as well as the Government itself."

Additional general officers and key personnel who attended included: Lt Gen Ben Harrell, CG, U.S. Army Combat Developments Command; Lt Gen Louis W. Truman, CG, Third U.S. Army, Fort McPherson, Ga.; Maj Gen Joe S. Lawrie, CG, 82nd Airborne Division, Fort Bragg;

Maj Gen David W. Gray, Deputy Chief of Staff for Unit Training and Readiness, U.S. Continental Army Command, Fort Monroe, Va.; Brig Gen Edward P. Smith, Acting Deputy CG, 82nd Airborne Division; Brig Gen Samuel G. Taxis (USMC-Ret.), Human Resources Research Office, Alexandria, Va.; Col E. F. Campbell, Director of Psychology, Australian Army Headquarters, Canberra, Australia;

Dr. S. Rains Wallace, Office of the Director of Defense Research and Engineering; Dr. Meredith P. Crawford, director, Human Resources Research Office (HumRRO); Dr. Theodore Vallance, director, Special Operations Research Office (SORO), Washington, D.C., and Dr. J. E. Uhlener, director of Research Laboratories, U.S. Army Personnel Research Office (USAPRO), Washington, D.C.

Chairing the sessions of the conference were Dr. Lynn E. Baker, U.S. Army chief psychologist, U.S. Army Research Office (USARO); Col Dwight W. Dickson, assistant commandant, U.S. Army Special Warfare School (USASWS), Fort Bragg; F. Loyal Greer, SORO; Arthur J. Hoehn, HumRRO; Maj John H. Johns, Social Science Research Division, USARO; and John D. Weisz, technical director, U.S. Army Human Engineering Laboratories, Aberdeen Proving Ground, Md.

Army Chemists Develop Heat-Reflecting Dark Paint

Olive-drab paint that reflects solar heat and helps to camouflage Army missiles has been developed at Aberdeen Proving Ground, Md.

Army Coating and Chemical Laboratory scientists consider the development of a dark paint that is heat reflectant a breakthrough in what was long considered "a nearly impossible" search.

In addition to a new look for the Army's missile family, the new paint formulation could also produce color changes in the home-building and automotive industries. An Aberdeen scientist said that the paint formula may be applicable to other colors as well as olive drab.

Generally it has been assumed that all light colors reflect the infrared rays of the sun better than darker colors and thus remain cooler. White paint on Army missiles does reflect heat and helps protect the temperature-sensitive components inside, but it also makes them easy to detect from the ground and air.

Dr. Charles F. Pickett, director of the Coating and Chemical Laboratory, said that the formulation of the new paint is the result of about a year of research. It shows a good degree of infrared reflectance which minimizes to "moderate" the heat buildup in a missile.

First weapon for which the new paint will be used is the Hawk ground-to-air missile system. Potential uses of the paint are not limited to missiles. Army instrument trailers and vans which require air conditioning would be easier to cool if

coated with the paint, tests show.

Durability of the paint under heat and rapid temperature changes remains to be determined, although both of these factors have been considered in the formulation. Industry will be asked to bid on production of the paint and the formula will be made available to interested private industries.

Melvin H. Sandler, chief of the laboratory's Paint, Varnish and Lacquer Branch, and Merrill Cohen, a physical science technician, were among those prominent in research and development of the paint.



OLIVE-DRAB paint that reflects the sun's heat is demonstrated by sample held against white coating of a Lacrosse missile by Merrill Cohen, physical science technician at APG, Md. Dr. Charles F. Pickett (right) is director of the USACCL, which developed the formula for the dark paint.

Papers presented at the conference included: Reflections on Social Science Support for Stability Operations—Past and Future, Dr. E. Kenneth Karcher, Jr., Social Science Research Division, USARO; The Army Role in Preventing Insurgencies, Maj David R. Hughes, International Policy Division, Office, Deputy Chief of Staff for Military Operations, Washington, D.C.;

The Present Challenge: Counterinsurgency Operations, Capt Melvin R. Bowdan, Jr.; U.S. Army Roles in Stability Operations: The Theoretical Deficiency and the Problems of Professionalism and Civil-Military Relations, Maj Francis A. Nerone, USASWS; Response of U.S. Personnel to Local Customs in Stability Operations, Maj K. Stanley Yamashita, USASWS; Organization for Counterinsurgency Operations Utilizing Economy of Force Type Units, Lt Col Vincent W. Lang, USASWS.

The Role of Minority Groups in Counterinsurgency, Roswell B. Wing and Richard P. Joyce, Research Analysis Corp. (RAC), McLean, Va.; Operational Psychiatric Research in the Field in South Viet Nam, Col William Hausman and Lt Col Harold S. Kolmer, Walter Reed Army Medical Center (WRAMC), Washington, D.C.;

The Organization and Evaluation of Data on Urban Areas in Counterinsurgency Planning, Michael Conley, SORO; The Role of Crowds in Civil Disturbances, Adrian H. Jones, SORO; Prisoner Behavior in Simulated Interrogations, Louis P. Willemin, Edward M. Sait and Solomon A. Weinberg, USAPRO;

Exploratory Research in the Genesis of Social Conflict, Edward W. Gude, SORO; Resettlement in South America and the Military Contribution, Milton Jacobs, SORO; Controversial Comments on the Current Concept of Civil Action, Alfred J. Kraemer, HumRRO;

Selection and Classification Research in Korea, Leo J. Kotula, USAPRO; The Development of a Short, Practical, Programmed Viet Name Course, Alfred I. Fiks, HumRRO; A Simulation Technique for Area Training, Edward C. Stewart, HumRRO; Psychological Factors in Selection of Special Forces Officers, Francis F. Medland, Calvin G. Green and Martin Marder, USAPRO;

Effects of Stress on the Performance of Riflemen, James P. Torre, U.S. Army Human Engineering Laboratories, Aberdeen P.G., Md.; Colored Smoke Marker Detection and Identification, H. Weasner and J. Carlock, Human Factors Section, Picatinny Arsenal, Dover, N.J.; Night

Operations, Human Capacities and Equipment Compromises, George S. Harker, U.S. Army Medical Research Laboratory, Fort Knox, Ky.

Additional highlights of the Army Human Factors R&D Conference were the Gabriel demonstration of simulated special warfare techniques; a buffet supper, with F. H. Lakin, Army Operational Research Establishment in England, making the featured presentation, "Psychological Warfare Research in Malaya 1952-55," and a banquet with General Palmer as the after-dinner speaker.

Objectives of the annual conference are to provide:

- Direct exchange of information on human factors research and de-

velopment among personnel of U.S. Army development agencies and between these and representatives of user agencies and other qualified individuals.

- Recommendations and suggestions to be followed up by the U.S. Army Human Factors Research and Development Committee to assure exploitation of all opportunities for improving man-machine compatibility in the design of U.S. Army materiel.

- A conference report which will serve as a useful, authoritative and complete compendium of current work programs and related information concerning all U.S. Army human factors research and development.

Pantless Pajamas Pique Professor Plaintiff Presents Plight, Promises 'Parade'

Provocative of paroxysms is the plight of the pajama-less professor on a worldwide research task for the Army, as attested by his letters seeking to recover the trousers—surrendered, supposedly temporarily, to wrap a dictaphone for its journey from Africa to the United States.

Authenticity of the loss is indisputably established by the letters, filed in the U.S. Army Research Office Contracts and Grants Branch. Reasonable discretion, however, dictates that the name of the professor and the university involved be kept secret.

The professor's research project called for a study of arid lands in various parts of the world as related to requirements for military operations. In Africa, he found that he no longer needed Dictabelts and a Travel-Master machine. Lacking normal wrapping materials to safeguard the machine, he used his pajama trousers to protect it against damage in returning it to the U.S.

Months passed. The professor resumed his normal duties at the university, located in the Far West. But the dictaphone equipment and the pajama trousers remained enroute. Now, let his letter to the university's Office of Arid Lands Research prompt the paroxysms.

"Dear Mr. ———:

This note is to advise you that your recent letter to Mr. — was carefully examined by me and was found to be wanting in one rather important particular. You have failed to mention the fact that if Intelligence is employed in this matter, that they should make every effort to recover my pajama trousers as well as the dictaphone.

"This may seem a small matter to one who is not personally involved.

However, I wish to advise you that the trousers in question were one-of-a-kind and not easily replaced. They were of white, Chinese silk, imprinted with hand-blocked exotic dancers.

"The latter appeared in various stages of a rather intricate terpsichorean routine. Moreover, as the evenings are now growing somewhat cool, the loss becomes more apparent with the passage of time. This is an obvious consequence of having only the top to the set at my disposal.

"I might well call your attention to my original letter to you concerning the dictaphone shipment. You will recall my statement to the effect that it was only because suitable wrapping materials were unavailable that I felt constrained to provide these pajama trousers in order to avoid damage to the machine.

"To demonstrate that this action was clearly in the interest of the U.S. Army, the University, and the Office of Arid Lands Research, I wish to have it duly noted on the records that I wrapped the dictaphone in my trousers, rather than the top to this unique pajama set, solely because the top had buttons which I felt might scratch the case of the machine in transit.

"In conclusion, I feel that my enormous personal sacrifice, a continuing sacrifice I might add, was clearly in the public interest. As Administrator of this project, I feel that it is your responsibility to spare no effort in the attempt to recover this garment.

"If you refuse this reasonable request you may look forward to a demonstration protest by me, garbed in the remainder of my pajama set, which will take place on the north lawn of the Arid Lands Office in the future. I shall await your reply."

President Directs Policy On R&D Work in Colleges

(Continued from page 1)

total research money spent by American colleges and universities.

The President's program has two basic parts—to assure a more equitable distribution of this research money on a geographical basis and to strengthen the academic research capability of the Nation as a whole. It provides for greater flexibility in research spending and wider distribution of funds among centers of educational excellence.

Individual agencies and departments charged with specific administration and funding of the Government-wide program will work under the guidance of Dr. Donald F. Hornig, Presidential Science Adviser and Special Assistant for Science and Technology. He will be assisted by the Federal Council for Science and Technology.

Responsibility for review of monthly reports from each agency and department and general implementation of the President's policy are assigned to a special committee under the Federal Council. Chairman of the committee is Dr. Leland J. Hayworth, Director of the National Science Foundation.

Dr. Chalmers W. Sherwin, Deputy Director of Defense Research and Engineering (Research and Technology), is Department of Defense representative to the committee.

Representatives of the three mili-

tary services and the Advanced Research Projects Agency (ARPA) assisting Dr. Sherwin are: Dr. Richard A. Weiss, scientific and deputy director, U.S. Army Research Office; Dr. William P. Raney, special assistant to the Assistant Secretary of the Navy (R&D); Dr. Robert Loewy, chief scientist, Department of the Air Force; and Dr. Robert A. Frosch, deputy director of ARPA.

The three services and ARPA are collecting and reviewing quantitative data on distribution of the Defense dollar to universities to revise their policies and procedures to assure consonance with the President's program to attain more equitable use of funds.

The importance of this program is evidenced by the fact that of the \$1.3 billion appropriated to universities for research, the Department of Defense share is 23 percent, exceeded only by the 34 percent from the National Institutes of Health.

Illustrating the need for more equitable distribution is the statistic that one-half of the Federal expenditures for research goes to 20 major institutions. This figure was cited by President Johnson in a statement to Cabinet members in which he said:

"We want to find excellence and build it up wherever it is found so that creative centers of excellence may grow in every part of the Nation."

Maj Gen Osmani Assigned as Deputy CG at SMC

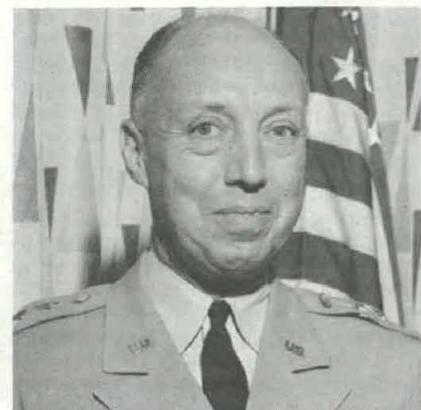
Maj Gen Frank A. Osmani, assistant chief of staff, J-4, in Viet Nam from March 1962 to March 1965, has been assigned as deputy CG, Army Supply and Maintenance Command and chief, Army Materiel Command Operational Readiness Office.

A 1935 graduate of the U.S. Military Academy, General Osmani has a master's degree in business administration from Harvard Business School, and has completed courses at the Harvard Center for International Affairs.

Military schools from which he has graduated include the Command and General Staff School (1942), Command and General Staff College (1947), Armed Forces Staff College (1950), and the Industrial College of the Armed Forces (1958).

Assignments prior to Viet Nam included tours in Europe; Korea, where he served as executive officer and later as commanding officer of the 7th Infantry Division (Artillery); Hawaii, as chief, Plans and Operations, G-4; and Fort Benning, Ga., as CO, 2nd Infantry Div. (Artillery).

Recipient of the Nation's highest noncombat award, the Distinguished Service Medal, for service in Viet Nam, General Osmani has been awarded the Legion of Merit with Oak Leaf Cluster, Army Commendation Medal, Croix de Guerre (French), Croix de Guerre (Belgian), and the Order of the Red Banner (Russian).



Maj Gen Frank A. Osmani

SATCOM Official Talks On Satellites' Potential

Promising prospects of satellites in meeting current tactical communications requirements were described by Samuel P. Brown at the recent Eleventh National Communications Symposium in Utica, N.Y.

The technical director of the U.S. Army Satellite Communications (SATCOM) Agency at Fort Monmouth, N.J., spoke on "Harnessing Satellites for Tactical Communication Use." His views were presented as a panelist at a session on "Impact on Satellites for Military and Industry."

"The time seems to be approaching," he said, "for consideration of these techniques at command echelons below the strategic level where serious communications problems exist."

"In the past, these problem areas have been attacked by variations in application of high frequency, very high frequency, and microwave radio relay equipment, and in recent years with systems employing tropospheric scatter techniques.

"Satellite communications offer another means 'of getting the message through' with long-haul characteristics of HF radio, while offering reliability, availability and capacity of microwave radio relay."

Cited as a prime advantage would be the flexibility obtained with tactical satellite communication systems. Terminals could be transportable or mobile, with mobility ranging from aircraft to surface terminals afloat and ashore. Effective range in terms of ground distance between terminals could range from a few miles to several thousand.

ARPA Chooses New Director Of Material Sciences Office

Dr. Robb M. Thomson has been appointed director of the Materials Sciences Office, Advanced Research Projects Agency (ARPA), succeeding Dr. E. I. Salkovitz, now on the University of Pittsburgh faculty.

Dr. Thomson is responsible for direction of a broad program of materials research conducted for ARPA by various university and industrial contractors. This research is generally in the fields of solid-state physics, metallurgy, chemistry and structural mechanics.

Prior to his appointment in ARPA, Dr. Thomson was a professor of physical metallurgy at the University of Illinois. He received an MS degree in physics from the University of Chicago and a PhD in physics from Syracuse University in 1953.

GIMRADA Satellite Yielding Anticipated Results

The Army Engineers' fifth geodetic satellite (EGRS-5), launched Aug. 10, is sending satisfactory data to ground stations in Hawaii and along the west coast in a mapping experiment called "angulation."

Developed by the Army Engineer Geodesy, Intelligence and Mapping R&D Agency (GIMRADA), Fort Belvoir, Va., the satellite is in elliptical orbit with an apogee of about 1,300 nautical miles, perigee 650.

The high polish of the aluminum sphere allows optical angular tracking by large-aperture cameras and trilateral electronic tracking by Army Map Service sequential collation of range (SECOR) stations. From this

McNamara Administers Oath to 4 Defense Officials

Secretary of Defense Robert S. McNamara administered the oath of office to four top Defense officials Oct. 1 in an unprecedented Pentagon ceremony viewed by high-ranking civilian and military personnel.

Dr. Harold Brown was sworn in as the eighth Secretary of the Air Force, succeeding Eugene M. Zuckert, who served in the position since Jan. 24, 1961. Dr. Brown was Director of Defense Research and Engineering for more than four years.

Dr. John S. Foster, Jr., nominated by the President on Sept. 13 and confirmed by the Senate on Sept. 24, received the oath of office as the new Director of Defense Research and Engineering. Like his predecessor, he was director of the Lawrence Radiation Laboratory in Livermore, Calif., at the time of his appointment.

Norman S. Paul, Assistant Secretary of Defense for Manpower for three years, was sworn in as Under Secretary of the Air Force. He succeeds Brockway McMillan, who resigned effective Sept. 30.

Thomas D. Morris, a former Assistant Secretary of Defense for Installations and Logistics, became Assistant Secretary of Defense for Manpower, replacing Mr. Paul. Mr. Morris left the DoD to return to private industry last year.

The date of the ceremony was a landmark for Mr. McNamara, who now has served longer than any other Secretary of Defense. On Oct. 1 he equalled the service record of four years, eight months and 10 days set by the late former Secretary of Defense Charles E. Wilson, who served from Jan. 28, 1953, to Oct. 8, 1957. Secretary McNamara's term of office began on Jan. 21, 1961.

tracking combination comes the GIMRADA-coined *angulation*.

Simultaneous tracking with the Baker-Nunn cameras of the Smithsonian Astrophysical Observatory and the SECOR stations enables scientists to calculate the absolute direction and distance between two widely separated points on earth.

The Master station for this angulation experiment is on a mountain at Maui, one of the Hawaiian islands, from which a Smithsonian camera and a SECOR system provide optical and range measurements. Three "slave" SECOR stations on the mainland coast—near San Diego and San Francisco, Calif., and Larson, Wash.—provide simultaneous range measurements with the master site. A second camera is located at Organ Pass, N.Mex.

Actual operational observations of the EGRS-5 began approximately 40 days after the launch to allow for the sphere's stabilization.

Based on GIMRADA's interrogation and telemetry records, the satellite's spin rate has decreased from 186 r.p.m. after launch to about 68.

Numerous interrogations of the satellite's transponder indicate that there is a 2-watt power output with a predicted operational cycle of 30-

45 minutes per day. Temperature channels show a normal internal range of 40° F. to 105° F. Skin temperature of EGRS-5 is about 105° F. Inclination of the orbit is 68.5°.

Scientists obtaining data in the angulation experiment have expressed confidence that the first direct geodetic tie from the U.S. continent to Hawaii will be accomplished.

The SECOR tracking stations being used in the experiment were moved to their present locations from regular sites especially for the test period. The station at Maui was "borrowed" from Iwo Jima, one of the regular Pacific SECOR locations.

Col Lloyd L. Rall, director of GIMRADA, said that the personnel of the agency most instrumental in the angulation experiment are Capt Robert A. Schow, Jr., Armando Mancini, Lawrence A. Gambino and John G. Armistead.

Dr. Hass Earns 10th OPA at ERDL

Dr. Georg H. Hass, internationally known physicist at the U.S. Army Engineer R&D Laboratories, Fort Belvoir, Va., recently received his tenth Outstanding Performance Award. In addition he holds several Sustained Superior Performance Awards, the Commanding Officer's Technology Medal (1958), and the Army R&D Achievement Medal (1961).

Col Goldenthal Upped From Deputy to SATCOM CG

Command of the U.S. Army Satellite Communications (SATCOM) Agency at Fort Monmouth, N.J., was assigned to Col Mitchel Goldenthal, Oct. 1, upon retirement of Brig Gen J. Wilson Johnston, SATCOM's first CG.

Col Goldenthal also was appointed acting project manager of the SATCOM Agency, which discharges Army responsibilities in the Defense Communications Satellite Program by developing, engineering, procuring, installing, and testing ground

facilities used in satellite communications systems.

Until elevated to his new duties, he served as SATCOM deputy commander and earlier was director of the Material Department. He is a recent graduate of the Army War College and was an instructor at the Command and General Staff College, from which he graduated in 1954. Educational qualifications include an MS degree in engineering from Texas A&M and a master's degree in international affairs from George Washington University.

Graduated from the U.S. Military Academy in 1943, he has served in recent years as chief of the Construction Section, U.S. Army Europe, and as acting district engineer and deputy district engineer in the Little Rock (Ark.) Engineer District.

During more than 25 years service, Col Goldenthal has won numerous awards with three Infantry Divisions, including the Legion of Merit, Bronze Star, Army Commendation Medal with Oak Leaf Cluster, and Purple Heart. He is a registered professional engineer (Texas) and a senior member of the Institute of Electronic and Electrical Engineers.



Col Mitchel Goldenthal

COSATI Establishes International Technical Information Panel

The Federal Council for Science and Technology's Committee on Scientific and Technical Information (COSATI) has established the fourth of eight projected panels to operate along functional lines.

COSATI Chairman William T. Knox announced that Melvin S. Day, director of the Scientific and Technical Information Division, National Aeronautics and Space Administration, is chairman of the new panel on International Information Activities. Harold L. Goodwin, assistant director for special projects under Mr. Day, is executive secretary.

Appointment of the first three panels—Information Sciences Technology; Education and Training; Operational Techniques and Systems—was announced on page 1 in the August 1965 edition of the *Army R&D Newsmagazine*.

Panels still to be established by membership and mission are Budgets and Statistics, External Relationships, Information Users, and Information Generation.

Other members of the International Information Activities panel are:

Dr. Burton W. Adkinson, head, Office of Science Information Service, National Science Foundation; Edward J. Brunenkant, director, Division of Technical Information, U.S. Atomic Energy Commission; Walter M. Carlson, director of technical information, Office of Director of Defense Research and Engineering; William H. Mills, Office of International Scientific Affairs, Department of State;

Foster E. Mohrhardt, director, National Agricultural Library, De-



Melvin S. Day

partment of Agriculture; Dr. Donald A. Schon, director, Institute for Applied Technology, National Bureau of Standards; and Dr. Martin M. Cummings, director, National Library of Medicine, Department of Health, Education and Welfare.

In a memorandum to COSATI members, Mr. Knox outlined the functions of the panel, which will be performed with the cooperation of observers from the FCTS's International Committee and the Department of State. The Panel will:

- Recommend policies and programs for Federal agencies regarding acquisition of foreign-produced, unclassified technical information.

- Recommend policies and programs for Federal agencies regarding dissemination of Federally produced, unclassified information and data to foreign countries.

- Identify, evaluate, and make re-

commendations on improved governmental organization for increasing the efficiency of exchange of information and data between the U.S. and other countries.

- Identify, evaluate, and make recommendations on improved techniques for acquiring, translating, and disseminating unclassified, foreign-produced information and data.

- Recommend policies for Federal agencies concerning the role of non-governmental organizations and their support in international information exchange.

MELVIN DAY joined the National Aeronautics and Space Administration in 1960 as deputy director, Office of Technical Information and Educational Programs. He was appointed S&TI Division director in 1962.

A native of Maine, graduate of Bates College, and an Army veteran of World War II, he entered U.S. Civil Service in 1947 as a scientific analyst in Oak Ridge, Tenn., for the U.S. Atomic Energy Commission. He later became director of the AEC's Technical Information Service in Washington, D.C., before transferring to NASA.

Mr. Day is also chairman of the Technical Information Panel of the Advisory Group for Aeronautical Research and Development (AGARD), an organization of NATO nations, and chairman of the Advisory Committee of the Science Information Exchange.

He is a member of the Chemical Abstracts Service Advisory Board, the Federal Library Committee, and the U.S. National Committee of the International Federation for Documentation (IFD).

Societies of which Mr. Day is a member include the American Association for Advancement of Science, New York Academy of Sciences, American Chemical Society, American Documentation Institute, American Space Club, Society of Technical Writers and Publishers, and Special Libraries Association.

Civilian Heads Avionics Aids Office at ECOM

The new head of the Avionics/Navigation Aids Commodity Management Office is John N. Montgomery, III, Special Assistant for Supply, Army Electronics Command (ECOM), Fort Monmouth, N.J., since 1963.

Montgomery has been detailed to the position, formerly a military billet, until concurrence in the change is obtained from higher headquarters. He has served continuously in Government supply for 23 years.

The new assignment entails responsibility for ECOM's role in providing flight control systems and aviation electronics (avionics) for helicopters and other tactical Army aircraft.

Several commodity management offices of ECOM are concerned with logically grouped electronics items and Montgomery will manage the "life cycle" of all items. It is his job to coordinate and expedite the work of the command's operating elements—the Avionics Laboratory, the Procurement and Production Directorate and the Materiel Readiness Directorate.

Montgomery began Federal service in 1942 with the Army Signal Corps, Washington, D.C. He is a native of Claysville, Pa., received a BS degree in physics from Washington and Jefferson College in 1934 and has done graduate work with the Carnegie Institute of Technology.



John N. Montgomery, III

Lt Gen Train Heads First Army

Lt Gen William F. Train, CG of the Second Army, has been named to command the newly established First Army (consolidated with the Second Army) at Fort Meade, Md., succeeding Lt Gen Thomas W. Dunn.

General Dunn, who is also senior Army member of the UN's Military Staff Committee, succeeds retiring Lt Gen Robert W. Colglazier, Jr., as Fourth Army CG. The First and Second Armies are being consolidated to form the First Army.

ODDR&E Effects Functional Shifts Establishing 2 New Deputy Directors

Realignment of responsibilities in the Office of the Director of Defense Research and Engineering (ODDR&E) has created two new titles.

Thomas F. Rogers is newly assigned as deputy director for Electronics and Information Systems and Daniel J. Fink is now deputy director for Strategic and Space Systems.

Since Feb. 1, 1964, Mr. Rogers has served as assistant director for Communications Electronics in ODDR&E. After joining ODDR&E in August 1963 as assistant director for Defensive Systems, Mr. Fink earlier this year became deputy director for Strategic and Defense Systems.

The Department of Defense announcement of the organizational changes explained that they are designed to obtain a more adequate balance of the workload, following recent departures of senior ODDR&E staff members.

The Deputy Director of Defense Research and Engineering position vacated by Dr. Eugene G. Fubini in mid-July has not yet been filled. Following the recent resignation of Dr. Albert C. Hall as deputy director for Space, functions of his office were assigned to the deputy director for Strategic and Space Systems.

The deputy director for Electronics and Information Systems will have as his principal staff, assistant directors for Communications and Electronics, Command and Control, and Intelligence and Reconnaissance.

Other ODDR&E changes include the redesignation of offices and assignments of functions under the deputy director of Tactical Warfare Programs, to include assistant directors for Tactical Aircraft Systems, Tactical Missiles and Ordnance, Tactical Control and Surveillance Systems, and Sea Warfare Systems.

The deputy director of Research and Technology will have principal elements consisting of assistant directors for Research, Materials, Chemical Technology, and Lab. Management.

MR. FINK's industrial and academic career includes broad research and development management and the application of diverse technical talents to problems of advanced weapons systems analysis.

Prior to serving as assistant director for Defense Systems, he was vice president of Allied Research Associates (ARA) Inc., Concord, Mass.

He headed a number of major projects in systems analysis and development pertaining to aircraft and ballistic missile defense and was in charge of several nuclear weapons effects test projects at the Nevada and Pacific Testing Grounds, for which he



Thomas F. Rogers



Daniel J. Fink

received Government citations.

Previous to association with ARA, Mr. Fink was chief of aircraft dynamics of the Bell Aircraft Corp., Buffalo, N.Y., and was also employed by the Cornell Aeronautical Laboratory. He received BS and MS degrees in aeronautical engineering from the Massachusetts Institute of Technology.

Principal elements of DDR&E under the deputy director for Strategic and Space Systems will be assistant directors for Strategic Weapons, Defense Systems, Space Technology, and Range and Space Ground Support.

MR. ROGERS began his professional career as a research associate in the Radio Research Laboratory at Harvard University in 1945, and has been associated with Government, industrial and research laboratories.

For several years before he joined ODDR&E, he was on the staff of the Lincoln Laboratory, first as associate head of the Radio Physics Division, then as head of the Communications Division and as a member of the Lab-

oratory's steering committee.

He has served as a member of several Government advisory groups, including the Communication's Satellite Panel of the President's Scientific Advisory Committee. Others are the IRE-EIA JTAC subcommittees concerned with communications and the Polaris Command Communications Committee. He was a member of the U.S. delegation to the United Nations meeting on the Application of Science and Technology for the Benefit of Less Developed Areas.

Mr. Rogers received a BS degree in physics from Providence College in 1945 and an MA, also in physics, from Boston University in 1949. He has published papers on radiowave propagation, communications, electronic memory devices, ultrasonics and molecular physics.

Affiliated with the Physical Societies of the United States and England, he is Fellow and member of the Board of Directors of the Institute of Electrical and Electronics Engineers.

Springfield Armory CO Reassigned to Command ATAC

Col William J. Durrenberger, Springfield (Mass.) Armory CO since July 1963, recently assumed command of the U.S. Army Tank-Automotive Center (ATAC), Warren, Mich. He succeeded Col Henry Davidson, Jr., who retired.

Graduated from the University of Minnesota with a BS degree in mechanical engineering and an ROTC Army commission, Col Durrenberger has spent most of his 27 years service in the management of research, development,

engineering, production, and comptroller jobs. Studies at the University of Maryland and Syracuse University earned him a master's degree in business administration. He is also a graduate of the Industrial College of the Armed Forces.

During World War II, he served in Europe for 3½ years in technical intelligence work. After the war, he led a special Army-Navy-Marine Corps Guided Missile Mission to Europe. Prior to duty as commander of Springfield Armory, he was chief of staff at the U.S. Army Weapons Command, Rock Island, Ill.

Col Durrenberger participated in the Army's early guided missile activities and at one time supervised activities of the Dr. Wernher von Braun's team. He was a member of the Army team that developed and launched Explorer I.



Col W. J. Durrenberger

ASAP Hears Reports on Army Mobility Advances

Presentations on Army air and ground mobility developments highlighted the fall meeting of the Army Scientific Advisory Panel (ASAP), Oct. 21-22, at Army Mobility Command Headquarters, Warren, Mich.

Assistant Secretary of the Air Force (R&D) Dr. Alexander H. Flax was guest speaker at the banquet. Assistant Secretary of the Army (R&D) Willis M. Hawkins gave the closing summation. Maj Gen William L. Lapsley, Mobility Command CG, welcomed conferees and discussed MOCOM responsibilities and operations.

Commanders of each of MOCOM's subordinate elements—Brig Gen Howard F. Schlitz, Army Aviation Materiel Command; Brig Gen Thomas B. Simpson, Mobility Equipment Center; Col W. J. Durrenberger, Army Tank-Automotive Center—spoke on the mission, technical operations and future plans of their organizations.

A session on "Hardware for Viet Nam" included presentations on the Remote Area Mobility Study, ad-

vanced surface vehicle concepts, and mobility enhancement and detection items. Helicopter airlift techniques and the mobile assault bridge ferry were demonstrated.

Army Materials Research Agency personnel briefed the Panel on the development and applications of metallic armors, ceramic composite armors, and protection against shaped charges.

Maj Gen W. G. Dolvin, Main Battle Tank (MBT) project manager, discussed the MBT cooperative program, being carried out with the Federal Republic of Germany. ASAP chairman Dr. Finn J. Larsen presided over the Panel business meeting, which included progress briefings on current ad hoc groups.

Donald G. Fink described a project on automatic electronic switching equipment which an ASAP Ad Hoc Group on Tactical Communications initiated by request of General Frank S. Besson, Jr., CG of the U.S. Army Materiel Command. Mr. Fink also is manager of the Institute of Electrical



Maj Gen William L. Lapsley

and Electronics Engineers, Inc., N.Y.

Dr. Harold C. Weber, acting for Maj Gen Leslie E. Simon (USA, Ret.) as chairman of the Barrier Research Ad Hoc Group, presented the highlights of the final project report. Dr. William C. Tinus, vice president of Bell Telephone Laboratories, Inc., Whippany, N.J., concluded the ad hoc group reports with a discussion of findings of the group studying combat vehicle weapons.

Brig Gen Alvin E. Cowan, Director of Developments, Office, Chief of Research and Development, reviewed recent progress on personnel detection devices to avoid ambush. This is a subject of much interest and concern since the problem was presented to the Panel during the June meeting at Fort Bragg, N.C.

Maj Donald E. Rosenblum, executive secretary of the Panel, and Irving Appleblatt, acting director of the MOCOM Research and Development Directorate, arranged the meeting.

Gen Grant Gets Policy Job In DoD Telecommunications

Lt Gen Harold W. Grant (USAF, Ret.) was recently appointed director of Telecommunications Policy in the Office of the Assistant Secretary of Defense for Installations and Logistics. Since 1962 he has served as deputy administrator of the Federal Aviation Agency.

General Grant will be responsible for the development and coordination of policies, programs and systems for the integration of current, long-range and mobilization telecommunications functions of the Department of Defense.

During his 35-year Air Force career, he served as commander of the Air Force Communications Service, deputy commander, U.S.-Taiwan Defense Command, deputy commander, Fifth Air Force, Japan, and vice commander, Japan Air Defense Force.

MOCOM Assigns Dr. Petrick as Chief Scientist

The U.S. Army Mobility Command has appointed Dr. Ernest N. Petrick as chief scientist at MOCOM Headquarters, Warren, Mich.

Dr. Petrick joined MOCOM after more than five years as chief of research engineer of the Kelsey-Hayes Co., Romulus, Mich. There he directed automotive and aerospace development programs.

As chief scientist, he will be concerned with MOCOM's \$2 billion annual program of research, development, production, and procurement of automotive, aeronautical, and general mobility support equipment.

The programs are carried out in three materiel centers staffed by more than 14,000 personnel. The Army Tank-Automotive Center is in Warren. The Aviation Materiel Command and the Mobility Equipment Center are in St. Louis, Mo. The Engineer Research and Development Laboratories at Fort Belvoir, Va., and the Aviation Materiel Laboratories, Fort Eustis, Va., are also part of the Mobility Command.

Dr. Petrick, a native of Pennsylvania, received a BS degree in mechanical engineering from Carnegie Tech (1943), then served in the Navy until 1946 as chief engineer of a destroyer in the Pacific.

Following World War II, he was on the staff at Purdue University until 1953. There he supervised the Gas Turbine Laboratory at the Jet Propulsion Center and earned MS and PhD degrees.

In 1953 he joined Curtiss-Wright Corp., where he directed heat transfer research at the Wright Aeronautical Division in Woodbridge, N.J., until he became responsible for new product development.



Dr. Ernest N. Petrick

Later he was named chief, Advanced Propulsion Systems, at the Curtiss-Wright Research Division in Quehanna, Pa. His group participated in some of the early developments in the United States on high-energy rocket propellants and on ion engines for space flight.

Dr. Petrick is the author of numerous articles on surface propulsion, flight propulsion, and project management. He is listed in *Leaders in American Science*, *American Men of Science*, and *World's Who's Who in Commerce and Industry*. He is a registered professional engineer in Michigan and Indiana, and is a member of numerous professional organizations, societies, and fraternities.

3 Research Teams Begin Operational Phase of DoD Project Hindsight

Project Hindsight, an intensive Department of Defense study of research and exploratory development patterns in weapons systems, moved from concept to operation with the recent selection of the initial three research evaluation teams.

The study, sponsored by the Office of the Director of Defense Research and Engineering (ODDRE), is being directed by Dr. Chalmers W. Sherwin, Deputy DDRE for Research and Technology.

Dr. Richard A. Weiss, deputy and scientific director, U. S. Army Research Office, is the Department of the Army representative on the project steering group. Col Harvey E. Sheppard, U.S. Army Materiel Command (USAMC) headquarters, is coordinating USAMC participation.

Representing each of the three military services, the research evaluation teams will study weapons systems developed by their respective services. The Army team, from the U.S. Army Missile Command (MICOM), Redstone Arsenal, Ala., will develop the technological history of the Lance missile system.

Consisting of eight senior scientists and engineers, the Army team is headed by Lewis L. Gober, who was deputy project manager for the Mauler weapon system.

Additional members of the Army team include: Henry A. Dihm and Herman R. Oswell, Advanced Systems Laboratory; Walter W. Kopcha and Ben J. Risse, Future Missile Systems Division; Lawrence W. Howard, Structures and Mechanics Laboratory; Joseph W. Connaughton, Propulsion Laboratory; and Corbet M. Cornelson, Ground Support Equipment Laboratory. All are with the MICOM Research and Development Directorate at Redstone (Ala.) Arsenal.

Potential RXD (research or exploratory development) events in the Lance development program has been estimated at 84, categorized as: guidance and control, 17; propulsion, 34; ground support equipment, 11; materials, 7; aerodynamics, 7; systems, 2; and warhead, 6.

The Air Force task group will study the C-141 cargo aircraft and is led by John J. Sereda, a general engineer with the Plans and Policy Division, Headquarters, Aeronautical Systems Division, U.S. Air Force Systems Command, Wright Patterson Air Force Base, Ohio. The other five

members represent USAF elements at Wright Patterson.

The 5-man Navy research team, composed of Bureau of Ships personnel, is led by Dr. J. H. Huth, chief scientist for Research, Development, Test and Engineering. Their study is on the AN/SPS-48-3D Radar.

Objectives of Project Hindsight, as set forth in a July 6, 1965 memorandum from the Director of Defense Research and Engineering to the Assistant Secretaries of the Army, Navy and Air Force for Research and Development, are:

- To identify and firmly establish management factors for research and technology programs which have been associated with the utilization of results produced by these programs.

- To measure the overall increase in cost-effectiveness in the current generation of weapon systems compared to their predecessors (when such can be identified) which is assignable to any part of the total DoD investment in research and technology.

The studies of weapons systems under Project Hindsight will be conducted as three separately identifiable but associated tasks.

The first task involves recognition and description of RXD events which were utilized in military systems. The means or paths by which these ideas were transmitted from the innovators to the eventual system designer will be traced. This task will be accomplished by teams of in-house scientists and engineers.

The second task involves identification of management and other en-

vironmental factors associated with research and technology programs characterized by a high degree of result utilization. The cases upon which these studies are based will be drawn from RXD events identified in the first task.

Primary study effort will be directed toward those laboratories, Government or non-Government, determined to have been most prolific in generating useful research and technology. This task will be undertaken by management scientists from in-house, commercial and university sources.

The third task concerns description of a suitable, credible and useful measure for effective investment in research or technology. This measure will be in terms of total programs rather than individual projects. It will attempt to relate the investment in research and technology to the increase in cost effectiveness for the resultant weapon system inventory.

Measurements will be applied to the systems and technology of the first two tasks. This task will be undertaken by operations analysts and economists from within DoD and from those not-for-profit organizations specializing in the appropriate study areas.

Each task group or research team is autonomous, working under the guidance of its own leader and directing its attention toward investigation of the research and technology underlying assigned weapon systems.

It is anticipated that other study teams, formed to evaluate additional weapons systems, will be introduced within the Project Hindsight framework at about 2-month intervals.

Electronics Command Announces Selection of Chief of Staff

Col Robert D. Terry, who recently became chief of staff of the U.S. Army Electronics Command at Fort Monmouth, N.J., served with the Office, Chief of Research and Development, from August 1955 until July 1958.

From 1963 until recently, he was with the XVIII Airborne Corps as assistant chief of staff for communications and electronics, J-6.

Graduated from the U.S. Military Academy in 1942, he was assigned to the European Theater of Operations in 1944 and earned the Rhineland and Central Germany campaign ribbons.

Col Terry has attended the Signal and Chemical Schools, the Command and General Staff College, the Naval War College, and has an MS degree in electrical engineering from the University of Illinois. In 1954 and 1955 he was assistant, then associate professor of electricity at the Military Academy.

From 1959 to 1962 he was stationed in Paris as assistant Army member, Mutual Weapons Development Team, Office, Secretary of Defense.



Col Robert D. Terry

ECOM Reports on Major Communications Advance

Unprecedented quantities of information can be transmitted by compact solid-state semiconductor modulators conceived in the Electronic Components Laboratory at the Army Electronics Command (ECOM), Fort Monmouth, N. J.

The devices developed by the Solid State and Frequency Control Division have been made to operate with modulation bandwidths ranging from 0 to 1000 megacycles (1 gigacycle) to modulate signals at carrier frequencies from microwaves through the infrared to wavelengths as short as 1.7 or 1.8 microns.

Frank Brand, the deputy division chief, said the short wavelength limit is set by the opacity of the semiconductor material. Modulation of the carrier signal occurs as the signal is transmitted or reflected by a small block of semiconducting high resistivity n-type germanium.

The reflection (or transmission) is varied by changes in the electrical conductivity of the block arising from minority carrier injection into the semiconductor from modulating electrodes. In the transmission mode, the thickness of the block is made to be approximated one-half of a wavelength of the carrier signal; hence different thicknesses would be used at different wavelengths.

Early work (1961-1964) of Dr. Harold Jacobs, senior scientist, with Mr. Brand and others of the Division was directed at an understanding of semiconductor properties using microwave energy as a research tool.

The long decay time of the current carrying holes (absence of an electron) made it impossible to have high-frequency modulation of the hole concentration in the bulk material.

It was found, however, that near the surface the decay proceeded rapidly, due to electron-hole pair recombination at the surface. Thus if the piece of semiconductor material could be made small enough for surface recombination to dominate the decay, the high-frequency modulation would be possible.

In a recent demonstration, such a modulator built by General Telephone and Electronics (GT&E) Laboratories, an ECOM contractor, was used to transmit a television program on a millimeter wave carrier.

Believed the first using semiconductor modulators of this type, this demonstration represents only a small part of the total future capability. Quality of the transmitted picture was



ECOM RESEARCH team leaders Dr. Harold Jacobs (left) and Frank Brand discuss prototype of solid-state semiconductor capable of operating in the X-band frequency range. Current research is expected to extend range of operation to the millimeter band—10 times higher than the X-band.

said to be as good as the average viewer receives in his home.

As the contractor, GT&E Labora-

DoD Reuse of ADP Equipment Attains High Rate

Almost 100 percent of Government-owned Department of Defense automatic data processing equipment screened for reuse under a Federal-wide program was utilized by other DoD elements during Fiscal Year 1965.

The first-year report on success of the DoD program was filed last month by the DoD Automatic Data Processing Equipment Reutilization Screening Office. Located in the Defense Supply Agency at Cameron Station, Va., this office is responsible for the DoD program. The General Services Administration (GSA) administers the reutilization program for civil agencies.

Value of the DoD equipment at the time of its original acquisition totaled \$26,143,592, representing 97 percent of the category total coordinated through the ADP Screening Office. A 10 percent reutilization of excess rented ADP equipment in which the Government had an equity was reported. This accounted for an additional \$6 million, raising the total sum to \$32 million.

Equipment on lease by one Government agency, in such cases, may be purchased by another agency to take advantage of reduced prices re-

ulting from accrued purchase options and lease credits.

tories has been extending the R&D in some of the functional areas of the modulator and is now producing a limited number of prototype models. Present models have design simplicity in which associated components are kept to a minimum and have a low modulation power requirement of less than one milliwatt.

A much wider application of millimeter frequencies, greatly increasing the volume of information handled by radio relay systems in the microwave range, is foreseen, as well as applications in coherent radar.

Tests pointed toward use in radio relay communications have been carried out by GT&E in a miniature millimeter wave system set up over a portion of Long Island Sound (N.Y.) between Bayside and Fort Schuyler.

"This new device makes it possible for a millimeter wave beam to carry extremely large amounts of information," stated Dr. Lee L. Davenport, president of GT&E Laboratories. "We believe the modulation bandwidths... are so wide they may have the potential of handling simultaneously all presently assigned U.S. television channels."

sulting from accrued purchase options and lease credits.

Participating in the DoD phase of the program, in addition to DSA, are the Army, Navy, Air Force, Defense Intelligence Agency, Defense Communications Agency, Defense Atomic Support Agency and the National Security Agency.

In addition to the program for redistribution within the Department of Defense, the Secretary of Defense has established procedures for Government-wide participation with GSA. Equipment already is moving both ways between defense and civil agencies.

With the total number of computers in Government use scheduled to grow to a projected 2,451 by the end of the current fiscal year, individual agencies are now required to consider excess equipment as the first source of acquisition in satisfying computer needs.

Once equipment becomes excess to an agency, it is reported to the DSA or GSA, depending on whether the agency is defense or civil. The screening office of GSA and DSA then circulates bulletins and takes other measures to advertise equipment availability among the various Government agencies.

ECOM Adapts Pinhole Camera Device to Microelectronics Fabrication

Camera obscura, the 5-century-old pinhole camera, is "in the picture" today as the prerequisite in fabricating microelectronic circuits by the U.S. Army Electronics Command.

From the primitive pinhole camera principle, ECOM researchers at Fort Monmouth, N.J., have learned that distortion-free photography is possible in preparing photolithographic masks for integrated circuits.

The making of masks without lenses was attempted by researchers in private industry some years ago but was abandoned when the "fly's eye" or multiple lens camera was developed.

The pinhole camera can make 48 registrations on an 8x10-inch negative from one original, with a resolution line of well under 5 mils. Film determined best for making the photolithographic masks is Estar-based Kodalith. Hole sharpness and uniformity of light and exposure give constant resolution over the mask.

The advantages of the pinhole camera are a combination of the 10:1 reduction of the original artwork and a shortening of the time to a small fraction of that required for the old stop-and-repeat process.

Masks are used in the layout of integrated circuits. A solid-state schematic process formed by the masks in a photoengraving places transistors, diodes, capacitors and resistors on a silicon wafer. The wafer is then scribed and diced; the dices are mounted, wired to outside connections, and hermetically sealed in a package.

The result is an inexpensive trouble-free miniaturized, integrated electronic circuit—a far cry from the

large, power-consuming tube and wire construction of years ago, even from the later transition to one-piece printed circuit boards.

An example of the use of integrated circuits is the squad radio which can be attached to a soldier's helmet or put in his pocket, thus eliminating the need to hand-carry the relatively cumbersome "handie talkie," its predecessor.

An advantage of the integrated circuit is the reduction of power requirement from several watts to only a few milliwatts (1/1000 of a watt). Increased reliability is gained; when rarely needed maintenance is required, a faulty component need merely be located in a defective circuit and simply replaced. Cost is reduced to one-fifth that of the tube systems.

This continuing progress in miniaturized circuits and low power requirements is important for Army

portable equipment, providing longer battery life and reduced battery size. In nonportable equipment using generator power supplies, it will mean reduced size and fuel consumption.

Adaptation of the pinhole camera principle to the production of microelectronic circuits was developed by Herbert Mette and Vincent E. Rible of the Army Electronics Command.

Mette studied solid-state physics at Gottingen University, Federal Republic of Germany, from 1947 to 1952 when he joined ECOM as a project engineer in charge of semiconductor research. He is now chief of the Integrated Device Techniques Branch.

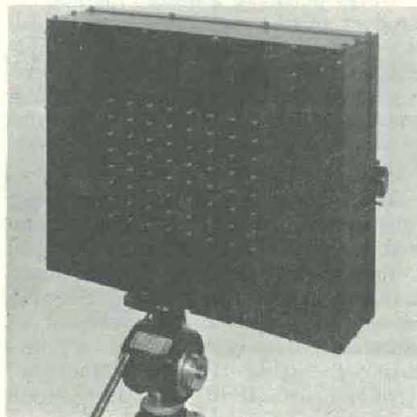
Assigned to the same Branch, Rible has been with the Fort Monmouth facility since 1950. He specializes in electronic equipment test and evaluation. The branch which deals with photography, photoengraving and solid-state assembly techniques. He graduated from the Navy School of Photography in Pensacola, Fla., and the Navy School of Photolithography, Anacostia, Md., during World War II.

Army Procuring 20-ton Cranes

The Army is accepting delivery of 363 heavy-duty cranes capable of operating in four feet of sea water and over rough terrain while performing difficult military construction projects. A utility bulldozer is combined with the 20-ton crane for routine land-clearing.

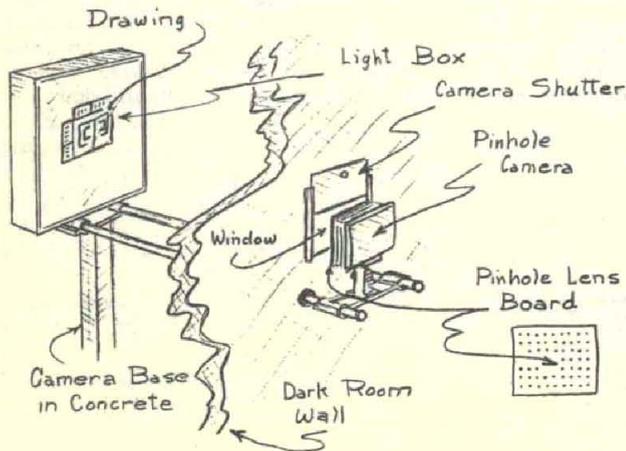
Developed by the U.S. Army Mobility Equipment Center, Engineer R&D Laboratories, Fort Belvoir, Va., the crane is being produced by the American Hoist and Derrick Co., Ft Wayne, Ind. Equipped with four 6-foot earth-moving tires, 4-wheel drive and steering it can negotiate 47 percent grades and travel on highways at 30 m.p.h.

It is designed for use in military construction projects including clamshell and dragline work, steel erection, and bridge assembly.



Multi-Pinhole Camera

PINHOLE ARRAY CAMERA SYSTEM for multiple reproduction of film masks in the rough sketch below. Pinhole camera and circuit drawing to be photographed are firmly mounted to avoid any possible distortion. The pinhole lens board, or matrix, is stainless steel sandwiched with foil between platens for rigidity. With uniform lighting of the drawing by the light box, exposure of 1-2 minutes is required to "get the picture."



Vincent E. Rible



Herbert L. Mette

Australia Broadens Quadripartite R&D Participation

Australia has broadened its participation in quadripartite exchange of information for research and development of standardized military materiel by joining the Tripartite Technical Cooperation Program, concerned with materiel for all armed forces.

The addition of the "down under" nation, which has been a member of the American-British-Canadian-Australian (ABCA) Army Standardization Program since late 1962, required the redesignation of the TCP. The acronym was preserved, however, by dropping Tripartite and substituting The—making it The Technical Cooperation Program.

In general, the TTCP—monitored by the Department of Defense, the Army, the Navy and the Air Force—reviews through specialized subgroups the R&D objectives and progress of quadripartite armed forces.

Dr. John Tregellas-Williams, representing a group of scientists at Australian Defence Standards Laboratories, was an unwitting "first" working scientist from his country on the "new" TTCP. Almost simultaneously with Australia becoming a member of the TTCP, he participated as an observer in a recent Laser working panel meeting of the former tripartite agreement.

Dr. Tregellas-Williams' Australian scientists are advisers to Australian Services, particularly the Australian Army, on Laser applications.

With the TTCP working panel, the Australian scientist recently visited the Naval Ordnance Laboratory,

TTCP Missilemen of 3 Nations Hold White Sands Conference

The U.S. Army recently was host for the 1965 meeting of guided missiles experts from three nations of The Technical Cooperative Program (TTCP) at White Sands Missile Range, N.Mex.

Approximately 20 scientists of the U.S., Canada and United Kingdom exchanged information on new developments in target missiles as members of TTCP's Aerial Target and Drone Working Panel. Discussion are scheduled soon to decide what participation newly affiliated Australia will have in this and other TTCP panels.

In a 3-day program planned by the U.S. Army Missile Command, Redstone Arsenal, Ala., the panelists were addressed by the deputy to the commanding officer of White Sands, Col Karl F. Eklund. They also heard presentations by speakers of the U.S. Army, Navy, Air Force and representatives of Britain and Canada.

White Oak, Md.; the Army Missile Command, Huntsville, Ala.; the Air Force Electro-Optical Facility at Cloudcroft, N. Mex.; and various contractors in the Los Angeles, Calif., area.

The complex TTCP is closely akin to the 17-year-old ABC—now ABCA—Army Standardization Program. The ABCA concentrates on collaboration in research, developments, combat and operational concepts, with standardization and interchangeability of materiel, tactical doctrines and military procedures as the ultimate goal.

Objectives of the TTCP include formulation of proposals to obtain maximum employment of each nation's resources and a continuing exchange of complete information related to military research and development among the four countries.

ECOM Limits Unwanted Modes in Filter Crystals

Development of a design method for production of very high frequency filter crystals, described as a simple but revolutionary means of suppressing unwanted modes, is listed among some 40 "highlights" in the FY 1965 report of the Electronics Components Laboratory at Fort Monmouth, N.J.

The ECL is one of the seven major laboratories of the Electronics Command under the U.S. Army Materiel Command. The Laboratory conducts a comprehensive program of research in areas related to improvement of electronic components in military materiel, including the Army fuel cell development activities. Laser research is another priority area of effort.

Many of the research accomplishments reviewed in the ECL FY 1965 report have been subjects of articles in the *Army Research and Development Newsmagazine*. An example is the new use of "pinhole" camera techniques. (See article on page 13.)

The new design method for VHF filter crystals reported by the ECL is for use in the 70 to 112-megacycle frequency range. It provides a minimum of unwanted modes and equiva-

9th Infantry Activation Set

Secretary of the Army Stanley R. Resor has announced that the 9th Infantry Division will be activated at Fort Riley, Kans., during the first quarter of calendar year 1966.

The CG will be Maj Gen George S. Eckhardt, currently at Fort Riley.

The 9th Division will increase the roster of active Army divisions from 16 to 17. It will be organized under the ROAD concept with nine maneuver battalions, a cavalry squadron, an engineer battalion, and a division artillery of three 105mm. battalions, one composite 155mm. and 8-inch howitzer battalion and Honest John battalion.

The 9th Infantry Division will be built around a cadre of experienced officers and noncommissioned officers drawn from other Army units. The balance of the Division will be drawn from newly enlisted or inducted men with advanced training.

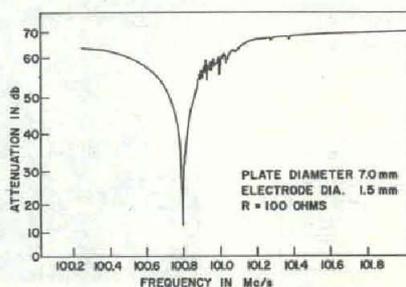
lent electric circuit parameters suitable for practical filter applications.

The technique used heretofore to assure a clean mode spectrum was based on the criterion of maintaining a constant electrode diameter to plate thickness ratio. In essence, this requires decreasing the electrode size with increasing frequency, thereby involving limitations of mechanical tolerances and resulting high resistances not suitable for a practical filter.

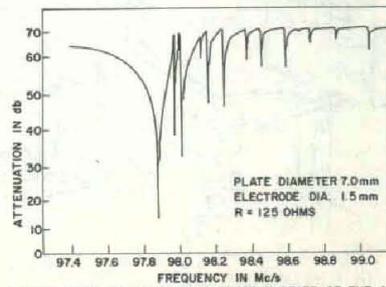
With the new concept, the electrode-diameter and plate-thickness ratio may now be varied to give wider range of crystal characteristics; at the same time the suppression of unwanted modes is achieved by properly varying the electrode thickness.

For crystal filter manufacturers, this discovery eases considerably the minimizing of spurious signals, thus simplifying filter making to a degree.

Using the new technique, flat crystal units in the one to eight megacycle range can be designed. Formerly this range required additional techniques to suppress unwanted modes, such as an induced crystal curvature to achieve suppression.



TYPICAL MODE SPECTRUM EMPLOYING NEW TECHNIQUE



TYPICAL MODE SPECTRUM USING PRESENT STATE-OF-THE-ART TECHNIQUES.

Army Displays Mobile Sea Water Conversion Plant At First International Desalination Exposition

U.S. Army development of mobile equipment to convert sea water into fresh water was exhibited as a highlight of the First International Water Desalination Exposition, Oct. 3-9, which attracted representatives of 58 nations to Washington, D.C.

The animated exhibit, pointing to the U.S. Army's needs for desalination plants that "don't stand still," attracted much attention, including a visit by Secretary of the Interior Stewart L. Udall, one of the principal speakers on the worldwide importance of low-cost desalination equipment. The exposition was sponsored by the U.S. Department of the Interior.

The trailer-mounted desalination unit, exhibited as a model, was developed by the Army Engineer Research and Development Laboratories, Fort Belvoir, Va. It is designed to satisfy the drinking needs of a mobile combat force of 1,000 men. Type-classified this year, the unit can be towed, or airlifted.

The unit displayed can distill 150 gallons per hour, 24 hours a day, and uses a percolating-type evaporator. Shown also was an experimental "crystal seeding" method being developed to prevent scale from being deposited on the heat-exchanger surfaces during distillation. This unit

also will be trailer-mounted.

The vapor-compression process used by the U.S. Army at present and the future crystal seeding plant were illustrated by a continuous short movie. Slides also depicted the work of crystal seeds in scale prevention that otherwise might mean a periodic shut-down to remove the accumulation.

Delegates from 17 nations presented some 100 technical papers, reporting on basic research, engineering design and development, conversion plant operations, energy sources, and economic and optimum design of systems.

Authors represented the United States, United Kingdom, Russia, Germany, Spain, Israel, Japan, India, Greece, Switzerland, Australia, Canada, Italy, South Africa, Kuwait, The Netherlands and France.

The Soviet delegation of scientists, headed by V. A. Klyachko, presented several desalination papers and showed acute interest in the U.S. Army display of portable plants.

Dr. Donald F. Hornig, Science Adviser to President Lyndon B. Johnson, traveled to Moscow last year and signed an agreement with Russia for a free and open exchange of information on desalination. Since then U.S. scientists have made available all in-



PORTABLE UNIT for distilling sea water, developed by the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., is displayed in model form at First Annual International Water Desalination Exposition, Washington, D.C. Richard J. Gainey, instrumental in development of the plant, explains operation to Carolyn Everett, one of the interpreters at the exposition.

formation on the U.S. program and are satisfied that the Russians are reciprocating fully.

Materials Evaluation Journal To Carry Newsmagazine Report

An accolade for the author of an article on pages 32-33 of the August 1965 edition of the *Army Research and Development Newsmagazine*, titled "Nondestructive Testing Activities of the Army Materiel Command," is in the form of a request to reprint it in a professional journal.

Authored by Eugene Roffman of Frankford Arsenal, Philadelphia, Pa., the article will be reprinted in an early issue of *Materials Evaluation*, official journal of the Society for Nondestructive Testing.

In requesting permission to reprint the article, Richard B. Socky, current treasurer and incoming vice president of the Society, reported that it was considered an exceptionally fine report on nondestructive testing, reflective of the lead role the Army is taking in this field. He termed it "exactly what is needed" to delineate the significance of nondestructive testing research to improve current techniques.

USCONARC Renames Division

The Training Research Division, U.S. Continental Army Command (USCONARC), Fort Monroe, Va., has been redesignated as Training Research and Development Branch, Plans-Development Division, Schools Directorate, Deputy Chief of Staff for Individual Training, USCONARC.

Federal Weather Plan Includes 2 Army Tasks

Two tasks directly related to future exploitation of information obtained from weather satellites will be conducted by the Army during 1966.

One would provide a mobile ground readout terminal to give Army field commanders photographs of clouds around the earth from automatic picture taking (APT) weather satellites passing over any lighted area where Army elements are engaged. The other project would give the field Army new techniques for using the information transmitted from such an orbiting weather satellite.

The mobile terminal station is an in-house design and this ground terminal has been tested extensively with the Tiros III and Nimbus satellites.

When a high resolution infrared radiometer (HRIR) is included in the APT system, the reflectivity of the earth and its surrounding medium can be observed. A pattern of relative "temperatures" is obtained which can be related to cloud cover. HRIR has produced dramatic nighttime "photographs" of the dark side of the earth, from which ordinary photographic observations are not possible.

The techniques to be developed for field Army use would enable commanders to extract and interpret meteorological data from weather satellite photographs which are not otherwise available. From these data, short-range weather information can be obtained that would assist commanders in imminent operation plans.

Both of these Army efforts have been coordinated through the DoD Joint Meteorological Satellite Program Office (JMSPO) which is composed of Army, Navy and Air Force representatives.

The DoD military plans associated with weather satellites are further coordinated with civilian agency plans in the Interdepartmental Committee for Applied Meteorological Research (ICAMR) within the office of the Federal Coordinator for Meteorology, and the Army's work will be included in the Federal Plan for Meteorology.

Lt Col Norman L. Durocher of OCRD is the Army representative within JMSPO and also served as the DoD member on the ICAMR Weather Satellite Subcommittee.

Federal Agencies, Industry Consider Plant for Meat Irradiation

Potential benefits to the public of building a pilot plant for radiation preservation of meat were discussed at a recent meeting of 70 executives of four major Federal Government agencies and industry.

Called by Alexander B. Trowbridge, Assistant Secretary of Commerce for Domestic and International Business, the meeting brought together executives of meat, poultry and radiation equipment industries, the Commerce, Agriculture and Army Departments, and the Atomic Energy Commission.

"Radiation processing is a new and dynamic industry which is growing at a rapid rate and food processing will become a significant factor in this industry," Mr. Trowbridge told the group, adding:

"We believe the time has come for a practical approach to industry-Government cooperation in establishing a pilot meat irradiation plant. We expect the meeting to result in specific proposals by food processors and food equipment manufacturers to build a pilot plant."

Approval of the U.S. Army 5-year (1966-70) Food Irradiation Program by the Congressional Subcommittee on Research, Development and Radiation, Joint Committee on Atomic Energy, was reported in a feature article in the September 1965 edition of the *Army Research and Development Newsmagazine*.

That report, delineating progress on the Army Food Irradiation Program since major effort was initiated in 1952, pointed to the current need for large-scale industrial participation as the key to future success if the Army's pioneering effort is to lead to general public consumption. Specifically suggested was industrial construction of a pilot plant to process irradiated meats and poultry.

Participants also were informed that the radiation preservation process, which exposes foods to controlled doses of nuclear energy, can prevent food spoilage by eliminating bacteria and can preserve meat at room temperatures for a year or longer without any danger to the consumer.

The group discussed the availability of Federal Government assistance to establish a privately financed and operated meat irradiation plant with an annual capacity of one million pounds. Through its Atoms for Peace Program, the Government would help stimulate commercial production of radiation-processed meat products.

The U.S. Army agreed to procure 150,000 pounds of radiation sterilized meat each year for three years. Dis-

cussions are under way with the U.S. Navy and Air Force to determine their requirements. It is hoped that the military will be able to absorb one-third of the annual production of the pilot plant.

The Atomic Energy Commission indicated its willingness to provide the radiation source for the facility, as well as design assistance. Other forms of Government cooperation, such as rapid tax amortization, also were discussed.

Participants tasted samples of irradiated meat, chicken and seafood on biscuits made from irradiated flour. The U.S. Army pioneered and developed radiation processing of these products.

Dr. Edward S. Josephson, associate director for Food Radiation, Food Division, U.S. Army Natick (Mass.) Laboratories, reviewed the U.S. Army's progress in irradiated foods research.

Anthony A. Bertsch, of the Department of Commerce and chairman of the Interdepartmental Committee on Radiation Preservation of Food, reviewed the program of the Interde-

partmental Committee. E. E. Fowler, acting director, Division of Isotopes Development, Atomic Energy Commission, reported on his agency's Food Irradiation Program.

U.S. Army participants included Dr. Allan L. Forbes, Scientific Analysis Branch, Life Sciences Division, U.S. Army Research Office; Lt Col Fred A. Coley, chief, Food Service Branch, Service Division, Office of the Chief of Support Services; Joseph Lindwarm, chief, Biological Sciences Section, Research Division, U.S. Army Materiel Command; Maj Roger Baker, Medical Research Branch, Research Division, Medical R&D Command, Office of The Surgeon General; Maj Rufus E. Lester, Jr., Medical and Biological Sciences Branch, Life Sciences Division, U.S. Army Research Office.

A study for the AEC on the "Current Status and Commercial Prospects for the Radiation Preservation of Food," was released in January 1965 by the Department of Commerce. It may be purchased for 55 cents from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

HIPAR to Boost Field Army Air Defense Capability

Improved defense capability for the Field Army against high-performance aircraft and short-range ballistic missiles is cited for a new mobile High Power Acquisition Radar (HIPAR) in an Army announcement of award of an \$8,135,430 production contract.

The mobile HIPAR is expected to provide the same full target detection capability for U.S. Army air defense units overseas as now exists at fixed Nike Hercules sites in the U.S. The Nike Hercules program is managed by the U.S. Army Missile Command, Redstone Arsenal, Ala., and the contract was awarded to General Electric Co.

The mobile configuration of HIPAR consists of five semitrailers, each pulled by a 5-ton truck tractor. The receiver, transmitter and control vans are each mounted on a semitrailer.

One of the other two semitrailers hauls the 43-foot-wide fan-shaped antenna in disassembled form and the other carries two prime power generators. Before the mobile HIPAR was developed, transport of the large radar system was time-consuming and required more than 30 vehicles.

Under tactical conditions, when HIPAR detects an enemy target as it searches the sky in a 360-degree sweep, the target's location is trans-

ferred to the target-tracking radar, which pinpoints it for intercept purposes.

The missile-tracking radar issues guidance and burst orders to the missile, which has a range of more than 75 nautical miles and can be armed with either a nuclear or conventional warhead.

Mobile HIPAR has been subjected to a variety of tests at White Sands Missile Range, N. Mex., Biggs Air Force Base, Tex., Fort Lee and Fort Eustis, Va., and Aberdeen Proving Ground, Md.



High Power Acquisition Radar

SATCOM Agency Picks Hawaii as Global System Link

Hawaii is the site of the first earth terminal of a planned worldwide military experimental satellite communication system, and installation of equipment at Helemano, 20 miles north of Honolulu on the Island of Oahu, was started in October.

The U.S. Army Satellite Communication Agency's AN/MSC-46 transportable satellite communications terminal is being installed as the first of eight that will be linked into the worldwide system.

Under the technical supervision of the Defense Communications Agency, the SATCOM Agency has responsibility for integrating Army, Navy and Air Force missions in the Initial Defense Communications Satellite Project (IDCSP).

In this IDCSP, the Air Force has the mission of developing the satellites. The Army has responsibility for developing and operating the ground terminals, and the Navy has the same mission with respect to shipboard terminals for the system.

Present planning contemplates installation of a second AN/MSC-46 terminal in Helemano in 1966, permitting traffic to be sent and received from one satellite in the west, relayed between terminals, and passed on through another satellite located eastward. The first terminal is expected to be completed in seven months.

Location of other ground terminal sites will be determined by the Defense Communications Agency, based on site surveys now being conducted by the SATCOM Agency in various parts of the world. Lt Gen Alfred E. Starbird is the director of the DCA.

Under the command of Maj Gen Richard J. Meyer, the STRATCOM Agency will provide personnel to man and operate the ground terminals. The first crew of 31 military and civilian personnel began training in

September at the Hughes Aircraft Co. plant in Fullerton, Calif., which is building the AN/MSC-46 terminals.

Suitable for use with either medium or high altitude communication satellites, the AN/MSC-46 features a 40-foot-diameter antenna and will be enclosed in a radome. It will be housed in seven vehicles: antenna van, operation control van, maintenance van, a transport vehicle, and three power units.

Transportable in C-130 or C-133 aircraft, the entire terminal is capable of being set up and placed in operation within 18 hours after delivery to the site.

During the R&D test period, which will extend through 1966, the SATCOM Agency will have a special team to conduct tests at the Helemano ter-

Italy Producing U.S. Army Armored Personnel Carrier

Under the Coproduction for Security Program (CSP), the U.S. Army-developed M113 Armored Personnel Carrier is now being completely produced in Italy for use by the Italian army, with a substantial number of components being supplied by American industry.

The M113 is the first U.S. Army item of equipment to be manufactured under the CSP and the arrangement commits the Italian Government to spend \$30 million on U.S.-built components for M113s. The CSP is considered a significant step forward in the U.S. Defense Department's efforts to achieve maximum standardization of NATO equipment.

In addition to demonstrating the possibilities of future cooperative effort between the U.S. and its NATO allies, the CSP success on the M113 assists the U.S. in the balance of payments problem and insures a capable M113 manufacturing base in Europe.

Phase I of the program began in February 1963 and about seven percent of the envisioned total of vehicles was produced in Italy from components and assemblies furnished from the United States.

Phase II consisted of producing another seven percent of the vehicles by incorporating hull assemblies and a small number of parts and components made in Italy and the U.S. providing the balance.

In the third phase, now underway, the remaining vehicles will be produced. Hull assemblies, track and other components will be manufactured in Italy, with some major items such as engines, transmissions and

minal. The 8-man team will be in addition to the normal STRATCOM operating crew.

The new AN/MSC-46 Hawaii terminal will be located near a smaller, experimental satellite communications terminal which has been operating at Helemano since 1964. The small terminal has passed test traffic between the Philippines, Southeast Asia and the U.S. mainland through the SYNCOM II and SYNCOM III experimental network.

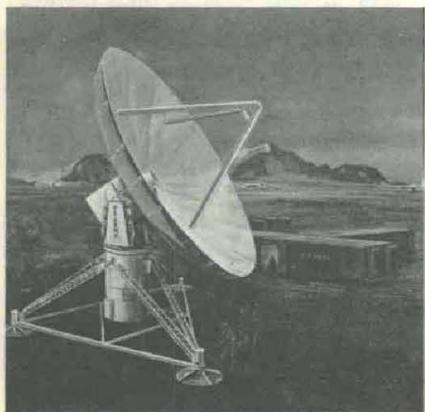
The AN/MSC-46 will not be used in the forthcoming Initial Defense Communications Satellite Project (IDCSP) network, because SYNCOM operating frequencies are different. Moreover, it will continue to work in the SYNCOM communications test program and will be manned by 33 military and civilian personnel of the U.S. Army Strategic Communications Command.

aluminum armor plate procured from the U.S.

The Italian-built M113 has successfully passed the rugged 4,000-mile test conducted by the U.S. Army Test and Evaluation Command at Aberdeen Proving Ground, Md.

The prime contractor in the U.S. is FMC, of San Jose, Calif., and Charleston, W. V. Principal Italian participants are OTO Melara, La Spezia; Fiat Co., Turin; and Lancia, Bolzano.

In addition to this progress in the program, \$21 million worth of M113s were ordered in the last half of FY 1965 by the Federal Republic of Germany and another \$12 million by the Netherlands. In the last four years, M113 orders have been received from many countries, including Switzerland, Australia, Federal Republic of Germany, Canada, Italy, Denmark and Norway.



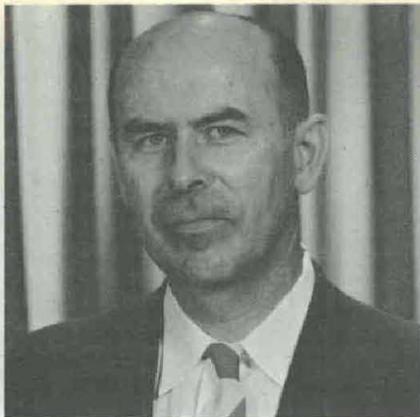
AN/MSC-46 SATCOM Terminal



M113 Armored Personnel Carrier



Charles E. Richardson



Dr. Oswald H. Lange

MICOM Picks Chief Scientist, Engineer for Nike X

Chief scientist and chief engineer positions in the Army Nike-X Project Office at Redstone (Ala.) Arsenal were filled recently by assignment of two civilian pioneers in missile and rocket development.

Chief Scientist Dr. Oswald H. Lange returns to the Army after more than five years with the National Aeronautics and Space Administration's Marshall Space Flight Center at Redstone. During that time he worked directly for Center Director Dr. Werhner von Braun, first as head of the Saturn Vehicle Project and for the past two years as assistant MSFC director for Scientific and Technical Analysis.

New Chief Engineer Charles E. Richardson was formerly chief of the Nike-X Project's Test and Range Operations Division.

Nike-X, the Army's biggest single research and development program, is an advanced missile system being developed as a defense against ICBMs and submarine-launched missiles.

Dr. Lange and Richardson will work in the office of Col I. O. Drewry, project manager, at the Arsenal, but will participate in Nike-X development activities being carried out at a number of locations in the United States and at the Nike-X operated Kwajalein Test Site in the Marshall Islands in the Pacific.

DR. LANGE received an MS degree in mathematics, physics and chemistry at the University of Breslau, Germany, and PhD in electronics, mathematics and physics at the Berlin Institute of Technology.

During World War II, he worked at the German Army Missile Center in Peenemuende, first on V-2 guidance and control and later in charge of development for the "Wasserfall" anti-aircraft guided missile.

Later he became a principal scientific officer at the Royal Aircraft Establishment in Franborough, Great Britain. After emigrating to the United States, he worked in the Advanced Design Department of the Glenn L. Martin Co., Baltimore, Md., and joined the Computation Laboratory of the Army Ballistic Missile Agency at Redstone Arsenal in 1955 as deputy director.

Coauthor of the book, "Space Carrier Vehicles," he has written papers on computers, guidance, instrumentation and project management. Pat-

ents on computers and instrumentation are held for him by the British Ministry of Supply.

As chief scientist, Dr. Lange also will be the technical director for research and development work, a post formerly held by Dr. Bruce Reese, now at Purdue University.

RICHARDSON, a native of Alabama, attended Georgia Tech, received a degree in electrical engineering from Auburn University, and worked with Southern Bell Telephone and Telegraph Co. until 1951 when he established his own engineering consultant firm. In 1952 he joined Redstone Arsenal to do missile research and development work and in 1958 was assigned to the Nike Zeus anti-missile missile program, forerunner of the Nike-X program.

Later, as chief of the Project's Test and Range Operations Division, he was responsible for testing activities carried out from Ascension Island in the Atlantic to Kwajalein Island in the Pacific as well as at several sites in the continental United States.

In 1964 Richardson was designated deputy Nike-X project manager for Range Operations in addition to his duties as a division chief. He is currently attending the Advanced Management Program at the Harvard University Graduate School of Business Administration.

AVLABS Engineer Studying in Belgium

An aerospace engineer of the Army Aviation Materiel Laboratories (AVLABS), Fort Eustis, Va., has been selected for study in aerodynamics at a NATO-sponsored training center in Belgium.

Clifton G. Wrestler, Jr., an AVLABS employee for three years, left Oct. 2 to study at The Von Karman Institute at Rhode-Saint-Genese, Belgium, until July 1966. His study is sponsored by the U.S. Army Materiel Command.

The Von Karman Institute was incorporated in 1956 as an international scientific association sponsored by NATO to contribute to dissemination of knowledge in fluid mechanics and applied aerodynamics.

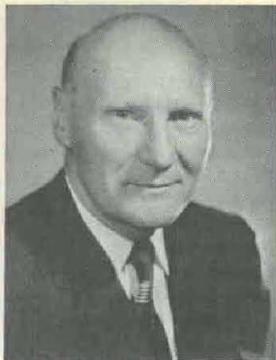
Wrestler will study at the Training Center for Experimental Aerodynamics (TCEA). Some 20 postgraduate students from 10 NATO countries attend each year. Training is specialized in the techniques and practice of a modern aerodynamics laboratory. One of the primary aims is to encourage research in experimental aerodynamics and fluid mechanics.

In addition to the full-year courses, the Center offers specialized courses of from two weeks to three months. Each year, several scientists of international reputation visit the Center to give lectures and seminars on their specialties. Visits to aerodynamic facilities in neighboring countries are arranged to allow students to compare equipment and research techniques.

Wrestler's AVLABS duties involve application of basic laws of physics and aerodynamics to aircraft design, performance, control and stability. He holds a BS degree in mechanical engineering from the University of Miami. Prior to joining the Army laboratories, he conducted theoretical and experimental studies in aerodynamics with the National Aeronautics and Space Administration (NASA).



Clifton G. Wrestler, Jr.



Dr. Ernst Weber



Dr. C. S. Draper



Dr. J. B. Wiesner

3 Distinguished Scientists Join ECOM Advisory Unit

Appointment of three of the Nation's distinguished scientists to the Electronics Advisory Group of the U.S. Army Electronics Command has been approved by Secretary of the Army Stanley R. Resor. Appointees are:

- Dr. Jerome B. Wiesner, former No. 1 science leader in the Federal Government as Presidential Science Adviser, who resigned in January 1964 to return as dean of the School of Science at Massachusetts Institute of Technology (MIT).

- Dr. Charles Stark Draper, a 1964 Medal of Science winner honored by President Johnson for "outstanding contributions to scientific knowledge. Dr. Draper is head of the Department of Aeronautical Engineering at MIT, with which he has been continuously associated since 1922, and has served as a member of the Army Scientific Advisory Panel (ASAP) since 1956.

- Dr. Ernst Weber, president of the Polytechnic Institute of Brooklyn, who has been active in Army science for many years and has served as chairman of the Advisory Council of the Army Junior Science and Humanities Symposium Program since February 1963.

Donald G. Fink, general manager of the Institute of Electrical and Electronics Engineers (IEEE), succeeded Dr. Andrew Longacre as chairman of the Electronics Advisory Group at its Sept. 21 meeting, marked by the farewell appearance of Maj Gen Frank W. Moorman as CG of ECOM.

Dr. Longacre, a professor of engineering sciences at Syracuse University, is a member of the ASAP and Mr. Fink is a consultant to the Panel. Edward Goldstein, director of the Military Communications Systems Engineering Center, Bell Telephone Laboratories, succeeded Mr. Fink as vice chairman.

Dr. William L. Everitt, dean of the

School of Engineering at the University of Illinois, attended the meeting as the last of his tenure. Membership on the Electronics Advisory Group is limited to two years by Army Regulations. The Group was established to advise the CG of ECOM in regard to research and development activities.

DR. WIESNER has served in the past as an adviser to ECOM and its predecessor organization. He became a member of the President's Science Advisory Committee in 1957 and served until he became President Kennedy's Science Adviser. Born in Detroit, he received his BS, MS and PhD degrees from the University of Michigan.

Dr. Wiesner has been at MIT since 1940, with the exception of a year when he served on the staff of the Los Alamos Laboratory and three

years as Presidential Science Adviser. Outstanding in his many contributions to science are those in the field of microwave theory. He is a Fellow of IEEE and the American Academy of Arts and Sciences, and a member of the National Academy of Sciences and the Acoustical Society of America.

DR. DRAPER, a pioneer in inertial guidance systems, has been associated with research and development of a majority of U.S. missiles and space vehicles. Currently he is working on the guidance-navigation system of the Apollo spacecraft designed to carry men to the moon and back.

He received his BA degree from Stanford University in 1922, then entered MIT, from which he received his BS, MS and ScD degrees. Since then he has become one of the Nation's most honored scientists.

DR. WEBER was educated at the Technical University of Vienna, where he received a PhD degree in physics and ScD in electrical engineering.

Prior to joining the Polytechnic Institute of Brooklyn as a visiting professor in 1931, he was a research engineer with the Siemens-Schuckert-Werke in Austria from 1924 to 1929 and in Germany the following year. He was elevated to the presidency of Polytechnic Institute in 1957.

He is a Fellow and past president of IEEE, a Fellow of the American Physical Society, vice president of the Engineers Joint Council, and a member of the Defense Science Board and the Army Scientific Advisory Panel (ASAP).

ABCA Food Group Holds First Meeting at Natick

Representatives from the United States, United Kingdom, Australia and Canada attended the Quadripartite Standing Working Group on Foods and Rations' recent first meeting at the U.S. Army Natick (Mass.) Laboratories.

Dr. F. P. Mehrlich, director of Natick's Food Division, presided at the ABCA Group discussions, covering its basic mission areas of stimulating R&D in military food processing, rations and food packets, related human factors, testing and evaluation.

The Group will operate as a part of the ABCA Standardization Program, which calls for free exchange of information between the four member nations in development of military materiel, operations research, human factors and other aspects of armed forces planning.

In addition to Dr. Mehrlich, members are Col R. V. Hatherly, United

Kingdom Ministry of Defense; Lt Col L. Jewson, Australian Army Headquarters Director of Supplies and Transport; and Maj F. J. Casey, Army Equipment Engineering Establishment, Canada.

Representatives of the U.S. Army Materiel Command, Combat Developments Command, the Army's Special Warfare Agency and other Army field agencies attended the 3-day meeting.

Agenda items were: major ration developments, indigenous foods and feeding the indigenous population, living off the land, and subsistence where re-supply is impracticable.

Continued effort to determine and standardize the energy value of ration packs developed by ABCA armies and intended for consumption under comparable circumstances was recommended.

The group is scheduled to meet in London, England, in September 1966.

Nike X Accounts for 40 Percent of \$573 Million in Contracts

A record \$573 million in research, development, test and production contracts was awarded by the U.S. Army in the 4-week period before this publication went to press. It was the highest total the Newsmagazine has reported in its 5-year history.

Accounting for 40 percent of the total was a \$221,216,696 contract for continued development and testing of the Nike X missile defense system to Western Electric Co., New York City, prime contractor.

Sharing the funds will be several thousand subcontractors in nearly every state of the union. The agreement covers work on the system from Oct. 1, 1965 to Sept. 30, 1966.

Nike X is being developed as a defense against intercontinental ballistic missiles and submarine-launched missiles.

As the only antimissile missile system in advanced development by the United States, it is a high priority Department of Defense research and development project.

The contract also will cover testing of the Nike X equipment at White Sands (N. Mex.) Missile Range and on Kwajalein Island in the mid-Pacific, but does not include funds for production of the system.

Col I. O. Drewry is Nike X project manager at the U.S. Army Missile Command, Redstone Arsenal, Ala. Bell Telephone Laboratories is responsible for design and development of the system.

Nike X includes the Multifunction Array Radar (MAR) for target acquisition, discrimination, tracking and interceptor missile tracking; the Missile Site Radar (MSR) for target tracking and missile tracking; the Zeus missile for long-range intercepts; and the Sprint high-acceleration missile for short-range intercepts.

Western Electric also received an additional \$48,021,680 in separate contracts for Nike X production engineering and production planning, research and development facilities, continuous research and development in connection with the Nike X Optics Program, design and development of the Nike Zeus (DM15X2) antimissile missile, operation of discrimination radar and target track radar stations, and for FY 1966 technical publications for use with the Nike Hercules System.

Kaiser Jeep Corp. received a \$46,045,847 contract as the third increment of a 3-year buy of 2½-ton trucks. Bell Helicopter Co. was

issued seven contracts and delivery orders totaling \$32,590,771 for transmission assemblies, machine tools, blade assemblies, drive shaft assemblies and other components and parts for the UH-1 Helicopters.

Chrysler Corp. was awarded \$29,691,312 for M60A1 tanks, with concurrent repair parts. Martin-Marietta Corp. received two contracts totaling \$19,747,847 for continued engineering support for the Pershing weapons system and installation of modification kits in support of Pershing.

Day & Zimmerman, Inc., Philadelphia, Pa., was issued a \$16,420,527 contract for classified ammunition. Continental Motors Corp., Muskegon, Mich., was awarded a \$14,939,440 agreement as the third increment of a 3-year buy for LD 465-1 multifuel engines.

Mason & Hanger, Silas Mason Co., Lexington, Ky., received two contracts totalling \$14,478,893 for ammunition and ordnance items and reactivation of portions of an Army ammunition plant.

General Electric Co. was issued four agreements totaling \$13,039,528 for aircraft machineguns, armament pods and ancillary hardware, acquisition radar for Nike Hercules (modification to previous contract), design, manufacture, delivery, installation and test of four generators, and design and development of an armament subsystem for the 30mm automatic gun to be used on UH-1B helicopters.

Other contracts included: Sperry Rand Corp., \$12,462,948 (two contracts) for classified ammunition and production engineering services for the Sergeant missile system; Olin Mathieson Chemical Corp., \$8,191,808 modification for ordnance items and maintenance and support services;

American Machine and Foundry Co., \$8,176,450 for plant equipment and production of ordnance items; General Motors Corp., three contracts totaling \$7,905,253, Phase III extension for two months of the design and development of the U.S.-FRG Main Battle Tank, continuation of a re-entry study program, and for engines for light observation helicopters;

Goodyear Tire and Rubber Co., two contracts totaling \$7,882,765 for track assemblies for M60 series tanks and for truck tires; Radio Corp. of America, \$7,753,452 for design, documentation, fabrication and testing of multisystem test equipment for the Shillelagh, Lance and TOW missile systems; Radiation Inc., Melbourne, Fla., \$7,175,356 for development and fabrication of satellite communication terminals (AN/TSC-54) for the Satellite Communication Agency;

Firestone Tire and Rubber Co., two contracts totalling \$6,951,538 for track assemblies for M60 series tanks and for maintenance and support services under standby conditions; Caterpillar Tractor Co., \$4,595,920 for tractors;

Atlas Chemical Industries, Valley Forge, Pa., \$4,281,100 for re-activa-



ARMY DEVELOPMENT OF CHAPARRAL, a new air defense guided missile system designed to combat low-altitude attack, advanced early in October with a successful firing at China Lake, Calif., Naval Ordnance Test Station. Chaparral uses a modified self-propelled vehicle (XM548) as a mount for launching the heat-seeking Sidewinder missile. The Sidewinder, originally developed by the Navy as an air-to-air weapon, has been modified slightly for Army use.

tion of the Volunteer Army Ammunition Plant and manufacture of TNT; Chamberlain Corp., \$4,181,292 for 155mm projectiles; Kentron Hawaii, Ltd., \$3,863,247 for Nike X range technical support; Boeing Co., \$2,950,830 for Chinook helicopter components and assemblies; Bowen-McLaughlin-York, \$2,537,594 modification for 8-inch howitzers (M110) and recovery vehicles (M578); Thiokol Chemical Corp., \$2,333,645 for illuminating shells; Federal Cartridge Corp., Minneapolis, Minn., \$2,252,018 modification for maintenance and sup-

port services at the Twin Cities Army Ammunition Plant; Colt's Inc., \$2,072,481 modification for AR-15 rifles with one each 20-round magazine; General Precision, Inc., \$2,034,960 for hydraulic actuation system for the Pershing missile system; Philco Corp., \$2,000,000 for Shillelagh missile system test equipment; Bendix Corp., \$1,852,268 for FY 1966 engineering services for guidance and control for the Pershing missile system;

Hercules Powder Co., \$1,845,321 modification for maintenance and sup-

port services at the Sunflower Army Ammunition Plant, Lawrence, Kans.; Highway Products, Inc., Kent, Ohio, \$1,706,231 for aluminum boats to be used for the erection of bridges; Cutler-Hammer, Inc., \$1,608,150 for one prototype and four service test models of a Search and Intercept Assembly with technical report and ancillary items;

Stanford Research Institute, \$1,602,119 for studies for an anti-missile missile system; Leland Stanford Junior University, Stanford, Calif., \$1,529,200 for research of advanced information processing; Rockell-Standard Corp., Detroit, Mich., \$1,505,395 for transmission assemblies for 2½-ton trucks; Eisen Brothers, Inc., Hoboken, N.J., \$1,367,338 for projectile assembly parts; Reeves Instrument Co., a division of Dynamics Corp., Garden City, N.Y., \$1,152,384 for fuze parts;

Benton Corp., Troy, Mich., \$1,119,100 for modification kits for the Hawk Loader Transporter; Fisher Chemical Co., New York City, \$1,021,746, for chemical agent CS1, a riot control agent; AVCO Corp., \$1,075,101 for bomb parts.

COSATI Publishes Standards for Microfiche

Specifications for microfiche production applicable to all scientific and technical reports of all Federal agencies and their contractors are prescribed in a new publication, "Federal Microfiche Standards."

The Committee on Scientific and Technical Information (COSATI) of the Federal Council for Science and Technology has adopted the set of standard specifications. Application to documents other than technical reports is optional at this time, pending future actions COSATI may take to extend their use.

Microfiche (pronounced microfesh) is a micronegative method of reproducing scientific and technical reports for rapid processing to meet user requests.

Microfiche currently is used by the six principal report-producing agencies of the Federal Government: National Aeronautics and Space Administration (NASA), U.S. Atomic Energy Commission (AEC), and the Departments of Commerce, Army, Navy and Air Force.

Presidential Science Adviser Dr. Donald F. Hornig, chairman of the Federal Council for Science and Technology announced publication of the "Federal Microfiche Standards" in a letter to agencies, urging rapid adoption by all concerned and stating in part:

"These standards offer opportunities for greater efficiency and economy in the preparation, handling and use of technical and scientific literature."

Standards include detailed specifications on such matters as microfiche size, film characteristics, reduction ratio, arrangement of material within the grid image area; and placement, content, and printing of title information. Drawings are included to illustrate certain specifications.

Edward J. Brunenkant of the AEC is chairman of the COSATI committee established in 1963 to revise the existent microform standards.

Dr. Jerome Wiesner, the President's Science Adviser at that time, set the goal of Government-wide adoption of a more extensive and refined set of microfiche standards, including specifications for reading and printing the miniaturized product and for reproducing full-size copy.

The standard microfiche size, as agreed by the prime report-producing agencies, is 4x6 inches. The film can be stored and retrieved with all the convenience of file cards and can be mailed in ordinary envelopes.

Committee members who worked with Chairman Brunenkant to establish the present standards are Armen G. Abrian and John T. Simons of the Department of Defense; Paul W. Larsen of the Department of Commerce; and Van A. Wente of the National Aeronautics and Space Administration.



MICROFICHE is on the left, microfilm is on the right, in the middle is Ann Kendall of the Defense Documentation Center, a field activity of the Defense Supply Agency, headquartered at Cameron Station, Alexandria, Va. She shows storage comparison with the actual document at center. The DDC recently changed from microfilm to microfiche sheets.

6 Army R&D Unit Reservists Attend Seminar at Penn State

Six officers from U.S. Army Reserve Research and Development Units attended a recent 2-week seminar sponsored by the Office of Naval Research and Naval Research Reserve Co. 4-4 at Pennsylvania State University, State College, Pa.

The first Naval Reserve Research Seminar on "University Research in Relation to Government and Industry" was designed to acquaint participants with the nature and scope of research conducted at a major university in support of industry and Government.

Among speakers were Rear Adm. J. K. Leydon, Chief of Naval Research, Dr. Eric H. Walker, president of Penn State, and Dr. E. F. Osburn, vice president for research at Penn State. Several additional U.S. Navy officials and a number of professors at the university made presentations.

U.S. Army Reserve participants were Col Alexander D. Johnson and Maj Samuel S. Dubin, 2101st USAR R&D Unit, State College, Pa.; Maj Thomas M. Jones, and 1st Lt Raymond H. Gompf, 3370th USAR R&D Unit, Cocoa Beach, Fla.; 1st Lt James A. McCann, 1002nd USAR R&D Unit, Springfield, Mass.; and Maj Grover C. Condon, U.S. Army Chemical Research and Development Laboratories, Edgewood (Md.) Arsenal.

Army Operating Subsonic Aviation Laboratory at NASA-Ames Research Center

Preliminary operations started this month in the wind tunnel of the Army's only subsonic aviation laboratory at the new Army Aeronautical Activity, NASA-Ames Research Center, Moffett Field, Calif.

Establishment of the Army activity is the result of a joint agreement between U.S. Army Materiel Command and the National Aeronautics and Space Administration (NASA)-Ames Research Center announced last March in this publication. It provides for Army participation in an expanded program of aeronautical research in low-speed and VTOL (vertical take-off and landing) aircraft.

Col Cyril D. Stapleton, an officer with one of the most extensive technical backgrounds in Army aviation, was assigned as chief of the aeronautical activity following the Army-NASA-Ames agreement.

First technical director of the new activity, announced recently, is Paul F. Yaggy who comes to the Army from the NASA-Ames Research Center with a 21-year background in low-speed aerodynamic research. Authorized personnel strength for the activity is 45 civilians, professional and technical.

In addition to a 7x10-foot wind tunnel made available for Army use, the Moffett Field research center provides administrative spaces, office equipment and supplies, most of the communications, and utilities.

The Army has refurbished the wind tunnel, long on a standby basis, as part of Army construction of an in-house aeronautical research capability of a type which does not now exist.

In addition to physical support, NASA-Ames will consider the Army's VTOL interests in its own in-house aeronautical research and will contribute appropriately to the search for more technical information on the VTOL potential.



FIRST TECHNICAL DIRECTOR Paul F. Yaggy of the U.S. Army Aeronautical Activity, Moffett Field, Calif., is welcomed aboard by the new activity's chief, Col Cyril D. Stapleton. Officials of the NASA-Ames Research Center with whom the Army activity will work are (from left) Russell G. Robinson, assistant director of aeronautics and flight mechanics, and Dr. Smith J. De-France, retiring director. G. G. Morehouse, administrative officer, is at right.

Army Materiel Command scientists estimate that air-stream calibrations, flow measurements, pressure distribution, pressure probes, even the delicate, low-tolerance placement of instruments to measure turbulence, among other preliminary preparations, should be in order for actual tunnel tests to begin in June 1966.

Speed of the wind tunnel's air stream will be approximately 250 m.p.h. maximum, and a low of about 30 m.p.h. "Upstream" from the test section of the tunnel is a "settling chamber" for very-low-velocity tests.

The Army's joint use and support of NASA-Ames facilities at Moffett is a mutual and substantial economic saving. NASA and the Army have common interests in fostering research in subsonic and VTOL aircraft on a continuing basis. Both have experienced aerodynamic problems and combined efforts are expected to permit

expansion of research at minimal cost to each agency.

Assistant Secretary of the Army for R&D Willis M. Hawkins recently made the following comments in a letter to Dr. Robert C. Seamans, Jr., associate administrator of NASA:

"... I trust that the recently signed agreement between NASA and the Army Materiel Command will prove to be of mutual and lasting benefit to both parties. I feel that the signing of this agreement will also demonstrate that there are many important advantages and savings to be gained by close interagency cooperation, such as evidenced by this (Army-NASA-Ames) agreement.

"I cannot overemphasize the importance to the Army air mobility concept of maintaining a strong and vigorous low-speed aeronautical research program, particularly in such areas as VTOL aircraft. . . ."

Col Stapleton, who first set up the Army Test and Evaluation Command's Aviation Test Activity at Edwards Air Force Base, Calif., was maintenance project officer for Army Supply and Maintenance Command, Washington, D.C., before becoming chief of the Army Aeronautical Ac-

Aviation Materiel Contract Let

Award of a \$306,210 contract recently was made by the U.S. Army Aviation Materiel Command to Sperry Rand Corp's Vickers, Inc., Division, Troy, Mich., for production of 121 hydraulic gear box motors and 62 hydraulic motors to be used in support of the CH-47 Chinook helicopter.



VIEW OF TEST SECTION of Number 2 wind tunnel at U.S. Army Aeronautical Activity at NASA-Ames Research Center, Moffett Field, Calif.

tivity. He holds an MA degree in mechanical engineering from Georgia School of Technology, Atlanta.

Technical Director Yaggy is known for research in low-speed aerodynamics, generally, and in important aspects of VTOL flight and spacecraft landing and recovery techniques. His work in recent years embraces wind tunnel test programs of particular interest to the Army.

Before joining the Army Aerospace Activity, Yaggy was the NASA-Ames representative in the field of propellers, rotors, and ducted fans as used in VTOL aircraft and other designs. He was educated at Taylor University, Notre Dame and San Jose State.

4 Services Agree on Portable Landing System R&D

Agreement of Army, Air Force, Navy and Marine Corps R&D chiefs on a plan to select a portable electronic tactical letdown system compatible to all military land-operated aircraft has been announced.

The system envisioned would meet "exigencies of the moment" in remote areas where the cumbersome Ground Control Approach (GCA) system has tactical disadvantages. The concept of the system was advanced last May by young officers assigned to the Pentagon, Washington, D.C.

Lt Col Lawrence C. (Chet) Wright, deputy chief, Guidance and Control, Headquarters USAF, was named "executive agent" for the Army, Navy, Air Force and Marine Corps group which expects to have such a system in operation "by December 1966."

The agreement on selection of the system was reached recently at a briefing for Lt Gen William W. Dick, Jr., Army Chief of R&D; Lt Gen James Ferguson, Air Force Chief of R&D; Rear Adm Harold G. Bowen, Jr., Deputy Chief of Naval Operations, Development; and Brig Gen Wood B. Kyle, U.S. Marine Corps Chief of R&D.

Backed up with data obtained through their own research and with the help of the Army Electronic Laboratories, Fort Monmouth, N.J., the 4-service briefing group pointed out in an illustrated presentation the need for such a system. They also noted the existent long-range programs for a tactical landing system.

As the only military landing guidance system in general use, the GCA was described as impractical for tactical purposes in remote areas.

The smallest GCA system weighs approximately 1,100 pounds, without the radarscope shelter; only one aircraft can be landed at a time; the voice radio link gives bit-by-bit instructions to the pilot for the land-



REFURBISHED EXTERIOR of Number 2 wind tunnel at NASA-Ames Research Center, Moffett Field, Calif., which the U.S. Army Aeronautical Activity will use for low-speed and VTOL aircraft tests. (NASA-Ames photographs)

ing instead of continuous 2-dimensional instructions; and each GCA system requires a skilled operator needing months of training.

The briefing team said the primary need now is an off-the-shelf portable system that can be quickly installed, operated by a comparatively unskilled person, has a range up to approximately 10 miles, and can be adjusted to various glide-slope angles to include landing of helicopters. It must give steering and glide-slope information simultaneously to the pilot.

Appearing before the four Armed Services R&D chiefs were Lt Col Lawrence Wright, Air Force; Lt Col Blanchard Shattuck, IV, Office of the Chief of R&D, Department of the Army; Maj Paul H. Salade, U.S. Marine Corps R&D; and Charles H. Taylor, Future Systems Requirements Branch, Office of the Chief of Naval Operations.

When requirements for a new tactical landing system first were publicized, Lt Col Shattuck, who initiated

discussions with the other services, said that 26 proposals, ranging from "just ideas" to actual working models, emerged from the communications-electronics industry.

During ensuing months these proposals were narrowed to the few with greatest potential. Currently, two landing systems appear most likely to meet needs of the four services for use by airplanes and helicopters.

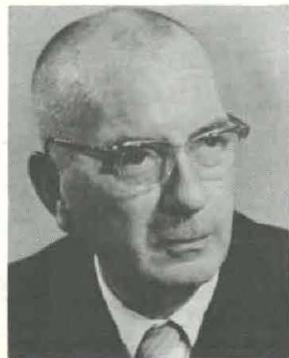
The R&D chiefs instructed the all-service group to explore the feasibility of the two systems and to investigate any additional systems which are competitive in technique, should they be presented by industry or recommended by military electronics experts.

Any additional system also will have to meet exceptionally tight time schedule for testing.

Efforts to obtain a tactical letdown system from off-the-shelf purchase, it was stressed, will in no way affect the long-range research and development program, which the R&D chiefs emphasized also will be conducted on a coordinated basis.

Nobel Prize Winner Speaks at Natick Conference

A Nobel Prize winner for chemistry in 1963, Dr. Karl Ziegler of West Germany, was guest speaker at the recent Ninth Annual Organic Chemistry Conference at the U.S. Army Natick (Mass.) Laboratories.



Dr. Karl Ziegler

The director of the Max Planck Institute for Coal Research in West Germany, discussed "Advances in Chemistry of Aluminum Alkyls."

Two other European scientists were among speakers at the conference sponsored by the National Academy of Sciences, National Research Council. They were Dr. Anders Kjaer, Royal Veterinary and Agricultural College, Copenhagen, Denmark; and Dr. Guy Ourisson, University of Strasbourg, France.

Other speakers included Dr. George A. Olah, Dow Chemical Co., Wayland, Mass.; Dr. David Y. Curtin, U. of Illinois; Dr. Philip E. Eaton, University of Chicago; and Dr. George S. Hammond, California Institute of Technology.

Dr. Louis Long, Jr., director of Natick's Organic Chemistry Laboratory, was moderator.

AFIP, AMA, FDA, Industry Pool Drug Reaction Data

Operation of a new Registry of Tissue Reactions to Drugs, expected to enhance greatly programs for drug reaction reporting, began Sept. 1, at the Armed Forces Institute of Pathology in Washington, D.C.

The Registry is sponsored jointly by the American Medical Association (AMA), U.S. Food and Drug Administration (FDA), and the Pharmaceutical Manufacturers Association Foundation (PMAF), Inc. It marks the first important cooperative effort between the three agencies.

Located in the AFIP Annex, the Registry was established to obtain autopsy and biopsy specimens from suspected adverse drug reaction cases. Results of the case studies will be reported to contributing pathologists along with monthly summary reports to the AMA, FDA and PMAF.

The Registry is administered by

Universities Associated for Research and Education in Pathology, Inc., through the American Registry of Pathology, also at AFIP. Dr. Nelson S. Irey, recently retired from military service after serving four years as chief of Walter Reed General Hospital Pathology Service, is registrar for the activity.

Slides, blocks, biopsy and autopsy reports, clinical history, photographs, X-rays and other pertinent information and material will be accepted from pathologists or from individual physicians through their pathologists.

All material submitted to the new Registry should be as complete and as detailed as possible. Tissue specimen shipments must be properly packed and labeled "Laboratory specimens," "Top," and "Fragile" or "Handle with care."

Each case should be sealed in

double plastic bags and the entire shipment placed in one large plastic bag, then heat-sealed securely or fastened to prevent leakage. The bag should be placed in a strong cardboard container heavily insulated with absorbent cotton or paper toweling.

Further information on packing and shipping may be obtained by writing to the AFIP. If shipped directly to the Registry, case material should be addressed to the Director, ATTN: Registry of Tissue Reactions to Drugs, Armed Forces Institute of Pathology, Washington, D.C. 20305.

Picatinny Engineer Develops Lightweight Case for Weapon

An exceptionally rugged 20-pound case for transporting a delicate, 180-pound weapon system has been devised at Picatinny Arsenal's Atomic Ammunition Development Laboratory, Dover, N.J.

The Army required a container capable of withstanding submersion in 50 feet of water, the abnormal shocks and shakes of rough transportation by land, air or sea; temperature extremes ranging from plus 160° F. to minus 65°; and hostile environments—salt spray, sand, dust, altitude and humidity.

The "home" of Army munitions research at Picatinny Arsenal found the answer as provided by Charles Lindstedt, project engineer, and it has been tried and found true. The solution is a honeycombed aluminum cylinder bonded to thin sheet aluminum and housed within another honeycomb cylinder with a 2½-inch wrapper. More than 36 inches long, it is 18 inches in diameter. Density is just over one pound per cubic foot.

AGARD Avionics Panel Reviews Opto-Electronics

Opto-electronics received international state-of-the-art assessment in Paris recently at the 9th Symposium of the Avionics Panel, NATO Advisory Group for Aeronautical Research and Development (AGARD).

(Opto-electronics is the subject of studies using optical beams, often Laser beams, combined with conventional electronic circuits for a variety of applications in information processing.)

More than half of the North American Treaty Organization nations were represented by approximately 250 scientists. The Avionics Panel chairman is Dr. Knut Endresen, senior scientist, Norwegian Defense Research, who also chaired the symposium.

Subject of the sessions was "Opto-Electronic Components and Devices," including techniques and applications. During the 4-day conference, papers were presented on the fundamental principles involved and on such subjects as radar spectrum analysis, aircraft altimeters, optical communications systems, optical data processing and processors for phased-array antennas.

Consensus of the AGARD panel is that opto-electronics is a unique field of research and development which is gradually materializing to a stage of major breakthroughs for critical civilian and military applications in the future.

The U.S. Army Office of the Chief, Research and Development was represented in Paris by Dr. Robert B. Watson, Physical Sciences Division,

Army Research Office, Arlington, Va., and Charles Ravitsky of the U.S. Army R&D Group, Frankfurt am Main, Germany. Maj Dominick V. Puccio represented the Office, Chief of Communications-Electronics (OCC-E), Department of the Army.

Nations with panel members and observers present in addition to the U.S. were Belgium, France, Norway, the Federal Republic of Germany, United Kingdom, Canada, Italy and The Netherlands.

MICOM U.S. Bond Sales Win Minuteman Flag for 6th Time

The Treasury Department's coveted Minuteman Flag was presented recently to Maj Gen John G. Zierdt, CG, U.S. Army Missile Command, Redstone Arsenal, Ala., on behalf of the entire Command work force.

The flag denotes 90 percent participation in the U.S. Savings Bond Program by Missile Command personnel. The award covers all elements of the Command exclusive of the three large directorates, each of which already flies the flag. It brings to six the total of Minuteman Flags being flown at Redstone Arsenal and completes the list of Army organizations there eligible for the honor.

Presenting the flag to General Zierdt was Oscar P. Drake, Alabama State director of the U.S. Treasury. Last year the flag was awarded to the Research and Development, Supply and Maintenance and Procurement and Production Directorates, the Army Missile Support Command and the Ordnance Guided Missile School.



PICATINNY Arsenal project engineer Charles Lindstedt displays honeycombed container developed to transport delicate 180-pound weapon.

CRREL Ice-Chipper Tested in Operation Deepfreeze

A new Army ice-chipper will be used in runway-building tests during the 1965-66 Operation Deepfreeze, the Navy's eleventh year of logistic support for the U.S. Antarctic Research Program (USARP) under National Foundation auspices.

Developed by the U.S. Army Cold Regions Research and Engineering Laboratory (USACRREL), Hanover, N.H., the chipper—a specially designed rotary head attached to a traxcavator—is a device for smoothing hummocked ice to provide landing strips for aircraft.

Operational tests will be conducted at McMurdo Station, Antarctica. Coordinating with the Naval Civil Engineering Laboratory (NCEL) representatives at McMurdo, Army CRREL personnel will operate the ice-chipper initially and train Navy men for future operation.

Operation Deepfreeze began Oct. 1 when ski-equipped C-130 aircraft arrived in Antarctica on the first resupply mission since early last March. Thus ended seven months of isolation for more than 280 scientists and Navy men at five U.S. South Polar stations.

Navy icebreakers this month began the annual mission to clear the way for surface resupply by Military Sea Transportation Service (MSTS) ships. The Antarctica wintering-over party includes 251 Navy personnel and 37 scientists at the five U.S. stations and one scientist at the Soviet Mirny Station.

Development of techniques for construction and maintenance of processed snow runways at McMurdo Station is being conducted by the U.S. Army CRREL at the request of the Naval Support Forces. Snow road and runway construction techniques have been successfully developed by the Army laboratory in

Greenland during the past decade.

Continuation of the development studies in Antarctica is necessary because of variation in environmental conditions from those in Greenland.

Gunars Abele, USA CRREL civil engineer, who investigated this trafficability problem at McMurdo Sound last year, will conduct the studies this season as a combined effort with the Naval Civil Engineering Laboratory (NCEL).

Assistants will include Francis Gagnon, USA CRREL equipment specialist, and Richard Haney, a specialist from the U.S. Army Research Support Group (USARSG), Fort Belvoir, Va. The RSG provides logistic and maintenance support for CRREL's research and engineering activities each summer in Greenland.

The Army has another role in Deepfreeze, that of continuing investigations begun during the 1957-58 International Geophysical Year (IGY). Studies at that time were conducted by a CRREL predecessor, the Snow, Ice, and Permafrost Research Establishment (SIPRE), of the U.S. Army Corps of Engineers. The Cold Regions Laboratory is now under the Army Materiel Command.

During the IGY studies, SIPRE drilled far into the icecap at Byrd Station to obtain deep-ice cores for detailed examination. Another objective of the drilling was to probe de-

formational and thermal properties of the antarctic ice sheet. A second hole was drilled at Little America on the Ross Ice Shelf in 1958 to analyze solubles content and gas.

Analysis made after two holes were bored through the ice in 1963 showed that the ice shelf consists entirely of fresh water. The McMurdo Ice Shelf, it has been determined, lies over a layer of fresh water of unknown depth.

It is believed the water is derived from surface melt water that has drained through the ice shelf's many cracks and fissures. Some of the water may have frozen onto the ice shelf, but cores from the deeper of the two holes indicate that most of the ice is snow-derived glacier ice.

Anthony J. Gow, CRREL geologist, is in Antarctica for his seventh field season. He will be making further stratigraphic, petrographic and chemical composition studies of ice cores to be taken from the ice shelf near Dailey Island. Results will be compared with data on cores previously drilled among the fish remains of the eastern-most islands.

Isotopic techniques also will be employed to aid in discriminating between glacier ice and ice formed by freezing of fresh water onto the bottom of the ice shelf.

In order to obtain some idea of the material balance of the McMurdo Ice Shelf, measurement will be sought of the movement of the ice and the surface ablation or melting process.

Developmental TOW Missile Scores in Redstone Test

A new supersonic guided missile being developed by the Army has scored center hits on tank-size targets more than a mile away by a gunner simply tracking the "prey" with the cross hairs in the sight.

The TOW (Tube-launched, Optically Tracked, Wire-guided) is the first supersonic missile guided by a 2-wire link between the launcher and the missile. A developmental model was fired recently by the Army Missile Command (MICOM) at Redstone Arsenal, Ala.

TOW is designed for use against hardpoint targets such as tanks and gun emplacements. Data obtained from the firings will be used to refine the final design of the missile system.

A simplified and highly accurate aiming device incorporated in the TOW is a major improvement over present antitank missiles in the Army inventory. Feasibility studies of TOW began in January 1962.

Lightweight and adaptable, TOW can be carried by troops, fired from a tripod-mounted launcher, or mounted on a variety of ground

vehicles, including the M-113 armored personnel carrier.

With TOW, the gunner has no need to estimate range and speed or target angle. By training the cross hairs of TOW's telescopic sight on the target, stationary or moving, the gunner controls the launched missile to its target. Signals transmitted by the 2-wire link correct course.



ARMY gunner demonstrates TOW.

Scientific Calendar

Fall Joint Computer Conference, sponsored by AFIPS, Las Vegas, Nev., Nov. 30-Dec. 2.
1965 Ultrasonics Symposium, Boston, Mass., Dec. 1-3.

14th Annual Wire and Cable Symposium, sponsored by the U.S. Army Electronics Command, Atlantic City, N.J., Dec. 1-3.

15th Annual Vehicular Communications Conference, Washington, D.C., Dec. 2-3.

Meeting of the American Institute of Chemical Engineers, Philadelphia, Pa., Dec. 5-9.

Symposium on the Nucleolus, Its Structure and Function, sponsored by the Research Institute of Biological Sciences, Montevideo, Uruguay, Dec. 6-10.

Conference on Tropicalization, sponsored by the Hungarian Society of Mechanical Engineers, Budapest, Hungary, Dec. 13-15.

Meeting of the American Association for Advancement of Science, Berkeley, Calif., Dec. 26-31.

International Symposium on Differential Equations and Theory of Systems, sponsored by AFOSR, Brown University and the University of Puerto Rico, Dec. 27-30.

ECOM Designates Director of Avionics Laboratory

Assignment of Lt Col Leslie G. Callahan, Jr., as the first director of the Avionics Laboratory was announced recently by the U.S. Army Electronics Command, Fort Monmouth, N.J. Lester M. Lang, who guided the organization as acting director since its establishment in March is now the deputy director.

Currently operating with 150 military and civilian personnel, the Avionics Laboratory is filling spaces for key avionics scientists and engineers to bring the total programmed strength to more than 250 by Dec. 31.

The Laboratory consolidates all of the Army avionics R&D activities. Personnel are concerned with all electronics components which assist aircraft in flight, including air traffic regulation systems, airborne com-

munications, navigational systems, and total electronic package design for all Army aircraft.

A 1944 graduate of the U.S. Military Academy, Col Callahan has a PhD degree (1961) and an MS degree in electrical engineering (1951) from the University of Pennsylvania. He is a graduate of the Command and General Staff College, the Industrial College of the Armed Forces, and the Army Signal School Advanced Signal Officers' course.

Col Callahan until recently commanded the 51st Signal Battalion (Corps), the Army's oldest Signal Battalion, in Korea. During World War II, he served as battery commander with the 866th AAA Battalion in the Pacific Theater.

In the post-war period, he attended



Lt Col L. G. Callahan, Jr.

the Antiaircraft and Guided Missile School at Fort Bliss, Tex., then served as an instructor in the Guided Missile Department. In 1952 he was assigned as combat developments staff officer (Guided Missile) under the chief of the Army Field Force, followed by a 2-year tour as R&D coordinator, CONARC, at Fort Monroe, Va.

For the next three years, Col Callahan was technical operations officer of the Army Liaison Group, Project Michigan, at the University of Michigan, and later was executive officer of the U.S. Army Research Office-Durham, N.C.

\$21.58 Million Contracted For Advanced Zeus Missile

An advanced, longer-range Zeus, one of two interceptor missiles in the Nike X system, is to be developed under a \$21,580,464 Army contract.

Designated DM15X2, the missile will be very similar in configuration to the present Zeus except for slightly greater length and weight. Powered by two solid-propellant motors, it will carry a nuclear warhead, and will be developed by Western Electric Co. through Douglas Aircraft as subcontractor.

Like the present Zeus, the DM15X2 will be guided in flight by ground-based radars in conjunction with high-speed computers. It will be capable of intercepting intercontinental and submarine-launched ballistic missile warheads outside the earth's atmosphere.

The shorter-range Sprint, designed for close-in intercepts, is the other missile in the Nike X system.

The \$21,580,464 will be administered by the Nike X Project Office at the U.S. Army Missile Command, Redstone Arsenal, Ala. Col I. O. Drewry is project manager.

500 Industrialists Briefed on Army R&D Plans

Long-range Army research and development plans were revealed to more than 500 industrial executives who attended recent classified sessions of an advanced R&D briefing at U.S. Army Weapons Command Headquarters, Rock Island, Ill.

Assistant Secretary of the Army for R&D, Willis M. Hawkins, and Brig Gen Alvin E. Cowan, Director of Developments, Office of the Chief of Research and Development, presented key R&D speeches.

Maj Gen Roland B. Anderson, AWC commanding general, gave an opening address at each session. The meeting was sponsored jointly by the AWC and the American Ordnance Association (AOA).

Col T. O. Blakney, director of Ma-

teriel for the Combat Developments Command, Fort Belvoir, Va., spoke on the Combat Development Objectives Guide. C. D. Cranahan, director of R&D for the Weapons Command, and heads of other divisions in the directorate, also made presentations.

Questions by the industrial and manufacturing executives were answered by a panel headed by General Anderson. The panelists included Colonels Blakney, Carnahan, and the following commanding officers.

Col P. S. Nilsson, Rock Island (Ill.) Arsenal; Col A. Sweeney, Springfield (Mass.) Armory; Col F. Kornett, Jr., Watervliet (N.Y.) Arsenal; Col G. H. Pierre, Jr., Frankford Arsenal, Philadelphia, Pa.; and Col W. J. Durrenburger, Jr., Army Tank and Automotive Center, Detroit.



INDUSTRY-MILITARY group gathered for R&D briefing at U.S. Army Weapons Command (AWC) Headquarters includes (l. to r.) Maj Gen R. B. Anderson, AWC CG; Maj Gen E. P. Mechling (USA, Ret.), American Ordnance Association (AOA) staff director of technical operations; Col George Carnahan, AWC director of R&D; Maj Gen N. M. Lynde (USA Ret.), former AWC CG; and E. L. Baugh, General Motors Co., the current AOA vice president.

MICOM Sets Up Rocket Propulsion Management Center

Establishment of a Rocket Propulsion Technology and Management Center at Redstone (Ala.) Arsenal, with Edward B. Dobbins assigned as director, was announced early in October by the Army Missile Command.

The centralized R&D facility for missile and rocket propulsion systems will operate as part of the Propulsion Laboratory, Research and Development Directorate, under the direction of Frank W. James. Laboratory personnel who have been doing work now assigned to the Center form its staff.

The RPT&MC is on the same level as the Inertial Guidance Technology and Management Center established by the Missile Command in 1963 to funnel Army work on missile and rocket on-board guidance control.

Assigned to Redstone Arsenal as a civilian employee in 1958, Dobbins served first as a unit chief in the Structures and Mechanics Laboratory

Army Tests Audio Warning System in Aircraft

An "Audio Warning System" in Army aircraft is being tested at Fort Rucker, Ala., to determine military potential as a supplement to visual warning methods.

The U.S. Army Test and Evaluation Command is collaborating with the Army Aviation Materiel Command in evaluating the system in two CH-47 Chinook helicopters. Later tests are planned for two UH-1 Iroquois helicopters and one OV-1 Mohawk aircraft.

The system supplements the visual warning display with a pre-recorded audio message to pilot and copilot headsets. A female voice is used. Typical messages are: "engine oil pressure low—transmission oil hot—five minutes fuel remaining—rotor r.p.m. abnormal."

A human factor study of the system has shown that pilot reaction time can be reduced to one second as opposed to several minutes on the conventional visual warning display.

In conjunction with the voice warning, a prerecorded pilot's checkout for both takeoff and landing conditions is being tested. The checkout procedure lasts 30 seconds for landing but can be increased as required. A repeat switch can be activated to re-run the check-out procedure.

A continuous magnetic tape recorder is also being added to record all messages delivered to the pilot by the system. These tapes will be available to the crew chief for maintenance diagnosis. The tapes will also be available to post-crash investigating

of the Army Ballistic Missile Agency. In 1960 he was promoted to chief of the Advanced Propulsion Engineering Branch of the Propulsion Laboratory.

He held that position until 1964, when he was assigned to the Advanced Research Projects Agency (ARPA) Division of the R&D Directorate. There, he managed the AMRAD program in the design and fabrication of reentry targets, and HIBEX, an experimental program in high-acceleration technology.

Until selected to head the Propulsion Center, he was chief of the Mis-

AMC Answers Inquiries of Press Regarding S&M Command Change

Persistent inquiries by Washington news media regarding rumors of a possible impending reorganization to merge the Supply and Maintenance Command into U.S. Army Materiel Command Headquarters prompted the AMC Information Office to state:

teams for possible use in determining accident causes.

If tests of this system prove successful, a way to the eventual elimination of all warning lights and check-out placards is foreseen.

Tests are scheduled to end this month and the final report will be available in January 1966.

Army Representative Assigned to Defense Documentation Center

The new Army liaison representative of the Defense Documentation Center (DDC) at Cameron Station, Va., is Lt Col Thomas E. Benson. In mid-September he received the Bronze Star Medal for service in Viet Nam from June 1964 to June 1965.

Col Benson is responsible for liaison Army representatives of the De-

partment of Defense Scientific and Technical Information (STI) Program, and Army scientists, engineers, contractors and grantees working on research, development, test and evaluation projects. The U.S. Army Research Office will continue to furnish to DDC a liaison representative for STI policy and programs.

Col Benson will assist in the acquisition of technical reports from Army sources and documents from DDC requested by the Army and its contractors.

As deputy chief of Transportation in the Military Assistance Command in Viet Nam, he was cited for his organization of a flood relief program. Previous experience has included teaching assignments at Fort Eustis and the U.S. Military Academy; also, as the first project manager of the Nuclear Powered Energy Depot System at the Atomic Energy Commission.

He is a graduate of the Command and General Staff College, Armed Force Staff College and the University of Michigan, where he specialized in nuclear engineering.

Released from active duty in 1957, he worked as a research engineer with Lockheed Missile/Space Division, Palo Alto, Calif., before returning to Redstone Arsenal.

Assigned to Aberdeen Proving Ground when he entered the Army in 1953, he has attended the Army Ordnance Guided Missile School at Redstone, and has served with the Field Service Division of the Army Rocket and Guided Missile Agency.

"In view of the increased need for close coordination between Headquarters, Army Materiel Command, and Headquarters, Supply and Maintenance Command, a physical regroupment was effected in April 1965, relocating staff elements of the two Headquarters (both in the greater metropolitan Washington area) so as to place similar functions under the same roof.

"This colocation action, although representing a geographical combining of the two Headquarters, did not affect their organizational integrity. Studies looking toward an actual merger of the two commands are underway, but no decision has been reached at this time."

Col Benson will assist in the acquisition of technical reports from Army sources and documents from DDC requested by the Army and its contractors.



DDC LIAISON representative Lt Col Thomas E. Benson receives Bronze Star Medal from Dr. Robert B. Stegmaier, Jr., DDC administrator.

Goldberg Succeeds Wiseman as Warfare Vision Chief

Twenty-four years with the Army Engineer Research and Development Laboratories, Fort Belvoir, Va., highlighted by selection for the Army Exceptional Civilian Service Award, have carried Benjamin Goldberg to a key position.

When Dr. Robert S. Wiseman, another ERDL veteran, recently became director of the new Combat Surveillance-Target Acquisition Laboratory of the Army Electronics Command at Fort Monmouth, N.J., Mr. Goldberg succeeded him as chief of the Warfare Vision Division.

In 1941, he started a Civil Service career with the Army in that same division, serving as chief of the Reflector Research Laboratory. Later he was chief of the Reflector Research Laboratory, the Illumination and Far Infrared Sections, and the Night Vision Equipment Branch.

Under his direction, the image intensifier program which now forms an important part of the Warfare Vision Division was initiated. He was also directly involved in the early stages of infrared and battlefield

Maj Gen Timmes Directs Project AGILE for ARPA

The Advanced Research Project Agency (ARPA) selected Maj Gen Charles J. Timmes to succeed retiring Maj Gen R. H. Wienecke as director, Remote Area Conflict (Project AGILE).

At the time of his selection, General Timmes was director of Programs, Deputy Chief of Staff for Personnel, Headquarters, Department of the Army. Previous assignments include: chief, Military Assistance Advisory Group, Vietnam; assistant division commander, 101st Airborne Division; and Chief of Staff, Korean Military Advisory Group.

In World War II he was a battalion commander in the 507th Parachute Infantry Regiment and participated in combat jumps at Normandy and the crossing of the Rhine.

He earned a B.A. degree from Fordham University (1928) and a Masters degree in political theory from Georgetown University (1957). In addition, he participated in the Russian language and Area Training Program and graduated from the Command and General Staff School, the Armed Forces Staff College and the National War College.

General Timmes' decorations include the Distinguished Service Cross, the Distinguished Service Medal, the Silver Star, the Bronze Star Medal with Oak Leaf Cluster and the Purple Heart with Oak Leaf Cluster.



Benjamin Goldberg

illumination—the other Division programs designed to give the Army the “night sight” essential to mobility.

From 1958, he was in charge of the Laboratories' Barrier Intrusion and Detection Division. He was instrumental in reorganization and expansion of the Division to include new areas such as guerrilla warfare countermeasures equipment, mine detection, and vehicle navigation.

In 1946, he received the Exceptional Civilian Service Award, the Army's highest civilian employee honor, for his solution of a difficult searchlight reflector manufacturing problem. In 1952 he was nominated by the Army for the Rockefeller Public Service Award, in recognition of his scientific achievements.

Graduated from City College of

New York in 1936 with a BS degree in physics, he also studied at George Washington and Catholic Universities. He is a member of the Optical Society of America, the American Association for the Advancement of Science, and is author of numerous technical papers in electrochemistry, illumination, infrared and optics.

* * *

Promotion of Manfred Gale, 41, to succeed Benjamin Goldberg as chief of the Barrier and Intrusion Detection Division was announced recently by Col Frank Milner, CO of the Engineer Research and Development Laboratories.

Following a year of Civil Service employment with the Bureau of the Census in 1949, Gale joined the staff of the ERDL Division he now heads. During the past 15 years, he has had positions of progressively increasing responsibility. He came to the United States from Germany with his parents.

In his new position, he is responsible for research and development of mine detectors, vehicular navigation, and guerrilla warfare countermeasures equipment.

Graduated in 1949 from the University of Virginia with a BS degree in electrical engineering, he has done graduate work at Catholic University in Washington, D.C. During World War II military service, he was selected to study engineering at The Citadel under the Army Student Training Program. He has presented technical papers before a number of professional meetings and is the author of several articles in professional journals.

MOCOM Names General Purpose Vehicles Project Head

Col Morton McD. Jones, Jr., recently joined the U.S. Army Mobility Command, Warren, Mich., as project manager for General Purpose Vehicles, after completing a tour as group commander 71st Ordnance Group and I Corps Support Brigade in Korea.

A 1941 graduate of West Point, Col Jones served with the 17th Cavalry Reconnaissance Squadron (ETO) during World War II, and as an intelligence, operations, and training adviser to the Philippine Army during the Korean War. From 1953-54 he was commanding officer of the 710th Tank Battalion of the 11th Airborne Division at Fort Campbell, Ky.

He received his master's degree in nuclear physics from the University of Virginia in 1956, then was assigned to the Washington, D.C. area as a nuclear weapons R&D coordinator for four years. His next assignment took him to the U.S. Army Tank-Automotive Command. There he served in the R&E Directorate as chief of the Long Range Technical Forecasting Office, later becoming Director of R&E. He left there in 1963 for his assignment in Korea.

Col Jones is a graduate of the Cavalry School, the Armor School, the Command and General Staff College, Armed Forces Staff College, and the National War College. His decorations include the Bronze Star Medal with second Oak Leaf Cluster and the French Croix de Guerre.



Col M. McD. Jones, Jr.



Lt Col W. E. Coleman



Lt Col B. A. Griffin



Lt Col G. B. Lundberg

OCRD Announces 4 New Officer Assignments

Officers newly assigned to the Office of the Chief of Research and Development include Lt Col George B. Lundberg, Lt Col Walter E. Coleman, Lt Col Bobbie A. Griffin and Lt Col Louis G. Klinker.

LT COL LUNDBERG, chief of the Range Branch, Nike X and Space Division, is a 1943 graduate of the U.S. Military Academy. He completed the Command and General Staff College in 1957, the Army War College in 1962 and received an MS degree in physics from Georgia Institute of Technology in 1953.

His most recent assignments include duty with the Special Review Board, Office of the Deputy Chief of Staff for Personnel, Washington, D.C.; deputy G-2, U.S. Army Alaska; deputy battle group commander, 171st Brigade, Alaska, 1962-64; instructor with the Department of Nuclear Weapons, Command and General Staff College and a military adviser in Viet Nam, 1957-58.

LT COL COLEMAN, assigned to the Program Review Branch, Review and Analysis Division, graduated with a bachelor's degree in business administration from William and Mary College in 1948. Ten years later he received an MA degree in political science from Tulane University.

His military schooling includes the Infantry School, the Command and General Staff College and counterinsurgency courses at the U.S. Army Special Warfare School. Recent assignments have been: CO, 2nd Battalion, 34th Infantry Division; executive officer, 2nd Brigade, 24th Infantry Division; committee chief, U.S. Army School, Europe; instructor and committee chief, Special Warfare School.

In 1961-62, he developed the instructional program and organized the Counterinsurgency Department of the U.S. Army Special Warfare School, Fort Bragg, N.C.

LT COL GRIFFIN, chief, Nike X Branch, Missiles and Space Director-

ate, is a 1943 graduate of the U.S. Military Academy with an MS degree in mechanical engineering from the University of Southern California. He has completed the Artillery School, advanced course, Command and General Staff College and the Industrial College of the Armed Forces.

Recent assignments include chief, Manpower and Personnel Division, headquarters, Eighth U.S. Army, Korea; chief, Zeus Test Branch, U.S. Army Air Defense Board, Fort Bliss, Tex.; general staff officer, Manpower Division and Personnel Policy Division, Deputy Chief of Staff for Personnel, Washington, D.C.; and battalion S-3, executive officer and commander, 519th Field Artillery Battalion, 36th Field Army Group, Babenhause, Germany.

LT COL KLINKER has returned to the Physical Sciences Division in the U.S. Army Research Office as chief of the Chemistry and Materials Branch, a position he vacated in July 1964 for an assignment with Headquarters, Military Assistance Command, Viet Nam.

For his meritorious service as a



Col Bui-Quang-Trach, director of CDTC-TV, presents Republic of Viet Nam Medal of Honor to Col Louis G. Klinker, U.S. Army Research Office.

project officer with an Advanced Research Projects Agency (ARPA) Research and Development Field Unit in Viet Nam, Col Klinker received the Republic of Viet Nam Medal of Honor.

While serving as an adviser to the Combat Development and Test Center, he assisted in establishing a specific Research Branch for the Republic of Viet Nam Army. He was cited for his exceptional organizational ability and outstanding professional competence in providing the Viet Nameese with an R&D capability.

Previous assignments have included chief, Chemistry and Materials Branch, U.S. Army European Research Office, Frankfurt, Germany; and deputy chief of the National Engineering Branch, U.S. Army Ordnance Command. A 1934 graduate of Purdue University, he did graduate work at Youngstown (Ohio) University in metallurgy and metallography.

ARPA Dedicates LASA In Vela Uniform Project

Dedication of a Large Aperture Seismic Array (LASA) installation at Billings, Mont., by the Advanced Research Projects Agency (ARPA), Oct 12, marked a milestone in advancing seismological science.

Linked to the ARPA Vela Uniform project, the new installation is the first of the very large aperture array facilities to be completed under this program. The goal is to determine the feasibility of distinguishing between underground nuclear explosions and earthquakes through seismic detection.

The Department of Defense (ARPA is a part of the Office of the Director of Defense Research and Engineering) said the LASA installation should "contribute significantly" to present ability to detect and identify earthquakes. Thus, by elimination, the number of seismic events which might be nuclear blasts, could be more reliably determined.

Data collected from the LASA will be available to all countries of the world, and conceivably could reduce on-site inspection requirements in verifying a comprehensive test ban.

The installation stretches over a distance of 150 miles and consists of clusters of seismometers, emplaced underground, which send data to a central analysis center at Billings. The seismometers are arranged in 4½-mile-diameter clusters at 21 sites, with each cluster having 25 seismometers. The complex has a total of 525 seismometers, each at 200 feet depth.

Army Veterinarian Lauded for Snakebite Antivenom Research in Costa Rica

Mid-November marks the first anniversary of an era in Costa Rica when the venomous bushmaster, fer-de-lance and other poisonous snakes scarcely dare raise their heads lest they be captured for science by a U.S. Army veterinarian.

Capt Herschel H. Flowers, VC, is a veteran capturer and "milker" of the reptiles for their venom. The practice of snake-milking is age-old, dating to aboriginal warrior use and even as a tourist attraction at Florida snake "farms" for many years.

Capt Flowers extracts the venom into sterile containers and uses it to produce antivenom serums to combat the serious snake problem in Costa Rica, a cause of governmental concern.

A recent dispatch to the U.S. Department of State from the American Embassy at San Jose, capital of the Central American country, praised the effective antivenom production work of Capt Flowers. He was assigned to Costa Rica by the Army Medical Research Laboratory, Fort Knox, Ky., at the request of Costa Rican authorities and with the support and interest of U.S. Ambassador Raymond Telles.

Capt Flowers was commended jointly by the Embassy and the Assistance for International Development (AID) Mission in Costa Rica for the antivenom project development; also for instructing Costa Rican medical personnel in antisnakebite procedures and first aid.

Typically North American is his reaction when advised of the laudatory message to high levels. Handwritten just after his name on the message distributed through the Departments of State, Army and cognizant agencies is the notation: "WOW!"

The current research and development program began in February 1964, with the Fort Knox laboratory and the University of Costa Rica School of Medicine pooling resources.



Capt Flowers, engaged for more than four years in an Army research project on snakebites, visited Costa Rica to discuss mutual problems with personnel of the Ministry of Public Health and the National University of Costa Rica.

From these informal talks came a Joint Costa Rica Ministry of Public Health/U.S. Army Medical Service Research Project on Poisonous Snakes, effected through an exchange of diplomatic notes in October 1964.

Capt Flowers arrived in Costa Rica Nov. 15, 1964, to start the program. Extraction of venom from the snakes abounding in the thickly wooded tropical coastal areas and uplands, processing the venom, the immunization of horses used in antivenom production and serum collection, separation and testing are among his duties. He also instructs indigenous medical personnel in new surgical procedures related to chemotherapeutic agents.

Laboratory spaces are provided by the University of Costa Rica School of Medicine. The University also processes the collected horse serum, transforming it into antivenom.

Latest reports are that antivenom production began on a commercial basis last month. Injection of 15 horses, donated by Costa Rican ranchers, began last April.

In this tropical land, where five major families of poisonous snakes are native, it is estimated that there are approximately 1,500 snakebite cases annually. A third of these result in permanent or partial disability to a limb. The mortality rate (1962 statistics) is about 32 out of approximately 10,000 "deaths from all causes," with many suspected of going unreported as death-by-snakebite in the remote areas.

Until recently facilities for producing antivenom serums did not exist in Costa Rica and the techniques of chemotherapy of snakebite victims

Hervy M. Reed, U.S. Army Ordnance Museum at Aberdeen (Md.) Proving Ground, and M/Sgt Frank A. Moyer, John F. Kennedy Center for Special Warfare, Fort Bragg, N.C., inspect French MAT-49 submachinegun used by Communists in Viet Nam. With them is Pfc Kenneth R. Franz, a JFK Center photographer. The 2-man Special Forces team visited the museum to get data on small arms manufactured in the Union of Soviet Socialist Republics and other Communist countries. The information will be published in a "Special Forces Weapons" handbook to inform Special Forces on weapons they can expect to encounter.

were virtually unknown.

In addition to the bushmaster (*Lachesis mutus*), largest poisonous snake in the New World, and fer-de-lance (*Bothrops atrops*), there are the Central American rattlesnake (*Crotalus*), the coral (*Micrurus*) and a sea snake (*Hydrophidae*).

Through the efforts of Capt Flowers and his colleagues, optimism has risen regarding the use of ERTA (ethylene-diaminetetraacetic acid) as an effective neutralizer of the venom of the bushmaster, fer-de-lance and related species. Preliminary results of chemotherapeutic and surgical techniques in 13 hospital cases have been encouraging.

The chemical EDTA is believed to be effective against certain venoms because it chelates, or binds, the metallic ion molecularly structured in venom enzymes. Thus it neutralizes the enzyme, making harmless or at least partially ineffectual, the venom in a snakebite.

While snake hunting in the jungles of remote Osa Peninsula, accessible only by launch or aircraft, Capt Flowers won the gratitude of the timber workers by teaching courses in snakebite treatment and general first aid.

An official of OSA Productos Forestales, S.A., expressed appreciation for Capt Flowers' work by letter to the U.S. Ambassador at Costa Rica. He credited the saving of at least one life to the first aid knowledge Capt Flowers had imparted to timber workers. In the Osa mountains, he taught several of the lumbermen how to catch live snakes for lab work at the University.

A native of Orlando, Fla., Capt Flowers entered the Army early in 1961 and began working with venoms six months later at the research laboratory, Fort Knox. The laboratory subsequently produced an antivenom serum effective against North American coral snakes.

Engineer Labs Award 2 Contracts

A \$583,770 contract for design and fabrication of a 10-kilowatt turbo-alternator was awarded recently by the U.S. Army Materiel Command Engineer Research and Development Laboratories at Fort Belvoir, Va.

The contract with the International Harvester Co., Solar Division, San Diego, Calif., calls for delivery of the developmental component in 1967.

The Engineer R&D Laboratories also awarded a \$49,140 contract for analytical and experimental studies of electromagnetic gas ion process to the College of Engineering at the Oklahoma State University.

Army, Industry Food Experts Exchange Views at Natick

An outstanding panel of military and industrial food authorities discussed food preservation and packaging techniques during the Oct. 26-27 Military-Industrial Conference at the Natick (Mass.) Laboratories.

Brig Gen W. W. Vaughan, CG of the Natick Laboratories, welcomed the conferees and Dr. F. P. Mehrlich, director of the Food Division, stated the purpose of the meeting. A. I. Totten, Jr., president of R&D Associates and general director of Packaging Research, Reynolds Metals Co., Richmond, Va., made introductory remarks.

Dr. Richard L. Hall, chairman of the Program Committee, executive vice president of R&D Associates, and director of Research and Development, McCormick and Co., Baltimore, Md., presided at the first session.

Presiding at following sessions were George A. Crapple, chairman of the Board, R&D Associates and technical director of Technical Services, Wilson and Co., Chicago, Ill.; Mr. Totten; Dr. Edward A. Nebesky, chief of the Container Division, Natick Labs; Dr. D.

Colonel Raaen Becomes CO Of Army Research-Durham

Command of the Army Research Office-Durham (ARO-D), N.C., has been assumed by Colonel John Carpenter Raaen, Jr., a 1943 graduate from the U.S. Military Academy with an MS degree in modern physics from Johns Hopkins University.

Col Raaen served until recently as commander of the U.S. Army Depot at Miesau, Germany, following a 2-year assignment at Headquarters, Berlin Brigade, Germany, initially as an Ordnance officer and later as assistant chief of staff, G-1.

As a member of the 5th Ranger Infantry Battalion in World War II, he served in Normandy, Brittany and the Saar. After the War, he was assigned to the U.S. Military Academy as an instructor. Then he attended the U.S. Naval Academy for a post-graduate course in military atomic energy uses. He is a graduate from the Industrial College of the Armed Forces and the Command and General Staff College.

During the Korean War, he served in various Ordnance assignments in Korea and then was transferred to the Ordnance Board at Aberdeen Proving Ground, Md. Subsequently, he served as staff officer for the Military Liaison Committee to the U.S. Atomic Energy Commission.

M. Doty, vice chairman of the Board, R&D Associates and technical director of the Fats and Proteins Research Foundation, Des Plaines, Ill.; and Dr. Herbert A. Hollender, associate director for Food, Natick Labs.

Radiation preservation of foods was discussed by Dr. Ari Brynjolfsson, Jacob Schaffer, Dr. Clarence K. Wadsworth, Dr. Eugene Wierbicki, Dr. Fred Heiligman and Dr. Edward S. Josephson, all from the Natick Labs.

Dr. Nicholas Raica, Jr., U.S. Army Medical Research and Nutrition Laboratory, Fitzsimons General Hospital, Denver, Colo., presented the "Wholesomeness of Irradiated Foods."

Other Government, commercial, industrial and educational leaders who made presentations included: Joseph Slavin, Bureau of Commercial Fish-

eries, Gloucester, Mass.; Dr. E. C. Maxie, University of California; George Dietz, Atomic Energy Commission, Washington, D.C.; and Dr. Samuel A. Goldblith, Massachusetts Institute of Technology, Cambridge.

The session on packaging techniques included presentations by Matthew A. Ventos, Dennis J. O'Sullivan, Daniel J. Palese, and Dr. Maxwell Brockmann, all from the Natick Labs.

Dr. Paul D. May of the Southwest Research Institute, San Antonio, Tex., discussed "Food Films from Amino Acids." Weld Conley, Votator Division, Chemetron Corp., Louisville, Ky., spoke on "Hydrostatic Sterilizers for Canned Foods."

A. I. Totten presented a paper titled "Tapper," and Robert Abercrombie, Jr., U.S. Army Limited War Laboratory, Aberdeen Proving Ground, Md., discussed "Free Drop Water Containers," currently under development.

Ordnance Association Meeting Airs Packaging Needs

Strict stability requirements in military packaging were emphasized to many of the Nation's leading specialists at a recent meeting at the Joint Military Packaging Training Center (JMPTC), Aberdeen Proving Ground, Md.

Sponsored by the American Ordnance Association, the seminar enabled some 100 military and industrial packaging experts to exchange information on recent advances in han-

dling and shipping of materials.

Sterilized packaging of food and equipment used in outer space, involving a 2-fold earth and space problem, highlighted a special panel discussion moderated by Henry C. Rowe of the U.S. Air Force Space Systems Division, Los Angeles, Calif.

Dr. Edward A. Nebesky of the Army Natick Laboratories Container Division spoke on food packaging for space travel. Other special panel speakers included Dr. Martin Edelstein, Martin Co., Baltimore, Md., and Gordon Oakley, Redstone Arsenal, Ala.

Sidney A. Culbertson, chief of the JMPTC, stressed the need to adopt packaging advances to functional reliability of product containers for military organizations.

"Our packaging requirements go far beyond the type designed to catch the eye of the consumer in the market place," he said. "Military specifications call for stringent stability in just about every area, from delivering a tank ready to fire to air-dropping a crate of eggs undamaged deep in a jungle."

Among recent developments he mentioned as notable are transparent flexible packaging, fiberboard, polyurethane foam and other synthetics that reduce the weight and size of a container. A volatile corrosion inhibitor, made of specially treated paper which emits a gas designed to preserve ferric metals, is another innovation.

The seminarists were urged to use "creative thinking" to meet future needs of the packaging industry.



A FAREWELL ACTION by Maj Gen Frank W. Moorman, CG of the U.S. Army Electronics Command until his recent retirement from the Army, was the presentation of a 1965 R&D Achievement Award to Dr. Robert S. Wiseman, director of the ECOM Surveillance-Target Acquisition Laboratory since April 1965. Until then he was chief of the Warfare Vision Division at the Army Engineer R&D Laboratories, Fort Belvoir, Va.

Army Nuclear Defense Laboratory Serves Preparedness Goals

Scientific projects ranging from neutron characteristics to plotting nuclear fallout patterns indicate the broad variety of research interests at the Army Nuclear Defense Laboratory, Edgewood Arsenal, Md.

As an important part of the Nation's preparedness program, concerned with requirements in nuclear warfare, this relatively small unit of the U.S. Army Materiel Command conducts programs in basic and applied research which enable the Army to maintain preeminence in this critical area.

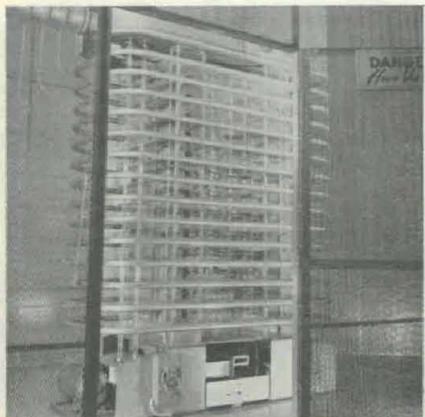
An outwardly ordinary-looking complex of buildings houses facilities at Edgewood where the NDL (so designated in 1962) has been a tenant, under several names, since 1948.

Succinctly stated, the NDL mission is to conduct research concerned with the various nuclear radiation phenomena resulting from detonation of a nuclear weapon.

Fulfillment of this assignment falls to a staff of military and civilian experts presently under the command of Lt Col Gordon L. Jacks, who has participated in nuclear weapons effects research and test operations for the past 17 years.

In 1963, he assumed command of NDL, following tours of duty in Joint Task Force 7 and JTF-8, Los Alamos Scientific Laboratories; and in the Research Division of the Defense Atomic Support Agency. Graduated with a master's degree in physics from Ohio State University, he served for two years in Europe during World War II.

Responsible directly to the Army



ARMY NDL SCIENTISTS advance knowledge of neutrons through use of 750,000-volt positive ion accelerator installed three years ago and used primarily in measurement of neutrons.



Lt Col Gordon L. Jacks

Materiel Command, the Laboratory performs a large number of its research tasks under sponsorship of the Defense Atomic Support Agency (DASA), which is charged with carrying out Department of Defense programs involved with nuclear weapons and their effects.

Categorized as either Weapons Effects Research or Weapons Effects Testing, the Laboratory programs encompass low-energy nuclear physics to chemical engineering. Since the implementation of the nuclear weapons test ban treaty, the research program has picked up in scope and intensity. Participation in the underground weapons test program remains a vital and integral part of the Laboratory effort.

Frequently requested to provide information and technical review for other branches of the Armed Forces, the NDL is responsive to them but does most of its tasks for the Army. No other facility in the military establishment is considered by experts to be better equipped to complete technical review assignments in nuclear weapons effects.

Most of the research and test data compiled at the NDL must eventually be related to the combat soldier. Findings and conclusions from the bench of the scientists must find application in materiel to protect the fighting man or increase his offensive capability.

This "gap" between the research and doctrinal agencies of the Army is bridged by the Evaluation Division, as illustrated by a recent request from Headquarters, Sixth Army.

In planning "Operation Silver Claw," the Sixth Army needed specific information on the extent and nature of nuclear weapons effects on tactical

units. Detailed tables and charts and narratives furnished by Evaluation Division technicians served as an integral part of the final operational plan.

High on the list of NDL priorities is a reliable, yet versatile, fallout prediction method. For a given atomic explosion, the various prediction systems existing today produce a variety of fallout figures.

What is needed, NDL's Evaluation Group recognizes, is a "granddaddy" system of predicting fallout that will stand as an all-encompassing, physical/mathematical system that is both reliable and versatile.

Overall responsibility for eventual development of such a system reposes with the Evaluation Group, working with the Naval Radiological Defense Laboratory, in California, and the Atmospheric Sciences Laboratory, at the U.S. Army Electronics Command, Fort Monmouth, N.J.

Research in this area will touch on cloud-rise phenomena, initial circulation temperatures, particle size distribution within the cloud, meteorology aspects, and the transport of particles at various altitudes.

Answers to these and related questions are determined in the Nuclear Chemistry Division, where constant study and analysis are underway on the mechanism of fallout particle formation. Under the high-temperature physical chemistry program, experiments are in progress to determine and evaluate mechanisms by which fallout particles from nuclear weapons are formed. Some experiments will seek to determine the influence of metals and scavenging materials.

Other questions related to nuclear fallout are asked. For example, what effect do weather and wind exert upon the drifting cloud? As these particles approach the ground, and mingle with dust and dirt in the lower atmosphere, how does their weight change? Solutions to such scientific problems will eventually produce refinements in the Army's atomic capability.

A constantly vigilant warning system to alert man to the presence of dangerous radiation particles is an objective in current NDL projects. Many dosimetry devices are in use today, in the laboratory and in the hands of combat-ready troops, but do not fully meet requirements.

Radiation chemistry—the study of the effects of radiation on materials—brings the scientists and technicians at NDL closer to the discovery and development of vastly improved de-

tection apparatus. In the search for increased knowledge of reaction mechanisms, trichloroethylene and pure water are two of the systems under study.

The top civilian employees at NDL are Edwin H. Bouton, test director for research, development, testing and evaluation, and Dr. Hermann J. Donnert, chief scientist. Bouton has been associated with the Army's R&D effort in the radiological field since 1948. Dr. Donnert is a graduate of the University of Innsbruck, Austria, and has studied at several universities and colleges in Europe.

Associated with the NDL since 1947, Dr. Donnert has combined his activities as chief scientist with his work as assistant professor of mathematics and physics at the Edgewood Arsenal branch of the University of Maryland.

The Nuclear Physics Division is involved in the study of radiation-transport, shielding, and theoretical nuclear cross sections. One major project involves a cooperative effort with the Los Alamos Scientific Laboratory to determine the distribution of radiation from a weapon in various atmospheres.

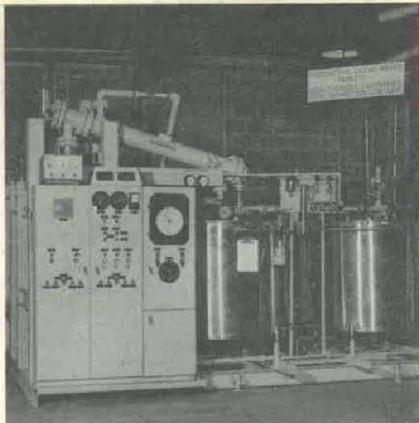
Solid-state physicists concern themselves with radiation damage and the development of new radiation measurement techniques. Considered in those NDL studies are superconductivity, Mossbauer effect, electron paramagnetic resonance, and solid-state electronics.

In addition, an extensive effort is being applied toward the preparation and evaluation of thin films for use as reaction or scattering targets in nuclear experiments.

The experimental nuclear physics group works mainly in the NDL accelerator facilities and has completed several measurements of neutron cross sections (total). Moreover, the capability to measure differential neutron cross sections by time-of-flight has recently been established. Projects involving charged-particle studies and gamma-ray spectroscopy are in progress.

NDL mobile laboratories (trailers) have traveled to various parts of this country and to overseas locations as part of the Nuclear Engineering Division's participation in the Department of Defense weapons testing program. Virtually all radiation dosimetry at these weapons test sites is carried out by these mobile units, staffed and maintained by NDL.

Two of these Mobile Radiation Counting Facilities provide the on-site capability of determining the



PROPER DISPOSAL of liquid waste is accomplished by the Radioactive Waste Facility, Engineering Division at the Army Nuclear Defense Lab.

kind, amount and energy of radiation materials within an hour of exposure.

Added information about the test can be fed into the computerized equipment on the trailer, such as time of day, time after detonation, and even the date of the test.

Automated equipment usually enables two men to operate these 40-foot vans. As part of the Engineering Division's field testing mission, personnel plan and conduct experiments and provide initial radiation data to the Department of Defense, and to contractors and industrial groups qualified for access to information.

In addition to thermal radiation measurement, the Engineering Division conducts programs of research and development in radiological protection and shielding, and provides other support as required. For example, radioactive waste, whether it be the "hot" water from an atomic submarine or contaminated material from a reactor, must be effectively buried.

One approach, now studied and applied in field tests, is the concentration of liquid waste into a small, easily handled package. The concentration of solid waste, on the other hand, is under scrutiny through use of highly efficient ovens and incinerators. Simple, portable equipment for handling dangerous residue eventually will be developed, based largely on data provided by the Engineering Division.

In the absence of above-ground nuclear testing, the value of nuclear reactors and accelerators has risen sharply in recent years. These instruments are in constant use to stimulate, in many respects, the effects of nuclear explosions.

In providing engineering support as requested, the Engineering Division operates and maintains a Cockroft-Walton accelerator, a positive ion type with a terminal voltage of 750,000 volts (750 KeV). Operational for the past three years, it is used primarily in neutron cross-section measurement. New NDL techniques have broadened the scope of this program.

Construction of a Tandem Van de Graaff Accelerator for NDL has started and installation is scheduled within two years. It will be the only accelerator of its kind within the Department of Defense, and will be one of only half a dozen in the country.

When operating at maximum capacity, the Van de Graaff accelerator will generate 15,000,000 volts (15MeV) for the acceleration of charged particles. It will greatly extend the energy range for the NDL cross-section measurement program and charged particle investigations.

Facilities expanded by the new accelerator will enable additional physicists to join the NDL research program. Without the highly exacting capability provided by the machine, their experience could not be effectively utilized.

Present plans call for experimental equipment at the Tandem facility to collect data required in certain computer programs. These programs will be written to predict effects of nuclear weapons under many different conditions.

When in operation, the accelerator will substantially widen the scope of the NDL mission in keeping the Army current in Nuclear Weapons effects information related to its national defense mission.



RINGS OF RADIATION surround M109 self-propelled howitzer at NDL test area where scientists simulate atomic exposure by passing radioactive source through plastic tubes arranged in circles around test subject.

WRGH Announces Appointment of Department Chiefs

Key personnel changes at Walter Reed General Hospital in recent weeks have been headed by assignment of Col Carl Wilson Hughes, MC, as chief of the Department of Surgery and Col Loren F. Parmely as chief, Department of Medicine.

Col Hughes has received the coveted A-Prefix for exceptional professional competency in his field of cardiovascular surgery, and is recognized for pioneering work in reconstructive peripheral vascular surgery at Walter Reed in 1950.

Later, he studied, repaired and taught the repair of acute vascular injuries in Korea. Techniques he introduced are credited with saving the arms and limbs of a high percentage of patients who otherwise would have been amputees. He is the author or coauthor of two books and 60 published works in his field.

After serving his residency in surgery at Walter Reed General Hospital beginning in 1949, he returned in 1954 as chief of Vascular Surgery at WRGH and director of the Division of Surgery, Walter Reed Army Institute of Research. He entered the Army in 1946 after graduating from the University of Tennessee with a medical degree. He also has a BA degree from the Univ. of Missouri.

Col Hughes has been assigned as chief surgeon, 57th Field Hospital at Wurzburg, Germany; chief of surgery

at the 385th Station Hospital, Nurnberg, Germany; member of the surgical research team, 43rd Surgical Hospital, Korea; and chief, General Surgery and later chief of the Department of Surgery at Tripler General Hospital, Hawaii; chief, Department of Surgery at Madigan General Hospital, Fort Lewis, Wash., and Letterman General Hospital, San Francisco, Calif.

COL LOREN F. PARMELY is on his third tour of duty at WRGH. The first was as assistant chief of Cardiology and chief of Medical Section No. 1 (1951-54); he was a resident in cardiology and assistant chief of that section from 1956 to 1958.

Between these assignments, he

MRL Studying Noise Effects on Hearing in Training

The Army's Medical Research Laboratory (MRL) at Fort Knox, Ky., is making a study of the relationship between loud noises and the loss of human hearing during training in tactics or use of materiel.

MRL is attempting to develop tests which will improve methods of spotting personnel likely to suffer hearing losses before such losses occur.

Claims resulting from hearing losses suffered during military training currently cost the Government about \$50 million per year. An esti-

served as assistant Army attache, American Embassy, India, at Letterman General Hospital as chief, Cardiology Service and chief, Department of Medicine, and as a medical consultant with the U.S. Army Europe.

During World War II, he was a general medical officer in the European Theater and the Pacific. From 1945 to 1947 he was CO of the 1st Medical Squadron and Division Surgeon with the 1st Cavalry Division, Japan.

Col Parmely received a BA degree from the University of Virginia at Charlottesville (1940) and a degree from the University of Virginia's Medical School (1943). He served his residency at Brooke General Hospital, San Antonio, Tex., and at the University of Wisconsin.

mated 10 percent of all military trainees have some hearing loss after training.

The MRL effort is directed toward reducing both the financial loss to the Government and the personal loss to the individual soldier.

The test consists of first examining an individual's hearing in a sound-proof booth. He is then exposed to a constant, loud noise in one ear for 10 minutes. His hearing is then tested again and the results are compared with those of the first test.

The objective is to determine, if possible, whether the examinee can tolerate the noise level required for his forthcoming training. If the test indicates that damage to his hearing is likely, he can be reassigned.

In addition, the test should prove valuable in determining in advance how much of a hearing loss is going to occur and how much recovery time an individual will need after exposure to loud noises. Such information is often invaluable in combat situations.

Extensive studies of the effects of impulse noise on human hearing have been made by scientists at the Human Engineering Laboratories (HEL) at Aberdeen Proving Ground, Md. (See page 24, January 1965 issue of this publication). Dr. David C. Hodge, director of that study, emphasized the scope of the problem in pointing out that noise is being studied in many research laboratories, university medical centers and private acoustical laboratories.

As a result of the research being conducted in relation to the problem of noise, major revisions may be made in weapons systems. Such human engineering will be particularly important in armor training.

AMRA Conferees Present 22 Papers

Scientists and engineers from industry, academic institutions and Government presented 22 technical papers at the recent 12th Sagamore Army Materials Research Conference held at Raquette Lake, N.Y.

Initiated in 1954, the series of metals and ceramics meetings is sponsored and conducted by the U.S. Army Materials Research Agency (AMRA), Watertown, Mass., in cooperation with Syracuse University.

Ninety scientists and engineers exchanged current information and theories unique to each research field. Discussion pointed to present gaps in materials research and provided guidance for future efforts in the metals and ceramics areas to meet military requirements.

AMRA representatives Dr. E. B. Kula and Dr. E. P. Abrahamson, II, presented papers on "Strengthening of Steel by Thermomechanical Treatments," and "Electron Concentration and Metallic Properties."

Other papers covered theories of strengthening, basic strengthening

mechanisms in metals and in ceramics, innovations in strengthening mechanisms, and methods of composite formation.

AMRA commanding officer Lt Col Joseph E. Black made the opening remarks for the Army. Norman L. Reed, AMRA, served as chairman of the conference, and John J. Burke of AMRA was conference secretary.

Committee members included: P. L. Goud, U.S. Army Mobility Command; Dr. W. J. Kroeger, U.S. Army Munitions Command; Dr. S. B. Levin, U.S. Army Electronics Command; Dr. B. Steverding, U.S. Army Missile Command; Dr. R. W. Weigle, U.S. Army Weapons Command; and Dr. V. Weiss, Syracuse University.

The program advisory committee was composed of Dr. E. P. Abrahamson, II, AMRA; Dr. H. M. Davis, U.S. Army Research Office, Durham, N.C.; Dr. N. J. Grant, Massachusetts Institute of Technology; and H. Markus, Frankford Arsenal, Pa.

Proceedings of the conference will be published by the Syracuse University Press early in 1966.

Physical Fitness May Give You Fits . . . But Walk, Man, Walk to Cut Heart Disease Risk

If you hope to live to 90, but suspect coronary disease may cut you short because of your way of life, take a cue from the Masai tribesmen of Africa, famed lion hunters, and become physically fit. The Masai do it by walking—up to 50 miles daily.

Research among the Masai by a noted American dietician, Dr. George V. Mann, supports his theory, "it isn't what you eat, it's what you do that counts" as related to risk of heart attack and sudden death.

Speaking to U.S. Army Research Office personnel on "Diet and Heart Disease," Dr. Mann, associate professor of biochemistry at Vanderbilt University, told about treadmill experiments to test endurance of Masai tribesmen as compared to physical stamina of American athletes.

Renowned for ability to hike 40 to 50 miles a day in search of big game (or girls) without fatigue, the Masai hunters who volunteered for the treadmill tests showed they could keep going two or three times as long as well-conditioned American athletes under identical conditions.

The question for which Dr. Mann was seeking an answer with respect to the relationship of cholesterol to heart disease was: "What happens to those who eat a lot of animal fat?" "Do they have more heart disease?"

As heavy meat eaters, with a diet supplemented by a high intake of milk, milk products and some cow's blood (the latter usually only in emergency), the Masai presented a solid base for scientific comparison. Their daily average fat intake is about 250 grams as against 150 grams for most Americans.

Still, despite their high animal fat intake, the Masai showed "little or no evidence of heart disease," Dr. Mann discovered. Also, they have "an exceptionally low cholesterol level, and it changes very little from birth to death, though it is somewhat higher than that of African pygmies, who are free of coronary heart disease."

Considered also was the possible relationship of salt to blood cholesterol and coronary disease. The average intake of salt among the Masai is very low and many get along without any salt, it was noted.

Another curious fact observed during the study was that Masai women maintain an exceptionally low cholesterol level during pregnancy, as compared to the heavy increase in blood cholesterol among women in the United States during this period.

In the treadmill tests, three of 53 Masai men remained on the treadmill for the maximum period of 30 minutes, which means they were walking up a 52 percent grade at 3.2 m.p.h. at the finish. Many others held up nearly twice as long as the average among Harvard athletes tested. Some athletes dropped off the treadmill at 12 to 15 minutes and the best effort was 23 minutes.

Among athletes who eat large amounts of food while engaged in strenuous training, tests revealed that blood cholesterol did not gain appreciably even with a high fat intake as long as they "worked off" the calories.

When weight increased, blood cholesterol increased. Moreover, among a group of young men, their blood cholesterol increased even with a low fat intake when daily calorie intake was raised from 3,000 to 5,000, permitting the weight to increase.

Even among the older Masai men

Scintillating Diamonds Flash Nuclear Data to Scientists

Scintillations of diamonds have no greater fascination for blushing brides or dazzling dowagers than they have for scientists at Redstone (Ala.) Arsenal, U.S. Army Missile Command.

"By studying diamonds," explained Dr. T. G. Miller, a nuclear physicist in the Physical Sciences Laboratory, "we can determine the nuclear properties of carbon. This data makes it possible to conduct experiments on the effects of nuclear weapons." Diamonds also can be used to measure the polarization of neutrons.

Currently, a 25-karat uncut diamond on loan from the Diamond Research Laboratory, Johannesburg, S. Africa, is being bombarded by neutrons produced by a nuclear generator, causing it to scintillate. Nuclear properties of carbon can then be calculated from the number of scintillations per second.

Future tests are planned that will determine whether certain grades of

IBM Awarded GIMRADA Contract

The U.S. Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency (GIMRADA), Fort Belvoir, Va., has awarded a \$98,445 contract to International Business Machines Corp., Federal Systems Division, of Bethesda, Md., for a study of Engineer intelligence and terrain intelligence functions in military operations.

(over 40), when they did yield to the strain of the treadmill in each case it was due to fatigue of leg and calf muscles, rather than from shortage of breath, which is what causes most men in the U.S. at that age to end the test.

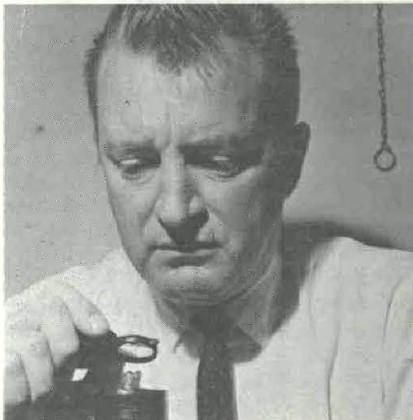
Physical fitness appears to be the answer to minimizing the risk of succumbing to a heart attack, studies to date indicate, Dr. Mann said.

Supporting this belief are statistics showing that coronary disease appears to be much higher among sedentary people who drive to work and spend most of their day in the office. The rate of heart disease among laborers in the U.S. is considerably lower than for the professional class, he said, adding:

"I think there is a great hiatus in our approach to coronary disease. Too many of us parents encourage our children to be 'eggheads' rather than athletes. Not enough attention is given to the importance of keeping in good physical condition. We ride too much, walk too little. A daily good, long, brisk walk may prove highly beneficial."

diamonds scintillate better than others. Successful tests in this area, Dr. Miller said, may lead to use of diamonds instead of liquid helium to measure the polarization of neutrons.

Early this month, Dr. Miller presented a paper, "Diamond as a Neutron Scintillation Counter," to the American Physical Society at the University of Virginia, Charlottesville.



THIS DIAMOND, 25 karats in the rough, is "worth a fortune" in research at the U.S. Army Missile Command. Dr. T. G. Miller (inspecting the stone) reports that scintillations of diamonds caused by nuclear bombardment are being counted to study nuclear properties of carbon.

Military Applications of Programed Instruction

Military training objectives for the modern Army, as well as for the Air Force and the Navy, have focused on research and development to increase effectiveness while minimizing time requirements. "Programed Instruction" has gained wide recognition for its results in military applications.

Rapidly increasing interest in this technique to improve, expedite and simplify military training was reported by Robert G. Smith, Jr. Assigned to the Human Resources Research staff, George Washington University of Washington, D.C., a contract agency of the U.S. Army Research Office, he spoke at a recent NATO Symposium on Programed Instruction held in Italy. As here presented, his report is believed of broad concern to the R&D community.

By Robert G. Smith, Jr.

This presentation is in two main parts: First is an indication of the influence of military applications of programed instruction on the development of modern concepts of programing; second is a description of some specific applications which might suggest ways in which Programed Instruction can be used.

It is readily understandable why the military services are interested in programed instruction. The services have courses with many students. They have to train under circumstances which make it difficult to assemble classes. They frequently have to teach material in which trained instructors are in short supply.

The U.S. Army, Navy and Air Force have all used programed instruction to some extent. However, the largest and most systematic uses have been made by the Air Force. I will explain in some detail the scope of the Air Force interest in and contribution to Programed Instruction.

In October 1961 a letter was issued by Headquarters, U.S. Air Force, to major commands, describing Programed Instruction. It called for an orderly and discriminate transition from research and development to application as rapidly as possible. The Air Training Command took the lead in this effort.

Initially, orientation sessions for key personnel were held, followed by further familiarization briefings. By March 1963, more than 8,000 personnel of the Air Training Command had

learned the basics of Programed Instruction techniques.

At the same time, approximately 100 short topics were selected for programing and about 300 programmers were trained by contract agencies. The quality standard was established at "90-90"—90 percent of the students had to get 90 percent of the material. This quality standard was the insurance against programmers being willing to quit too soon, before they had attained high quality.

The Air Force programmers went through the following stages: 1) Preparation of Objectives; 2) Development of Criterion Test; 3) Preparation of Draft Program; 4) Development Testing (involving administration of the program and its revision on successive groups of students until the 90-90 criterion was reached); 5) Comparative Testing (program compared with the regular, conventional instruction).

A progress report was prepared when 46 programs had completed the comparison testing stage. On the average, these programs resulted in a reduction of training time of 33 percent and an average gain of 9 percent in achievement.

Results were considered so promising that plans were made to move into the next stage—the development of instructional system development teams. The Air Training Command has established an Instructional Systems Division at Lackland Air Force Base, Tex. Under the Division are the Instructional Technology Training Team and nine production teams.

ITTT Team operates a programing school, provides a traveling team to upgrade training and orientations,

Dr. Robert G. Smith, Jr., joined HumRRo in 1958 and was assigned to Division No. 5 (Air Defense) at Fort Bliss, Tex. He was serving there as director of research in 1962 when he was assigned to his present position of director's representative at Headquarters, U.S. Continental Army Command, Fort Monroe, Va.

Dr. Smith has BA and MA degrees (1942 and 1947) from the University of Florida. He received his doctorate in philosophy (1950) from the University of Illinois, after serving with the U.S. Army Air Corps during World War II (1942-46). From 1950-57 he was a civilian psychologist with the U.S. Air Force and was associate professor of psychology at Texas Technological College in 1957-58.

A past president of the National Society for Programed Instruction, he is a member of the American Psychological Association and the Association of the United States Army.

and is developing a manual for the programing course.

The production teams are developing programed training systems for large courses, in accordance with the following seven principles:

- Behavioral Analysis—a detailed analysis of the performance required of the student graduate when he reaches the job.

- Optimum Operant Span—how much learning can the student manage at one time? This does not necessarily mean small steps, but a step which is optimum for the student.

- Continuous Active Responding. This means planned interaction on a continuous basis, between the student and the system.

- Immediate Confirmation—rapid and continuous knowledge provided to the student as to the correctness of his response.

- Self-pacing—permitting the faster learner to progress, and the slower learner to take the time he needs, within reasonable limits. This includes the planning of methods to allow for, and take advantage of, individual differences in ability. Self-pacing is not always possible, but it is still considered to be a desirable principle.

- Validation—testing and revising the system until it is guaranteed to be both effective and efficient. Validation must be done with an adequate sample of the target population.

- Student Centered—this means an honest endeavor to place all emphasis on the student, and to avoid instructor-centered classes. If all of the above six principles are accomplished,



Dr. Robert G. Smith, Jr.

it is believed that the learning experience will be student centered.

If I may quote from a recent briefing—"These are the principles, this is our philosophy. Our systems approach is the detailed analysis of required behaviors, and the application of all these principles to any media of presentation used, whether it be a live instructor and his lesson plan, a motion picture, slides, TV, a programed instruction package (PIP), a tape recording or a book.

"In fact, when we speak of programing now, we mean exactly that—applying the principles of Programed Learning to everything we do. If we are talking about a paper and pencil booklet in programed form, as you are used to seeing, we call them PIPs and a PIP is only one of the media or subsystems in our system."

In addition to the work just described, the Air Force has taken an active role in the dissemination of information about Programed Instruction. The head of the initial Air Force effort—Col Gabriel Ofesh—was the founder and first president of the National Society for Programed Instruction. Air Force personnel have taken an active role in the Society ever since.

The Army and the Navy have not taken as direct and organized an approach to Programed Instruction as the Air Force, although a certain amount of programing has been done.

For the Army, at least, the most important effect of Programed Instruction has been as a catalyst for new developments in training. Whenever Programed Instruction has been introduced, it has, like no other system before, required precise thinking about the fundamental processes of training.

As an example, it is widely recognized that the development of objectives is a vitally important first step in programing. As people begin to learn about programing, a natural question is: Why aren't job-related, clearly described objectives important in all our courses, even those we don't plan to develop programs for?

Of course the courses are job-related. It is of considerable interest to note that many of the Army Schools—and there are 26 of them—which have been most interested in Programed Instruction have also been those which have taken the lead in getting good objectives for all their courses.

Specific applications of Programed Instruction by the Army, Navy and Air Force herein described have been selected to provide a range of possibilities for continuing consideration.

A problem faced by many schools, especially the more technical ones, is that their prospective students may lack certain prerequisites, or may need to review material they learned several years before. One Army school technical course had a number of officers attending who needed refresher work on mathematics. Those who did not pass a mathematics test were required to take a program developed for the specific purpose of providing this review.

Incidentally, this same program has been used successfully for refresher training by the U.S. Air Force.

An Air Force School offered a 4-hour block of instruction on the staff study. When programed, it required about one hour to complete, on the average. Then someone asked, "Why don't we make the student do this as homework?" They did, and four hours were saved out of the course. When four hours are multiplied by 2,500 students per year, some rather substantial savings emerge from a small effort.

Students at one Army Training Center were encountering difficulties mastering the concept of the mil, an angular unit used in artillery. A program was prepared which produced an increased level of achievement on this previously difficult topic.

In some instances, Programed Instruction provides a means for increasing the efficiency of training which is already quite effective. For example, the Human Resources Research Office, in research for the U.S. Army, analyzed the performance requirements for low-level aerial observations.

This research identified four basic visual skills: Visual Search, Recognition, Geographic Orientation, and Target Location. A special training program, developed to teach these basic skills, reduced the time to obtain proficiency in aerial observation from 117 hours to 32 hours. It was adopted as the official Army training program in manuals and regulations.

Problems persisted, however. First, aerial observation is not a formal school course. It is unit training, which means that the training is geographically dispersed and is conducted on a small scale at any one point. The second problem was support for the training. It required a trained instructor. It required an elaborate support system, including approximately 750 color slides, slide projectors, etc.

Now, suppose color slides could be supplanted by black and white photographs. Suppose one didn't need a slide projector—that the requirement

could be eliminated by putting the photographs in a book. Further, imagine that a program could do the job instead of a trained instructor. Put all these together, and we have training that is much less expensive and much easier to conduct.

This was done. The training of the aerial observer was put into a programed format. When compared with the previous course, it was just as effective. It is being published as official training literature.

In another example, a HumRRO Task with the code name of FORECAST developed new training and task analysis methods for electronics maintenance technicians. In several studies, it was shown that the use of FORECAST methods reduced training time and increased proficiency over previous types of instruction.

One application was made by the Navy when a FORECAST course in the maintenance of two pieces of LORAN equipment was developed which was two weeks in length. Previously, two weeks of training were required for one LORAN set.

In addition to the reduction in time, the FORECAST-trained students found three times as many malfunctioning parts as the conventionally trained students. At the present time, the course is being put into Programed Instruction format. The intention here is to see whether all or most of this training can be conducted while the sailors are at sea.

The Navy is instituting a new effort to collect data concerning maintenance aboard ship. This information will be used to improve maintenance management. One program will be used for these purposes:

- 1) As part of a course of study to train two coordinators for each ship;
- 2) As part of a course to train 10 percent of the crew of each ship as supervisors;
- 3) As the means of training the entire crew of each ship through supervised self-study.

To give a view of the magnitude of the training effort required, 300,000 copies of this program are being printed for the Atlantic and Pacific fleets. This is an example of the use of Programed Instruction in widespread training generated by a change in procedures.

Most military forces have certain requirements to conduct training on a periodic basis in certain subjects which are mandatory for every person in the service. Examples in the

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Military Applications of Programed Instruction

(Continued from page 37)

U.S. services are military justice and the Code of Conduct governing actions if captured. These requirements generate the need, under conventional methods, for a tremendous number of instructors to prepare lessons and present them.

The quality of these lessons is highly variable. The time taken for instructors to prepare and present lessons is enormous. The Strategic Air Command, however, is using a program to meet the mandatory training requirement for the Code of Conduct. Thus the lesson is prepared once, and presentation is a matter of distributing the programs.

There may be a requirement for widespread training in a topic for which qualified instructors are in short supply. The scarcity of instructors may refer to those qualified either by knowledge of subject matter or proficiency in specialized teaching methods.

Perhaps the best example of use here will be in the language teaching methods. HumRRO has developed programs for limited, special purpose language. In Russian and Mandarin Chinese, these languages were designed solely for the purpose of permitting combat troops to question newly captured enemy personnel, and thus obtain highly perishable tactical intelligence. In Viet Nameese, the purpose was to permit limited conversation with friendly personnel.

For this point, it is clear that if there were ever a sudden requirement for these language skills on the part of large numbers of troops, there would not be enough language-qualified instructors to meet the need. On the other hand, the language tapes can be mass-produced very readily.

One of the growing trends in military operations is the use of automated or semiautomated command and control systems. One of the features of these systems is that high-ranking personnel will interact directly with computer consoles to obtain information required for decision making and the control of operations.

This generates two problems. First, it is not possible to talk to the computer in plain language. Instead, the computer responds to a highly formal language called a Query Language. Query Language is a pseudo-English language with a fixed format, special punctuation, and specific abbreviations. The people who operate the system must learn this language.

If the people who must learn the

Query Language are of high rank, there are some special problems. In learning, they are bound to make mistakes. They should be permitted to learn under conditions which keep them from possible embarrassment when they commit errors.

The Air Force has sponsored research into this problem, and has developed a 2-stage training program. The first stage required a minimal use of the system. This was achieved by the use of programed text, with occasional uses of the equipment, primarily to provide motivation.

Speaking generally, the requirement for the trainee at the programed text phase was to define technical terms, to know the structure of the data files, to be able to explain the operation and capabilities of the computer retrieval programs, and, ultimately, to write appropriate Query Language statements from English Language statements of moderately difficult problems.

The reason for the programed text approach is to minimize use of the equipment. The Query Language is sufficiently rigid for analysis by the computer. A computer program can be developed to detect errors in an incorrect statement and classify each error. Thus a trainee can write Query Language statements and submit them to the computer for grading. The computer can analyze statements and choose material to present to the trainee to recognize and correct his errors.

The computer itself was then used as a teaching device to develop final proficiency levels. Both the programed test and the computer provide the privacy to prevent embarrassment to high-ranking officers.

Most of the applications which have been described have been in the area of knowledge. However, it is quite possible to teach procedural skills of a performance nature by means of a program. This was done by the Air Force in a program for the K-38 revolver. The objectives of this program were to:

- Identify and name each of the 30 parts of the K-38 revolver.
- Describe the mechanical function of each part.
- Disassemble and assemble the revolver.
- Clean and lubricate the revolver.
- List the corrective action to be taken if a malfunction occurs.

The program prepared served to guide the student successfully

through all these activities of disassembling, assembling, and lubricating the revolver. It reduced training time by 35 per cent—from 150 minutes to 98 minutes. The students did better than 98 percent, on the average, on both the written and the performance tests.

Implications of military applications of Programed Instruction may be summarized thus:

First of all, the best way to introduce Programed Instruction into a military service and get maximum results is to develop a command policy, and provide adequate organizational direction and support for the effort.

Second, a number of applications of Programed Instruction can be made to solve particular kinds of military problems. Among illustrations I have cited are:

- The leveling of students with regard to prerequisites.
- The reduction of training time to a point which permits the elimination of a topic from formal training.
- The effective teaching of a previously difficult topic.
- Decentralized training not requiring formal classes.
- Training for the introduction of new procedures.
- Training for subjects that are mandatory for every person in the service.
- Training for which qualified instructors are scarce.
- Training in which senior officers are not embarrassed through making errors.
- Training in mechanical procedures.

Top AMC Executives Review R&D Activities at Redstone

Six U.S. Army Materiel Command (AMC) officials recently met with top personnel of the U.S. Army Missile Command, Redstone Arsenal, Ala., to review research and development activities there.

The meeting was part of a survey of all AMC laboratories ordered by AMC CG General Frank S. Besson to promote effective utilization of resources and timely accomplishment of military objectives.

The AMC visitors included Dr. R. G. H. Siu, scientific deputy of the Research Division; Dr. Colin M. Hudson, technical director of the Development Division; Norman Klein, chief, Chemistry and Materials Branch, Research Division; Robert Phillippe, chief, Environmental Sciences Branch, Research Division; and Col John French, executive secretary.

CRD Addresses Optical Industry on Army Vision Research Needs

(Continued from page 2)

bility of revising the Army color vision testing methods as well as standards for acceptance of pilots, General Dick said. Rejection statistics recently showed that about 50 percent were due to visual defects, and that imperfect color vision was a major cause.

In today's era of electronic safety controls, the Army studies may show that lack of color vision does not impede flight safety and a pilot's ability to carry out his mission, it was stated, and may lead to revision of test methodology and standards.

Allied to the problem of protecting the eyes of pilots, the speaker said, is that of protecting the eyes of the combat soldier. Army ophthalmologists have estimated that over 50 percent of Army eye injuries in battle could have been prevented by eye armor.

The Army has been conducting research on ballistic susceptibility of eyes and lenses to various types of small high-velocity missiles since 1954, and the work is continuing.

The Army's need for improvements in fire control instrumentation, involving better optical components, was discussed by General Dick as it is related to advances in sophistication of weapons in modern warfare.

"Whereas the total World War I purchase of military optical items amounted to something like \$65 million, our World War II effort used about \$100 million per year—or five times as much in both raw glass and finished instruments," he reported.

The "grievous shortage" of optical glass and the scarcity of companies with manufacturing know-how at the outset of World War II resulted in substantial expansion of the industry, so that today a firm base had been established upon which to expand to meet military requirements. Still, in General Dick's opinion, "the challenge is great."

In discussing that challenge, he pointed to the U.S. Army's need for much higher standards of fire control accuracy than existed in the past, due to the high rates of speed of many targets and the need to destroy them at greater ranges—involving a first-round hit-and-kill capability.

Among the U.S. Army weapons systems in which optics technology has contributed importantly, General Dick mentioned the TOW (Tube launched, Optically Automatically Tracked, and Wire Guided) missile; the Shillelagh guided missile and

conventional-type round system capable of being fired interchangeably; and the Redeye for forward area air defense.

"I think that you can understand from these examples," the General said, "the growing sophistication of modern fire control requirements. But all of these advances we have made, and those we are seeking in weaponry, will be, as I said at the beginning of my talk, of little value if we can't answer these four questions: Is a target there? What is it? Where is it? How big is it?"

"Part of the answer to this problem area rests with a better night-vision capability. One of the great changes in warfare which came about in the 20th Century has been the growing use of night hours as a time for operations. . . . Today there is an ever-increasing tendency, particularly among under-armed and insurgent forces, to fire at night. . . . As a result, the U.S. Army has an urgent need to develop better night-vision equipment.

"Ultimately, we would like to be able to operate in the field with near daylight efficiency—or, in any event, with a considerable advantage over our enemy. To that end, the Army has been pushing the development of such devices, particularly passive types or image intensifiers.

"The great advantage of this approach over the infrared systems of World War II and Korea is that the image intensifier does not emit any electronic signal which is subject to detection, thereby rendering the user liable to positive countermeasures. These devices are capable of intensifying any available light many thousands of times.

"However, there are many problems still to be overcome, not the least of which are weight, cost and durability. For example, the lens assembly alone for one type device currently weighs 14 pounds—a vast improvement over previous systems of similar performance with weight in excess of 60 pounds.

"In addition, the development cost for each of these assemblies was over \$10,000 each, and in limited production quantities of approximately 100 units the cost is still more than \$7,000 per lens. Ways must be found to lighten the weight and to reduce the cost.

"Still other answers to the problem of finding and identifying your target rest with such sensory devices as acoustical infrared imagery, ultra-

violet, photography, radar, TV-type scanners, and perhaps some facet of Laser-optics.

"Currently, we are exploring means of improving the capabilities of all of these, since no one of them can do the job alone. Each has its strong points but each has its limitations as well. These limitations may be occasioned by size and weight, range, and by weather factors such as rain, fog, mist and cloud cover, and resolution.

"Of the various sensory devices I have mentioned, optical components are a key part in the infrared and photographic approaches, and the use of optical radars is being explored. Tremendous advances have been made in recent years in developing new photographic optics. . . .

"The Army is also undertaking research on Lasers, which may find application in optical radars, in communications links, in computers, and in battlefield illumination. Special optical problems are involved because of the extreme brightness and power of the Laser as an optical source, which tend to degrade the glass in optical components used with this source.

"In this connection, let me mention that the Army is undertaking research in the fascinating field of fiber optics. Fiber optics, as you know, are very-high-aperture light conduits that find useful application in transferring images from one point to another over otherwise difficult optical paths; for example, in surgical work as an inspection device.

"Another example is the use in transferring an image on a cathode ray tube to subsequent optical equipment without the size and length requirements of normal optical devices. Unfortunately, end fibers currently become optically joined, with the result that in high-resolution devices streaks appear along the length of the fiber. We are hopeful we can eliminate this end fusing.

"Gentlemen, I have now talked for some 45 minutes, so I will bring my appearance to an end. However, I believe that I will leave with you an awareness that the Army, as well as its sister services, has steadily increasing requirements in the field of optics—from protective and corrective devices for its soldiers to optical, optically-aided sensors capable of penetrating the jungle cover.

"We feel confident that today and tomorrow will see the entire optical industry ready and able to meet and solve our problems."



The Legion of Merit was presented recently to five U.S. Army officers assigned within the research and development community.

An internationally known authority on hematology and blood transfusion, Col William H. Crosby, director of Medicine at Walter Reed Army Institute of Research (WRAIR), Washington, D.C., from 1959 until his recent retirement, received the award for his outstanding contributions during a 24-year Army Medical Service career.



Col and Mrs. William Crosby and Col William D. Tigertt, WRAIR director.

Col William D. Tigertt, director of WRAIR, presented the award. The citation commended Col Crosby's "consistently demonstrated inspiring leadership, outstanding organizational ability and administrative excellence in his able direction of many diverse activities.

"Through his professional skill, vast technical knowledge and dedication to medicine and hematology, he contributed materially to the technical operation and advancement of the Walter Reed Army Institute of Research and to the accomplishment of the mission of Walter Reed General Hospital and the Army Medical Service."

Author and coauthor of more than 200 medical technical papers, Col Crosby received the Stitt Award in 1964. He is a member of the American College of Physicians, the American Society of Hematology and is on the editorial board of such professional organizations as the National Research Council and the Blood Research Foundation. He received AB and MD degrees from the University of Pennsylvania.

Upon retirement from the Army, he was appointed chief of Hematology, New England Medical Center Hospital, Boston, Mass., and professor of

medicine, Tufts University School of Medicine.

COL WILLIAM HUPALO, also awarded the Legion of Merit, until recently was commander of the U.S. Army Electronic Research and Development Activity, U.S. Army Electronic Proving Ground, Fort Huachuca, Ariz.

Maj Gen Benjamin H. Pochyla, USAEPG CG, presented the award which recognized Col Hupalo's contributions to electronics. His organization consistently achieved optimum results and he was cited for his able direction, as reflected in an outstanding program that led to a maximum utilization of resources and substantial savings to the Government.

Before his arrival at Fort Huachuca in May 1961, Col Hupalo was signal officer for the I Corps Group in Korea. He is a graduate of the University of Maryland and member of the Army Aviation Association.

COL DALE L. MORGAN, formerly deputy senior military adviser to the Research Analysis Corp., McLean, Va., until his recent retirement from the Army, was presented the Legion of Merit by Lt Gen William W. Dick, Jr.



Col and Mrs. Dale L. Morgan

Col Morgan, the citation states, "distinguished himself by exceptionally meritorious service while serving in positions of responsibility from February 1958 to December 1964." He served as intelligence officer, Technical Division, then as chief of the Scientific Section. Later he was project officer and then chief of the Systems Development Section, Technical Branch, Collection Division, Office of the Assistant Chief of Staff for Intelligence, Washington, D.C.

Subsequently he served as plans officer, Plans Division and deputy assistant chief of staff for Plans, Joint



SMILES ACCOMPANY award of the American Ordnance Association's Scott Gold Medal to General Frank S. Besson, Jr., commanding general of the U.S. Army Materiel Command, by Admiral Arleigh Burke, former Chief of Naval Operations. The occasion was the 47th annual meeting of the AOA at Aberdeen Proving Ground, Md., where the association was founded in 1919. General Besson was cited for his organization of the vast Army Materiel Command. The medal honors the late Col Frank A. Scott, a pioneer in industrial preparedness; he was also a founder of AOA.

Military Assistance Advisory Group, Korea (Provisional). Later he was deputy chief of the Research Planning Division and deputy senior military adviser, U.S. Army R&D Operations Research Advisory Group, Office of the Chief of Research and Development.

COL ROBERT K. SAXE, also a Legion of Merit recipient upon retirement from the Army, served most recently as director of the Atmospheric Sciences Laboratory and deputy director of the Electronics Laboratories at the U.S. Army Electronics Command, Fort Monmouth, N.J.

"Through his inspiring leadership, professional competence and dedicat-



Col Robert K. Saxe

ed devotion to duty, combined with his objectivity and whole-hearted cooperation," the citation states, "he materially enhanced the readiness posture of the armed forces of his country and the prestige of the United States Army at regional and international levels."

A 23-year Army veteran, Col Saxe served with the British Royal Air Force and the U.S. Army Air Corps during World War II. He received a bachelor's degree from Northeastern University and MS and PhD degrees in electrical engineering from the University of Illinois.

TECOM Honors 10 Employees With Incentive Awards

Two Presidential Citations, seven Meritorious Civilian Service Awards and an Army R&D Achievement Award were presented at the U.S. Army Test and Evaluation Command (USATECOM) Third Annual Incentive Awards Program.

Maj Gen James W. Sutherland, Jr., USATECOM commanding general, presented the awards at USATECOM Headquarters, Aberdeen Proving Ground (APG), Md.

Presidential Citations were awarded to James C. Linard, White Sands Missile Range, N.Mex., and Robert N. Dempsey, APG. Linard was cited for his "white elephant" campaign on supply items which resulted in material savings of \$380,000. He was also selected as the "Suggestor of the Year" for a number of proposals adopted in the interests of improved management and cost reduction.

Dempsey, a mechanical engineer with Development and Proof Services, APG, was awarded a Presidential Citation for a suggestion which initiated the recovery of ammunition worth millions of dollars.

Seven Meritorious Civilian Service awards, the second highest Department of the Army civilian award were presented to James J. McKenna, USATECOM; Miss Alice P. Chancellor, Marvin A. Jantz and Leo Blumberg, all of the U. S. Army Electronic Proving Ground (USAEPG), Fort Huachuca, Ariz.; Mrs. Carolyn B. Jones, Yuma Proving Ground, Ariz.; Dr. Howard W. Hembree, General Equipment Test Activity (GETA), Fort Lee, Va.; Robert P. Perez, White Sands Missile Range; and Morris A. Levin, Dugway Proving Ground, Utah.

McKenna, a USATECOM Headquarters employee, was recognized for developing test programs for Army air defense fire distribution systems.

Miss Chancellor, a multiple amputee graduate engineer, was honored for important technical contributions

COL WILLIAM L. SCHREIBER, another Legion of Merit recipient, is director of Plans and Requirements for Joint Task Force Two at Sandia Base, N. Mex. He was cited for "outstanding effectiveness" as a military analyst with the Weapons Systems Evaluation Group, Office of the Secretary of Defense, from June 1962 to January 1965. The award was presented by Maj Gen George S. Brown, commander of Joint Task Force Two.

The Decoration for Meritorious Civilian Service for Bravery was presented recently to Peter S. Merson, a

tentage technologist at the U.S. Army Natick (Mass.) Laboratories.

He was cited for efforts to rescue an 11-year-old boy and a 15-year-old girl struggling in a body of water near Natick. On his way home from a checkup visit to his doctor after prolonged hospitalization, Merson nevertheless plunged fully clothed into the water and directed the girl to safety and succeeded in bringing the boy to shore.

In addition to a bronze medal, lapel rosette and citation certificate, Merson received a token award of \$100.

cialist in the civilian personnel office at White Sands during periods of extreme changes in reorganization and consolidation of missions.

Levin, a research chemist at Dugway, was cited for his contribution in the fields of aerobiological and safety studies. He also developed the use of embryonated eggs, a technique which saved more than \$100,000 from 1963 to 1964.

The Department of the Army R&D Achievement Award presented to Dr. Richard L. Wilburn, Dugway Proving Ground, Utah, acclaimed accomplishments in the design and development of instrumentation used for sampling and assessment of chemical and biological agents.

A \$250 Special Act or Service award was presented to Miss Eugenia A. Lane, USATECOM, for imagination and ingenuity in developing a suggestion program which resulted in a significant increase in savings command-wide.

to test and evaluation projects at USAEPG; also, for the preparation of test plans and final reports in the field of electronic compatibility.

Jantz and Blumberg received a joint award for work as electronic engineers at Fort Huachuca. Their efforts were responsible for the relocation of test sites now used to evaluate radio relay equipment.

Miss Jones, a mathematics technician at Yuma, was credited with substantially increasing the quality and quantity levels of data analysis, reduction and evaluation operations.

Dr. Hembree's citation acclaimed his exceptional performance of duty as technical director of General Equipment Test Activity at Fort Lee; also, his research and development work in test techniques and standardization.

Perez was cited for exemplary performance of duty as a personnel spe-

RESA Branch Cites Research of Dr. Savitz on Fuel Cells

Meaningful contributions of women to Army science are well illustrated by Dr. Maxine L. Savitz, who joined the staff of the U.S. Army Engineer Research and Development Laboratories in 1963 and recently was hon-

ored for her research on fuel cells.

The Research Society of America (RESA) Branch of the Laboratories at Fort Belvoir, Va., presented its annual award for scientific achievement to Dr. Savitz. The award is based on individual achievement in pure or applied research. She is assigned to the Electrical Power Division at the Engineer R&D Laboratories.

Consisting of a certificate of achievement and a technical book, the RESA award was presented to Dr. Savitz by Francis Paca, vice president of the ERDL Branch, at a luncheon. Dr. Savitz was recognized for work in anodic oxidation of hydrocarbons, which is of particular interest for direct generation of electrical power from liquid fuel in a fuel cell.

Graduated from Bryn Mawr College in 1958, Dr. Savitz earned a PhD degree in physics from Massachusetts Institute of Technology in 1961. Her husband, Dr. S. Alan Savitz, is assigned to DeWitt Army Hospital.



DR. MAXINE SAVITZ receives RESA scientific achievement award from Francis Paca, vice president of the society's branch at the ERDL.

Helicopter Static Electricity

By S. Blair Poteate, Jr.

The ever-expanding role of the helicopter in military operations brings with it new and challenging problems. One of the most severe of these is the generation and accumulation of static electricity by helicopters in flight, which is being studied intensively by researchers at the U.S. Army Aviation Materiel Laboratories, Fort Eustis, Va.

In the forward flight regime of an aircraft, the presence of static charges on the airframe presents no outstanding operational problems. Although radio and navigation equipment interference may be experienced during the sudden release of energy to the atmosphere if no precautions are taken, the installation of passive dischargers satisfactorily eliminates the difficulty.

The cargo helicopter, since it possesses a hovering capability and is required to perform in the vicinity of ground personnel and equipment, i.e., in external cargo hookups, in air-sea rescue, etc., requires further consideration. In instances such as these, the presence of large electrostatic potentials on the airframe presents a serious hazard.

The problem is divided into three basic areas: first is the possible injury to ground personnel performing cargo hookup; second is the possible damage to the cargo itself resulting from the sporadic discharge of high voltages through it; and third is the possibility of ignition of fuel vapors in the vicinity of the arc produced.

Reported injuries to ground personnel have varied in severity, from minor shocks to one instance in which a man was rendered unconscious for about 10 minutes by the sudden discharge of electrical energy from an H-34 aircraft. Numerous reports have been received that ground personnel have been knocked from their feet and, in many cases, have suffered stiff arms and shoulders and headaches for several days following such occurrences.

Although no serious accidents involving external cargo and static electricity have been reported to date, the sudden discharge of relatively large amounts of electrical energy through missile ordnance and guidance components is of great concern to the Army.

The U.S. Army Aviation Materiel Laboratories have sponsored and conducted a substantial amount of research into the causes and methods

of elimination of the static electricity generation by helicopters.

Briefly, there are three causes of this electrostatic charging of helicopters. First, and probably the most important, is the triboelectric charging which takes place as a result of the rotor blades passing through the atmosphere. This is basically the same phenomenon as in the classroom experiment of rubbing two dissimilar materials together to demonstrate electrostatic charging.

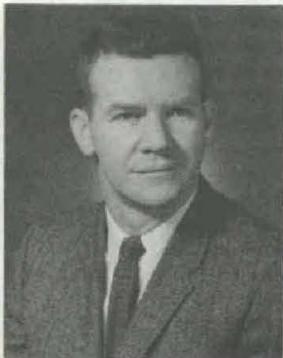
When the two materials are placed in contact, electrons are transferred and a potential difference is created. Upon separation, if one of the materials is an insulator, and especially if the separation is rapid, the electrons cannot return to the material from which they originally came.

As a result, the two materials have acquired equal and opposite charges. The polarity of these charges is determined according to the Law of Coehn, which states that the material having the higher dielectric constant will acquire a positive charge. The presence of particulate matter in the atmosphere substantially increases the magnitude of this electrification.

The second cause of electrification is the ionic unbalance of the engine exhaust gases. During the combustion process, ions are generated and, through their release in the engine exhaust, a net charge can be produced on the aircraft.

The third method by which an aircraft can become charged is by induction, which becomes effective when the aircraft is flying through large variations in the earth's electrical field, e.g., in the vicinity of charged clouds.

During the course of the flight test



S. Blair Poteate, Jr.

and measurement programs conducted to date, a substantial amount of information has been gathered on the charging currents generated by various helicopters in various environments. The largest natural charging current measured to date was on the H-37 helicopter hovering in recirculating snow. The current generated then was 120 microamps.

In the clear, dry air of the California desert, this same machine generates a charging current of about two microamps. The voltage buildup on the aircraft in flight is difficult to measure. The voltage on the H-37 in the above mentioned desert environment was 50,000 volts.

Although no direct voltage measurements have been made in the recirculating snow environment, the length of arc discharges and limited theoretical calculations indicate the voltage on the helicopter to be in excess of a half a million volts.

It has been observed that the charging current generated by different-sized helicopters in a constant environment is roughly proportional to their weight.

Once a helicopter leaves the ground, it is effectively one plate of a capacitor, the other plate being either the earth, the atmosphere or some combination thereof. The electrical energy stored on the helicopter can be determined if the voltage on the helicopter and the helicopter's capacitance to ground are known.

For example, it can be shown that the H-37 helicopter, hovering at 25 feet with 50,000 volts accumulated, has an electrical energy level of approximately one joule.

In order to arrive at a proper solution to the problem, it is first necessary to establish an acceptable residual energy level for the helicopter. A review of the literature and a limited amount of testing have indicated that a residual energy level of ap-

The author, S. Blair Poteate, Jr., is chief of the Environmental Effects Branch, Aeronautical Systems and Equipment Division, U.S. Army Aviation Materiel Laboratories, Fort Eustis, Va., with responsibility for direction of in-house and contracted efforts in aircraft environmental research.

Formerly employed by the General Electric Co. (1956-59) he was responsible for the environmental test program and worked on the development of a hydro mechanical main fuel control for the J-85 engine.

From 1951-56, he held positions with Vertol and Martin aircraft companies engaged in the design and testing of aircraft and missile systems. He is a registered engineer in Virginia.

proximately one millijoule is tolerable from the standpoint of the three basic problem areas: personnel, fuel, and munitions.

Logically, two approaches to the reduction of the electrical energy maintained by the helicopter appear feasible. On the one hand, one might attempt to ascertain all the charge generation mechanisms to evaluate them quantitatively and qualitatively with regard to the factors which affect them, and, in turn, attempt to determine methods of eliminating these mechanisms in the design and manufacture of helicopters.

In light of the knowledge of the subject we have to date, it seems unlikely that this approach will be productive. For instance, it is theoretically possible to match the dielectric of the rotor to that of the atmosphere and to eliminate the rotor's contribution to the charging process in a given environment.

However, chances in this environment would again create a mismatch, and a charge would be generated. It can be seen that this is a virtually impossible process.

To employ the second approach, one would accept the fact that a helicopter is inherently a good generator of static electricity and provide a means of dissipating the charge accumulated as well as the charge subsequently generated when the helicopter is in the vicinity of the ground, where the danger of an uncontrolled discharge occurs. This approach appears to have a much higher probability of success.

The basic principles of a discharging process is the ionization of the atmosphere. Ionization can be produced by numerous methods, among which are radioactive sources, thermal ion generators, and electrical field strength ion generators (corona discharge).

Based on laboratory and flight tests, and an analytical evaluation, it appears that the high-voltage corona discharge system is the most practical method of dissipating an electric charge from the helicopter.

The phenomenon of corona discharge has been known for years. If a body that is being charged with an electric potential has on its surface a sharp point, the electrical field strength around this point will be extremely high, the field strength being a direct function of the voltage and an inverse function of the radius of curvature of the point.

As the voltage increases and reaches a certain level, which is determined by the shape of the point,

atmospheric conditions, etc., the atmosphere surrounding the point will become ionized and an actual flow of electrical current from the point can be observed.

This is a corona discharge. The voltage on the body will continue to increase, with a commensurate increase in current discharged, until the corona point discharge current is equal to the charging current. This is basically the principle of operation of the passive dischargers previously mentioned.

A passive discharger or wick, although fairly effective in the reduction of electrical discharge noise, is ineffective from the standpoint of reducing the voltage on the aircraft to zero or to essentially zero. The steady-state voltage attained is generally quite high and is, in almost every circumstance, higher than that which would produce the one millijoule energy level.

To reduce the residual voltage on the helicopter and yet retain a voltage on the corona point high enough to produce the required corona current, a voltage source must be placed in the electrical circuit between the helicopter and the corona point, with the corona point being otherwise electrically insulated from the airframe.

Inasmuch as charging currents of both positive and negative polarity

are encountered by helicopters, it is necessary that the voltage source provided have a bipolar capability.

Under the sponsorship of the U.S. Army Aviation Materiel Laboratories, a helicopter static electricity discharger for the CH-47 is being developed which employs the basic principles outlined above.

The system consists essentially of a rotating vane field sensor, which senses the electrical field around the helicopter produced by the voltage on the helicopter; a positive and a negative high-voltage generator, each connected to its own corona point; and appropriate control circuitry which monitors the polarity and magnitude of the electrical field around the aircraft and actuates the proper polarity high-voltage generator when the electrical field strength reaches a predetermined level.

This system, which weighs approximately 30 pounds, is capable of discharging approximately 140 microamps when installed on the CH-47 helicopter and will maintain a residual energy level of one millijoule.

The device can be used on other helicopters producing charging currents of 140 microamps or less. It is also possible to redesign the discharger for smaller helicopters to effect a weight saving or for larger machines to meet their discharge requirements.

AMC Assigns Col Lawless to Manage Tactical Radios

Project manager responsibility for the U.S. Army Materiel Command's Selected Tactical Radios (STR) Activity at Fort Monmouth, N.J., was assigned recently to Col Roger E. Lawless.

Assigned until recently to the North Atlantic Treaty Organization in France, he succeeds Col James H. Schofield, Jr., now with the Defense Weapons Systems Management Center at Dayton, Ohio.

One of the six Army Materiel Command project offices at Fort Monmouth, STR is concerned with specific FM and Single-Side-Band tactical radios used in field Army modern communications systems.

Col Lawless interrupted studies at Fordham University Law School in 1941 to enlist for World War II service. Commissioned upon graduation from OCS, he served at Fort Monmouth, New Guinea, Biak and the Philippines. Separated from service in 1945 as a major, he returned to Fordham, received an LLB degree and was admitted to the New York Bar.

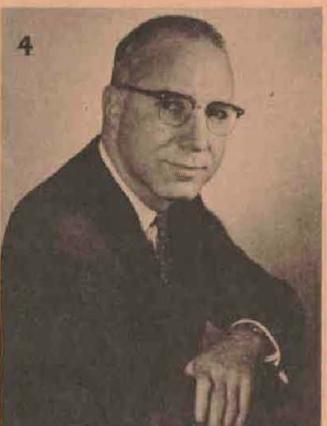
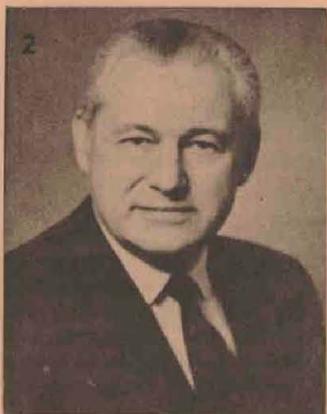
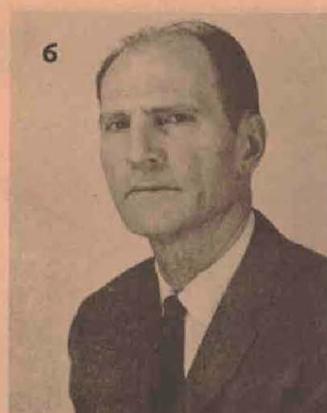
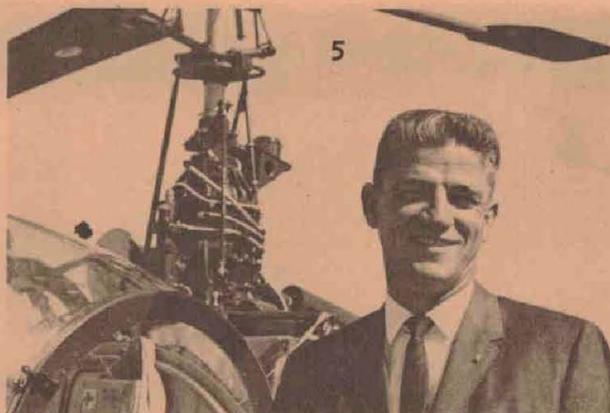
When recalled to active duty in 1949, he attended the Command and General Staff College (CGSC) at Fort Leavenworth, served with the Army Field Force Signal Division, then was assigned to the CGSC faculty.

After a year's assignment with the office of the Chief Signal Officer, Col Lawless joined the staff of the Chief of Legislative Liaison, office of the Secretary of the Army, where he was admitted to practice before the U.S. Supreme Court.

In 1962, Col Lawless attended the NATO Defense College in the Ecole de Guerre, Paris, then was assigned as chief of the Telecommunications Programs for NATO's southern region embracing Italy, Greece and Turkey.



Col Roger E. Lawless



Army R&D Personnel Earn 6 of 9 SA Annual Awards

Pictured on this page are winners of the Ninth Annual Secretary of the Army Awards. The decorations were presented by Secretary of the Army Stanley R. Resor, assisted by Deputy Under Secretary of the Army for Personnel Management Roy K. Davenport, Oct. 7, at Pentagon ceremonies attended by many high-ranking Army leaders.

(1) *Exceptional Civilian Service* (posthumously)—Dr. Arthur J. Dziemian, former chief of the Biophysics Division, U.S. Army Chemical Research and Development Laboratories, Edgewood Arsenal, Md. (2) *Exceptional Civilian Service*—Albert L. Nowicki, supervisory cartographer, U.S. Army Map Service, Washington, D. C. (3) *Exceptional Civilian Service*—Benjamin D. Pile, mechanical engineer, U.S. Army Medical Equipment Research and Development Laboratory, Fort Totten, N.Y. (4) *Exceptional Civilian Service*—Billy M. Horton, technical director, Harry Diamond Laboratories, Washington, D.C. (5) *Distinguished Civilian Service*—Richard L. Peck, director of Flight Operations, Hiller Aircraft Co., Palo Alto, Calif. (6) *Outstanding Suggestion and \$3,060 cash*—Eugene L. Simpson, chief, Ammunition Division, Sierra Army Depot, Herlong, Calif. (7) *Meritorious Civilian Service*—Raymond Warren, mechanical engineer, Harry Diamond Laboratories. (8) *Meritorious Civilian Service*—Charles E. Leadman, engineer, Army Corps of Engineers. (9) *Meritorious Civilian Service*—Priscilla Alden, chief, Current Year Section, Technical Service Division, Research and Development Directorate, Headquarters U.S. Army Materiel Command.

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