ARMY RESEARCH AND DEVELOPMENT

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ILIR Program Achievements Gain FY 1965 Funding of $11.2 Million

Accomplishments in the Army In-House Laboratories Independent Research Program during the past year have been sufficiently impressive to warrant an increase from $10 million to $11.2 million in the FY 1965 budget.

Reports on significant results submitted in mid-October to assistant Secretary of the Army (R&D) Willis M. Hawkins reflect that the ILIR Program has moved ahead progressively since it was established in 1962.

Policies for administration of the program are prescribed in Army Regulation 705–55, issued in October 1962 and titled "Research and Develop-

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OCRD Shifts Merge 8 Units in 4 New Divisions

Realignment of functions within the Office of the Chief of Research and Development, effective this month, is the result of in-depth studies to achieve fully effective utilization of personnel, consolidation of similar or overlapping areas of effort, and expeditious achievement of major programs.

Chief of Staff General Harold K. Johnson approved, on Oct. 8, a plan that calls for creation of four divisions to consolidate functions of three divisions and five offices abolished.

Most of the action is centered in the Directorate of Missiles and Space, a redesignation of the Directorate of Special Weapons, which is headed by Col F. J. Pallister. The International Division, with Col Ned T. Norris retained as chief, is redesignated the International Office under the Deputy Chief of R&D for International Programs, Brig Gen William T. Ryder.

The Directorate of Missiles and Space is composed of three divisions that supplant two of the divisions and four of the offices eliminated in the functional realignment. The new Air Defense and Missiles Division combines the former Air Defense and Missiles Divisions.

Similarly, the Nike-X and Space Division is a merging of the Anti-Ballistic Missile Office and the Space Office, while the new Atomic, Chemical and Biological Division takes the place of the Atomic Office and the Chemical-Biological Office.

Further, the Review and Analysis Division is established under the Director of Plans and Programs as the successor to the Review and Analysis Office and the Policy Division. The Special Warfare Office becomes a

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COSATI Issues STINFO Progress Report

Strides of all Federal Government major agencies toward coordinated, integrated effort to improve collection and use of scientific and technical information during the past 15 months reflect a concentrated attack on an extremely complex problem.

That indication is contained in a COSATI "Summary Progress Report" covering the period from June 18, 1963 to September 1964, distributed this past month. COSATI is the acronym for Committee on Scientific and Technical Information, established by the Federal Council of Science and Technology in May 1962 as a permanent agency composed of senior Federal agency representatives. Its stated mission is:

". . . To contribute to the information and development of an articulated but decentralized Federal information system designed to provide an important tool for improving research and development both in and out of Government."

Chairman of COSATI is Lt Gen William G. Ely, former Director of Army Research and later Deputy CG of the U.S. Army Materiel Command. The executive secretary is Col Andrew A. Aines, who served as director of

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STAR-STUDDED LINEUP—Six U.S. Army generals wearing a total of 16 stars flank two executives of the University of Michigan, Marvin L. Niehuss, executive vice president (third from left) and A. Geoffrey Norman, vice president for research. Attending the recent Project Michigan briefing were (l. to r.) Lt Gen Ben Harrell, Assistant Chief of Staff for Force Development; General Frank S. Besson, CG, Army Materiel Command; Lt Gen Dwight E. Beach, CG, Combat Developments Command; Lt Gen William W. Dick, Jr., Chief of R&D; Maj Gen F. W. Moorman, CG, Electronics Command; and Brig Gen Charles J. Denholm, Deputy Assistant Chief of Staff for Intelligence.

Featured in This Issue...

Army R&D Newsmagazine

Vol. 5, No. 11 November 1964

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Purpose: To improve informal communication among all segments of the Army scientific community and other Government R&D agencies; to further understanding of Army R&D progress, problem areas and program planning; to stimulate more closely integrated and coordinated effort among the widely dispersed and diffused Army R&D activities; to maintain a closer link from top management through all levels to scientists, engineers and technicians at the bench level; to express views of leaders, as pertinent to their responsibilities, and to keep personnel informed on matters germane to their welfare and pride of service.

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Distribution requirements for the Office of the Secretary of the Army, Under Secretary of the Army, Assistant Secretary of the Army (R&D), Chief of Staff, Chief of Research and Development, and Chief of Information will be submitted by the Office of the Chief of Research and Development.

All other Department of the Army agencies should submit their requirements through channels to the Army Publications Distribution Center servicing them.

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The Next 50 Years in Aviation

By Willis M. Hawkins
Assistant Secretary of the Army (R&D)

Growth potentialities of the aircraft industry during the next half century are excellent, as viewed by Assistant Secretary of the Army (R&D) Willis M. Hawkins, Jr., in a major address to the Convocation of the Fiftieth Anniversary of Aeronautical Engineering.

Presented with an honorary degree as Doctor of Engineering by the University of Michigan, which was host to the Oct. 9 meeting at Ann Arbor, Secretary Hawkins spoke on "The Next 50 Years in Aviation."

Covered in his imaginative and knowledgeable forecast were the categories of general aviation, short-range transport, long-range transport, and the future of military aircraft, all in respect to growth environment.

All of his predictions, he emphasized, are based on assumptions that international relations and trade will not be affected by a major conflict, and that the population and economic growth of the world community will continue to be progressive.

In many respects, he said, an "educated guess" must be made, based upon facts currently available and the potentialities for the future as present growth trends indicate, or as known experts in their fields anticipate. A basic premise of his forecast is "that a moderate 4 percent per year expansion of our Gross National Product (GNP) will be achieved during the next 50 years."

Another expectation supporting his views on the future of aviation is that "by the year 2014 there will be approximately 420 to 450 million people in the United States'; also, that by the year 2014 the United States GNP "will produce $10,000 per person and between $16,400 and $28,200 per wage earner, depending upon the number of wage earners necessary to keep the GNP at four percent increase per year."

Other fluctuating, intangible factors considered by Secretary Hawkins in his predictions include an assumption that the increase in GPN will be attributable about 50 percent to increased efficiency of workers and the remaining half to an increase in the percentage of wage earners.

Further, he joins with noted economists in anticipating that the trend toward a shorter work week will give the average wage earner three hours more leisure by 1976 and eight hours more per week by the year 2000. Thus, by 1976 the average worker would have 19 more free days each year, by 1990 he would have 38 days and by the year 2000 an estimated 50 days.

Augmentation of the amount of time and money workers will have for cultural and other activities, he states, "can be counted on to induce an increase in travel, some of which certainly must benefit the aviation industry."

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WILLIS M. HAWKINS, Jr., Assistant Secretary of the Army for Research and Development since September 1963, has been involved in research, development, production and testing in the aeronautical field since graduating from Michigan University (1937 B.S. degree, aeronautical engineering).

Joining the staff of Lockheed Aircraft Corp. shortly after graduation, he was assigned to the Preliminary Design Office. He advanced successively to head of the Division, assistant general manager for operations, assistant general manager (1958), vice president and general manager of the Space Systems Division (1961). His assignment with Lockheed when he became Assistant Secretary of the Army (R&D) was general manager and vice president (engineering).

Secretary Hawkins served on the Army Scientific Advisory Panel since April 1957 and on important subpanels engaged in top studies.

In his last assignment with Lockheed, Mr. Hawkins provided weapon system management of the research, development, production and test activities necessary to the creation of a family of military satellite systems.

He holds a number of patents on complete aircraft designs, five major patents on aircraft component designs, and has contributed substantially to missile developments. In 1961 his notable achievements earned the U.S. Navy Distinguished Public Service Award.

Willis M. Hawkins

STINFO Committee Distributes Summary Progress Report

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Army Technical Information until June 1, 1964.

In a highly condensed style, the summary report comments on progress of COSATI, the Department of Defense and 12 other major Federal agencies toward current and future objectives in assuring inter-agency program coordination and development of Government-wide standards and compatibility of technical information systems.

Major COSATI activities covered by the report include:

- Consideration of Federal responsibilities and problems concerning scientific and technical information.
- Establishment of a new COSATI charter, which defines the scope more clearly to include engineering information activities in addition to those of a more scientific nature.
- Endorsement of the concept of a clearinghouse of Federal scientific and technical information to provide a single point of contact for Government activities in the physical and engineering sciences.

Such a clearinghouse would complement services now available through the National Library of Medicine and the National Agricultural Library. Thus a major responsibility for information dissemination would be placed with the Department of Commerce, as previously authorized by Congress in PL 776.

Primary future action of COSATI will relate to problems of scientific and technical information within the Executive Branch and problems of National and Federal planning for improved handling of scientific and technical information within the existing framework of Government and non-Government efforts, considering needs, scope and economic factors.

To this end, COSATI is preparing to undertake a project to contribute to the development of a national policy for handling scientific and technical information. A COSATI "blueprint," charting concepts and goals, is intended to facilitate cooperation and participation by Government and non-Government scientific and technical information groups.

As a related action, COSATI has formed a task group to analyze dissemination of scientific and technical information through journal literature.

Major steps toward a coordinated and integrated national scientific and technical information system cited by COSATI in its report include publication this fall of a directory of existing information sources by the Na-

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OCRD Shifts Merge 8 Units in 4 New Divisions

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division under the Director of Developments.

While the functional changes will involve some shifting of officers and civilian personnel, the actual manpower losses will be minimal. Five officer spaces and 10 civilian employee positions, including two higher level professional personnel, are abolished.

One of the officer spaces eliminated is that of assistant deputy in the Directorate of Plans and Programs. Proposed establishment of a second deputy to the Director of Developments was disapproved. The position of deputy chief in the Communications-Electronics Division is abolished.

The new organizational chart for the Office of the Chief of Research and Development retains a Deputy CRD, Maj Gen Austin W. Betts, and, as mentioned earlier, a Deputy CRD for International Programs, Brig Gen Ryder, to assist Lt Gen William W. Dick, Jr. Dr. Harold C. Weber continues as Chief Scientific Adviser.

Four directorates—Developments, Missiles and Space, Plans and Programs, and Army Research—actually show only Missiles and Space as new. Since the Atomic Office, the Chemical-Biological Office, the Space Office and the Anti-Ballistic Missile Office formerly were components of the Directorate of Special Weapons until it was redesignated the Directorate of Missiles and Space, the realignment is not as extensive as might at first appear.

Two offices formerly shown on the organizational chart at directorate level are now absorbed—the Special Warfare Office as a Division in the Directorate of Developments, as earlier stated, and the Research and the Review Analysis Office in the Directorate of Plans and Programs.

Col Allan G. Pixton carries on as Director of Developments, Brig Gen Raymond B. Marlin as Director of Plans and Programs, and Brig Gen Walter E. Lotz, Jr., as Director of Army Research.

THE ARMY SCIENTIFIC ADVISORY PANEL held its quarterly meeting at Headquarters, U.S. Army Materiel Command (AMC) in Washington, D.C., Oct. 15–16. Army Chief of Staff General Harold K. Johnson, the guest speaker, was apparently enjoying his role when caught by the cameraman. Dignitaries present included (l. to r.) General Frank S. Besson, Jr., CG of the AMC and host to the meeting; Assistant Secretary of the Army (R&D) Willis M. Hawkins; Dr. William Van Royen, vice chairman of the Panel; Dean Morrough P. O'Brien, chairman of ASAP; Chief of R&D Lt Gen William W. Dick, Jr.; Commanding General (Lt Gen) Dwight E. Beach, U.S. Army Combat Developments Command.

COSATI Issues STINFO Progress Report

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tional Referral Center for Science and Technology at the Library of Congress. This will complement services of the National Agricultural Library, the National Library of Medicine, and the National Bureau of Standards' Office of Standard Reference Data.

When fully operational, the Standard Reference Data System will help organize the expanding data-producing community effort to provide scientists and engineers with critically evaluated numerical data in the physical and engineering sciences.

Measures such as these not only will strengthen the Federal information system but will assist American industry to benefit from defense and space research.

COSATI, the report states, continues to work toward the adoption of measures to speed up and simplify the interagency processing of reports.

The Committee has sponsored agreements on a standard photographic form for document storage (including the internal and external dimensions of microfiche) and the adoption and publication of standards for the descriptive cataloging of technical reports. Industry has also accepted some of these standards. Both agreements are expected to be fully implemented by Federal agencies during the next year.

COSATI Ad Hoc groups are working on technical vocabulary compatibility; research and development in information science; initial distribution of Executive Agency R&D reports; the concept of a single Government depository library system; the conspicuity of scientific and technical information; and descriptive cataloging standards.

Federal agencies involved in scientific and technical information which reported to COSATI on their progress during the past 15 months are:

ATOMIC ENERGY COMMISSION —Intensified efforts were made to mechanize technical information handling techniques. A number of studies were undertaken to evaluate contractor and depository libraries, as well as the feasibility of establishing additional specialized nuclear science information centers.

DEPARTMENT OF AGRICULTURE—Each agency designated a science information coordinator to work under the director of the Library, and a clearinghouse was established at the National Agricultural Library. Translation services have been increased significantly. A Pesticide Information Center is being established. Information concerning 341 USDA information resources was transmitted to the National Referral Center for Science and Technology. Data on USDA, USDA-State and State-supported research projects have been transmitted to the Science Information Exchange of the Smithsonian Institute.

DEPARTMENT OF COMMERCE —The Office of Technical Services (OTS) also identified as the Technical Documentation Center (TDC) has been redesignated the Clearinghouse for Federal Scientific and Technical Information, which has assumed the unclassified-unlimited document processing and request workload of the Department of Defense.

Plans call for doubling the workload and staff of the Clearinghouse during FY 1965. Plans have been initiated to publish a Federal (Government-wide) Index, which will represent a listing of all scientific and technical reports prepared by and for Government agencies.

Agreement has been reached with the Science Information Exchange and the National Referral Center on cooperative arrangements for clearinghouse services in areas of current research projects and referral to sources of information of the industrial and technical community.

DEPARTMENT OF DEFENSE —The Defense Documentation Center (DDC) was substantially reorganized and a new computer facility installed. A study of the information-gathering techniques of DoD's research and development personnel was undertaken and results are expected to be available before the end of this year.

Formal instructions have been issued for uniform practices in setting up and operating specialized information centers, with 22 existing centers designated as components of the new system of centers and more under consideration.

During the past year, the Army made an extensive study of chemical information network systems, the Navy developed computer-aided document retrieval procedures for local units and the Air Force planned extensive orientation and specialized training courses in handling technical information, all in coordination with the DDC.

DEPARTMENT OF H.E.W.—Considerable effort in the Department of Health, Education and Welfare is being devoted to the development of plans for a Drug Information Clearinghouse and System to overcome gaps, overlaps and inadequacies in the handling and exchange of information about drugs.

All Public Health Service hospitals and clinics are reporting adverse drug reaction, and the Food and Drug Administration is computerizing inspection reports. The Public Health Service was designated agent for air pollution information by the Office of Science and Technology.

DEPARTMENT OF INTERIOR—A thesaurus of descriptors for indexing and retrieving literature on water resources development has been completed and placed in wide use. Increased use of selective dissemination systems has been initiated, especially in the Bureau of Reclamation and the Bureau of Sport Fisheries and Wildlife.

DEPARTMENT OF STATE—The Agency for International Development appointed a science information staff to survey the state-of-the-art of science information management. The Foreign Area Research Coordination Group (FAR) was established to ensure efficient, cooperative use of governmental, private, social and behavioral sciences research on foreign areas.

FEDERAL AVIATION AGENCY

6 Generals Attend Briefing On Target Indicator Radar

Six top-ranking U.S. Army generals attended a recent briefing on the concept of Repetitive Area Search utilizing the Project Michigan-developed Long-Range Moving Target Indicating Surveillance Radar.

Following the orientation at the University of Michigan's Willow Run facility, action was initiated for further testing of the Search Concept in forthcoming field maneuvers.

Attending the briefing were: General Frank S. Besson, CG, Army Materiel Command; Lt Gen William W. Dick, Jr., Chief of Research and Development; Lt Gen Dwight E. Beach, CG, Combat Developments Command; Lt Gen Ben Harrell, Assistant Chief of Staff for Force Development; Maj Gen F. W. Moorman, CG, Electronics Command; and Brig Gen Charles J. Denholm, Deputy Assistant Chief of Staff for Intelligence.

Assistant Secretary of the Army (R&D) Willis M. Hawkins, his new special assistant, Howard P. Gates, and Brig Gen P. A. Feyereisen, Deputy CG for Plans and Programs, Electronics Command, were briefed subsequently on the overall target acquisition and surveillance research of Project Michigan by its director, Dr. R. L. Hess.

—The Federal Aviation Information Retrieval System (FAIRS) was established as a semi-automated system for indexing and searching scientific and technical information contained in research reports.

NASA—A Selective Dissemination of Information (SDI) program, using computer techniques to inform National Aeronautics and Space Administration scientists and engineers of new reports of specific interest in their work was developed. The NASA tape-index search program was extended to 19 NASA Centers and major contractors.

NATIONAL SCIENCE FOUNDATION—A management study of science information exchange was started to provide effective and efficient operation. The Office of Science Information Service was reorganized to improve its effectiveness in expanding research in science information techniques and to stimulate scientific societies and organizations to improve their information activities. An NSF-supported study by the American Psychological Association on the flow of research information among psychologists was completed.

NATIONAL REFERRAL CENTER—Major progress was reported by the NRC for Science and Technology in three areas: Compilation of the comprehensive inventory of scientific and technical information; first directory of information sources completed; an increase in referral service was registered and a user survey indicated over 75 percent of patrons were satisfied fully with service rendered.

SCIENCE INFORMATION EXCHANGE—Primary mission of SIE is to facilitate more effective planning, management and coordination of scientific research and development activities sponsored or supported by the U.S. Government agencies. Registration of research task reports rose rapidly and output processing and flow of information and data proceeded smoothly during FY 64.

Assigned to Information Post

Lt Col Raymond H. White has been assigned as chief of the Scientific Information Branch, U.S. Army Medical R&D Command, Washington, D.C. Previously, he served as commanding officer, 34th Medical Battalion in Wertheim, Germany, where he was also executive officer from 1961 to 1963.

A native of Fall River, Mass., Lt Col White enlisted in the U.S. Army Signal Corps in 1942. During World War II, he was a warrant officer with the 85th Division in North Africa and Italy.

Army Awards $309 Million Contract for Nike X

Continued development and testing of the Nike X missile defense system is the basis of a recent contract award of nearly a third of a billion dollars—the largest single contract in Army history.

The cost plus incentive fee contract to Western Electric Co. for $309,664,200 will cover work on the Nike X system from Oct. 1, 1964 to Sept. 30, 1965.

Being developed as a defense against intercontinental ballistic missiles and submarine-launched missiles, Nike X is the only antimissile missile system in advanced development in the Free World and has Department of Defense top priority.

The contract will also cover testing of the Nike X equipment at White Sands Missile Range, Kwajalein Island in the mid-Pacific and other smaller test sites, including Ascension Island in the mid-Atlantic.

The Nike X Project Office at Redstone (Ala.) Arsenal said the $309,664,200 will be divided among several thousand firms, located in nearly every state in the Union, which furnish goods and services for the Nike X development program. Bell Telephone Laboratories is responsible for the design and development of the system, with work centered at Whippany, N.J., and test sites at White Sands and Kwajalein.

The contract does not include funds for production of the system. Nike X includes a multi-function array radar (MAR), the first of its kind ever built, and the Sprint interceptor missile which will have a higher acceleration than any guided missile yet flown. The contract will be administered by the Nike X Project Office. Col. I. O. Drewry is the Project Manager.

The first test version of the MAR is now being operated at White Sands (N. Mex.) Missile Range for testing purposes. Sprint components are being tested at contractor's plants.

The principal Nike X subcontractors and their locations are: Avco Corp., Everett, Mass., discrimination techniques and studies; Douglas Aircraft Co., Santa Monica, Calif., Zeus missile equipment and engineering services; General Electric, Syracuse, N. Y., radar techniques and signal processing equipment; and Martin Co., Orlando, Fla., Sprint missile engineering and services.

Others are: Raytheon Co., Wayland, Mass., Missile Site Radar and Multi-function Array Radar development services; and Remington Rand Univac Division, St. Paul, Minn., data processing equipment.

LATIN-AMERICAN RESEARCH ACTIVITIES conducted through the U.S. Army Element of the Defense Research Office, U.S. Regional Science Office for Latin America, are increasing as the capabilities of scientists submitting research proposals for support through grants are reliably determined. For the first time since the office was opened in August 1962, two grants were issued simultaneously this past month. Shown (left to right) are Dr. Gerhard Jacob, the American Consul Thomas J. Duffield, Dr. Fernando Zawislak and David H. Barnhart, cultural aide of the U.S. Consulate in Porto Alegre. Dr. Jacob's research is on "Applications of Methods Common to Elementary Particle Physics and Many-Body Problems." Dr. Zawislak is working on "Application of Gamma-Gamma Angular Correlation to the Study of Interactions Between Nuclei and the Environment in which They are Embedded."

ILIR Program Achievements Gain FY 1965 Funding of $11.2 Million

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ment of Materiel, Management of U.S. Army R&D Laboratories or Activities."

The major objective of the ILIR Program is, "To promote a vigorous internal research program of the highest technical caliber"—that is, to provide individual Army scientists and engineers an additional opportunity to maintain and increase their competence by doing original work in areas suited to research talents.

In discussing the ILIR activities at the recent annual Commanders and Technical Directors Conference at the U.S. Army Natick (Mass.) Laboratories, Deputy Assistant Secretary of the Army (R&D) Charles L. Poor explained the origin of the Program by saying:

"In response to the findings and recommendations of the Bell Committee, Department of Defense Task Force 97, and other study groups, President Kennedy directed that Government in-house R&D activities be strengthened. As you know, this represented a significant change in policy from that of previous Administrations.

"In the Army, we felt that our efforts to strengthen laboratories should be directed toward improvement in quality rather than increasing the number or size of our laboratories and other R&D activities. Included in the recommendations of DoD Task Force 97 was one to establish a Laboratory Technical Directors' Fund for independent research.

"Because of the management levels, numerous funding sources, commodity orientation of some organizations, etc., it appeared to the Director of Defense Research and Engineering that there might be a tendency for some laboratories to become nothing but 'job-shops.'

"One of the objectives in establishing the Laboratory Technical Directors' Fund was to provide a source of funds which he can use to counter the 'job-shop' operations in maintaining a balanced R&D program in the scientific and engineering areas of concern to his laboratory.

". . . Previously he had no source of funds for his laboratory that were not subject to justification, review and approval by other organizations or individuals who were only concerned with parts of his program."

Emphasis in the ILIR Program is on "new and challenging tasks."

A further stated objective of the program is: "To promote the effective utilization of available resources and to foster an awareness of management policies and principles necessary for the proper utilization of these resources in accomplishing the research and development mission."

Under the guidance of the Chief of Research and Development, the commanding general of the U.S. Army Materiel Command, The Surgeon General and the Chief of Engineers have the responsibility of implementing research, development, testing and evaluation policies pertinent to the ILIR Program.

Directors of Army in-house laboratories are given wide latitude in deciding the nature of independent research efforts that will best serve the mission objectives of their respective laboratories.

The Assistant Secretary of the Army (R&D) appoints a committee after July 1 each year to review utilization of the Laboratory Technical Directors' Fund during the previous fiscal year, and to make recommendations for its use during the current year. The funding process is unique in that technical directors justify their decisions after, rather than before, they are made.

SUMMARY OF FY 1964 RESULTS. ILIR Program reports for FY 1964 activities reflect very broad range and diversity of effort.

Independent research sub-tasks in Army in-house laboratories totaled 411 in FY 1964, involving many hundreds of scientists and engineers. Even a highly condensed report of this overall effort, excluding those tasks of a classified nature, would require the greater portion of space available in a single issue of the *Army R&D Newsmagazine.*

Many of the results, though directed primarily toward Army objectives in the development of new or improvement of existing military materiel and supplies, or the advancement of techniques in medical treatment, have broad potential application to civilian community needs.

For example, the Army Chemical R&D Laboratories at Edgewood Arsenal, Md., in response to a request for the three tasks considered most significant in the FY 1964 ILIR Program, listed as No. 1 the research in cooperation with the National Institutes of Health to determine the susceptibility of man to selected respiratory diseases.

Second on the CRDL list were studies to determine the influence of spontaneous diseases in laboratory animals exposed to experimentally induced infections. Isolation and characterization of toxins, directed toward better toxoids and improvement therapy for paralytic poisons, was No. 3 on the list. The latter studies were made in conjunction with the National Institutes of Health and the U.S. Public Health Service.

A single paragraph from the CRDL report serves to point up the potential of just one of the 411 sub-tasks in the ILIR Program, as follows:

"Investigations were initiated to determine the potential of insect tissue cell substrates for the propagation of selected viral and rickettsial agents. The following achievements have been attained to date: (1) Surface sterilization of mosquito eggs, (2) limited growth of mosquito larvae in sterile media, (3) formulation of several insect tissue culture media (currently being evaluated), and (4) development of procedures for surface sterilization, immobilization, bleeding and dissection of wax moth larvae. Successful establishment of arthropod tissue cultures for the propagation of viruses and rickettsiae should constitute a broad basic technological contribution to the worldwide study of viral and rickettsial diseases."

The Army Missile Command reported that ILIR projects in two areas, solid-state physics and material sciences, "achieved substantial results and made tangible contributions to the R&D mission of this Command." Studies were made of the interaction of coherent electromagnetic energy in the optical spectrum with crystalline materials and with gases "to acquire a better understand-

ARPA Appoints Dr. Huff Behavioral Sciences Head

The Department of Defense Advanced Research Projects Agency (ARPA) recently appointed Dr. Lee W. Huff as director of Behavioral Sciences.

The assignment makes him responsible for Project CARINA, a program of research in behavioral sciences, including human performance, language and communication, teaching, learning and motivation.

An ARPA member since 1959 and program manager of the ARPA field unit in Thailand since 1962, he also served as special assistant to the director, Plans and Policy Division.

ing of the processes which contribute to the inefficiencies in the solid Laser."

"Very successful" is the term applied by the Missile Command to the research in material sciences. The report states: "Composites for structural applications in rocket nozzles or other high-temperature, high-erosive applications have been formed and examined by X-ray and Balphot Metallograph. Composites containing metal powder and graphite clothe were formed and heat treated at temperatures ranging from 2500° F. to 4800° F.

"Composite forming of tantalum wire mesh and graphite clothe ranged between 4400° F. and 4700° F. X-ray data on the silicon metal composites indicate that conversion of the metal-to-silicon carbide has occurred. Further examination will be required to determine the crystalline structure and relate structure to sintering temperature. . . ."

The Missile Command also reported on results of research on refractory metal specimens for eventual application in a high-temperature environment, and on a "new technique which can be used to determine the areas of critical loading in a hemispherical structure which can be used as an alternate to current methods."

Frankford Arsenal in Philadelphia, Pa., reported that the most significant results on its ILIR Program were on tasks titled "An Investigation of Improved Computer Simulation Techniques for the Analytical Determination of the Interior Ballistics and Performance of Propellant Actuated Devices (PAD) and PAD Systems," and "New Fundamental Mechanism for Energy Conversion."

The report said the "overall progress is exceedingly gratifying . . . Continuation of this program is highly recommended." Studies programed for a digital computer included thrust coefficients, thruster performance, solid-propellant rocket motor, recoilless launcher, boundary layer control, Foelsch Nozzle Design, the egress program, and forced volume control.

The Frankford achievement on energy conversion is described as:

"A new fundamental mechanism . . . operates from a start or stalled condition as a positive displacement piston engine and operates on a continuous basis as a turbine. The total number of metal working components . . . is less than those in a positive displacement piston engine but slightly more than a turbine.

"In manufacturing, the new mechanism does not require the exacting machining of the turbine, and the envelope dimensions, weight, and manufacturing costs are less than either the turbine or the positive displacement engine. . . .

"Future efforts will center about the experimental testing of the device. With the aid of the computer, data obtained will be utilized to correlate the equations. During the experimental testing phase, a solid-propellant gas generator will replace the air accumulator."

U.S. Army Natick Laboratories highlights of the ILIR Program in FY 1964 are listed in the report as: "Synthesis of Organo-Sulfur Compounds for Use as Biodegradable Detergents." "Terrain Analysis as Related to Off-Road Vehicle Mobility." "Radiation Biodosimitry."

Regarding the research on biodegradable detergents, the report states:

"Two organo-sulfur compounds similar in molecular structure to conventional synthetic detergents but containing sulfur atoms at various locations in the functional side chain have been synthesized, tested and found to possess satisfactory detergency characteristics and exceptional ease of degradability by microorganisms. A patent application has been prepared.

"Because of contamination of water supplies by synthetic detergents, the problem of biodegradability is of much concern in the United States. In Germany, where large numbers of troops are stationed, the use of biodegradable detergents has been prescribed by law. A thoroughly satisfactory biodegradable detergent would be of value not only to the Army, but of even greater significance to the civilian economy."

Work of the Natick Laboratories on terrain analysis as related to off-road vehicle mobility includes development of a new technique for analyzing available world maps and aerial photographs in terms of frequency and occurrence of terrain obstacles as related to capabilities of various types of military vehicles. The report states:

"Knowledge of the frequency and occurrence of impassable obstacles would be of special interest to the tactical commander in deciding where he may expect his vehicles to go and where they will come to a grinding halt. Such knowledge should also be valuable to R&D personnel as design criteria for new military vehicles."

Results of ILIR Program activities at the Natick Laboratories on radiation biodosimetry, as reported in a technical paper presented at the 1964 Army Science Conference, won a Certificate of Outstanding Achievement. The abstract of the paper states:

". . . For certain biological systems, the measurable chemical, biological, or physical changes resulting from the radiation of selected test microorganisms appeared to offer a reliable means for measuring radiation dose.

"Because it releases easily measured phosphate, bakers' yeast has been studied as a biodosimeter species. This study has shown that the amount of phosphate released is a function of radiation dose. The range of the dosimeter is ca 400,000 to 1,400,000 rads. The range of the system can probably be extended by using more resistant microorganisms, especially bacterial spores.

"It was also found that certain compounds reported to be radioprotective for mammals inhibited radiation-induced release of phosphate

(*Continued on page 8*)

Missile Command Gets Shillelagh System Management

Management of the Army's Shillelagh weapon system has been transferred from the U.S. Army Weapons Command, Rock Island, Ill., to the Missile Command at Redstone Arsenal, Ala.

The recent move separates management of the missile system from the Sheridan/Shillelagh project to permit the potential application of the Shillelagh missile to other uses.

Capable of being mounted on a wide variety of vehicles, including helicopters, Shillelagh is a highly accurate direct-fire guided missile developed as the main armament for combat vehicles.

Coincidental with the move, Lt Col R. M. Pearce, a veteran R&D officer with more than 15 years in missiles, was named project manager.

Serving as liaison officer to the Missile Command for the Combat Development Command since November 1962, Col Pearce is now on his second tour of duty at Redstone Arsenal.

Since 1956, he was assigned to the Army Ballistic Missile Agency, attended the Command and General Staff College, served in the Office of the Chief of Research and Development, then joined the 42nd Artillery, Korea, in 1961.

A native of Louisville, Ky., he attended the University of Louisville before graduating from the U.S. Military Academy in 1944. He earned a master's degree in aeronautical engineering at New York University.

ILIR Program Achievements Gain FY 1965 Increase

(*Continued from page 7*)

from yeast; the nonprotective compounds used did not. The system may offer promise as a rapid screening procedure in the study of radioprotective substances."

White Sands (N. Mex.) Missile Range listed its three most important ILIR tasks as: "Effect of Pressure Variations on Oscillating Piezo Electric Crystals." "Attitude Measurement by Infrared Techniques." "The Effects of Band Limiting, Phase and Amplitude Distortions in FM Communications Systems."

The WSMR investigations on piezo electric crystals were directed toward determining a possible basic source of frequency instability, as related to the gas environment of the crystal plate. The report explains:

". . . Lowering this pressure by a factor of 10^8 should produce a measurable increase in frequency stability. . . . This project will demonstrate the extent to which frequency stability of crystal oscillators can be improved by reducing the residual gas content of the crystal envelope. It is felt that a reduction of the aging time requirement for crystal oscillator frequency standards may be accomplished through results of this study."

The WSMR task on attitude measurement by infrared techniques is an investigation of the use of black body radiation from an incoming missile to determine missile attitude. It is expected that successful conclusion of this study, which has yielded good results to date, will produce a method of attitude determination in situations where this determination "was previously impossible."

WSMR studies in the ILIR Program on the effects of band limiting, phase and amplitude distortions in FM communications systems are aimed at more successful operation of real-time instrumentation systems supporting modern missile test programs. Results, it is believed, "will permit the optimization of signal parameters to achieve significant improvement in the quality of FM data."

The Harry Diamond Laboratories in Washington, D.C., reported that the most significant results in the ILIR Program were achieved in "Propagation of Laser Beams in Air"; "Semiconductor Delay Line"; and "Thin-Film Devices."

The HDL report explains that, "Since the discovery of Lasers, their use has been suggested for a wide variety of military applications. Success in many of these applications depends on the Laser beam propagating in a straight line with little attenuation.

"However, when a Laser beam passes through the air, especially near the surface of the earth, air turbulence causes both deflection and attenuation. Furthermore, the attenuation is not uniform over any cross-section of the beam. Neither are the deflection and attenuation constant in time."

The studies included observations of atmospheric-optical perturbations in near-ground paths in a temperate, a desert and in an arctic environment. In an effort to determine optimum and unfavorable conditions for Laser beam propagation, the observed phenomena were studied and experiments were designed to test theories that were formulated.

HDL studies of a semiconductor delay line are concerned with devices proposed to take advantage of recent advances in information theory, as related to the fields of fuzing, communications, instrumentation, and control equipment. HDL is "especially interested in microminiature delay lines for use at microwave frequencies." The goal is a class of devices, made of homogenous base materials, operating at GHz with microsecond delays. The report explains:

"The HDL concentrated primarily upon studies of the nature of the conductivity in vacuum-deposited semiconducting cadmium sulfide (CdS) films, the structure of such films, and the behavior of CdS-metal film interfaces. These studies showed that the films are polycrystalline, highly oriented, with a particle size several hundred A.

"This work also indicated that the initial high conductivity of CdS films deposited at room temperature is due to excess Cd in the films, and that the characteristics decrease in conductivity upon heat treatment results from diffusion of the excess Cd to the film surfaces, from which it evaporates. . . .

"Additional work related to the goal of achieving vacuum-deposited thin-film microcircuits involved the development of: (1) high resistivity Bi-Sb alloy films for use as high-resistance elements; (2) test procedures for measuring quantitatively the adhesion between vacuum-deposited films and their substrates; and (3) a rapid-cycling ultra-high-vacuum system to permit operation at pressure sufficiently low ($<10^{-9}$ torr) to prevent film contamination from the residual atmosphere. Each of these is being continued."

The U.S. Army Electronics Command report on ILIR activities at the headquarters laboratories at Fort Monmouth, N.J., the Electronic Proving Ground at Fort Huachuca, and the electronics research at White Sands (N. Mex.) Missile Range listed 68 sub-tasks. Results selected as the most significant at Fort Monmouth are "Research in Atmosphere Electricity" and "Global D-Layer and VLF Propagation Research."

The project on atmospheric electricity was centered on "relationships between the electric and meteorological life history of thunderstorms by the use of novel approaches of artificial modification of thunderstorm electricity. Since the electric field is used for proximity fuses, and since it is responsible for lighting strokes, the importance of its modification for the Army mission is obvious."

Field experiments in the Flagstaff, Ariz., area in July and August 1964 utilized an aircraft, two ground stations and an M–33 tracking radar to record the lightning history of a storm. Repeated passes of the aircraft under the cloud-base of the storm established the pattern of the electric field. Metallized nylon chaff (fibers about three inches long) was disseminated into the areas of highest field strength, while the passes back and forth under the cloud-base were continued. The report states:

"In three out of five well-documented tests the field decreased after seeding and in one of them strong corona discharge on the chaff particles caused excessive noise on the tracking radar.

"It appears that these experiments highlight the beginning of a new chapter in atmospheric electric research: the chapter of lightning prevention. They would crown a development that began in the United States of America 210 years ago with the invention of the lightning rod by Benjamin Franklin. The experiments constitute an encouraging beginning; they will be continued."

Electronics Laboratory ILIR Program investigations at Fort Monmouth on the global D-layer and VLF propagation are seeking new knowledge to solve military problems of global navigation and distribution of standard frequency and time to communication centers, missile ranges, and satellite tracking stations; emergency communication; monitoring of high-altitude nuclear tests; and geophysical research.

The objective of this research is explained in the report as "coordinated worldwide study of D-layer behavior and FLF propagation characteristics, with particular emphasis on

economy and concentration on hitherto neglected geographic areas, e.g., entire Southern Hemisphere, Central and East Asia, West Pacific, and polar regions."

The study comprises statistics of seasonal, diurnal and regional D-layer variations; correlation between VLF phase and amplitude anomalies and natural or artificial ionospheric disturbances; interference dispersion, nonreciprocity, and group conductivity effects; propagations through storms, ice, and underground layers; and whistler propagation.

Watervliet (N.Y.) Arsenal's Benet Research and Engineering Laboratories listed the three ILIR projects which accomplished the most outstanding results as: "Dispersion Strengthening Mechanisms"; "Effects of Pressure on Structure and Deformation in Solids"; and "Effects of Stress Aging Treatment on Standard Tensile Properties." The report states:

". . . For many years investigators have been attempting to study and establish the dispersion strengthening mechanism for such materials [for example, such as strengthing a single crystal of gold using an electrodeposition process]. Up until relatively recently the only means of obtaining such materials was through powder metallurgy internal oxidation methods.

"For composite materials obtained in such a fashion, it has been almost impossible to acquire a thin enough slice to make feasible the utilization of transmission electron microscopy methods.

"Through the electrodeposition means of obtaining dispersion-strengthened materials developed at this installation, it is a simple process to acquire specimens thin enough to permit electron transmission observation of dislocation motion and behavior. Thus dislocation pileup in the vicinity of the strengthening particle can be quite readily observed.

"In particular, since single crystals have been obtained with the dispersion hardening particles imbedded therein, it is possible to observe the strengthening mechanism without the effects of grain boundaries and/or a polycrystalline structure influencing the strengthening mechanism.

"Only preliminary observations have been made, but no real difficulty is anticipated in establishing quantitatively the dispersion strengthening effects."

ILIR studies at Watervliet Arsenal on effects of pressure on structure deformation in solids have produced results termed in the report "a significant advance in the state-of-the-art knowledge." The report explains:

"The fact that several metals, mainly zinc and bismuth, exhibit a marked transition in ductility as a function of pressure is extremely significant, particularly with reference to potential application to extrusion methods. It appears that other metals, such as tungsten and 1045 steel, exhibit this pressure-deformation dependency and, consequently, extrusion-forming conducted at high pressure may be entirely feasible without introducing surface cracking and fracture as a consequence of the extrusion process.

"The mechanism or mechanisms which operate to enhance ductility are not understood but are being investigated. If these mechanisms can be isolated and determined, there exists the distinct possibility that gross-deformation processes may be developed for utilization with metals which normally cannot be formed in any other way, or a process may be established wherein the presence of a high hydrostatic pressure will not be a prerequisite."

The Benet R&E Laboratories' report on effects of stress aging treatment on standard tensile properties deals with an extension of earlier studies on precipitation hardening of various types of steels used in gun barrels and other weapons. The report states that the ILIR studies "have resulted in the acquisition of extremely significant information relative to material property improvements that can be achieved through utilization of this process.

"It is of the utmost importance to note that appreciable improvements in the yield strength can be obtained for these materials without any real loss in ductility. Hence, in terms of practical application, the same material can be utilized for situations where higher working stresses must be tolerated while still enjoying the advantages of using a relatively ductile material.

"Again in terms of practicality, it appears reasonable to consider applications of this type of treatment to thin-walled types, with paraticular reference to recoilless rifles or mortars. Such a process might simply consist of pressurizing the thin-walled type in the presence of a temperature field, thus inducing the required stress field through the application of pressure and, consequently, 'stress aging' the tube in its nearly finished configuration."

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First Theodolites Produced in U.S. by AMC Contract

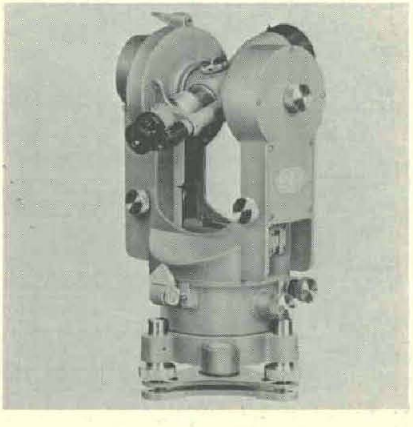
Military theodolites, high order surveying instruments which possess features not found in the ordinary transit, are being manufactured in quantity in the United States for the first time.

The U.S. Army Engineer Laboratories (USAERDL) at Fort Belvoir, Va., report that production of 480 theodolites is being carried on by Brunson Instrument Co., Kansas City, Mo., under a half-million dollar contract with the U.S. Army Materiel Command (AMC).

The 0.2 Mil and 1-minute theodolites, developed under research and development programs by the U.S. Army Engineer, Geodesy, Intelligence and Mapping Research and Development Agency at Fort Belvoir, are produced for quantity procurement in accordance with specifications engineered and prepared by USAERDL, an AMC element.

Revision and upgrading of specifications used in quantity procurement of Engineer equipment is aimed at making the specifications sufficiently flexible to promote multiple bidding and, thus, to reduce unit cost. This work, conducted by USAERDL in close cooperation with industry, has encouraged American firms to produce other items of supply formerly obtained abroad.

Difficulties were encountered in the first quantity production of an instrument as delicate as a theodolite, but were overcome with the assistance of industrial experts. Based on plans for tests engineered by the Laboratories, preproduction models of both the 0.2-Mil and 1-minute models were run through a cycle of 27 tests and examined for a possible 425 defects before production was initiated. The units will be tested this winter under field conditions.



MILITARY THEODOLITE manufactured for first time in the U.S.

Col George Sammet, Jr.

Col Paul Gray, Jr.

Lt Col R. W. Samuel

Lt Col R. J. Miller

OCRD Personnel Changes Hold High Rate

Personnel assignments to the Office of the Chief of Research and Development (OCRD) in recent weeks continued at the normally heavy summer turnover rate.

The new deputy director of Special Weapons is COL GEORGE SAMMET, JR. Assigned to OCRD as a staff officer from July 1959 to August 1962, he served in the International Division, Programs and Budget Office, and finished as assistant chief of the Combat Materiel Division.

For a year before his present assignment, Col Sammet was commander of the 4th Missile Command in Korea, following his graduation from the National War College. He holds a B.S. degree in agriculture from the University of Illinois (1940), an M.A. from George Washington University in international affairs (1964), and is a graduate of the Command and General Staff College and the Armed Forces Staff College. His decorations include the Bronze Star, Air Medal and Purple Heart.

COL PAUL GRAY, JR. is the new chief of the Air Defense Division. A 1941 U.S. Military Academy graduate, his 23-year Army career has been mainly as an Artillery officer, most recently as executive officer of the 52nd Artillery Brigade. From 1959-62 he was Artillery and surface-to-surface missile adviser to the Federal Republic of Germany Ministry of Defense.

Col Gray is a graduate of Arkansas State College (1937) and George Washington University (M.A., international affairs, 1963), the Command and General Staff College, Armed Forces Staff College, and the Army War College. He holds the Bronze Star and Army Commendation Medals.

LT COL ROBERT M. HALL, who was an Infantry battalion commanding officer in Germany for the past year, has been assigned as action officer, Combat Arms Branch, Combat Materiel Division.

Previous assignments have included over three years as an instructor at the Command and General Staff College and Infantry weapons project officer at Fort Benning, Ga.

A 1945 graduate of the U.S. Military Academy, he received an M.S. degree in electrical engineering from the University of Pennsylvania in 1950 and has graduated from the Command and General Staff College and the Advanced Infantry Course, Fort Benning.

His service during the Korean War earned him the Bronze Star, Colombian Medal of Merit and Combat Infantry Badge.

LT COL ROBERT W. SAMUEL is the new chief, Chemistry and Materials Branch, Physical Sciences Division, U.S. Army Research Office. Recently he completed a year in Viet Nam as executive officer, Advanced Research Projects Agency R&D Field Unit. For two years prior he was deputy director for engineering testing, Development and Proof Services, Aberdeen Proving Ground, Md.

He is a graduate of the U.S. Military Academy (1944), the University of Michigan with an M.S. in mechanical engineering (1957) and the command and General Staff College (1961). His decorations include the Silver Star, Legion of Merit with Oak Leaf Cluster, Bronze Star and Distinguished Unit Citation.

LT COL RALPH T. TIERNO, JR., was assigned recently by OCRD to the Operations Research Advisory Group at Research Analysis Corp. after nearly 20 years experience as an instructor, intelligence officer and technical operations officer.

He holds a B.S. degree from the U.S. Military Academy (1945) an M.S. in electrical engineering from Oklahoma University (1959), and is a graduate of the Command and General Staff College. His decorations include the Bronze Star, Purple Heart, Commendation Ribbon and Combat Infantryman Badge.

LT COL WILLIAM A. WALKER, JR., who just finished a 1-year tour as a battalion commander in Korea, is a new staff officer in the Atomic Office, OCRD.

From 1959-63 he was a project officer with the U.S. Army Combat Developments Command group at Fort Bliss, Tex., and he also was a test officer with the Los Alamos Scientific Laboratory, Los Alamos, N. Mex. (1950-53).

He holds a B.S. degree from the U.S. Military Academy (1945), an M.S. in physics from the University of Virginia, and is a graduate of the Command and General Staff College.

LT COL LOUIS F. FELDER reported as assistant executive for International Programs after a year in Viet Nam as assistant deputy chief, Army Section, Military Assistance Advisory Group and deputy senior adviser, Viet Namese Airborne Brigade.

He previously had served as an R&D Coordinator in OCRD and in various staff and command assignments in Infantry, the Office of the Chief of Staff, Department of the Army, and Allied Land Forces Central Europe.

Col Felder received a B.S. degree in military science from the University of Maryland after attending the University of Wisconsin and City College of New York, and in 1963 earned an M.B.A. degree from George Washington University. His military schooling has included the Command and General Staff College, Armed Forces Staff College and the Industrial College of the Armed Forces. He has won the Bronze Star and Army Commendation Medal.

LT COL DONALD B. MILLAR reported recently to the OCRD Mid-Range Plans Branch, Plans Division, as a staff officer after a year as executive officer with the 25th Infantry Division and a tour as chief of the

Air Defense Division with the U.S. Army in Hawaii.

Previous assignments have included Army Test Director for Phase II of the Sage Missile Master and member of the negotiating team with the Military Armistice Commission in Korea (1956-57). He has attended the University of Maryland, Texas Western University, the University of Hawaii and is a graduate of the Command and General Staff College. His decorations include the Soldier's and Army Commendation Medals.

LT COL MARTIN O. F. SCHROEDER, a native of Iowa, has been assigned to the Environmental Sciences Division, U.S. Army Research Office. Previous assignments have been with various Signal Corps elements in Europe and the U.S.

Initially a Naval officer, Col Schroeder has also worked as an airways forecaster with the U.S. Weather Bureau at LaGuardia Field, New York City. He has a B.S. in chemistry and math from Wagner College, New York City, and an M.S. in meteorology from New York University. He is a graduate of the Navy Language School and the Command and General Staff College. Decorations include the Army Commendation Ribbon and the National Defense Service Medal.

LT COL J. CRAWFORD CATON, a graduate of the Command and General Staff College and Army War College, has been assigned to the Programs Branch, Programs and Budget Division. Previous assignments have been deputy commander, 1st Brigade, 7th Infantry Division; project officer and secretary, Review Board, U.S. Army Combat Developments Experimentation Center; and assistant Army attache to the U.S. Embassy in India.

Graduated with a B.S. degree in textile engineering from North Carolina State College, he has an M.A. in international affairs from George Washington University.

LT COL WALTER BEINKE reported as a staff officer with the Combat Arms Branch, Combat Materiel Division. A 1948 graduate of the U.S. Military Academy and 1960 graduate of the Command and General Staff College, he has experience in guided missiles and served as assistant G-3, 25th Infantry Division, and battalion commander of the 3rd Bn, 13th Artillery, 25th Infantry Division. He holds the Bronze Star Medal with Oak Leaf Cluster and the Army Commendation Medal.

LT COL WILLIAM O. PERRY, JR., who served as chief of the Combat Arms Branch of OCRD in 1961-62, has returned to an OCRD assignment as military adviser to the Research Analysis Corp.

A 1945 graduate of the U.S. Military Academy, he has completed courses at the Armed Forces Staff College and the Air Command and Staff College. He served overseas in various battalion and tactical officer assignments, and from 1962 until his present assignment was assistant executive to the Assistant Secretary of the Army for Research and Development.

LT COL RICHARD L. CLARKSON reported to the Mid-Range Plans Branch, Plans Division, OCRD, after completing a year as battalion and defense commander for the Nike Hercules Bn, Turner Air Force Base, Ga. For three years previous he was the assistant U.S. military attache in Turkey.

Other tours were as a battalion commander in Korea and at White Sands Missile Range, N. Mex. A 1941 graduate of Wesleyan University, Middletown, Conn., he has completed the Command and General Staff College, the Strategic Intelligence School and the U.S. Army Language School. His Korean service earned him the Bronze Star Medal.

LT COL JOHN E. KUFFNER, assigned to the Atomic Office, recently completed a year with the Eighth U.S. Army in Korea following four years as a staff officer for weapons production with the U.S. Army Electronics Command. Earlier he was a nuclear weapons technical staff officer with the U.S. Army Europe and commandant of the Seventh Army Weapons Assembly School in Germany.

He is a graduate of the U.S. Military Academy (1943), the Command and General Staff College (1954), and holds the Army Commendation Ribbon with two Oak Leaf Clusters.

LT COL CHESTER R. SMITH, assigned to the Long Range Plans Branch, OCRD, holds a B.S. from the University of Alabama and M.A. and Ph.D. degrees from the University of Virginia. He is a Command and General Staff College graduate.

Previously he served two years as an Infantry adviser in the Military Advisory Group in Greece, staff officer with Continental Army Command headquarters, and operations officer in Korea.

LT COL RUSSELL J. MILLER, the new chief of the Standardization Branch, International Division, has served mainly as a battalion staff officer and commanding officer, in gunnery research and review, and in the Estimates Office of U.S. Army Europe.

A Command and General Staff College graduate, he holds a B.A. degree from the University of Utah and has received the Bronze Star, Purple Heart and Army Commendation Medal.

MAJ CHARLES H. SUNDER has been detailed temporarily to the Ad Hoc Working Group on Development Requirements Definition. Before his recent assignment to OCRD he was deputy terminal commander in Korea with the 2nd Transportation Terminal Command. Graduated in 1948 from the U.S. Military Academy, he holds an M.B.A. from American University and has completed the Command and General Staff College.

MAJ ALBERT B. SUTTLE, JR., was assigned recently to the Aircraft-Aerial Delivery Branch, Air Mobility Division, after serving as a project officer with the Advanced Research Projects Agency's R&D Field Unit in Viet Nam.

From 1962-63 he was an associate professor at the U.S. Military Academy, where he graduated in the Class of 1949. He also holds an M.S. degree from Massachusetts Institute of Technology and is a Command and General Staff College graduate.

Electronics Meeting Draws Scientists From 7 Nations

Seven nations were represented by about 350 scientists at the Seventh Gaseous Electronics Conference in Atlantic City, N.J., Oct. 14–16.

The conference was sponsored by the U.S. Army Electronics Command Laboratories, Fort Monmouth, N.J., with assistance from the U.S. Army Research Office, Durham, N.C.

Chaired by Sol Schneider of the Fort Monmouth Laboratories, the program consisted of 88 papers covering ionization, excitation, striations, electron scattering, compound states in atoms, ion-molecular reactions, breakdown, recombination, afterglow, and brush discharges.

Conference banquet speaker Professor William P. Allis of the Massachusetts Institute of Technology discussed "A Scientist in NATO." He recently served two years as Secretary General for Scientific Affairs, North Atlantic Treaty Organization (NATO) in Paris, France.

Invited papers were presented by T. M. Donahue, University of Pittsburgh, on Radiation Transport and Gaseous Electronics Processes in the Upper Atmosphere; R. E. Meyercott, Lockheed Missile and Space Co., Contribution of the Program of Auroral Measurements to the Physics of the Upper Atmosphere; and K. B. Persson, U.S. National Bureau of Standards, The Brush Cathode.

ASA (R&D) Hawkins Reviews Next 50 Years in Aviation

(*Continued from page 2*)

Even a GNP increase of four percent (some economists foresee a six percent rate of increase) could lead to about 340,000 general aircraft by the year 2014, Mr. Hawkins calculates, that is, about 80,000 multi-engine aircraft and some 260,000 single engine, 4-place aircraft.

"It is obvious," Mr. Hawkins points out, "that no such increase in general aircraft will take place unless the industry offers the buying public more utility than can be bought today. It may be profitable, therefore, to conjecture on the change in character of present-day aircraft to make them attractive to such a large number of potential new owners.

"Let us look first at the multi-engine general aviation picture which is primarily a corporate picture. A very healthy industry has grown in this area, based on evolutionary designs that are generally scaled-down versions of long-range transports. We can point readily to the highly developed bi-motors with reciprocating engines, and I am certain that present experiments and production models with turbine propellers will find reasonable acceptance.

"Finally, the market for small pure-jet general aircraft will undoubtedly increase in future years. This type of evolutionary development will fall short, I am certain, of producing characteristics that will permit a population of 80,000 business aircraft within the next 50 years.

"What then is needed? I suggest that the following characteristics are reasonably obvious and should form the basis for future development.

- *Quiet* vertical takeoff and landing capabilities.
- Multi-engine safety in the takeoff and landing maneuver.
- Precision landing and takeoff aides for minimum visibility operation in a multiplicity of areas — primarily roof tops in cities and industrial areas.

"It is probable that the executive market can, indeed, borrow from a larger market the developments which will produce these characteristics; however, this borrowing is dependent upon the development of similar characteristics for an entirely new commercial market. This will be suggested later.

"Probably more challenging than the executive field is the field of private owner aircraft, which generally cannot rely on any parallel field for its development. Furthermore, expansion up to 260,000 registered aircraft cannot possibly take place if private aircraft utility does not increase in a major way.

Therefore, we should look closely at the following performance specifications to determine whether or not it will be technically possible to produce an airplane to attract such a market.

1. In parallel with the executive transport, it is necessary to have *quiet* VTOL [vertical takeoff and landing] characteristics.
2. Multi-engine safety for takeoff and landing will be essential.
3. Simplicity of flight and navigation must be improved.
4. A universal system that provides for en route emergencies and traffic control must be developed.

"This is a larger order; however, an increase of between $8,000 and $19,000 of GNP per wage earner per year and an increase by 50 days per year in the wage earner's available free time will certainly produce a market if a reasonably priced transportation package can be produced. Several suggestions are worthy of detailed study:

- If quiet VTOL can, indeed, be obtained with multi-engine safety for takeoff and landing, roof-top centers should be acceptable to most commuters and it would appear that some type of community concentration is not only desirable but necessary for the use of such a product.
- It is my personal opinion that an all-weather navigational system which attempts to guide a man directly to his home with an aerial vehicle is much too complicated to consider. We will, therefore, have to assume that he keeps his airplane in a community center garage where facilities for landing and takeoff, particularly the navigation, are available. This facility . . . may also provide the community a central station for commuting.
- The United States and all of its cities are crisscrossed by telephone wires or power systems. If these wires could carry a coded signal and the private airplane could have a 'wire follower,' perhaps a partially-made navigation system is now in existence.

"If this technical order sounds difficult, industry should be spurred by the fact that producing these vehicles alone represents a potential gross income of over $5 billion annually for someone."

SHORT-RANGE AVIATION. In his forecast, Secretary Hawkins describes short-range transport aircraft as those traveling between cities with trip distances up to 300 miles. He points out that this type of business currently constitutes about 9.3 percent of the total commercial traffic in the United States.

The critical problem to be solved if short-range transportation of pas-

Gen Jacobs Becomes Deputy Chief of C-E

Brig Gen Lawrence P. Jacobs became deputy chief of Communications-Electronics, Department of the Army, effective Oct. 15, following two years of duty as Signal Officer, U.S. Army Pacific.

Col Donald R. Bodine, who had served as deputy chief of Communications-Electronics since Mar. 1, 1964, is now assigned as chief, Plans, Policies and Programs Office, Office of the Chief of Communications-Electronics.

General Jacobs has served 23 years in Signal Corps assignments. Since 1952 his successive assignments have been: deputy president, Signal Board, Fort Monmouth, N.J.; Deputy Signal Officer, then Signal Officer, Eighth U.S. Army, Korea; chief, Plans, Programs and Operations Division, Office of the Chief Signal Officer.

A graduate of the Georgia Institute of Technology (1935), he has completed courses at the Command and General Staff College (equivalent, 1947), Armed Forces Staff College (1953), National War College (1957), Command Management School, Fort Belvoir, Va. (1955), and the Advanced Management Program of the Harvard Business School (1960).

His decorations include the Legion of Merit with Oak Leaf Cluster and the Army Commendation Medal.

Brig Gen L. P. Jacobs

sengers by air is to be significantly increased, in Mr. Hawkins' opinion, is that of substantially reducing the time needed to get to and from an airport, and in clearing aircraft for takeoff and landing. In many instances, the total travel time requirement, including flight, is about the same as for travel by rail or car.

An aircraft designed to improve service to the short-haul transportation market might, if done well enough, Mr. Hawkins contends, attract an entirely different category of passengers, the commuters—millions now, and increasing substantially within 50 years. Regarding this market, he states:

". . . A good commuter aircraft system, which would permit the commuter to live over 100 miles from work, opens up many possible living areas that might easily cause a wage earner to spend a substantially greater portion of his wages and time on his transportation to work. Since the cost of this long-range commuting is only a little more than a very short-range 'chauffeur' drive, it is possible that the first air commuter service could be a cooperative executive charter from a remote 'country club' community."

Assuming that by the year 2014 the average commuting distance per worker will have increased to eight miles (double that at present), Mr. Hawkins cites that 805 billion passenger miles a year will be traveled going to and from the wage earner's place of business.

"Certainly this is a pool of business that the aircraft industry must not ignore," he comments. Even one percent of the business, he states, might mean $2 billion worth of business in producing the transport vehicles, and, on the basis of five cents per passenger mile, it is $400,000,000 worth of business per year.

In conjecturing on the future of short-range domestic travel-by-air growth, Mr. Hawkins estimates that an increase of four percent a year (based on 8.4 billion actual passenger miles on trips under 700 miles in 1961) would produce 67.4 billion revenue miles in year 2014. That would require an estimated 1,100 airplanes, costing $3.3 billion to manufacture, and yielding revenue of $3.37 billion a year at five cents a passenger mile.

LONG-RANGE DOMESTIC TRAVEL. In considering the growth potential in this area, Mr. Hawkins uses an estimated 1964 base of 30 billion revenue passenger miles on trips of over 700 miles. An increase of two percent a year (only half of that for the short-haul market because of the current advanced state of development in long-range transport) would produce by 2014 a total of 90 billion revenue passenger miles. That would require 470 airplanes, manufactured at a cost of $4.2 billion ($9 million per airplane), and would produce $4.5 billion of business at five cents a passenger mile.

INTERNATIONAL TRAVEL. A greatly expanded market for the aviation industry in international travel (estimated at five percent increase a year) will result by year 2014, Mr. Hawkins envisions, because of 3-day weekends becoming standard, plus much longer vacation periods and the growth of "sabbatical" educational and cultural tours. He states:

"For those contemplating the future of the Supersonic Transport, it was decided to emphasize the year 2014 potential by estimating the number of supersonic transports required to fulfill this expanding market. . . . It should be remembered that the supersonic transport is a powerful producer, delivering 386 million revenue passenger miles per year at 60 percent load factor (100 percent equals 150 passengers), 2,000 miles per hour, and six hours per day utilization."

About 395 supersonic aircraft could meet international travel requirements in year 2014, as estimated by Mr. Hawkins, but he weighs also the merit of a 200-passenger aircraft that would travel 550 miles an hour and possibly compete successfully by offering a lower cost per mile to passengers.

SUBSONIC TRANSPORT. In respect to possibilities of lowering the cost per mile of international travel, the subsonic transport envisioned by Mr. Hawkins could have the same annual "production" capacity as a jet transport, in spite of

(*Continued on page 14*)

Missile Command Ion Microscope Shows Metal Atoms

An ion microscope newly acquired by the U.S. Army Missile Command's Directorate of Research and Development at Redstone Arsenal, Ala., will enable Army scientists to look at metal atoms for the first time.

Scientists of the Structures and Mechanics Laboratory, by looking at these basic blocks of matter, hope to find reasons why metals used in missiles behave as they do as a basis for discovering methods to change some of the characteristics into a more desirable channel.

Headed by James T. Davidson, the study group of physical metallurgists includes Julian Bynum and William McClane.

The ion microscope is priced at approximately one-sixth the cost of an electron microscope and is about four times more powerful. The electron microscope magnifies up to 300,000 diameters, while the ion microscope magnifies in excess of one million diameters.

Davidson said that one of the first projects for the new instrument will be a study of pure tungsten and molybdenum. When heated and cooled slowly, the metal is brittle. But when heated and cooled fast, it is ductile. The group hopes to find a means to retain the metal's hardness and eliminate the brittleness.

The first step will be to obtain special specimens of the metal to be studied. The specimen is a small wire with a point which must be perfectly round, but is too small to be seen except with an electron microscope.

The specimen is inserted in the microscope, inside a glass jar with the air removed and helium substituted. When a high voltage is applied between the specimen tip and a phosphor-coated screen, helium ions are formed at the tip and are accelerated radially from the tip to the screen. The bright and dark pattern created on the screen is the image of the atomic pattern on the tip surface.

Studies with the ion microscope are limited for technical reasons to metals that have a higher melting point than iron.

One theory which Davidson and his group hope to prove or disprove is the belief that atomic imperfections in metals tend to "pile up," which means that a weakness too small to be detected by present means will form a troublesome flaw later.

PHYSICAL METALLURGIST Julian Bynum adjusts vacuum hose on ion microscope that enables scientists at Redstone Arsenal to look at metal atoms for the first time.

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nearly 1,500 miles per hour cruise speed difference, by carrying 490 passengers as compared to the supersonic transport's 150. It would be smaller than the supersonic transport and would have approximately half the wing area.

The Semi-Ballistic Transport possibilities also have been considered by Mr. Hawkins for operational capability by year 2014. He states that in view of space progress in recent years, "it would be technically reactionary not to admit the possibility of ballistic passenger transports."

In this concept the ballistic transport might be launched "piggy back" or towed to altitude by a slower transport headed in approximately the same direction. Mr. Hawkins explains:

". . . The essence of this concept is the rather universally (from a scientific standpoint) available sleep machines. These devices can be contemplated as reliable sleep producers which only fail upon loss of power and can be counted on to permit full wakefulness on the cessation of power.

"To carry this idea further, the passenger arrives at the terminal, enters an attractive roomette, lies down with his baggage beside him, clamps his head set, and is immediately in sound sleep.

"The crew gathers his baggage, zips his full-length 'safety belt' (a head-to-toe nylon net restraining cover) and the passenger is 'stored' on board with a minimum space—oriented to take lead factors in the optimum way. He is awakened by power turn-off in a similar roomette at his destination, refreshed, with his baggage beside him and immediately available. He has remained totally unconscious of any noise, load factors, or minor discomforts."

AIR CARGO. Recent growth of the air cargo industry—an increase of 33 percent in the 1962 total as compared to the 1961 figure for the U.S. and a 40 percent gain in 1962 international air cargo over the 1961 total—supports optimism that the long-anticipated "explosion" in growth may be imminent, Mr. Hawkins states, adding:

". . . If we take 1962 as a base with its 1.6 billion revenue ton miles of international and domestic freight and express, and if we take a hypothetical 80,000 pound payload cargo transport operating at 60 percent load factor at 500 miles per hour with 10 hours per day utilization, only 38 airplanes would be required.

"This points up the fact that the business is not yet large enough to form a statistical base and it would be extremely dangerous even to conjecture on the expansion of the last few years. One thing can be done, however. We can take our recent experience as a sure base for optimism and look at the problems facing the cargo operator to see if ingenuity on the developer's part can prevent this market from being limited in the future.

- Low-cost operations imply large payloads. Railroads can couple cars together. Can aircraft loading be rapid enough to keep the airplane flying (maintain high utilization)?
- Rapid distribution must follow rapid transit. Can terminals and ground transport match a rapid expansion?
- With demands for rapid loading and unloading, can the tare weight on cargo be kept below present levels to maintain low cost per ton mile?
- Can air cargo hope to reach far into the ship and rail business without major storage facilities at the terminals? Aircraft cannot sit on sidings or tie up to piers and hope to compete.

"Of the various new ideas beginning to appear for air cargo traffic, the most attractive appears to be the close-to-surface traveling, low-aspect ratio, low-speed (200 m.p.h. per hour) transport. Some theorists predict L/D ratios approaching 40 if techniques can be developed for flying close enough to the surface to be measured in fractions of the wing chord. This is a large technical order when surface conditions force an average altitude of at least 50 feet, thus dictating chord lengths in the vicinity of 200 feet.

"This translated into useable designs implies payloads approaching a million pounds and airplane weights of nearly that much. It is obvious that the main problem for vehicles of this description has to do with creation of the first one. It would be convenient if there were an obvious trade route of high cargo potential that was entirely over water that never had wave heights over three feet. For that route one would consider a modest size prototype system. As of this writing no such route appears to exist."

MILITARY AIRCRAFT. Mr. Hawkins' views on the future of military aircraft are presented in toto because of their application to problems now under consideration by RDT&E personnel, as follows:

"Predicting the future of military aircraft during peacetime may depend in some way on the growing economy of a nation, but the dependence is not obvious since any estimate for the next 50 years of military spending, even if it were predictable, would not contain a logical, defined element called aviation.

"One trend is reasonably clear, however, and it may permit the military and civilian aviation expenditures to be more mutually helpful than they have been in the past. This trend is toward the use of aircraft more in the utility role than in the weapons role.

"Future military planning in times of peace—particularly the kind of unstable peace we are now experiencing, generally reverts to the contemplation of crisis areas and the planning for conflict in those areas. For the United States, this means in

SPRINGFIELD (Mass.) ARMORY Research and Engineering Division personnel hit the awards jackpot early last month when 13 were presented with checks for acceptances of applications for patent awards by Lt Col Vincent W. Rasper, deputy commander, Armory. Left to right (front row) are John Rocha, Charles Packard, Richard Colby, Herve Sedelow, Col Rasper, Giulio Savioli, Richard W. Livingston; (back row) Herve J. Ouellette, Frederick Reed, Charles Lanizzani, Cyril A. Moore, Paul Benoit, Stanley Silsby and Earle Harvey.

large part logistics planning.

"Even in a local area, the worth of the airplane as a logistics tool has begun to emerge since most of the actual or potential fields of conflict are in the undeveloped areas of the world where the only logistics or communications system that can be installed without large capital expenditures and long lead times is an aircraft system.

"Rather than attempt any predictions about future military aircraft or aviation, it might be profitable to list some problem areas that are inhibiting development. Here, as in the cargo aircraft area, any solution may spark rapid expansion — sometimes only in specialized areas—both other times in the entire field. Notable in this list is the absence of air frame problems—this is an historic pattern in the aircraft industry and one that is apparently continuing. The technical items limiting expansion are generally exterior to the air frame.

"*Navigation.* Military aircraft have always been limited in utility because of lack of valid maps—known landmarks and the fact that very few missions are repetitious. Navigational schemes of relatively short range to support reconnaissance and follow-on strikes, to support the use of aircraft as command centers, and to serve as "get-home" aids on missions of opportunity and in emergency are needed. We have ideas but all of them are expensive to buy and are not reliable with the maintenance that can be provided by a forward unit.

"*Communications & Traffic Control.* Military missions can profit very little from the very successful development of the civilian communication and traffic control system. The environment of military air is such that almost all such systems must be self-contained, or at least air transportable and immediately operational at deployment. As a result of having no large base on which to build, the solutions in this area have been cumbersome at best and useless in too many cases.

"It is hoped that many of our space-borne experiments may help in both the navigation and communications fields. Space-borne computers, with wideband data links and lightweight power supplies, should be applicable before too many years have passed.

"*Night Vision.* For many years the problem of presenting information acquired by sophisticated data-gathering systems in such a way that it simulated direct vision has preoccupied major developers. Large strides have been made, but complexity is still extreme and the presentations very limited.

"Constantly supplementing these efforts have been the direct-vision efforts, starting with searchlights and culminating in recent years in systems using 'nonvisual' illumination coupled with conversion sighting systems which make the nonvisible visible to the equipped operators. Finally, light augmentation schemes have begun to show promise and it is hoped that soon we will be able to operate with limited direct vision.

"Military advantages for such a system are obvious—surveillance, direct target attack, local navigation, and night operations with covert bases.

"*Low-Cost, Quiet VTOL.* Although the achievement of many forms of VTOL is one of the dramatic accomplishments of recent years, there have been very few of these types of aircraft accepted for actual operation over and above the straight helicopter. Where VTOL has been essential, the cost of the helicopter to purchase and its high operational costs have dwindled into insignificance in the face of the new capabilities added to the services by the VTOL feature. It should also be noted that the pure helicopter has improved impressively in operating efficiency and cost.

"Whenever there are only marginal advantages for VTOL, the more normal aircraft usually wins because of its high ton-mile per day production, its high utilization per day, and its low operating cost. The fact remains that every task an airplane performs should be benefitted by VTOL capability. As soon as this can be obtained with reasonable economy, such aircraft will be universally adopted.

"Unique in the field of requests for aircraft designs for the military is a new request from the Army that contains noise level criteria for the vertical takeoff and hovering mode.

"The military usefulness of this is contained in Army experience where the very slow-flying and hovering aircraft have been found extremely difficult to see, and if there is no warning maneuvers can be accomplished before the enemy is aware of the aircraft's presence.

"For a high- or moderate-speed airplane at low altitude, the airplane usually precedes any coherent warning noise. (Turbo props are particularly good at low altitudes.) For a helicopter, however, there is little or no speed to reduce the exposure time; therefore, the requirement for a very low noise becomes predominant.

"Here is obviously a program which could complement or lead a commercial VTOL program since VTOL, with economy and low noise, is the foundation upon which any short-haul commercial market will develop. For the sake of both the military and civilian operators, I hope the solution of this problem is soon."

In concluding his presentation, Mr. Hawkins summarized the challenge of the future for the aviation industry. By the year 2014, based upon his estimates of population and economic growth and assuming that major technical strides within the aviation industry will keep pace, he pointed to the possibility of a cost of $26 billion to procure aricraft to handle the volume of traffic, with about $36 billion per year in revenue passenger miles.

For the short-range commuter type of aircraft, achievement of the anticipated goals would be dependent upon reducing the passenger cost per mile to between one-third and one-fourth of the cost "presently being experienced by the best vertical-rising machines and the vehicle will have to be a good neighbor.

"This means that it will have to operate in highly populated areas without imposing crash hazards and without increasing the ambient noise. In a small community that ambient noise will certainly be a major challenge.

"Extending this, or similar machines, out to ranges of 300 miles suggests that the competition with conventional aircraft may be somewhat difficult to meet. The airlines today offer shuttle service at a cost that is attracting many new customers.

"Here, again, a quiet vertical-rising and landing airplane with velocities in the neighborhood of 300 to 400 miles per hour can have these customers and multitudes more, but the added multitudes will not exist unless the machine serves the centers of population rather than the fringes.

"Even at ranges above 1,000 miles, we cannot ignore the advantages that accrue to takeoff and landing operations close to population centers. It is worth considering that flight routes of 1,000 to 1,500 miles may more expeditiously be served by vertical-rising airplanes with modest cruising speeds (between 400 and 500 miles per hour) as long as they are quiet and safe enough to operate close to the center of communities and as long as these characteristics can be obtained while simultaneously reducing the cost per seat mile to that of our present airline shuttles.

"In stepping out to 3,000 to 4,000 miles, the problem becomes more complex. It is not entirely clear that

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conventional landing and takeoff will be superseded at all ranges if in the future a high average speed for the conventional airplane can be maintained.

"It is reasonably obvious today that the major problem to be faced by the supersonic transport is noise. This noise problem extends all the way from takeoff to destination; and, if altitude alone won't solve this problem, it is entirely possible that the long-range transports of the future will take on an entirely different form, perhaps involving capacities approaching 500 passengers. So, in this field, a very severe challenge exists to somehow solve the enroute noise problem.

"One obvious solution is, of course, the ballistic transport bringing with it additional problems. If our space programs can be maintained at the current levels and if our successes continue in this field, I would like to suggest that the ballistic transport may, indeed, be the best solution for high-speed long-range operations.

"The one singular conclusion that can be drawn is that the challenge of the next 50 years may be of an entirely different character than it has been for the last 50 years, during which miracles have been produced in increasing velocity, capacity and economy simultaneously.

"We appear to have a choice to make in continuing the race toward more speed. The airplane is becoming less sociably acceptable at its terminals and it is not clear that additional economies are certain to be obtained.

"On the other hand, if we were to retain our present operating speeds and look back to those problems of terminal operations which make the airplane a good neighbor in the centers of our cities, we might tap an entirely new element of our population.

"If my predictions are even approximately correct, millions of new passengers are about to enter the market. They will have both the opportunity and the money to fly. With the proper service they will want to fly often and everywhere."

DDRE Names Assistant For Strategic Weapons

Richard D. Geckler was recently appointed Assistant Director of Defense Research and Engineering (Strategic Weapons), succeeding Dr. Richard A. Montgomery, who resigned to return to private industry.

Vice president for future operations of Aerojet-General Corp. since March 1963 and vice president and manager of the firm's solid-rocket plant for the five previous years, Mr. Geckler joined Aerojet in 1945 as a development engineer. At that time he worked primarily on production problems of the solid asphalt base JATO (Jet Assisted Takeoff) for aircraft.

As manager of the solid rocket plant, he was responsible for development and production of rocket motors such as those for Polaris, Minuteman, Hawk, Tartar and JATO.

Born Nov. 4, 1918 in Toledo, Ohio, Mr. Geckler was graduated from DePauw University in 1939 with a B.A. in chemistry and was elected to Phi Beta Kappa. He holds the U.S. Navy Meritorious Service Citation and for two years was chairman of the physical properties panel of the Joint Army, Navy, Air Force solid propellant group.

Mr. Geckler is a member of the American Chemical Society, American Institute of Chemical Engineers, American Mathematical Society, American Ordnance Association, and the American Institute of Aeronautics and Astronautics.

AMC Scientists Contribute to Inertial Guidance Parley

Three scientists from the Army Missile Command played prominent roles in the Second Biennial Inertial Guidance Test Symposium held recently at Holloman Air Force Base, N. Mex.

William V. Gudaitis, deputy director of the Army Inertial Guidance and Control Laboratory, served as chairman of a session on Sled Testing.

Electrical engineer Brooks Grimme gave a paper on "Centrifuge Linearity Verification of Analog and Digital Accelerometers," in which he described one method the laboratory scientists use to verify the performance of accelerometers in missile guidance and control. Accelerometers give scientists a precise measurement on any change in a missile's speed.

James V. Johnston, also an electrical engineer, gave a paper on "High-g Linear Acceleration Sled," a testing method which uses a rocket-powered sled to achieve as much as 200-g acceleration rates. This rate is more than that encountered in an actual missile firing.

About 200 inertial guidance and control specialists from Government agencies all over the Nation attended the symposium.

Newsmagazine Distribution Procedure Outlined

Complaints about distribution of the Army Research and Development Newsmagazine continue to harass the editorial staff, despite numerous announcements in the publication regarding the procedure to be followed in requesting to be placed on distribution.

Again it must be emphasized that distribution of the Newsmagazine is not a responsibility of the editorial staff. Neither should requests for changes of address be sent to the editors. Handling these matters is a function of other offices. However, the following information is offered.

ALL REQUIREMENTS for the Newsmagazine must be stated by filling out a Department of the Army Form 12–4. Provided the unit or installation to which the requesting office or individual is assigned has an account established at the U.S. Army AG Publications Center, 2800 Eastern Boulevard, Baltimore, Md. 21220, the DA Form 12–4 should be mailed to that address.

In the event an account must be established, DA Form 12 (May 1, 1964) should be filled out and submitted with the DA Form 12–4. Both of these forms are available in the installation or unit publications stock room and may be obtained upon request to the publications officer. Complete guidance on how to fill out both forms and submit them is provided in DA Pamphlet 310–10, May 1964.

Distribution of the Army R&D Newsmagazine on an individual name basis is restricted to members of the U.S. Army Atomic Energy and Research and Development Officer Specialist Programs, and to members of the U.S. Army Reserve R&D Unit Program. Otherwise, distribution can be made only to the Army installation, office or organizational element to which the requester is assigned.

Changes of address for AE and R&D Office Specialist Program enrollees should be addressed to: ECP, OPD, Office Personnel Operations, Washington, D.C. Reserve R&D Unit members should contact: Special Assistant for Reserve Affairs, OCRD, Department of the Army, Washington, D.C.

Individuals having questions about how to obtain the Newsmagazine regularly should contact their installation or office publications officer. It is his responsibility to insure that an adequate supply is obtained and is promptly and properly distributed upon receipt.

WRAIR Medical Researchers Study Viet Nam Health Problems

Renowned doctors and specialists form a U.S. Army Medical Research Team in Viet Nam that is enhancing the international prestige of Walter Reed Army Institute of Research in Washington, D.C.

Laboratory facilities of the group of medical researchers were officially opened in August this year by General William G. Westmoreland, CG of Military Assistance Forces, Viet Nam.

Occupying 23 rooms in a converted section of a modern hospital, the research facilities are considered as up-to-date as any in Southeast Asia. That includes three other U.S. Army medical teams—the SEATO Medical Research Laboratory in Bangkok, Thailand; the 406th Medical Laboratory at Camp Zama, Japan; and the Medical Research Unit in Kuala Lumpur, Malaysia.

Heading the Team in Viet Nam is Lt Col Paul E. Teschan, who last month was elected to the Halsted Society. Honoring the memory of Dr. William Stewart Halsted, the first surgeon-in-chief of Johns Hopkins Hospital in Baltimore, Md., when it opened in 1889 and holder of that title until his death in 1942, the Society limits its active members to 75 surgeons and others in allied branches of medicine.

Col Teschan earlier this year was awarded the Most Noble Order of the Crown of Thailand (Third Class) in recognition of his distinguished service to Field Marshal Sarit Thanarat, late prime minister of Thailand. Col Teschan was part of a team led by U.S. Army Surgeon General (Lt Gen) Leonard D. Heaton, which treated the prime minister during his illness.

Members of the newly formed research team in Viet Nam were assigned to their task from the Walter Reed Army Institute of Research (WRAIR), a facility of The Army Surgeon General's Office and the largest unit of the Medical R&D Command, which operates seven laboratories in the United States and six more in foreign countries.

Col Teschan stressed that research efforts of the team in Viet Nam will be coordinated closely with investigative activities of the U.S. Army medical units in Bangkok, Kuala Lumpur and Camp Zama to avoid unnecessary duplication or overlapping of programs. Study of certain infectious diseases can best be conducted in conditions peculiar to each area.

"In essence," he explained, "the main researchable health problems as we see them are certain types of malaria, dysentery of various kinds, dengue viruses, viral hepatitis . . . early care for recovery from shock, and definitive treatment of the wounded, that is, those conditions that interfere frequently with duty effectiveness of U.S. as well as Viet Namese military and civilian personnel."

Work of the U.S. Army Medical Research Team will be coordinated with the Minister of Health in Viet Nam and the medical service of the Viet Namese Army, Col Teschan stated in explaining the degree of cooperative effort.

Studies of cross-cultural communication in the U.S. Army advisory activities to the Viet Namese forces constitute an important part of the research project. Lt Col William Hausman, MC, a social anthropologist, Dr. David H. Marlowe and a RAND Corp. consultant, Dr. Gerald C. Hickey, have been coordinating efforts in this area.

Other Walter Reed Army Institute of Research staff members who have served on the Team for varying periods of time include Lt Col William F. McDonald, MC, an orthopedic surgeon and chief of the Department of Experimental Surgery; Lt Col Timothy G. Barila, MC, chief of the Department of Resuscitation; and Lt Col Edward L. Buescher, MC, chief of the Department of Virus Diseases.

USAR R&D Units Respond To CRD Policy Statement

Chief of Research and Development Lt Gen William W. Dick, Jr.'s action in April this year directing intensified effort to utilize the full potential of highly trained scientific and engineering talent within the Army Reserve R&D Units is getting results.

OCRD Assistant for Reserve Affairs Lt Col William B. Murray reports that General Dick's strong support of the Reserve R&D Units is stimulating interest among the Units in R&D active duty tours and in research projects that will give members an opportunity to use their talents to good advantage.

Col Murray has outlined a schedule of visits to 70 Reserve R&D Units, with more than 1,200 members, between now and June 30, 1965. From Oct. 14-28 he made a tour of Units throughout the Southeastern U.S.

During that period he talked with personnel from the Third Army Headquarters and the XII Corps in Atlanta, Ga., the IV Corps in Birmingham, Ala., and the following R&D Units: 3251st, Atlanta; 3369th, Birmingham; 3356th, Opelika, Ala.; 3355th, Gainesville, Fla.; 3370th based at Orlando, Fla., but meeting at Patrick Air Force Base; 3372nd, Miami, Fla.; 3353rd, Huntsville, Ala.; 3352nd, Oak Ridge, Tenn.; 3253rd, Kingsport, Tenn.; and the 3256th, Raleigh, N.C.

Frankford Physicist Receives Karl Fairbanks Award

The Karl Fairbanks Memorial Award was presented recently to Dr. Paul D. Flynn, Frankford Arsenal physicist, by the Society of Photo-Optical Instrumentation Engineers.

Presented as a highlight of the 9th Annual SPIE Technical Symposium at Miami Beach, Fla., the award recognized the 38-year-old scientist for "contributing significantly to the advancement of photo-optical instrumentation engineering through his work for the Government."

Since 1960, Dr. Flynn has played a major role in Frankford Arsenal's basic research program in photoelasticity and experimental stress analysis, using high-speed photographic techniques to record dynamic stress.

Publication of articles in professional journals and patent awards have gained Dr. Flynn wide recognition. He received his bachelor's and master's degrees from Johns Hopkins University and his Ph. D. in mechanics from Illinois Institute of Technology (IIT).

Prior to entering Federal Government service, he did industrial photoelasticity work at the General Electric Co. (1954-59), was an instructor in mechanical engineering at Johns Hopkins University (1948-51), and an associate professor of mechanics at IIT (1959-62).

Dr. Paul D. Flynn

$2.72 Million Contract Let for 2 Missile Systems

Two versions of a man-portable, shoulder-fired antitank missile system expected to provide a major boost in firepower for Infantry units are under development, the Army has disclosed.

The announcement came with U.S. Army Missile Command recent award of a $2.72 million contract to the McDonnell Aircraft Co. for exploratory development effort on a medium assault antitank weapon (MAW).

Like the Army's TOW heavy assault antitank weapon, MAW is planned as a tube-launched, wire-guided missile. In a tactical situation, the MAW would cover a shorter range than the TOW, but will have a longer range than any other man-portable antitank weapon.

The Missile Command's Directorate of Research and Development at Redstone Arsenal, Ala., is developing a second version of the weapon, which will feature an accurate, simple and rugged control system.

As envisioned by the Army, the MAW will complement the TOW missile, also in development. The DC-MAW was conceived in and is under exploratory development by the laboratories of the Missile Command's Research and Development Directorate.

Management of both of these exploratory development programs is centered at the U.S. Army Missile Command's Antitank/Aircraft Weapons Commodity Office. Col Cyril D. Sterner, who as commodity manager directed the early development of TOW, is project manager of MAW and head of the Commodity Office.

Technical supervision of the MAW program is under Allan Platt and the DC-MAW under John Pettitt, both of the Missile Command's Directorate of Research and Development.

TOW well along in the R&D cycle, recently became the ninth project-managed missile system under Missile Command control. Lt Col Ballard B. Small, Jr., has been named mgr.

A graduate of the University of California (B.A.) and Columbia University (M.A.), Col Small was assigned to Redstone following a tour of duty at Frankford Arsenal, where he was chief of the Army Metrology and Calibration Directorate. Prior to that, he was a student at the Command and General Staff College.

Lt Col Ballard B. Small

TOW MISSILE system mounted on M–113 carrier. Weighing about 160 pounds, the weapon can be broken down into separate units for carrying by troops and is also being developed for use on other forms of ground transport and on helicopters.

CSC Short Courses Prepare Federal Managers

Intensity of the U.S. Civil Service Commission (CSC) training program for Federal employees in middle and higher management to increase overall effectiveness is indicated by short course offerings.

"Job Classification and the Management Process" began Nov. 2 and will continue until Nov. 13. This course is designed to prepare employees new to the field of classification to assume their operating and staff roles of advising and assisting managers to carry out their salary and wage responsibilities of the Classification Act.

Three sessions of a 4-day course, "Training Institute for Recruiters," will be offered Nov. 9-13, Nov. 30-Dec. 3 and Jan. 11-14. Designed to help Federal recruiters sharpen their skills, it will stress methods and techniques and will include talks by outstanding authorities from colleges, industry and Government.

"Supervisory Scientists and Engineers: A Management Institute" will be offered Nov. 16-20 for individuals at GS 11-14 level who are presently filling or are being trained to assume supervisory and managerial positions in research and development activities in the Federal Government.

The course is designed to explore new and significant ideas in scientific management and to develop broader understanding of recent advances in traditional management practices and the adaptations necessary to successfully utilize these techniques in managing scientific groups.

Scheduled Nov. 16-20 is "Supervision and Group Performance," which is intended to introduce experienced or new supervisors to modern concepts of effective supervision.

"Techniques and Methods of Operations Research," offered Nov. 23-25, enables participants to work with various operations research techniques and to gain a clearer and more complete insight into possible applications in the job situation. The program will cover theories of model building and solving, probability, inventory models and gaming.

About 30 Federal officials in grades 13 through 15 assigned to positions in the financial management field will attend an "Institute in Management of Government Finances" from Nov. 30 to Dec. 4. The course provides a broad view of financial management in the Federal Service, stressing its role as part of general management.

The program is designed to achieve an increased awareness and appreciation of overall Federal fiscal policies, processes and control, including insights into the roles of the Bureau of the Budget, Treasury Department, General Accounting Office, Federal Reserve System, the President's Council of Economic Advisers and the Congress.

"Introduction to ADP in Technical Information Systems" is slated Dec. 3-4 for librarians and others concerned with the storage and retrieval of technical data and documents, such as archivists, research analysts and information analysts, GS-9 and above.

This introduction to automatic data processing (ADP) is a basic program designed to provide a general overview of the uses and potential of ADP as well as examples of successful applications in technical libraries.

Correction on Rollin Keyes

Rollin Keyes was incorrectly identified as technical director of the U.S. Army Satellite Communications Agency, Fort Monmouth, N.J., in our October issue. Samuel P. Brown has served as technical director since activation of SATCOM in 1960. Mr. Keyes and Alan S. Gross are assistant technical directors.

Army, DoD, AEC Review Gas-Cooled Reactor Project

Representatives from Department of Defense, the Army and the U.S. Atomic Energy Commission (AEC) convened recently at AEC Headquarters, Germantown, Md., for a 2-day in-process review of the Army Gas-Cooled Reactor Systems Program (AGCRSP).

Funded jointly by the Defense Department and the AEC, the AGCRSP seeks development of mobile, low-power, gas-cooled nuclear power plants capable of supporting military field operations. Emphasis has centered on the design, fabrication and testing of an engineering test model.

The resultant ML–1 is the first application of the closed Brayton cycle to a nuclear power plant. It combines a high-temperature, gas-cooled reactor with compact power-conversion equipment. The ML–1 has been under test at the National Reactor Testing Station in Idaho since 1961.

The second of the In-Process Reviews was conducted by Maj Frederick P. Reynolds, III, ML–1 Series project manager and chief, Gas-Cooled Reactor Branch, Army Reactors, Division of Reactor Development, AEC.

The purpose was to inform interested agencies of the significant events occurring in ML–1 test operations since the first In-Process Review in June 1963; also, to review the preliminary design of the ML–1A, the follow-on improved version.

Another objective was to solicit comments and advice from attendees on plans formulated for future activities in ML–1 Series development.

The AGCRSP systems contractor, Aerojet-General Nucleonics of San Ramon, Calif., participated in the review by presenting the resume of Nuclear Reactor Testing Station activities and reviewing major points of the ML–1A preliminary design.

The Atomic Energy Commission was represented by staff members of Headquarters Division of Reactor Development, Washington, D.C., and the Idaho Operations Office. Defense agency representation included: U.S. Navy, U.S. Air Force, Army Mobility Command, Army Engineer Research and Development Laboratories, Army Combat Developments Command, Army Human Engineering Laboratories, Army Test and Evaluation Command;

Army Environmental Hygiene Agency, Army Combat Service Support Group, Army Combat Developments Engineering Agency, and Department of the Army Headquarters staff agencies such as Office of the Chief of Research and Development, Office of the Inspector General, Assistant Chief of Staff for Force Development, Office of the Chief of Transportation and Office of the Chief of Engineers.

Fort Monmouth Supplies County With 45 School Board Members

Fort Monmouth, N.J., Headquarters of the U.S. Army Electronics Command, with a civilian population of just under 7,500, provides Monmouth County, population approximately 350,000, with more than 10 percent of its school board members.

Forty-five Fort Monmouth civilians serve on 25 of the county's school boards and there are 442 school board members in the county. The members come from the various elements of the U.S. Army Electronics Command, the Signal School, the Army Materiel Command's Project Managers' offices, and Patterson Army Hospital.

The material on school board members at Fort Monmouth was compiled for Brig Gen Paul A. Feyereisen, deputy CG of E-Command, by Norman J. Field, deputy director of research in the Command's labs.

2 E-Command Physicists Join Laser Advisory Group

Two physicists of the U.S. Army Electronics Command at Fort Monmouth, N.J., have been named to the Army Materiel Command's Laser Advisory Group.

Frank A. Brand is a member and Dr. Edith J. Tebo is an alternate member of the group which advises, assists, and provides technical guidance on Lasers to AMC's Research and Development Directorate.

Consisting of representatives of AMC major subordinate commands and laboratories, the group will maintain a current and continuing review of Laser scientific and technological developments.

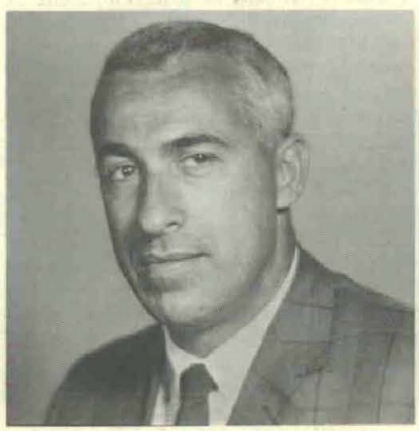
Currently chief of the Microwave and Quantum Electronics Branch of the Electronics Command's Laboratories, Mr. Brand joined what was then the Army Signal Corps Laboratories in 1950 as a research physicist. He is responsible for most of the R&D activities of the Electronics Command for solid-state microwave devices and circuits, microwave and optical Masers, and atomic frequency standards.

Author and coauthor of more than 40 technical papers on microwave and quantum electronic devices, semiconductors, and solid-state Lasers, he holds several patents in those fields. He received a B.S. degree (1950) and a master's degree (1958) in physics from the Polytechnic Institute of Brooklyn, Brooklyn, N.Y.

Dr. Tebo has been employed at the Laboratories as a physicist since 1952 and has been active in Laser research for the past three years. She is assigned to the Applied Physics Division of the Surveillance Department where she is responsible for planning studies and investigations in optical radar and Laser technology directed toward the development of new concepts, materials, equipment or systems to determine feasibility.

Formerly she worked in radio astronomy, atmospheric physics and astrophysics. She is the author and coauthor of many technical papers in these fields.

Graduated with a B.A. degree in astronomy from Vassar College, Poughkeepsie, N.Y., she received her Ph. D. in astrophysics from the University of Virginia in 1949 and then spent a post-doctoral year at Harvard. She has taught at Vassar, the University of Chicago, and the University of Virginia.



Frank A. Brand

Dr. Edith J. Tebo

OTSG Claims 4 of 17 Medics on Generals Nominee List

President Johnson's recent nomination of 17 U.S. Army Medical Service officers for promotion to major general and brigadier general includes four assigned to The Surgeon General's staff.

Subject to U.S. Senate confirmation, the nominations list Deputy Surgeon General Brig Gen Conn L. Milburn, Jr., for 2-star rank.

Other OTSG officers nominated for brigadier general rank are: Col Glenn J. Collins, executive officer; Col Colin F. Vorder Bruegge, deputy commander, Medical R&D Command; and Col Frederic J. Huges, Jr., director of the Directorate of Professional Services.

In Washington, D.C., Walter Reed Army General Hospital Commanding General (Maj Gen) Henry S. Murphey was nominated for permanent 2-star rank, along with Maj Gen George H. Powell, CG of Brooke General Hospital, Fort Sam Houston, Tex.

Nominated for permanent brigadier general rank are: Brig Gen William D. Graham, CG, Tripler General Hospital, Hawaii; Maj Gen Douglas B. Kendrick, Jr., chief surgeon, U.S. Army Europe; and Brig Gen Norman E. Peatfield, head of Dependents' Medical Care, Fitzsimons General General Hospital, Denver, Colo.

The list for promotion to temporary rank of major general includes Brig Generals Byron L. Steger, CG, Madigan General Hospital, Tacoma, Wash.; James T. McGibony, commandant, Medical Field Services School, Brooke General Hospital; and Laurence A. Potter, CG, 9th Hospital Center, Europe.

Col George J. Hayes, chief of Neurosurgery Service and Col Richard I. Crane, chief of Medical Service at Walter Reed General Hospital, is on the list for promotion to temporary brigadier general rank, along with Col Philip W. Mallory, commander of the Medical Unit, 97th General Hospital, Europe; and Col Elliott Ursin, surgeon, U.S. European Command.

Col Stephen G. Asbill, assistant for Veterinary Services, Surgeon's Section, Eighth U.S. Army, Korea, is nominated for promotion to permanent brigadier general. He will report for a key assignment in Washington, D.C., about Dec. 1.

DoD Consolidates 3 Services Information Liaison Offices

Consolidation of public information liaison functions of the Military Departments with national organizations, business and labor was effected recently by the Defense Department.

Secretary of Defense Robert S. McNamara announced establishment of a single office within the Department of Defense. It will function within the Directorate for Community Relations, Office of the Assistant Secretary of Defense (Public Affairs) Arthur Sylvester, who said:

"The main objective of this consolidation of functions, formerly handled both by my office and by the offices of the Chiefs of Information of the Military Departments, is to increase the flow of information and to provide better coordination of participation by components of the Department of Defense in public events."

The three functional divisions of the Directorate for Community Relations are headed as follows: National Organizations, Col Robert A. Carr, USA; Business-Labor, Capt Harvey O. Webster, USN, and Projects, Lt Col Thomas J. O'Mahoney, USMC. Col Julian B. Cross, USAF, is Director of Community Relations and Eugene J. Sleevi is Deputy Director.

National organizations and representatives of national business and labor groups may now direct their requests for information or cooperation in public events to the appropriate liaison office in the Directorate for Community Relations, Office of the Assistant Secretary of Defense (Public Affairs), Room 2E 772, the Pentagon, Washington, D.C.

Telephone contacts may be made by calling OXford 5-2113 for the Director; OXford 5-3227 for National Organizations; OXford 5-0208 for Business-Labor; and OXford 7-4170 for Projects.

Fluid Amplifier Controls Tested in Missile Firing

Successful firing of a test instrumentation missile (TIM) carrying a fluid flow control system was announced recently by Maj Gen John G. Zierdt, CG, U.S. Army Missile Command.

Conducted at a Redstone Arsenal missile test range, the firing demonstrated feasibility of the fluid amplifier in controlling missiles. The system tested in the TIM differs from conventional hydraulic and pneumatic controls in that it has no moving parts except the working fluid which performs functional operations.

Pure fluid flow control systems use streams of air or gas directed by tiny channeled plates inside the missile. By amplifying the pressure, complicated functions necessary for missile control can be performed—such as telling the missile where it is, where it is going, and which way is up or down.

General Zierdt said development of an acceptable fluid flow system would provide the Army with the simplest, most economical and most durable control technique yet devised. He said that while the system has some drawbacks, it seems ideally suited for controlling some of the Army's short- and medium-range missiles of the future.

Development of the fluid system for possible missile use is managed by the Inertial Guidance and Control Laboratory of the Missile Command's Directorate of Research and Development.

Honeywell, Inc., holds a development contract from the Missile Command. Work done in the Army laboratory on the pure fluid valve is an extension of principles developed by the Army Materiel Command's Harry Diamond Laboratories in Washington, D.C.

Fluid amplification devices, being investigated for application in other fields, are the basis of the Army's dramatic new artificial heart pump and are applicable to computer controls now under development.

USAEL Preparing Report On Progress of Fuel Cells

Fuel cell research reports from all known sources of activity have been collected by the U.S. Army Electronics Laboratories, Fort Monmouth, N.J., for incorporation in a forthcoming *Fifth Status Report on Fuel Cells.*

Initiated by the U.S. Army Research Office in 1959, the annual status reports on fuel cells have been prepared by the Electronics Laboratories for the past three years, following primary assignment for the Army fuel cells program to the Laboratories. The report includes industrial, university and nonprofit research organization as well as Government agency activities.

The *Fifth Status Report on Fuel Cells* will not contain any classified or proprietary information and, like the four previous volumes, will be made available to the public through sale by the U.S. Department of Commerce, Office of Technical Services, Washington, D.C. The date when the report will come off the press had not been announced at press time.

SORO Creates Counterinsurgency Analysis Center

Establishment of a Counterinsurgency Information Analysis Center (CINFAC) at the American University's Special Operations Research Office, under a contractual agreement with the Army, was announced in mid-October by the Department of Defense.

The Special Operations Research Office has functioned for many years as one of the Army's major contract agencies in the social science research field. CINFAC, however, will develop the capability to service specialized informational needs of the entire Defense Department community as well as those of other Federal agencies.

The DoD announcement stated that in accordance with regulatory policies, CINFAC will classify, store and retrieve information. The Center also will provide analytical and other specific advisory services to customer agencies in the non-materiel aspects of counterinsurgency problems.

Services provided by CINFAC, with Col Richard Moore (USA, Ret.) as manager, are designed to supplement those provided by the Special Operations Research Office (SORO) in its continuing cross-cultural research.

Over a period of years SORO studies on cross-cultural problems affecting military operations in foreign countries have produced an impressive accumulation of information. Results of counterinsurgency research and analytical expertise developed within SORO will be utilized by CINFAC.

SORO's Foreign Area Studies Division has produced a series of more than 50 background studies published in Foreign Area Handbooks to present balanced pictures of the sociological, political, economic and military factors characterizing the countries under study.

SORO's activities have included studies in support of Army missions involving psychological operations, unconventional warfare, counterinsurgency, military assistance, behavioral and social processes, role of the military establishment in foreign countries, and related problems.

CINFAC services may augment and be augmented by efforts of other research and information analysis centers, such as the Battelle Memorial Institute's Remote Areas Conflict Information Center (RACIC) and the Army's Limited War Laboratory, Aberdeen Proving Ground, Md.

MIT Issues Paperback Edition Of Dr. Siu's 'Tao of Science'

Accolades for a paper-back book, *The Tao of Science*, are beginning to pour in to Dr. Ralph G. H. Siu, chairman of The Army Research Council (TARC) and author of "T-Thoughts," the popular column appearing monthly in the *Army Research and Development Newsmagazine*.

Issued by the Massachusetts Institute of Technology, which published the hard-back version of the book in 1958, *The Tao of Science* carries a front cover page tribute from F. L. Kunz, author of *Main Currents in Modern Thought*, stating that:

"In the year since Northrop published *The Meeting of East and West*, no book has been issued more valuable than *The Tao of Science* . . . he (Dr. Siu) opens the way to reintegration of the sciences and humanities."

Termed "an essay on Western knowledge and Eastern wisdom," Dr. Siu's literary effort is characteristic of the inimitable humor and pithy observations that have made him an exceptionally popular after-dinner speaker. Ever since the Army Science Conference was initiated in 1957, he has been the unquestioned choice as master of ceremonies at the banquet.

Project VELA Site Selected

The Miles City-Glendive area of Montana has been selected as the site for a large seismic array station as a part of the Advanced Research Projects Agency's (ARPA) activities in Nuclear Test Detection (Project VELA). ARPA has previously constructed five smaller stations now in operation in Oregon, Utah, Tennessee, Arizona and Oklahoma.

Engineer R&D Labs Working on 3 Gas Turbine Cleaners

Three experimental high-performance air cleaners designed to increase performance and durability of the Army's industrial gas turbines have been developed by the U.S. Army Engineer Research and Development Laboratories.

The new cleaners include an advanced inertial type, a high-efficiency, compact filter type, and a special application model. All are part of an R&D program initiated when laboratory and field tests showed that ingested dust substantially reduced the performance of gas-turbine engines operating in dusty environments.

Conventional air cleaners were found unsuited to Army gas-turbine application because of their large size, weight and pressure loss. The inertial model is an improved type incorporating aerodynamic developments to give it an efficiency of 86 percent with fine test dust. Pressure loss is 2.6 inches of water. Built by Farr Co., El Segundo, Calif., it is scheduled for application in an experimental gas-turbine-powered tractor.

Developed for severe dust environments, the filter-type cleaner has a 97 percent efficiency, and is capable of removing most of its collected dust. Approach velocity is 2,400 feet per minute. It was built by Donaldson Co., Minneapolis, Minn., and consists of a pleated, high-velocity rectangular element cleaned by vacuum nozzles.

The special purpose cleaner, built by Southwest Research Institute, San Antonio, Tex., incorporates a rotary drum self-cleaning filter. It will be used on a gas turbine which has provision for bleed air flow, and will use this supply of air at moderate pressure for filter cleaning and drum rotation.

FIVE EXHIBITS depicting Picatinny Arsenal's primary job of designing Army munitions were displayed at the World's Fair Oct. 5-10 by invitation of officials at the New Jersey Pavilion. Exhibits included firepower of the M60 tank, a miniature mechanized battlefield of the future, and the combustible cartridge case developed at Picatinny Arsenal which eliminates shell cases when a gun is fired. Pictured above, Information officer Stanley Leon checks display.

ORTAG Reviews Nuclear Energy Depot System

Reports on studies of the Army's concept of a nuclear-powered energy depot system and accuracy of the M14 rifle highlighted the seventh meeting of the Operations Research Technical Assistance Group (ORTAG).

Held at Redstone (Ala.) Arsenal, the meeting marked the second year of ORTAG activities in accomplishing operations research projects and in identifying problems amendable to solution by operations research.

The report on the study of operational feasibility of particular types of nuclear-powered energy depot systems was made by L. H. Todd, Office of the Deputy Chief of Staff for Logistics, who substituted for George H. Orrell, Office Chief of Engineers.

Dr. Donald S. Burdick of Duke University reported on the study of the accuracy of the M14 rifle, based on tests conducted at Springfield (Mass.) Armory. Findings involved data collected from the 600-yard indoor range. Nearing completion is a third phase of the study, using data obtained at 100 yards from production samples of rifles fired under acceptance test conditions.

A report on a survey of air defense models conducted earlier this year by ORTAG was given by Capt Donald R. Campbell of the Human Factors and Operations Research Division, Office Chief of Research and Development.

Dr. Alan S. Galbraith, director of the Mathematics Division at the Army Research Office-Durham (AROD), spoke on the Military Theme in Operations Research. AROD was allocated $125,000 of special FY 1964 funds and an additional FY 1965 allocation of $100,000 for this project. Twelve proposals have been received.

Dr. Frank E. Grubbs of the U.S. Army Ballistic Research Laboratories, Aberdeen Proving Ground, Md., proposed that a conference be scheduled by ORTAG to establish Army requirements for terrain studies. Approved by the group, the suggestion would call for consideration of overall problems of quantification of terrain to permit computer data processing.

Results of a study on methods of relieving congestion at self-service Xerox machine centers were reported by Dr. Marion Bryson, Duke Univ.

ORTAG members voted to accept the invitation from the U.S. Army Electronics Command, Fort Monmouth, N.J., to hold the 1966 U.S. Army Operations Research Symposium at that installation. The 1965 meeting will be held again at Redstone Arsenal, home of the U.S. Army Missile Command.

Reporter Wrote What He Should But Headline Man Goofed It Good

Sharp-eyed readers of this publication who knew Col Charles M. Prosser when he reported to the U.S. Army Weapons Command at Rock Island (Ill.) Arsenal would rather fight than have his assignment switched by the Newsmagazine.

The Newsmagazine staff will have to take the mandatory 10-count for knocking out the headline on page 22 of the September issue, reporting assignment of Col Prosser as deputy commanding officer, Rock Island Arsenal. As reported in the text of the story, Col Prosser reported for duty as deputy commander, U.S. Army Weapons Command, Rock Island (Ill.) Arsenal.

NPFO Tests Use Ammonia to Power Truck Engine

Experiments to demonstrate the feasibility of using ammonia as a fuel, reported initially in the July 1964 edition of this publication (p. 28), have been carried a step further by the conversion of a vehicle to operate with ammonia. The research program is linked to the Army's Nuclear Power Energy Depot project.

Corps of Engineers personnel at the U.S. Army Nuclear Power Field Office (NPFO), Fort Belvoir, Va., last February completed modification of a 1¼ horsepower military standard engine and operated it successfully with anhydrous ammonia.

Shortly thereafter, a used but serviceable half-ton truck was issued to NPFO and the more ambitious effort was undertaken.

The same procedures by which the smaller engine was modified were used in converting the vehicle engine. A commercially available LPG conversion kit was installed, a 12-volt coil added and the ignition timing advanced to 30° BTDC.

Determination of the optimum mixture of air and ammonia was made after an electric motor, connected to the transmission output shaft, made possible sustained engine turnover at a higher speed than could be achieved with the conventional starter.

Extensive testing at this point revealed that the vehicle engine could not operate in excess of 30 minutes because of pressure loss in the ammonia cylinders resulting from cooling as the ammonia vaporized.

This operating limitation was eliminated by construction of a metal container around the cylinders and passing the engine exhaust through it to maintain temperature. Following development of a successful technique for switching from gasoline to ammonia operation, the electric motor was removed from the output shaft and the drive shaft was replaced.

During road testing of the vehicle at Fort Belvoir, a maximum speed of 25 m.p.h. was attained and enough power was developed to climb 6 to 8 percent grades.

SFC Herbert L. Kappel, who is responsible for these experiments, will continue his efforts in a series of tests aimed at improving the operating characteristics of the converted engine.

Modification of the engine is a step toward future development under the Army Nuclear Power Program Energy Depot project. The Energy Depot concept envisions employment of a mobile reactor as the primary source of energy in producing a substitute fuel from materials such as air and water indigenous to the field Army operational environment.

The Depot would consist of three major sub-systems: the reactor plant, a fuel production complex and utilization devices. Ammonia has been selected as the fuel product objective of the initial development phase.

Responsibility for developing the reactor and fuel production subsystems is assigned to the Chief of Engineers. The U.S. Army Materiel Command is responsible for development of utilization devices.

Total feasibility of the Energy Depot concept is to be decided in 1966.

SFC Herbert L. Kappel, who is responsible for engine modification experiments at Fort Belvoir, Va., regulates fuel intake on converted half-ton truck, while assistant E–1 E. D. Groover operates the ignition.

Services Consider Joint Testing of Loran-D

Plans for joint testing of a tactical navigation system were developed at a recent meeting of Army, Air Force and Coast Guard representatives at the U.S. Army Electronic Proving Ground, Fort Huachuca, Ariz. The Navy also has been invited to share in the program.

Participating in a 3-day discussion of the various testing phases of the Loran-D system were representatives of the Army Chief of Research and Development, the U.S. Army Materiel Command Headquarters, the Army Electronics Command, the Army Test and Evaluation Command, several major Air Force commands and the Coast Guard.

Each of the Armed Forces has specialized requirements which must be satisfied by a tactical navigation system. The Army is interested in determining if the Loran-D, an adaptation of the widely used Loran aircraft-marine navigation system, can provide accurate position fixing for personnel, vehicles and aircraft over a battleground.

Under the testing concept developed tentatively at the Fort Huachuca meeting, and since confirmed through coordinated activities of the Department of Defense agencies concerned, operations will begin about November 1965. Tests will be conducted at Eglin Air Force Base, Fla., and Fort Huachuca, with the movement from Eglin to Huachuca as part of the test program.

Large-scale tests were conducted at Fort Huachuca about a year ago on a similar tactical navigation system, the AN/GRN–14, but results showed that the equipment was generally unsatisfactory.

The indication was, however, that the concept of a hyperbolic grid system superimposed over a land area was sound; it could be used by anyone having a proper receiver to locate himself in unfamiliar surroundings or to proceed from one point to another in unmapped territory.

The principle of the Loran-D system is similar in many ways to the GRN–14. A master transmitter and two "slave" stations located at surveyed points on the ground send out radio waves. Special radio receivers not only detect these waves but measure the time difference of arrival of the signals from the transmitters. This information is used to give the position or "fix" of the receiver.

Unlike the GRN–14, which used continuous wave broadcast, the Loran-D uses pulses. It is believed this will overcome the problem of sky wave, echoes from ionosphere which bounced back to earth and caused trouble during the GRN–14 tests.

One problem, which the Army already foresees, is the size of the antenna towers presently used in Loran systems. The Army would like to find out if a 150-foot antenna tower will serve as well as a 300-foot tower. Mobility is an important consideration, since the Army would have to move the towers to meet changing tactical situations.

★ ★ ★

BITTER MELONS AND SOUR WINE. Salesmen flourished a thousand years ago as they do today. Even then the observation had been made and recorded in the old proverb that: "No melon-peddler cries: 'Bitter melons.' No wine-dealer cries: 'Sour wine.'"

DoD Cost Reduction Saves $2.83 Billion in FY 64

The Department of Defense Cost Reduction Program saved $2.831 billion during Fiscal Year 1964, according to final audited figures released Oct. 7. This was a gain of $278 million over the $2.55 billion estimated late in August.

The Army reduced its FY 64 costs by $1.005 billion, a gain of $168 million over previous $837 million estimates. That achievement was 123 percent of the Army's FY 1964 goal of $818 million.

Of the 24 different areas of effort in the Army Cost Reduction Program, the Office of the Chief of Research and Development monitors 2-value engineering and technical data and reports. Value engineering final figures were $62.7 million or $2.7 million more than the $60 million estimated.

Secretary of Defense Robert S. McNamara, in commenting on official results of FY 1964 cost reduction efforts, said: "This additional progress in our efforts to assure military readiness at the lowest possible cost gives me renewed confidence that we will realize savings of $4.6 billion a year by Fiscal Year 1968 and each year thereafter, while at the same time increasing military readiness."

Fort Detrick Scientist Publishes Virology Papers

A collection of 40 outstanding papers tracing the history and development of virology as a major biological science has been compiled by Nicholas Hahon of the Aerobiology Division, U.S. Army Biological Laboratories, Fort Detrick, Md.

Selected Papers on Virology, published recently, spans the era beginning with the imaginative studies of Edward Jenner that marked the inception of experimental virology. More than a century and a half ago, his research attempted to meet demands for control of smallpox and other epidemic diseases affecting man and his crops in England.

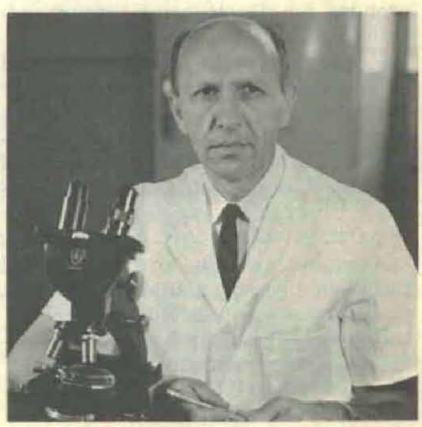
One of the more recent papers, published in 1911, is by Peyton Rous, one of the first scientists to indicate that viruses may be the cause of cancers. In spite of his 80 years, he is presently working in research at the Rockefeller Institute.

In explaining his motivation for the book, Hahon points to a long-standing interest in the older classical scientific literature, papers that are difficult to obtain, or papers published in a foreign language. "Although scientists and educators have often referred to these classical papers, few have been read because of these difficulties," he states.

Employed at Fort Detrick since 1951, he has published 20 scientific papers and has contributed articles to eight scientific journals.

Graduated from Davis and Elkins (W. Va.) College with a B.S. degree (cum laude) in 1958, he was awarded an M.S. degree in hygiene at Johns Hopkins University in Baltimore and was selected to continue research there for a year as a Kellogg scholar.

He is a member of the Research Society of America, American Society of Microbiology, American Association for the Advancement of Science, and is certified in Pathogenic Bacteriology and Virology by the National Registry of Microbiologists of the American Board of Microbiology. He is also listed in *American Men of Science* and *Leaders in American Science*.



Nicholas Hahon

Army Awards $31 Million AUTODIN Contract

The U.S. Army Electronics Command, Fort Monmouth, N.J., recently awarded a $31,381,167 contract to provide 10 overseas installations with AUTODIN, the Defense Department's high-speed digital communications system.

The AUTODIN (Automatic Digital Network) contract requires Philco Corp. to design, fabricate, install, test, maintain and operate for one year the 10 overseas centers. Equipment for a military training center at Fort Monmouth also will be provided.

The centers will permit worldwide teletype and high-speed digital data communications. Computers literally will be able to "talk" to each other and to handle information at rates up to 3,000 words a minute.

Digital signals used in AUTODIN present a cacaphony of sounds to the human ear; they require electronic equipment to convert them to usable information at the receiving end.

The AUTODIN centers will carry out the vital function of handling messages and data information traffic and speeding its flow from center to center on a worldwide system. Each center will store messages and send them to designated destinations as soon as transmission lines are available. Messages are processed on a priority basis and top priority messages are transmitted without delay.

The two magnetic drums used at each switching center will store more than two million words each and the 10 magnetic memories at each center will each store 16,000 words.

A special switch function at each center will automatically replace any part of the system that fails to insure continuous operation.

The AUTODIN was awarded by the U.S. Army's Electronic Command. The Defense Communications Agency's Defense Communications Engineering Office will manage the implementation, and the centers will be operated by the Military Departments.

Each Automatic Digital Message Switching Center (ADMSC), as they will be officially known, will contain:

- An automatic digital switch, which is essentially a grouping of high-speed data processors.
- A communications subsystem known as Technical Control to maintain service continuity to other connected switching centers and tributaries.
- An uninterrupted power supply.

The 10 ADMSC's will be located in Alaska, France, Germany, Guam, Hawaii, Japan, Okinawa, Panama, Philippine Islands, and the United Kingdom.

The centers will eventually replace separate facilities now maintained by the U.S. Army, Navy and Air Force. They will be located in new air-conditioned buildings, for which Philco will prescribe architectural and engineering standards.

The company initially will design and build a pilot model, installed at Willow Grove, Pa., for testing and evaluating systems effectiveness.

Philco scientific and engineering personnel began their pre-proposal studies of the program approximately 18 months ago. The company's low bid was among four opened by the U.S. Army Electronics Command in August. The four final bidders had been selected from among eight companies in the initial competition.

Lloyd W. Cali of Philco's Communications and Electronics Division has been appointed AUTODIN program director for the division and T. J. Heckelman is his deputy.

E-Command Advanced Study Program Aids Fishbein

The research and study program of the U.S. Army Electronics Command is enabling William Fishbein, an engineer in the Electronics Laboratories, to begin advanced studies under a fellowship at the Polytechnic Institute of Brooklyn, Brooklyn, N.Y.

Mr. Fishbein's studies over a period of one year will be directed toward design of an antenna system that will be lighter, cheaper and more efficiently reliable than existing systems.

The Electronics Command program under which the fellowship was awarded is designed to give qualified employees of the Electronics Laboratories an opportunity to conduct full-time independent research and study projects. Selectees must demonstrate outstanding ability, initiative and promise for development through advanced work.

Fellowship recipients are relieved of all other duties for a full academic year and are paid on the basis of a normal tour of duty with the Laboratories. The program supplements and extends the civilian career development programs now provided under Department of the Army regulations.

Assigned as chief of the Applied Research Section, Radar Division at the time he was selected for a fellowship award, Fishbein has been an employee of the Laboratories since 1952. He received a B.S. degree in electrical engineering, magna cum laude, from City College of New York in 1948 and a master's degree in the same field from Rutgers University in 1955.

He is the author of numerous technical papers, among them, "Combat Surveillance Correlation Radar," Army Science Conference, 1962; "Evaluation of a Miniaturized Video Processor for Radars with Moving Target Indication," Radar Symposium, University of Michigan, 1961; "Continuous-Wave Radar with High Range Resolution and Unambiguous Velocity Determination," Institute of Radio Engineers Transactions on Military Electronics, April 1962; and "Correlation Radar using Pseudo-Random Modulation," Institute of Radio Engineers Convention, 1961.

William Fishbein

AEC Nuclear Scientist Assumes Key Advisory Post at USAEPG

Dr. Lawrence E. Killion has been named scientific adviser and director of the Test Plans and Evaluation Department, U.S. Army Electronic Proving Ground, Fort Huachuca, Ariz.

Until he accepted his new duties, he was chief of the Nuclear Quality Assurance Agency in the Albuquerque (N. Mex.) Operations Office of the Atomic Energy Commission for six years.

Before that he was with the Defense Atomic Support Agency in Washington, D.C. A graduate of Baylor University, Waco, Tex., he received his master's degree in physics from Indiana University in 1948 and a doctorate in physics from Washington University, St. Louis, Mo., in 1955.

During World War II he served with the Infantry. Commissioned in the Air Force in 1947 he attained the rank of major before he resigned in 1958 to accept a Civil Service job.

Army Lets Contracts Totaling $113 Million

A $31,381,167 contract for 11 automatic digital message switching centers, awarded to Philco Corp., was the largest of U.S. Army research and development contracts in recent weeks totaling $113,704,000.

Martin-Marietta Corp., Orlando, Fla., was awarded a $23,188,823 grant for industrial engineering services for the Pershing Missile System. Sperry Rand Corp. received four contracts totaling $10,347,270 for engineering services and repair parts for the Sergeant Missile System, indicators for aircraft radio magnetic compasses and electrical equipment.

Caterpillar Tractor Co., Peoria, Ill., received an $8,292,615 award for 330 tractors. Clark Equipment Co., Benton Harbor, Mich., will produce 212 4-wheel tractors for $6,644,830. Johnson Furnace Co., a small business firm located in Bellevue, Ohio, was issued two contracts totaling $3,962,434 for 3,500 1½-ton cargo trailers and 5,000 ¼-ton, 2-wheel cargo trailers.

Honeywell, Inc., Hopkins, Minn., was awarded two contracts totaling $3,929,552 for metal parts and fuzes for classified ammunition. Bendix Corp., Teterboro, N.J., was issued a $3,152,975 contract for research and development and engineering services for guidance and control and ground support equipment for the Pershing missile.

Firestone Tire and Rubber Co., Akron, Ohio, will produce rubber track shoe assemblies for the M-48 series tanks for $2,218,838. Melpar, Inc., Falls Church, Va., was granted a $2,168,100 contract for warning and detection instrumentation for chemical agents.

Belock Instrument Corp., Long Island, N.Y., a small business firm, will perform industrial engineering services supporting the Hawk Missile simulator trainer for $1,977,933.

Western Electric Co., New York City, was issued a $1,715,530 contract for a Department of the Army technical manual and a catalog of parts, supply and catalog illustrations for the Nike Hercules Missile System.

Melabs, Inc, Palo Alto, Calif., was awarded a $1,500,000 contract for a classified quantity of microwave receivers. Day and Zimmerman, Inc., Philadelphia, Pa., received a $1,477,927 award for various quantities of fuzes, boosters, primers and detonators.

Magnovox Research Laboratories, Torrance, Calif., received a definitization of a letter contract in the amount of $1,460,000 for Radio Communication Sub-systems, AN/URC–55 with auxiliary items and technical reports.

Stanford Research Institute, Menlo Park, Calif., was awarded a $1,409,346 contract for study and evaluation of the potential effectiveness of the Nike X Anti-Missile Missile System.

Raytheon Co., Lexington, Mass., was issued a $1,360,758 contract for Hawk Missile System Field Service Documentation. Midwest Metal Stamping Co., Inc., St. Louis, Mo., was awarded a $1,336,516 grant for 795 1½-ton, 2-wheel, watertank trailers. Norris Thermador Corp., Los Angeles, Calif., received a $1,290,900 contract for a classified quantity of metal parts for a high explosive projectile.

Collins Radio Co., Richardson, Tex., will produce 100 Airborne Weather Avoidance Radar systems under the second increment of a contract for $1,290,864. Olin Mathieson Chemical Corp, New York City, was awarded a $1,238,077 grant for maintenance and support services and miscellaneous propellant charges.

American Electric Inc., Paramount, Calif., was issued a $1,186,020 contract for metal parts assemblies for 100-pound bombs. Chrysler Motor Corp., Detroit, Mich., received a $1,080,000 modification to a previously awarded contract for 375 1-ton power wagon trucks.

Picatinny Employees Cited For Saving $40 Million

Eight Picatinny Arsenal employees credited with saving American taxpayers more than $40 million were recognized at recent Cost Reduction Week ceremonies.

"All eight people worked independently on different projects, but all had the same goal of doing the best job for the least money," said Col H. H. Wishart, commanding officer, in presenting cash awards to:

Anthony M. Amendola, a munitions operator foreman, for his work in processing propellant bags; Warner Kopp, calibration and measurement inspector, for an administrative improvement; Morris R. Buchanan, tool, die and gauge maker, for manufacturing an intricate ammunition part; Charles Zglenicki, industrial engineer, for his work on the Sting Ray shell;

John A. Riccobono, management analyst, for his general assistance in the cost reduction program; Daniel Katz, chief of the Process Engineering Lab, for a method of reducing gun tube wear; Joseph J. Gurrera, supervisory aerospace engineering technician, for improvement in rocket propulsion systems; Frederick M. Held, industrial specialist, for planning and directing the procurement of ammunition hardware.

NDL Operates New Gammacell 220 Irradiation Units

The U.S. Army Nuclear Defense Laboratory at Edgewood Arsenal, Md., is now operating two Gammacell 220 Irradiation Units, identical in appearance and differing only in their amount of radioactive material.

One of the Gammacells is loaded with 240 curies of Cobalt–60; the other has a loading of 26,000 curies, which provides a maximum dose-rate of $2x10^6$ rads/hour at the center of the 6-inch diameter by 8-inch high right cylindrical sample chamber.

The irradiators are used for basic research in solid-state and chemical dosimetry systems. Inside the 4-ton shield of each cell are located welded stainless steel pencils filled with metallic Cobalt–60. The pencils are held vertically in a circle forming an annulus around the sample chamber.

Materials to be irradiated are loaded into the sample chamber when it is in the up position and driven downward electrically to the center of the source array.

The chamber can accommodate electrical, liquid, gas, and mechanical inputs to meet experimental requirements.

The Gammacell 220's enable the NDL to eliminate many of the costly problems encountered in using hot cells or free fields techniques for irradiation studies.

Ronald A. Sasse inserts sample into cobalt 60 gammacell 220 irradiation unit at Army Nuclear Defense Lab.

ILIR Program Achievements Gain FY 1965 Increase

(*Continued from page 9*)

The Engineer R&D Laboratories at Fort Belvoir, Va., selected from a list of 18 ILIR projects conducted in FY 1964 the work done in the field of water supply and purification as the most important to operations of field troops.

Results of one phase of this program were demonstrated dramatically this past summer when an experiment showed the feasibility of extracting water from exhaust gases from a gasoline engine powered 3 kw. generator.

Laboratory tests of a process which removes water from exhaust gases indicate that it is theoretically possible to obtain 1.2 pounds of water from one pound of gasoline, but critical purification problems remain to be solved.

Further progress in this investigation calls for a study of methods of removal of toxic or objectionable materials; for additional thermal analysis of the laboratory engine exhaust condenser; and for qualitative and quantitative measurement of organic and inorganic substances contained in the condensate.

Engineer R&D Laboratories investigations in the field of water purification, conducted with ILIR funds, demonstrated that seeding, or nucleation, techniques can control the calcium sulphate scale build-up in evaporator tubes that has made distillation of brackish water impracticable. This is an important step toward solving the problem of practicable conversion of sea water into fresh water.

Using existing methods, the heavy scale resulting from the high saturation of calcium sulfate in brackish water can be removed only by mechanical means, necessitating shutdown of the distillation equipment. In the Engineer R&D Laboratories research, the water has been seeded with crystals of calcium sulfate so that the calcium sulfate already in solution precipitates on these crystals rather than on the equipment.

Studies have been conducted to date on the amount of seed crystals required for the best results; on the cleansing of the crystals by acid treatment; and on the characteristics of various calcium sulfate crystal forms.

Seeding techniques established for a natural convection distillation unit will now be subjected to longer test runs, and also will be incorporated into a forced circulation system model for evaluation of equipment and methods for large capacity mobile distillation units.

Further tests will be run on the re-use of blowdown crystals for seeding, with treatments including grinding and chemical cleaning. Studies also will be made on the corrosion-erosion effects of the crystal slurry.

The Ballistic Research Laboratories at Aberdeen Proving Ground, Md., chose from a long list of projects three "representative tasks" to indicate the broad scope of activity in the ILIR Program. The major effort involved a variety of investigations pertaining to the general problem of target acquisition and guidance.

Other BRL important areas of effort selected for the ILIR report to the Assistant Secretary of the Army (R&D) are titled: "A Study of Resistance to Dynamic Deformation," pertaining to firings of various types of ammuntion into various types of targets, and "Study of Man-Guided Missile Systems."

The primary purpose of the latter study, as stated in the report, is "to develop techniques and a theoretical basis for the simulation of performance of man-guided missiles and the evaluation of systems." Effort to date has centered on preparation of analogue equipment for system simulation, using human operators, and an analytical study of missile stability and damping characteristics using root locus techniques. The report explains:

". . . Eventually, when a higher order approximation to human responses is obtained from the first phase of this research effort, it will be fed into the computational simulation scheme, and hopefully result in a better evaluation of networks for simulation, as well as indicate new directions in this area."

As the *Army R&D Newsmagazine* went to press, information on significant results of the ILIR Program at many in-house laboratories was not available.

For example, Walter Reed Army Institute of Research in Washington, D.C., listed 19 ILIR projects; the Waterways Experiment Station at Vicksburg, Miss., was working on 11 projects; the Land Locomotion Laboratory at Center Line, Mich., was active on 29 sub-tasks; the Feltman Research Laboratories at Picatinny Arsenal, Dover, N.J., were engaged in 18 tasks; and the Materials Research Agency at Watertown (Mass.) Arsenal was pushing ahead on 13 projects.

The U.S. Army Biological Laboratories were using ILIR funds to pursue interests in 18 research projects and Dugway (Utah) Proving Ground was busy on 17 projects. The Pitman-Dunn Institute for Research at Frankford Arsenal had 19 projects and Rock Island (Ill.) Arsenal reported on 12.

Other in-house research facilities making use of ILIR funds on less than 10 projects each included the Medical Equipment R&D Laboratory, Fort Totten, N.Y.; Medical Research Laboratory, Fort Knox, Ky.; Medical Research and Nutrition Laboratory, Fitzsimons General Hospital, Denver, Colo:;

U.S. Army Personnel Research Office, Washington, D.C.; Springfield (Mass.) Armory; Research Institute for Environmental Medicine, Natick, Mass.; Surgical Research Unit, Brooke General Hospital, Fort Sam Houston, Tex.; Transportation Research Command, Fort Eustis, Va.; Tropical Research Medical Laboratory, Canal Zone, Panama; Nuclear Defense Laboratory, Edgewood Arsenal, Md.;

Human Engineering Laboratories, Aberdeen Proving Ground, Md.; Geodesy, Intelligence and Mapping R&D Agency, Fort Belvoir, Va.; Cold Regions Research and Engineering Laboratory, Hanover, N.H.; Coating and Chemical Laboratory, Aberdeen Proving Ground, Md.

WRAMC Element Offers Graduate Dental Course

Qualified Regular Army and Reserve dental officers and civilian dentists may attend a graduate course in Prosthodontics offered by the U.S. Army Institute of Dental Research, Walter Reed Army Medical Center, Washington, D.C., Dec. 7–11.

The course will review biochemical principles and clinical techniques as they involve prosthodontic practice, and also will evaluate prosthodontic problems in the Armed Services and utilization of the Regional Dental Activity as an adjunct to clinical practice. Examination, diagnosis, treatment planning, and prognosis for complete and partial dentures will be stressed.

Other subjects to be covered include: impression making, jaw relation records, and articulators; the nonanatomic concept of complete denture occlusion and the selection and arrangement of artificial teeth for esthetic and phonetic results; immediate denture service, surgical prosthesis, and cleft palate prosthesis.

For further details write to: Director, U.S. Army Institute of Dental Research, Walter Reed Army Medical Center, Washington, D.C. 20012.

Army Tactical Air Traffic Control Goals Outlined

Brig Gen John J. Tolson, Director of Army Aviation, Office Assistant Chief of Staff for Force Development, presided at the Armed Forces session of the recent 1964 meeting of the Radio Technical Commission for Aeronautics in Washington, D.C.

"Tactical Air Traffic Control," a presentation by Lt Col A. B. Shattuck as the Army speaker, provided an imaginative look into the time frame of the 1970s on development of electronic control systems for mass movement of low-flying Army aircraft in support of field Army operations.

Assigned to the Communications-Electronics Division, Office of the Chief of Research and Development, Col Shattuck outlined objectives of Army air traffic control development. His talk described some of the features of the manual systems which will be the first to be developed, and compared the Army's air traffic control problems to those of the Federal Aviation Agency.

Whereas the FAA is concerned with traffic control systems for aircraft flying at altitudes as high as any customer needs air space, he explained, the Army "will use only a few discreet altitudes up to 4,000 to 6,000 feet."

The Army system must also accommodate flight that will clear terrain obstacles by only a few hundred feet, for "nap-of-the-earth" flight. Connecting the terrain avoidance radar directly to the flight control system will "automatically fly the helicopter at a low altitude clearing all obstacles by a pre-set height."

In the system envisioned by Col Shattuck in his presentation, all Army helicopters and other low-flying aircraft would have station-keeping (formation control) equipment that would give each pilot the exact range and bearing of every other aircraft in his flight.

Under this system aircraft in a single mass flight would be separated by a few hundred meters. The controller thus would have no more difficulty with a flight of, for example, 12 helicopters than for a single aircraft. The density of traffic that could be accommodated along any Army tactical airway would be greatly increased. Station-keeping radars would serve as "a great help in collision avoidance even in good weather in broad daylight."

The envisioned Army air traffic control system would provide aircraft with greatly improved sensors, point-to-point ground communications, air-to-ground communications on a variety of UHF frequencies and in other bands. A central computer would integrate all information and send it to the pilot in vertical and horizontal displays on the control panel.

Finally, in an imaginary briefing session involving two generals on plans for air support of ground combat forces, Col Shattuck has one of them asking: "What about our relations with the other services? Would the Army air traffic control system affect their operations?"

The other general replies: "Absolutely not. There is nothing that excludes aircraft from any airspace. Flight plan information is exchanged and clearances obtained wherever necessary. Air Force transports fly over the Army area to make paradrops.

"Fighter bombers make strikes near the FEBA [Forward Edge of Battle Area] regularly. Likewise, our medium observation planes fly up into the airspace above us to make their surveillance runs using their side-looking airborne radars. Army planes also fly back and forth from the Army rear area to the communications zone.

"The Theater Commander gives overall responsibility for air traffic control to a single commander. Under his guidance, the various controls are established and the procedures worked out for communications, the flight plans, and flow of traffic."

FlorCruz Heads U.S. Army Tropic Test Center

Col Pedro R. FlorCruz has assumed command of the U.S. Army Tropic Test Center at Fort Clayton, Canal Zone, Panama.

Assigned until recently to the Research and Development Directorate, Headquarters, Defense Atomic Support Agency in the Pentagon, Washington, D.C., Col FlorCruz is an Infantry officer with widely varied service in command and staff assignments. During World War II, he served in New Guinea and the Philippines as battalion and regiment operations officer.

After the war, he was assigned to the joint U.S. Military Advisory Group as adviser to the chief of staff, Philippine Army. In that capacity he edited plans for the re-establishment of the Philippine Military Academy and drafted its social sciences and humanities curriculum.

From 1950 to 1953, he was a physicist at Las Alamos Scientific Laboratory, N. Mex., where he gained recognition for his development work on blast instrumentation and calculations of total energy released from nuclear devices in Nevada and Pacific test sites.

In Germany, from 1953 to 1955, he served as commanding officer, 1st Battalion, 22nd Infantry, 4th Division, U.S. Army, Europe. From 1956 to 1959 he was with the Artillery and Atomics Division, U.S. Continental Army Command and was chief, Control Team, Analytic War Games, Headquarters, Eighth United States Army.

Col FlorCruz received a bachelor's degree in mechanical engineering from the University of the Philippines in 1938 and is a 1942 graduate of the United States Military Academy. He received a master's degree in nuclear physics from Princeton University in 1950 and has attended the U.S. Army Command and General Staff College, Ft. Leavenworth, Kans.

Col Pedro R. FlorCruz

Engineer R&D Labs Contract For Ammonia Fuel Plant Study

The U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., recently awarded a $98,015 contract for analytical and experimental studies of an ammonia-air fuel cell power plant.

The same firm, Pratt & Whitney Division of United Aircraft Corp., also received a $97,470 contract to conduct a fuel cell study.

Basically, a fuel cell is similar to a battery which converts the chemical energy of the fuel directly into electrical power, without the necessity of an intermediate thermal stage. It may be able to convert more than half of the potential energy of the fuel into electrical power, which is much more than that converted by present internal combustion engines.

Successful development of fuel cell power has been a priority R&D program of the Army for five years.

Army Contract Scientist in Brazil Joins WHO Panel

A Brazilian scientist working under an Army contract was appointed recently to a 5-year term on a United Nations World Health Organization (WHO) panel of experts on equine encephalitis, a disease of worldwide concern.

Dr. Jose Pellegrino was selected on the basis of 20 years of research experience that has gained him international recognition in tropical medicine, particularly in diseases of major importance in Latin America.

Assigned to the staff of the Institute of Biology, University of Minas Gerais, Belo Horizonte, Brazil, Dr. Pellegrino currently is studying "Basic and Tropistic Behavior of Schistosoma Mansoni Cercariae Relating to Cercaricdal Agents and Repellents."

The U.S. Army grant financing this study was made through the Defense Research Office (DRO), U.S. Regional Science Office for Latin America. When that office was established in August 1962, prime responsibility for its operation was assigned to the U.S. Army by the Department of Defense.

As a member of the WHO panel of experts, Dr. Pellegrino will focus research attention on equine encephalitis as a disease that currently affects an estimated 200 million victims. The WHO panels evaluate the current state of knowledge of medical problems of international concern, identify new methods of approach, and suggest future actions for WHO.

One of Dr. Pellegrino's significant contributions to research was the discovery that up to six percent of the persons appearing as donors at Belo Horizonte blood banks carried parasites of Chagas Disease. Due to his efforts, several countries now require pre-testing of all potential blood donors.

Dr. Pellegrino is one of an increasing number of research scientists whose efforts are being encouraged through grants by the Defense Research Office, U.S. Regional Science Office for Latin America.

Established through efforts of several major U.S. Government agencies with the Department of Defense, the office is intended to broaden the base of U.S. research with a view to results of major scientific importance.

Acting by direction of the Army Chief of Research and Development (at that time Lt Gen Arthur G. Trudeau), the U.S. Army Research Office took a lead role in stimulating the interest of other Federal agencies in opportunities to develop basic research activities in Latin America.

As a result of the U.S. Army Research Office suggestion through the Department of Defense to the Department of State, a U.S. Science Mission to Brazil, Uruguay and Argentina was organized in 1959. Potentialities for research in Latin America were emphasized in the Mission Report prepared by the U.S. Army Research Office.

Mission representatives included high ranking officials of the National Science Foundation, National Academy of Science, U.S. Atomic Energy Commission, Department of the Army and Department of Defense. Currently both the U.S. Air Force and the U.S. Navy are interested in Latin American research.

Col Leonard M. Orman has served as chief of the Defense Research Office since it was established. His previous assignment was special assistant to the commanding general of the U.S. Army Ordnance Special Weapons-Ammunition Command at Picatinny Arsenal, Dover, N.J. Dr. Francis W. Morthland was recently assigned from the U.S. Army Research Office Life Sciences Division to serve as scientific adviser in the Defense Research Office.

NSF-I Winner Views CRDL Research Activities

Scientific talents that won numerous coveted scholarship opportunities for Charles G. Taylor, now enrolled at Harvard University, made him highly appreciative of research in progress during a recent week-long visit to the U.S. Army Chemical R&D Laboratories.

Selected by the Army as one of its top winners at the 15th National Science Fair-International Taylor was the last of three NSF-I winners to observe research activities at CRDL during a week-long all-expense-paid visit.

Charles G. Taylor, 18, a 1964 National Science Fair-International winner, gets an inside look into his chosen field of biochemistry during a week of orientation at CRDL. Dr. Clarence A. Broomfield explains use of a spectrocolimeter that measures changes in protein structure.

After his tour of the Laboratories he left for Harvard University where two of the scholarships he earned while a student at Brunswick's Glynn Academy will be put to use. He plans to major in biochemistry and at CRDL he observed work being done in the field as well as in physiological chemistry, stereo-organic chemistry and other research programs.

Taylor's scholastic awards include Ford Foundation and Alfred A. Sloan Foundation scholarships to Harvard. He also won a Proctor and Gamble scholarship to Yale and was nominated for the U.S. Naval Academy, but declined both when he chose to attend Harvard.

Taylor was among the 13 students who shared first place awards in the 1964 National Science Fair-International. He also receivel a plaque and a cash award from the Armed Forces Chemical Association for his NSF-I achievement. He is past president of the Georgia Junior Academy of Science and was one of the top 20 Ford Foundation Future Scientists of America.

Maj Thomas Heads Bacteriology At 406th Medical Lab in Japan

The Bacteriology Department, 406th Medical Laboratory, U.S. Army Medical Command, Japan, has a 37-year-old Ph.D. as its new chief.

Maj Evan T. Thomas assumed the post shortly after receiving his doctorate degree at the University of Texas. An enlisted man in World War II, he earned a B.S. degree in 1950 from Mansfield (Pa.) State College, an M.S. in 1951 from Syracuse University and a T.M.B. degree from the University of Bristol in England in 1952.

Commissioned in the Medical Service Corps in October 1953, he has served as chief, Laboratory Technician Training School, U.S. Army Europe Training Center, and chief of Immo-Hemotology, Lab Technicians School, Fort Sam Houston, Tex. He is a member of the American Society for Microbiology and American Association for the Advancement of Science.

Value Engineers Study Universal Engineer Tractor

Value engineering factors are being applied to a 6-week study of the Universal Engineer Tractor (UET) as a joint effort of the Department of Defense and the U.S. Army Materiel Command's Engineer R&D Laboratories.

George E. Fouch, Assistant Secretary of Defense for Equipment Maintenance and Readiness, was the principal speaker Oct. 12 when the study was initiated by Col J. H. Kerkering, Laboratories commander.

Other speakers included C. H. Katreeb, manager of the study for the Value Engineering Services Office, Department of Defense, and P. V. Dobrov, chief of the Value Engineering Division, Army Materiel Command.

Directed toward discovery and elimination of unnecessary costs in production of parts and manufacturing processes through final design considerations prior to large-scale procurement, the VE study of the UET is the first of its kind involving a large item of equipment to be made by the VE Services Office of the Defense Department.

The VE Services Office was established to assist Defense Department organizations in value engineering studies of new military materiel items involving substantial expenditures. Six UETs built under a $2 million contract with International Harvester Co. are scheduled to be tested soon.

The UET is being developed by the Army Engineer R&D Laboratories as an armored, air-droppable machine that can perform the operations of a bulldozer, grader, scraper, dump truck, prime mover, cargo carrier and combat vehicle.

Although primarily a VE study, the 6-week program at the Laboratories also will serve as a training seminar to provide engineers with greater experience and appreciation of value engineering as a means of meeting Army goals in the DoD cost reduction program.

R. W. Beal, director of engineering at the Laboratories, is the UET Task Force director. W. H. Leathers is project engineer of the UET and W. B. Super is chief value engineer.

Engineer R&D Labs Develop Lightweight Mobile Welder

A duel-purpose field welder is being developed by the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., to keep pace with lightweight metals used in mobile military equipment.

The lightweight (700-pound) welder can furnish power for the metal-inert gas (MIG) welding required for such metals as aluminum, magnesium, and titanium. It will supply 300 amperes constant voltage power for the MIG semi-automatic welding process or 300 amperes constant-current type power for conventional welding.

In keeping with the Army's search for lightweight, highly mobile equipment, the welder weighs 70 percent less than conventional single-purpose units. No additional operator training is necessary.

Expected to be in service in 1967, the new machine will enable an entire field welding shop to be transported by vehicles normally used to carry the conventional generator alone. It is being built by Hobart Brothers Co. under contract with the Laboratories.

DUAL-PURPOSE WELDER, mounted on trailer above, was developed by ERDL to keep pace with lightweight metals used in Army equipment.

Col Astor Heads Future Missile Systems at Redstone

The Future Missile Systems Division, U.S. Army Missile Command Directorate of Research and Development at Redstone Arsenal, Ala., is now headed by Lt Col R. J. Astor.

The Division is composed of four groups: Combat Requirements Branch; Exploratory and Advanced Development Branch; Advanced Systems Laboratory; and the Army Air Defense System of the 1970's.

Assigned until recently as commander of the 15th Ordnance Battalion in Frankfurt, Germany, Col Astor replaced Lt Col James C. Miller, Jr., who was recently assigned to Bangkok, Thailand, with the ARPA Research and Development Field Unit, Office of the Secretary of Defense.

A native of Chicago, Col Astor received a B.S. degree in mechanical engineering from Chicago Technical College in 1943, and entered service for basic training at Amarillo, Tex. He earned an M.S. degree in engineering sciences in 1956 from Purdue University in Lafayette, Ind., and is a graduate of the Command and General Staff College at Fort Leavenworth, Kans.

Gorgas Medal Recipient Named Deputy Commandant at WRAIR

Col William S. Gochenour, recipient of the Gorgas Medal in 1962 for outstanding contributions to preventive medicine, is the new deputy director and deputy commandant of Walter Reed Army Institute of Research.

Formerly with the Deseret Test Center, Fort Douglas, Utah, he has been engaged in research on infectious diseases since 1949, and is the first individual in veterinary medicine to receive the Gorgas Award.

Col Gochenour's association with WRAIR dates back over the last decade and a half, during which he authored or coauthored more than 40 treatises on subjects in the field of Zoonoses, in particular leptospirosis, "Q" fever and Venezuelan equine encephalomyelitis.

Initially he was assigned to WRAIR in 1949 (then known as the Army Medical Service Graduate School) and served as chief of the Department of Veterinary Bacteriology until 1953.

Scientific Calendar

Food Law Institute and Food and Drug Administration Conference, sponsored by the Department of Health, Education and Welfare, Washington, D.C., Nov. 30–Dec. 1.

Joint Winter Meeting and Atom Fair, sponsored by the American Nuclear Society and the Atomic Industrial Forum, San Francisco, Calif., Nov. 30–Dec. 3.

Short Course on Gas Chromatography, sponsored by ISA, Pittsburgh, Pa., Nov. 30–Dec. 4.

13th Annual Wire and Cable Conference, sponsored by AMC's Electronics Command, Atlantic City, N.J., Dec. 2–4.

Annual Meeting of Synthetic Organic Chemical Manufacturers Association, N.Y.C., Dec. 3.

15th Annual Conference on Vehicular Communications, sponsored by IEEE, Cleveland, Ohio, Dec. 3–4.

55th National Meeting of the American Institute of Chemical Engineers, Boston, Mass., Dec. 6–10.

51st Annual Meeting of the Chemical Specialties Manufacturers Association, Atlantic City, N.J., Dec. 7–9.

3rd Conference on Performance of High Temperature Systems, Pasadena, Calif., Dec. 7–9.

Laboratory Animal Anesthesiology, sponsored by the AF School of Medicine, Brooks AFB, Tex., Dec. 14–16.

22nd International Geological Congress, New Delhi, India, Dec. 14–22.

9th Annual Inter-American Congress of Psychology, Miami, Fla., Dec. 16–21.

131st Annual Meeting of the American Association for the Advancement of Science, Montreal, Canada, Dec. 26–31.

NASA, Air Force to Exchange Scientists

New arrangements for the exchange of technical management and scientific personnel have been effected by the National Aeronautics and Space Administration (NASA) and the U.S. Air Force.

Under a basic agreement dating from 1959, about 100 Air Force personnel have been on duty with NASA but no NASA employees have been assigned to the Air Force.

Under the new agreement NASA civil servants of GS–13 and above will be assigned to the Air Force on a when-needed basis. Air Force personnel sent to NASA normally will be the rank of major or higher.

No corollary effort is planned or even contemplated by the Army, according to the U.S. Army Office of Personnel Operations and the Office of the Deputy Chief of Staff for Personnel.

The NASA-Air Force agreement was affected through two memoranda of understanding by Air Force Secretary Eugene M. Zuckert and NASA Deputy Administrator Dr. Hugh L. Dryden.

The agreed criteria specify that the positions in NASA for Air Force officers "will be at key or middle management level of NASA activity, experience which would be potentially beneficiary to the Air Force." Specifically mentioned is manned space flight which may contribute to future Air Force capabilities.

NASA has agreed to request officers for only those positions requiring education, experience or skills especially developed by the Air Force in the fields of technical program management, engineering and physical or life sciences, but only after NASA has made a reasonable effort to fill these positions from civilian sources.

Requests from either agency will be by required technical skills and scientific knowledge. Civilians selected from NASA will be from five areas: aeronautical and aerodynamic sciences; astrophysical and space sciences; aeromedical and physiological sciences; communications, tracking and launch-site technology; and spacecraft and launch vehicle technologies.

The assignments of NASA personnel to Air Force generally will be for two years, with the understanding that these may be extended for an additional year. Air Force personnel will be assigned to NASA for three years, a normal tour of duty for military personnel.

The criteria were established by a Joint Air Force/NASA Military Requirements Review Group.

AMSC to Review Activity Of MRC, AROD, SRINA

The 18th meeting of the Army Mathematics Steering Committee (AMSC) is scheduled Nov. 12-13 at the U.S. Army Research Office-Durham (AROD), N.C., on the campus of Duke University.

AMSC Chairman Dr. Ivan R. Hershner, Jr., chief, Physical Sciences Division, U.S. Army Research Office, Arlington, Va., will preside.

Dr. John Barkley Rosser, director, will review progress at the U.S. Army Mathematics Research Center (MRC), Madison, Wis., and Dr. F.J. Murray, director, Special Research in Numerical Analysis (SRINA) at Duke University will review progress and projected activities of SRINA.

Scheduled also are reports on conferences sponsored by AMSC for the Chief of Research and Development, including the Army Design of Experiments Conference by Dr. Walter D. Foster; Conference of Army Mathematicians, by Joseph Weinstein; and the Conference on Computers, scheduled for next year, by Dr. John H. Giese.

Committee members also will review the AROD mathematics activity, with overall functions discussed by Chief Scientist Dr. John W. Dawson and the program in basic research in mathematics by Dr. Alan S. Galbraith.

Other presentations on the agenda are: Military themes in mathematics and their connection with AMSC's recommendations, by Dr. Gene B. Parrish; AROD's program of research in the information sciences by James E. Norman; Functions of the Operations Research Technical Advisory Group (ORTAG), by Dr. J. J. Gergen; AMSC-sponsored conferences and meetings, by Dr. F. G. Dressel; and Army Research Office-Durham scientific services, by Mrs. Grace C. Boddie.

Campbell to Direct Key Aircraft Armament Systems

Springfield (Mass.) Armory has announced the assignment of Donald R. Campbell as project director in the Research and Engineering Division for the XM30 and XM40 Aircraft Armament Systems.

Responsibility for the overall planning, direction, and control on all phases of effort on these advanced air weapons is assigned to Mr. Campbell, a 1953 graduate of Worcester Polytechnic Institute with a B.S. degree in mechanical engineering (major in aero-mechanics).

Backed by extensive experience in the aircraft industry, he formerly was employed as a field representative and instructor for Hamilton Standard Division of United Aircraft Corp. and worked in Inspection and Production Control for Hawaiian Airmotive Ltd.

Donald R. Campbell

As Industrial Relations Training Coordinator and Service Engineer for Lockheed Aircraft Corp. in Honolulu, he was instrumental in establishing the major overhaul and maintenance facility for the Navy Pacific Barrier early warning radar aircraft fleet.

In 1960 he became interested with the Army Aviation program when he accepted a position with the U.S. Army Aviation Materiel Command in St. Louis as a development engineer for propulsion systems. Later he was promoted to project engineer for the H–21 helicopter in worldwide support operations.

Further assignments included membership on the Air Vehicle Environmental Research Team for study of crash injury and active and passive defense of aircraft in combat. He also was supervisor of the Tri-Service VTOL evaluation team, and was selected to head the engineering effort under task group assignment in development and implementation of Department of Defense programs in data control.

Mr. Campbell returned to Springfield in February 1964 to join the engineering staff at the Springfield Armory. He has worked in new weapons concepts programs, and was assigned the project of investigation of facility and equipment requirements for development of the integrated Air Weapons Technical Center at Springfield Armory.

Ranger Ration Earns Dr. Mehrlich MCSA

The Army's Meritorious Civilian Service Medal was awarded in mid-October to Dr. Ferdinand P. Mehrlich, director, Food Division, U.S. Army Natick (Mass.) Laboratories.

The award recognized his work in developing the "Ranger Ration," one of a group of new lightweight, easily prepared meals for combat troops. Based on dehydrated and compressed indigenous foods, the ration is packed in flexible, readily carried packets and is serving requirements of forces of the Republic of South Viet Nam for whom it was designed.

The medal was presented to Dr. Mehrlich by Brig Gen Woodrow W. Vaughn, commanding general, at a retreat ceremony.

Born in Cincinnati, Ohio, Dr. Mehrlich received his A.B. (magna cum laude) from Butler University, Ind., did graduate work at the University of California at Berkeley, and was awarded a Ph. D. from the University of Wisconsin in plant physiology and plant pathology. He was also enrolled in post doctorate studies in mycology at Cornell.

Before his Natick assignment Dr. Mehrlich was the scientific director, Armed Forces Food and Container Institute, Chicago, until its deactivation in 1963. Prior to entering Government service, he served in director-ate and consultant capacities for food research, processing and production for General Foods Corp.; Arthur D. Little, Inc.; National Planning Association and Cocoa Research Institute, both in Washington, D.C.; the Research Institute of the International Basic Economy Corporation (IBEC); and the Dole Corp., Hawaii.

Dr. Ferdinand P. Mehrlich, director, Food Division, U.S. Army Natick Laboratories, accompanied by his wife, receives Meritorious Civilian Service Medal and accompanying citation from Brig Gen Woodrow W. Vaughan, CG Natick Laboratories.

Picatinny Dedicates Ramsey Munitions Lab

The Ramsey Building, a new $1 million laboratory, will house about 200 employees and provide modern facilities for examining and testing munitions parts as a segment of the Picatinny Arsenal (Dover, N.J.) Inspection Division.

Presently almost completely staffed, the building was dedicated recently and named in honor of Brig Gen Norman F. Ramsey, who died last year. He commanded the Arsenal from 1922 to 1926.

Maj Gen John S. Cone, director of Quality Assurance for the U.S. Army Materiel Command, was guest speaker at the dedication. The ceremony was highlighted by unveiling of a memorial plaque by the General's widow and his only son, Dr. Ramsey, Jr., a member of the physics department at Harvard University.

The plaque reads: "Throughout his service, General Ramsey adhered to an ideal of quality: That all materiel provided to the American soldier must be the best that can be produced by man's intelligence, skill, ingenuity and devotion to duty. This building, dedicated to this ideal, is named in his memory."

Maj Gen F. A. Hansen, CG of the Army Munitions Command, conducted the ceremonies and welcoming remarks were made by Picatinny commanding officer Col H. H. Wisehart who introduced some of the 250 distinguished guests representative of Government and industry across the Nation.

ARPA Names Dr. Auer Deputy To Project Defender Director

Dr. Peter L. Auer was recently appointed deputy to Dr. Samuel J. Rabinowitz, Director for Ballistic Missile Defense (Project Defender), Advanced Research Projects Agency (ARPA), Department of Defense.

Formerly the head of the plasma physics department at Sperry Rand Research Center, he will be responsible for assisting supervision of ARPA research efforts in re-entry physics, penetration aids, kill mechanisms, radar technology and weapons effects.

Dr. Auer, 36, received his B.A. degree from Cornell University in 1947 and his Ph. D. in chemistry and physics from the California Institute of Technology in 1959.

By Ralph G. H. Siu

THE SCHOPENHAUER STYLE. It seems that quite a number of people in Washington must have read Schopenhauer. Or perhaps—like Day's father—they don't need to. In any case, as Clarence Day put it in his *Life with Father* (Knopf):

"Schopenhauer, in his rules for debating, shows how to win a weak case by insidiously transferring an argument from its right field, and discussing it instead from some irrelevant but impregnable angle. Father knew nothing of Schopenhauer, and was never insidious, but, nevertheless, he had certain natural gifts for debate. In the first place his voice was powerful and stormy and he let it out at full strength, and kept on letting it out with a vigor that stunned his opponents. As a second gift, he was convinced at all times that his opponents were wrong. Hence, even if they did win a point or two, it did them no good, for he dragged the issue to some other ground then, where he and Truth could prevail.

"When Mother said it surely was plain that I had no ear (Father had ordered Clarence to learn the violin), what was his reply? Why, he said that the violin was the noblest instrument invented by man. Having silenced her with this solid premise, he declared that it followed that any boy was lucky to be given the previlege of learning to play it. No boy should expect to learn it immediately. It required persistence. Everything, he had found, required persistence. The motto was, Never Give Up."

THREE IN THE MORNING. The readiness to criticize on the part of some people and their ease of being satisfied reminds me of an old parable.

To wear out one's spirit and intelligence to unify things without knowing that they are already in agreement—this is called "Three in the morning."

What is meant by this?

A keeper of monkeys said that for their rations each monkey was to have three nuts in the morning and four at night. But at this the monkeys were angry. Then the keeper said that they might have four in the morning and three at night. And with this arrangement they were all well pleased.

Kudos

A White Sands Missile Range (N. Mex.) engineer, Ernest A. Gessner, was recently presented with a cash award under the U.S. Army Incentive Awards Program for his 35th patent.

Protected under his 10th U.S. patent, the invention is an eccenter-drive with means for changing the output amplitude during operation. He is presently employed in the Flight Simulation Laboratory.

Dr. Gessner's other patents were issued in eight European countries including his native Germany. He came to the United States in 1953 and has been working at the national missile range since 1957.

Four U.S. Army Edgewood (Md.) Arsenal Chemical Research and Development Laboratories (CRDL) employees were recent recipients of awards presented by Col William G. Willmann, CRDL Commander.

Mrs. Martha J. Coulter, chief of the admininstrative offices in the Directorate of Defensive Systems, received the Army Meritorious Civilian Service Award.

Mrs. Marion P. Royston, a technical publications writer in the Directorate of Medical Research, and Mrs. Elizabeth H. Sanders, an administrative officer in the Directorate of Weapons Systems, both received Quality Performance Awards. Chester K. Pheil, a pattern-maker in the Experimental Engineering Division, was presented a Sustained Superior Performance Award.

A recipient of a Department of the Army 1964 R&D Achievement award recently received additional recognition at the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va.

Myron C. Cole was awarded an Outstanding rating certificate and a Quality Salary Increase for his work as chief of the Maintenance Equipment Section in the Mechanical Equipment Branch.

Last July, Cole was presented the Army's R&D Achievement award for his work in developing a welding machine capable of spanning all applications of the several types of electric welders now in the hands of troops and, in addition, with the added capability of welding non-ferrous metals of heavy and light gauge including magnesium.

WSMR engineer and inventor Ernest A. Gessner receives cash award for 35th patent from Lt Col W. W. Paris.

Dr. George H. Hass, internationally-known physicist at the U.S. Army Engineer Research and Development Laboratories (ERDL), Fort Belvoir, Va., recently received his ninth Outstanding performance rating and two Special Act and Service awards in recognition of his work as chief of the Physics Research Laboratory.

The special act awards, one for $75 and the other for $50, were for co-authoring two articles, "Improved Dielectric Films for Multilayer Coatings and Mirror Protection" and "The Optical Properties of Evaporated Gold in the Vacuum Ultraviolet from 300A to 2000A," both of which were published in the January-February 1964 issue of the French Journal of Physics.

Lt Col Phil R. Phelps, Jr., also of ERDL, received an Army Certificate of Achievement for his service first as a military assistant in the Military Department, then as chief of the Logistics Services Department and later as special assistant to the deputy commander of ERDL. It was also the occasion of the retirement of Col Phelps from the Army after a 20-year career. He is a 1943 graduate of the U.S. Military Academy.

Howard G. Lasser, a chemical engineer at ERDL, was appointed by the District of Columbia Society of Professional Engineers as a representative on the Air Pollution Control Board. Lasser, who holds a B.S. degree from Lehigh University and chemical engineering degree from Columbia University, has been associated with the Laboratories since 1951. He is a member of a number of professional societies and has written numerous scientific papers.

Robert P. Macchia, a physicist at the U.S. Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency (GIMRADA), also at Fort Belvoir, was honored recently by being made a Fellow of the National Institute of Public Affairs.

Macchia received the honor for having completed a year of graduate study at the University of Virginia, following his selection in nation-wide competition for a Ford Foundation Career Education Award.

The 36-year-old New York native was one of six U.S. Army civilian employees among 42 civil servants selected last year from 21 Federal agencies to receive the Ford Foundation grants under the program administered by the National Institute of Public Affairs.

A 1950 graduate of Fordham Uni-

SARS Winner Returns to Assignment at WSMR

The first winner of a Secretary of the Army Research and Study Fellowship at White Sands (N. Mex.) Missile Range is back on his job assignment with a full year of graduate study to his credit.

Robert H. Paul is a young research engineer in the U.S. Army Electronics Research and Development Activity, and he recently completed a year of graduate study at New Mexico State University. There he did advanced work in the development of Laser (light amplification by simulated emission of radiation) devices for detection and tracking of missiles and satellites.

His salary, books and other expenses were paid for by the Department of the Army under the terms of the Fellowship first established by the Secretary of the Army as part of this educational program.

Paul received a master's degree in electronic engineering from New Mexico State University in 1955 and he received his first grant for graduate study at NMSU in 1960. He has worked at White Sands Missile Range since 1951, was transferred to the Army Electronics R&D Activity in 1963, and is now assigned as a Research Engineer in the headquarters of the Instrumentation Directorate of USAERDA.

Robert H. Paul

versity with a B.S. degree in physics, Macchia has been employed at Fort Belvoir since 1952 and is acting assistant chief of the Strategic Systems Division of GIMRADA.

Randall D. Esten, chief of the photogrammetry Division at GIMRADA, received his fourth Outstanding Performance rating and a $200 Special Act and Service Award for his article, "Automatic Photogrammetric Instruments," which was published in Photogrammetric Engineering Magazine's international issue of July 1964.

Esten also was invited to present the paper at the 10th Congress of the International Society of Photogrammetry in Lisbon, Portugal.

Four engineers and scientists who work in the U.S. Army Electronics Command Laboratories at Fort Monmouth, N.J., were promoted recently to Civil Service GS–16 supergrade.

They are Rudolph Riehs, director of the Transmission Division, Communications Department; Dr. Helmut Brueckmann and Dr. Georg Goubau, both with the Exploratory Research Division C, Institute for Exploratory Research; and Dr. Eberhard Both, Electronic Parts and Materiels Division, Electronic Components Dept.

These are the first supergrade appointments in the Electronics Command, although there are 12 other men in the Command at Fort Monmouth who have equivalent or higher grades under Public Law 313, an act of Congress which provides special compensation for selected scientific and professional personnel.

Lt Col Bernard J. Pankowski recently received a Certificate of Appreciation from Brig Gen J. Wilson Johnston, CG of the U.S. Army Communications (SATCOM) Agency. Col Pankowski, until his recent departure to attend the Industrial College of the Armed Forces, was serving as General Johnston's representative to Headquarters, U.S. Army Materiel Command, for which SATCOM functions as a project manager.

Col Pankowski is a graduate of the U.S. Military Academy and the Command and General Staff College and holds an M.S. degree in electrical engineering from the Massachusetts Institute of Technology.

Sp/5 Michael G. DeGennaro, a mathematical-statistician assistant with the U.S. Army Personnel Research Office (USAPRO), was recently presented a Certificate of Achievement by Col Charles S. Gersoni, CO of USAPRO in recognition of the specialist's "outstanding performance of his duties."

USAPRO Appoints Head Of Monitor Performance

Dr. Michael Kaplan, 39, was recently appointed senior project director, Monitor Performance Task, Combat Systems Research Laboratory, U.S. Army Personnel Research Office, Washington, D.C.

From 1954 until his present appointment, Dr. Kaplan was senior research scientist and chief, Experimental Psychology Laboratory, Creedmoor Institute for Psychobiologic Studies, Creedmoor State Hospital, Queens Village, N.Y.

During that period he was program director for the "Undergraduate Research Scholars in Experimental Psychology," made possible through National Science Foundation grants.

In addition he was principal investigator for a number of major studies, including "Research in Motor and Autonomic Response"; "Experimental Analyses of Punishment"; "Growth Prediction and Manipulation of Food Motivation"; and "Reinforcing and Depressant Effects of Aversive Stimulation."

From 1952-54 he was a Post-Doctorate Research Fellow, National Institute of Mental Health, U.S. Public Health Service and from 1951-54 was a lecturer in psychology at Columbia University, where he earned A.B., A.M. and Ph. D. degrees.

Author of numerous articles published in technical and professional publications, he is a member of the American Psychological Association, Eastern Psychological Association, American Association for the Advancement of Science and the New York Academy of Sciences.

Chemical R&D Labs Establish Two Annual Awards

Two new annual awards have been established to honor outstanding personnel of the U.S. Army Edgewood (Md.) Arsenal Chemical Research and Development Laboratories.

The awards, one for scientific achievement and the other for leadership, were initiated by Col William G. Willman, Laboratories' commander, and Dr. S. D. Silver, technical director.

Winners will receive individual plaques of appropriate design and their names will be inscribed on perpetual honor rolls prominently displayed within the Laboratories. The first presentation ceremony is expected to take place about the first of the year.

Nominees for the Scientific Achievement Award will be CRDL military or civilian scientists recognized for an outstanding research or development effort which led to or accomplished a scientific breakthrough, or the attainment of a new engineering concept or process.

An alternate basis for selection will be an outstanding technical or scientific paper prepared by the nominee, covering significant advances in research or development and published in a suitable media or presented to a professional organization.

The Commander's Leadership Award is open to CRDL civilian and military personnel engaged in professional, technical, administrative, or support activities. A nominee must have "inspired, guided, and directed other persons in such a manner that his efforts were productive in advancing the mission" of the Laboratories.

Further, he must have been responsible for a significant achievement in a technological field or have made an important contribution in administration, management, budgeting, staff coordination, supply, security, safety, or other support function.

An award panel will review and evaluate the qualifications of the nominees. Final selection of the winners will be made by the Laboratories commander and the technical director.

Creation of the new awards brings to more than a score the total number of honors—exclusive of military decorations—for which Laboratories personnel are eligible. The list ranges from certificates through medals to educational fellowships.

DISTINGUISHED FLAG of the Army's newest major field command is presented to Maj Gen Richard J. Meyer (left), CG of the Army's Strategic Communications Command (STRATCOM), by General Creighton W. Abrams, Army Vice Chief of Staff. The flag reveals the newly designed orange and white insignia of STRATCOM, which achieved major command status in March and directs Army strategic communications worldwide.

McNamara Explains Satellite Interception System

President Johnson's announcement recently that the United States is able to intercept and destroy armed satellites was amplified promptly by Secretary of Defense Robert S. McNamara.

The Army operates one of the two anti-satellite systems using the Nike Zeus missile, Mr. McNamara explained, and the Air Force employs the Thor missile in the other. Both missiles are under the operational control of the Continental Air Defense Command and also utilize certain facilities.

Each of the systems makes use of the data from U.S. global space detection and tracking networks, which include various radars, sensors and computers. The Army program to develop an anti-satellite capability was begun in May of 1962 and the Air Force program early in 1963.

"It is especially significant," Mr. McNamara said, "that both the Army and the Air Force successfully intercepted satellites a year after I directed them to achieve this capability." The Army system was operational on Aug. 1, 1963 and the Air Force system on May 29, 1964.

"The two systems have been effectively tested," Secretary McNamara continued, "and have intercepted satellites in space, their missiles passing so close as to be within the destruction radius of the warheads." Mr. McNamara said that the bases at which these anti-satellite systems are deployed is classified information.

Cost of achieving the capability has been $80 million, which does not include funds being spent on the Space Detection and Tracking System and the Anti-Intercontinental Ballistic Missile systems.

"The family of over-the-horizon radars also announced by President Johnson is one of the most dramatic examples of new development," Mr. McNamara continued. These new systems will bounce radar signals off the ionosphere and send them back to the earth far beyond the horizon.

"More than $50 million has been invested in this program to develop and produce installations for these missile and aircraft detection systems," Mr. McNamara said. "This radar will provide detection of missiles within seconds of launch at a distance of several thousand miles."

Army Surgeon Assigned To Thailand Joint MAG

Lt Col Richard R. Taylor, MC, assigned since 1959 to the U.S. Army Medical Research and Development Command in Washington, D.C., departed recently to serve as surgeon of the Joint U.S. Military Advisory Group in Bangkok, Thailand.

With the Research and Development Command he served successively as chief of the Biophysics and Astronautics Research Branch, chief of the Research Division, chief of the Program Planning Office, and most recently as deputy commander.

From 1947 to 1953, he served at Army-Navy Hospital, Hot Springs, Ark., and Letterman General Hospital, San Francisco. Commanding officer of the 7th Medical Battalion, 7th Infantry Division, in Korea (1953-54), he later served at Fitzsimons General Hospital on the Medical Service and then as deputy commanding officer, U.S. Army Medical Research and Nutrition Laboratory, and as assistant clinical professor of medicine at the University of Colorado School of Medicine, Denver, from 1955 until joining the Medical R&D Command.

Missile Command Names Chief Of Combat Requirements Branch

The Army Missile Command's Directorate of Research and Development has announced that Lt Col Almon R. Roth is the new chief of the Combat Requirements Branch of the Future Missile System Division.

Col Roth will relate the missile needs of the field soldier to the scientists who plan missile systems to counter expected threats. His previous assignment was commander, 1st Bn, 77th Artillery in Korea.

Immediately after receiving the B.S. degree in military science and engineering from the United States Military Academy at West Point, N.Y., in 1945, he entered Army service. He later received an M.S. degree in mechanical engineering from the University of Southern California.

University Scientists Review AROD Research Programs

Four leading university scientists who served as summer advisers at the U.S. Army Research Office-Durham, N.C., reviewing aspects of AROD programs in which they are experts, have prepared suggestions to improve AROD liaison with the academic community.

The group included Dr. Milton J. Thompson, professor and chairman, Department of Aero-Space Engineering and Assistant Director, Defense Research Laboratory, University of Texas; Dr. Samuel Seely, Engineering Division, Case Institute of Technology; Dr. Eugen Merzbacher, Department of Physics, University of North Carolina; and Dr. Robert W. Lindsay, head of the Department of Metallurgy, Pennsylvania State Univ.

Visiting scientists who analyzed and made suggestions on U.S. Army Research Office-Durham programs are (left to right) Dr. Eugen Merzbacher, University of North Carolina; Dr. Milton J. Thompson, University of Texas; Dr. Samuel Seely, Case Institute of Technology; Dr. Robert W. Lindsay, Pennsylvania State Univ.

Dr. Thompson, a specialist in aerodynamics, both low- and high-speed, and in the related problems of heat transfer, concentrated his review on AROD projects in aeronautical engineering and flow mechanics.

Dr. Seely, who recently completed two years as head of the Engineering Section, National Science Foundation, is a specialist in electronics and network theory. He examined AROD projects in electronics and systems research, and also, drawing upon his NSF experience, analyzed various administrative aspects of the AROD operation.

Dr. Merzbacher served as adviser in theoretical physics. His field of specialization includes problems of applying quantum mechanics to atomic and nuclear systems.

Dr. Lindsay is a specialist in the physical metallurgy of ferrous base materials, particularly constructional, carbon and alloy steels, and cast irons.

At AROD Dr. Lindsay studied the military theme "Principles and Mechanics of Brittle Fracture," analyzing that program in the light of existing knowledge and of contemporary investigations. He also studied the projects supported under the military theme "Corrosion," with particular reference to stress-corrosion.

White Sands Missile Range Simulates A-Bursts in New NEL

White Sands (N. Mex.) Missile Range engineers and scientists are studying behavior of missile systems in a nuclear environment through controlled atomic bursts at the new Nuclear Effects Laboratory (NEL).

Located southeast of the White Sands Missile Range (WSMR) control facilities, and less than 80 miles from the site of the world's first atomic explosion, the NEL contains a linear electron accelerator and a pulsed neutron generator in addition to administrative and working space.

Another structure, about a mile from the main building, houses the fast-burst reactor facility and its control and support activities.

By assembling a linear accelerator producing gamma rays, a neutron generator and a fast-burst reactor in the same area, WSMR scientists may study all or most aspects of nuclear effects safely and conveniently.

The NEL will serve all Department of Defense agencies and contractors requiring testing in a nuclear environment. The laboratory operates under the direction of Glenn E. Elder, long associated with the Electro-Mechanical Laboratories of WSMR, and is staffed with 39 military and civilian specialists in nuclear tests and analysis, technical and facility operations, and health physics.

Design and construction of the lab incorporates the latest concepts in safety, measurement, instrumentation, communications and material handling. Experimenters can bring their "over the road" vans directly adjacent to the generator and reactor areas for calibration and testing.

Closed circuit television enables a technician to watch a critical or hazardous operation from outside the test cell in complete safety. A system of interlocks with doors and light signals prevents entry into test cells when radiation is present.

Dean Lawry, physicist, sets up missile guidance platform (left) for a test in Gama Linac exposure room in WSMR Nuclear Effects Laboratory.

Physicist Richard Dysart adjusts missile component for testing on Pulsed Neutron Generator in Nuclear Effects Lab at White Sands, N. Mex.

Gamma rays, close relatives of X-rays, are one of the common products of nuclear explosions. For study of the effects of these rays, the NEL uses a gamma linear accelerator (LINAC).

To produce the rays, timed pulses of electrons are fed into the breech end of a classical Stanford (University) traveling wave tube and accelerated toward the muzzle. where they strike a high-density target such as lead and release very high-energy photons.

The acceleration of the electrons is achieved much in the same manner a surf boarder gains momentum by riding a wave to shore. These electrons, however, reach speeds approaching that of light. The materials to be studied are placed at the target end of the gun in a large, shielded cell and instrumentation devices carry information to the consoles in the screening room.

High-energy neutrons, another by-product of fusion reaction, are produced at WSMR's nuclear effects lab with a pulsed neutron generator (PNG). Essentially this generator consists of a power source that may be pulsed (turned on and off at a specified rate), driving deuterium ions into a copper target coated with a very thin layer of titanium sponge in which tritium has been trapped.

The bombardment of the ions will produce as many as one billion free neutrons per power pulse. As in the LINAC, a shielded cell receives the neutron burst and holds the materials to be tested. The PNG cell walls and door are made of a 5-foot thickness of concrete.

The fast-burst reactor (FBR), perhaps the most sophisticated generator in the group, has its own building and test cell well apart from the NEL main building. It provides an excellent source of neutrons and gamma radiation for the simulation of nuclear weapon environments.

Man's knowledge gained in the last two decades has enabled him to produce with this device more closely than with any other in the U.S. laboratory-scale multi-radiation effects of a fission reaction without the attendant heat and blast.

The FBR at super-critical condition will generate 50 billion watts of energy for .000035 of a second. Utilizing uranium 235, it is designed for a chain reaction though an explosion does not occur.

Acting as "watch dogs" for the entire operation, health physics monitors serve to protect the health of the workers and the property from accidental radiation exposure.

Veteran CRDL Employee Gets Graduate Study Scholarship

An employee of the U.S. Army Edgewood (Md.) Arsenal Chemical Research and Development Laboratories for 24 years has been awarded a year's scholarship for graduate studies at the University of Delaware.

Col William G. Willmann, CRDL commander, said the award to Joseph Epstein is part of CRDL's continuing program to encourage self-improvement of personnel and to develop talents needed to fill present and future executive positions in the Army's research program.

Chief of the Laboratories' Defensive Research Division, Mr. Epstein holds an A.B. degree in chemistry from Temple University, a master's degree from the University of Pennsylvania, and has done graduate work at the University of Maryland.

A member of the American Chemical Society, the New York Academy of Sciences, and the Scientific Research Society of America, he is the author of numerous scientific publications, and has served as consultant to the U.S. Public Health Service.

During his employment at Edgewood Arsenal, Mr. Epstein has been the recipient of various awards, including the Army's Meritorious Civilian Service Award.

HARP Records Successful Telemetry Probes to 350,000 Feet

Major advances in the U.S. Army High Altitude Research Program (HARP) were recorded recently when 9 out of 12 gun-launched telemetry probes successfully transmitted information at altitudes ranging from 100,000 to 350,000 feet.

Encapsulated in fin-stabilized, sabot-controlled projectiles, the transmitters were fired from two 5-inch guns at Wallops (Va.) Island and a 140-ton, 16-inch gun at Barbados, West Indies Federation.

In the Wallops Island firings, two of three transmitters were tracked to apogee by National Aeronautics and Space Administration (NASA) radar systems, used to track 85 percent of the 53 high altitude 5-inch gun probes by the Army at Wallops since September 1963.

The transistorized transmitters launched at both sites were built by the Harry Diamond Laboratories in Washington, D.C., under direction of the U.S. Army Ballistic Research Laboratories (BRL), Aberdeen Proving Ground, Md. They operated at a nominal frequency of 250 megacycles.

Information relayed to ground stations included payload compartment temperature, operation time of fuzes, tri-methyl aluminum (TMA) release mechanisms and rocket motor ignition, and signals from on-board sun-seekers.

Firings at Barbados during a 33-round series in July included TMA-bearing projectiles launched for high-altitude wind measurements and developmental tests of a 9-inch gun-boosted rocket.

SMOOTH-BORE, 140-ton, 16-inch gun at Barbados is raised for vertical firing of projectiles in the Army's High Altitude Research Program.

Five TMA trails, extending from 90 to 106 kilometers, were photographed by camera stations located on the islands of Barbados, Grenada, St. Vincent and St. Lucia. Space Instruments Research, Inc., an Army contractor operating one of the stations, is analyzing the data.

The telemetry studies are the latest in a series of high-altitude gun-probe studies sponsored by the U.S. Army since 1960. The U.S. Army Ballistic Research Laboratories and McGill University of Canada, operating as an Army contractor, are conducting the tests. (See March 1963 issue, p. 34, for initial firings of HARP.)

Dr. Richard A. Weiss, deputy and scientific director of the U.S. Army Research Office and a firm supporter of Project HARP since its beginning, and A. C. Jones, Canadian Defence Research Board Scientific Liaison Officer, Canadian Joint Staff, Washington, D.C., observed the July firings at Barbados.

The U.S. Army Research Office (USARO) provided logistical support to Project HARP operations in Barbados in the movement of the 16-inch gun from Hampton Roads, Va., to Barbados in July 1962. Financial support has been shared by USARO and the Army Materiel Command.

Instrumental in initiating the Army's role in Project HARP were Dr. Hoyt Lemons, chief of the Geophysical Sciences Branch, Environmental Sciences Division, USARO, and Col Norman Hall, now chief engineer, Army Southern Command.

Considerable interest has been indicated by the Canadian and British Governments and other U.S. Government agencies since January 1963 when the first Martlet 1B gas-seeding projectile, utilizing 730 pounds of propellant, was fired and tracked at Barbados to an apogee of 74,000 feet.

Since that time, under the direction of Dr. G. P. Bull, professor of engineering science at McGill University and one of the originators of the vertical-fired gun probes, several records have been established at Barbados for gun-fired vehicles used in high-altitude atmospheric studies.

Further tests at Barbados are designed to reach altitudes of 500,000 feet, using projectiles equipped with rocket boosters.

A tentative "firing schedule" submitted by Dr. Charles Murphy, chief of the Free-Flight Aerodynamics Branch at BRL and project leader for HARP, calls for several firings of the 5-inch guns at Wallops and the 16-inch gun at Barbados by Dec. 31.

Dr. Charles Murphy, chief of the BRL Free-Flight Aerodynamics Branch, and Army project leader for High Altitude Research Program (HARP).

Additional firings are also planned for several 16-inch horizontal firings at Dahlgren, Va.; 5-inch firings at White Sands, N. Mex.; 5-inch firings at Fort Greeley, Alaska, or Thule, Greenland; and 7-inch shots at Wallops Island.

The firings at White Sands and Fort Greeley or Thule (site not definite) are designed to test out operations of the guns, vehicles, powder, etc., under extreme environmental conditions of hot and cold.

Wallops Island Probes Test Gun-fired Telemetry System

Two 5-inch gun probes carrying a new telemetry system were fired at Wallops Island, Va., Oct. 14, in what promises to be a breakthrough in the art of solid-state technology for transmission of radio signals from gun-fired probes.

Developed at BRL, and tracked by NASA personnel to altitudes ranging between 140,000–200,000 feet, the new telemetry system operates on a 200 milliwatt power output and a frequency of 1,750 megacycles.

The system employs a Solistron transmitter made by Western Microwave Labs, Santa Clara, Calif., and has ability to withstand high acceleration of gun firings (30,000 times acceleration of gravity).