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TARC Updates 5-Year Army Research Plan

A two-volume classified report prepared by The Army Research Council (TARC) as the major input for an updated Army Research Plan has been approved by top research and development leaders and submitted for publication.

Distribution to selected Department of Defense R&E executives and to Army agencies having a need-to-know to tentatively is scheduled late this month.

Volume 1, a 122-page document entitled "U.S. Army Research and Exploratory Development Program" provides guidelines for the distribution of research resources and portrays the ongoing program by 6.21 budget element and 6.11 budget subelement. Emphasis is on relevance of ongoing work to the Army's interest.

Volume 2, with 734 pages, presents the "Detailed Scientific and Technical Program" in a series of succinct, understandable summaries of the technical objectives and ongoing work at project level.

(Continued on page 4)

Realignment Affects 4 Divisions in OCRD

Realignment and redesignation of four divisions in the Office of the Chief of Research and Development (OCRD) and reapportionment of OCRD military operations research advisory personnel were completed Apr. 10.

Chief of Research and Development Lt Gen A. W. Betts approved the reorganization recommendations of a special OCRD Planning Group headed by Col Robert B. Bennett, then chief of the Social Science Research Division (since redesignated).

The purpose of the group was to recommend actions "to enhance the capabilities of OCRD" in the areas of operations research, systems analysis, Army Study Advisory Committee (ASAC) matters and test and evaluation.

(Continued on page 3)

Cheyenne Prototype Tested As Speedy Combat Helicopter

Cheyenne, the first of 10 prototypes of a swift new type of armed helicopter being manufactured for the U.S. Army, is undergoing systems tests at the Van Nuys plant of Lockheed-California Co. where it was unveiled in a roll-out ceremony May 3.

First flight tests of the Advanced Aerial Fire Support System (AAFSS) aircraft, designated the AH-56A, are planned later this year.

The vertical-rising-and-landing aircraft is designed to fly at nearly twice the speed of combat helicopters the Army is using in Vietnam. It is one of the first major weapons systems originated under

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Three Nations Join Efforts On Communication Network

Brig Gen Paul A. Feyereisen

Activities of the Mallard Project, a 10-year multimillion-dollar program to develop a comprehensive communications system for field armies of Canada, Australia and the United States, were centered Apr. 10 at Fort Monmouth, N.J., HQ, U.S. Army Electronics Command.

Secretary of Defense Robert S. McNamara announced selection of the U.S. Army Materiel Command installation as

(Continued on page 7)

Army Nurse, Engineer Win Pace Achievement Awards

Achievements in research, development and engineering are recognized in the 1967 Pace Awards, presented May 5 by Secretary of the Army Stanley R. Resor in ceremonies at the Pentagon, Washington, D.C.

The awards honor the work of Lt Col Patricia T. Murphy, a Regular Army nurse with the U.S. Army Medical R&D Command, Office of The Surgeon General, and Carleton H. Gray, a GS-13 electronic engineer in the Office of the Chief of Engineers, Department of the Army.

Named for Frank Pace Jr., Secretary of the Army from 1950 to 1953, the awards are presented annually to one civilian employe of the Department of the Army and one Army officer for individual achievement of outstanding significance during the previous calendar year.

Emphasis is on technological or military development requiring executive and scientific abilities of civilians in grade GS-14 or below and Army officers hold-

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AH-56A

Featured in This Issue

Army R&D Newsmagazine

Vol. 8, No. 5 May 1967

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

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Army Nurse, Engineer Win '67 Pace Awards

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ing the rank of lieutenant colonel or below.

In keeping with the pattern established with initiation of the awards in 1962, at least one of the winners each year has been representative of Army research and development.

Lt Col Murphy was recognized for her achievements as executive project officer, Office of the MUST (Medical Unit, Self-Contained, Transportable) Project Manager. MUST is a field medical equipment system which replaces current obsolete field medical and dental facilities with easily transportable, tailorable, functional modules responsive to tactical needs.

The nomination leading to her citation acclaims ability she demonstrated in influencing design and evaluation of the equipment for use in treatment and for the capability to provide maxiumum restorative care for the patient — the wounded or sick combat soldier.

"Through her outstanding professional competence as the spokesman to industry, other federal agencies, and to her Army Medical Service colleagues," the nomination states, "she has welded a military-industry team which is meeting the most exacting medico-military requirements.

"She is credited with a major role on a team which directed the safe and expedient delivery of the original MUST to the combat area of Vietnam in November 1966."

Within the MUST equipment system, Lt Col Murphy has personally directed development of the operating table, the surgical light, the surgical glove washer and dryer, the 2-chamber sterilizer mechanisms, and new equipment for the patient ward.

In addition to her other duties, the colonel personally spent much time and effort in training personnel of the first hospital to receive the MUST equipment — the 45th Surgical Hospital at Fort Sam Houston, Tex.

Before pursuing her program in nursing education, Lt Col Murphy attended public, parochial, and private schools in Massachusetts and Europe, and Emmanuel College in Boston. She graduated from the School of Nursing, Peter Bent Brigham Hospital, Boston, and later earned a baccalaureate degree at Incarnate Word College, San Antonio, Tex. She completed the Army Medical Service Career Course, Medical Field Service School at Fort Sam Houston with highest honors.

Lt Col Patricia T. Murphy

CARLETON GRAY was cited for development and design of a completely integrated system of radar and radio service for the safer and more efficient dispatching and control of waterborne traffic through the Cape Cod Canal.

Elimination of manned observation stations and patrol boats and development of the central control system that provides for radar surveillance, vessel identification and command control communication, is estimated to result in an annual saving of $125,000.

Employed in the Operations Division of the Directorate of Civil Works, Gray is credited by his superiors for spending many hours of his own time and displaying considerable ingenuity and ability in the study, surveys, and investigations on shore-based radar equipment used in restricted waterways.

While radar control systems have been used successfully in the United Kingdom and Holland, the nomination for the Pace Award states that the system conceived and developed by Gray "is the first of its kind in the United States and is of greater magnitude and sophistication than any other installation now in existence."

Gray studied electrical engineering at South Dakota State College (1931-32) and North Dakota State College (1933-36) before starting his civilian government career in 1941 with the Signal Office of the 7th Service Command.

In 1942 he attended the Signal Corps School at Fort Monmouth, N.J., entered active Army Service in 1943, and served as radio officer for the 7th Service Command until discharged from active duty in 1946.

He returned to civilian employment as an electronic engineer with the U.S. Army Engineer Division, Missouri River, Omaha, Nebr., where he served until transfer to the Office, Chief of Engineers in 1962.

Carleton H. Gray

Realignment Affects 4 Divisions in OCRD

(Continued from page 1)

OCRD Director of Plans and Programs Brig Gen Thurston T. Paul Jr. implemented the following changes Mar. 29:

o The Review and Analysis Division was redesignated the *Management and Evaluation (ME) Division* and reorganized with three branches — Management, Policy, and Test and Evaluation. Division chief is Col Charles T. Anders. Branch chiefs are Lt Col Marvin J. Krupinsky, Management; Lt Col William H. Young, Policy; and Lt Col James M. Elder, Test and Evaluation.

The ME Division has General Staff responsibility within the Army research, development, test and evaluation (RDT&E) program for overall policies for management and management systems, equipment, value engineering (VE), procurement and contracting. Its materiel test and evaluation function includes test-support aircraft, test plans, review and analyses of program execution.

Some functions of the former Review and Analysis Division were transferred to the OCRD Technical and Industrial Liaison Office (TILO) under Lt Col H. H. Berke. Included are responsibilities for coordinating, preparing and presenting OCRD briefings on Army organization and procedures for R&D, and on the scope, coverage and status of the RDT&E program.

• *The Systems Analysis Division,* established with Lt Col Chester R. Smith as chief, is authorized three officers and three civilians. It supervises and coordinates OCRD program responsibility for the Army Master Study Program, studies funded by RDT&E appropriations, and Army Study Advisory Committee matters related to operations research and systems analysis activities pertaining to the Army RDT&E program.

Director of Army Research Col Charles D. Y. Ostrom Jr. announced the following changes effective Apr. 10:

• *The Studies and Analyses Division* was established with Col Robert B. Bennett as chief. The Studies Branch is headed by Lt Col William H. Travis. Lt Col Ralph T. Tierno is chief of the Military Advisers Branch for which five officers are authorized.

Several officers of the Army R&D Operations Advisory Group with the Research Analysis Corp. were reassigned to the Military Advisers Branch. The Branch maintains liaison and monitors various studies and projects under contractual operations research programs.

The Division assumed the operations research responsibilities of the disestablished Human Factors and Operations Research (HF&OR) Division. Charged with project management in studies and analyses for the Army RDT&E program, the Division monitors designated OR projects of other developing agencies, provides input to OR/SA studies and projects funded by RDT&E, and manages OR studies as required to meet the needs of the Army General Staff, the Army Materiel Command and Combat Developments Command.

• *The Behavioral Sciences Division* combines the human factors functions of the former HF&OR Division and the Social Science Research Division in two branches — Human Factors and Social Science. Assistance to contractors is provided through a third branch of Military Advisers.

Col Charles D. Canella is Division chief and Dr. Lynn E. Baker is Army chief psychologist. Lt Col Joseph A. Davis is chief of the Human Factors Branch, and Dr. E. Kenneth Karcher Jr. heads the Social Science Branch.

The Division is concerned with the areas of research concerning human behavior and performance — individually and in groups. This includes research to improve selection, classification, utilization, training, motivation and leadership.

A significant area of endeavor concerns interaction with equipment encompassing training devices and simulators, human engineering or man-machine compatibility, and the role of man in a systems environment.

A critical responsibility of this Division relates to social science research in support of the Army's role in low intensity warfare and internal defense in developing nations.

The Division prescribes policy, operating instructions and performs technical review of research programs. It advises the U.S. Army Behavioral Science Research Laboratory (USABESRL) — formerly U.S. Army Personnal Research Office — the Center for Research in Social Systems of the American University (CRESS/AU), the Human Resources Research Office (HumRRO) of George Washington University, and other contractor organizations. It also supervises and monitors the Army Research Unit, Korea.

Fifty years of providing administrative and technical assistance to the Medical Corps were celebrated by the Army Medical Service Corps May 18.

Presently headed by Brig Gen Philip W. Mallory, the MSC was begun May 18, 1917 as the "Sanitary Corps." Today it has 5,600 officers serving around the world in 18 career fields.

International Meet Reviews Subsonic Aircraft Research

Some 30 technical papers attesting to the rebirth of research in subsonic aerodynamics in recent years were heard by approximately 250 persons at the Apr. 3-6 International Congress of Subsonic Aeronautics in New York City.

Attended by representatives of government, industry and academic institutions, the Congress was sponsored by the New York Academy of Sciences, marking its sesquicentennial year. Session chairmen included scientists and engineers from Great Britain, Canada and France as well as the U.S.

Papers were presented on aerodynamics of fixed-wing aircraft, rotary wings, thermodynamics and aerodynamics of propulsion, boundary layer, the transport role of subsonic aviation, vertical short takeoff and landing (V/STOL), and facilities and techniques.

Aeronautical engineer Paul Carpenter of the U.S. Army Aviation Materiel Laboratories (AVLABS), Fort Eustis, Va., presented a paper on "Design Trends in Future Helicopters, Compounds and Composite Aircraft." It outlined the potential performance of the various types of aircraft and the relative merits and ranges of application for each type.

Participants from the Army R&D community included Col Harry Bush, AVLABS commanding officer, and Robert Powell, Leroy Leudi and William Sickles, all of AVLABS; Richard Ballard, U.S. Army Research Office, Office of the Chief of Research and Development; and Dr. Sud Kumar, Army Research Office, Durham, N.C.

Summary presentations by Dr. Raymond Bisplinghoff of Massachusetts Institute of Technology and Prof. Courtland Perkins of Princeton emphasized that subsonic aeronautics is an important technology that needs continued investigation.

The speakers were in accord that total responsibility for R&D in this field does not belong to government — that industry and the academic community have a significant position in maintaining it.

AVCOM Expands Role In Aircraft Repair

Aircraft overhaul and maintenance operations formerly conducted by the U.S. Army Aeronautical Depot Maintenance Center at Corpus Christi, Tex., were assigned Apr. 1 to the U.S. Army Aviation Materiel Command (AVCOM), St. Louis, Mo.

Brig Gen Howard F. Schiltz, AVCOM commanding general, also announced assignment to his command of the aircraft maintenance missions conducted at New Cumberland, Pa.; Sharpe, Calif.; Atlanta, Ga., and Red River, Tex., Army Depots.

In assuming the latter mission, AVCOM is authorized to program and place workloads directly with the Depots' aircraft maintenance activities, to provide funds necessary to accomplish the assigned workloads, and to furnish staff supervision essential to accomplishment of the activities.

Transfer of the depot missions follows reassignment last November of similar functions to AVCOM from the U.S. Army Aviation Test Activity at Edwards Air Force Base, Calif.

Army Research Council Updates 5-Year Research Plan

(Continued from page 1)

An Executive Summary of the report also was prepared by TARC, containing recommendations for a balanced profile of research and exploratory development effort. It will be an important input in the development of the Army Research Plan by the Army Staff.

Based on an intensive study conducted by TARC over an extended period under the chairmanship of Dr. Richard A. Weiss, Deputy and Scientific Director of Army Research, the report reflects an in-depth consideration of programing R&D for more effective coupling with materiel requirements.

The first 5-year Army Research Plan was published in August 1964. It was the result of daily sessions, often extending until midnight or later, following the organization of TARC in January 1964. TARC is representative of Army in-house laboratories as well as the Army General Staff.

Established by direction of the Assistant Secretary of the Army (R&D) in cooperation with the Chief of Research and Development, TARC consists of 10 of the Army's senior scientists, and a chairman who normally serves one year.

Members are selected as authorities in each of the major disciplinary areas, and they also represent the Army on the Joint Discussion Forums for the Office of the Director of Defense Research and Engineering.

Objective of the latest study to update the Army Research Plan, Dr. Weiss said, is to "provide clear-cut definitions of the work to be done, current status and its relevance to Army needs — present and future . . . provide for all levels of management a clear and comprehensive picture of the Army's research program as we know it today."

Under the heading of "Basic Premises," the report discusses Army roles, missions and combat operations as affected by the world-wide changes now taking place, including the newly emerging nations, and the threat to the security of the Free World.

In discussing the characteristics and nature of research, the report discusses the management of research and cites, as a responsibility, the viewpoint expressed by Presidential Science Adviser Dr. Donald F. Hornig:

"In short, we must communicate a wider sense of the meaning of scientific research, its internal value system, and its value to the nation and its people. We must convey not only its significance to our security, health and welfare, but its wider meaning as one of the humanities, as one of the important forces which shape our appreciation of man's role in the universe."

Motivation of research scientists is discussed as a problem of taking "cognizance of their value, motivation and long-range goals. These characteristics stem, in many instances, from the identification of the individuals with their professions, as distinct from the organization."

The report states: "The most important facet of a philosophy of research management which determines the effectiveness of management is a recognition of the centrality of the people doing research." It contends also:

"Thus, an effective philosophy of Army research management should adhere to an emphasis on the use of the individual scientist's abilities toward science-oriented values, in freedom to pursue original ideas and in contributions to both basic and applied scientific knowledge.

"Therefore, there is nothing unique about the Army as an organization supporting the range of activities characteristic of research. Just as in academic or industrial communities, skillful Army management must recognize its responsibility to identify itself both with the organization and with the scientist. It consciously should be concerned that the ultimate return to the Army is the nature of the answers to questions asked both by management and the scientist.

"It should direct the attention of the scientist toward Army-oriented options when, as so often is the case, there is a potential for pursuing work on alternate approaches, when experimental details are structured to yield knowledge more readily adaptable to Army deficiencies in knowledge, or when the materials of interest more nearly approximate those of Army interest. . . ."

Recognized as one of the problems of research management today is the concern about possible duplication of effort in activities supported by the U.S. Government. The report takes the position that preoccupation with duplication does inhibit creativity and cites, as one of many refutations of this concern, a statement by F. Seitz:

"The risk of duplication is negligible in the areas of good basic science as long as the products of research are subject to the scrutiny of the societies and associations of professional workers either at scientific meetings or in the recognized journals.

"A good scientist does not add to his reputation by copying the work of another unless a new principle is involved or he is checking a crucial experiment carried out by another in order to confirm its range of validity."

Contending that redundancy in research increases the reliability of the results obtained and insures a higher probability of their discovery and acceptance, the report also cautions:

"Blind adherence to a deliberate policy of duplication, however, even when accepted as competitive rivalry, is as much an anathema as rigid demands for no duplication whatsoever."

Coupling of fundamental science to technological needs is stressed as one measure of the effectiveness of research management. The report states:

"The research manager must therefore be a leader but not so vigorous a leader that he stifles the individuality of effort which the research leader must preserve. He attempts to keep his research community informed of the broad areas where technological needs exist and in addition interprets the knowledge being generated in research, to technology. He is influenced in his responsibilities to the coupling process by interpretations of the activities characteristic of research and technology."

In listing reasons for Army involve-

HDL Names Campagna Associate Director

Youthful appearance of Joseph H. Campagna, newly appointed associate director for administration with the Harry Diamond Laboratories, Washington, D.C., is somewhat deceiving in view of 32 years U.S. Government service.

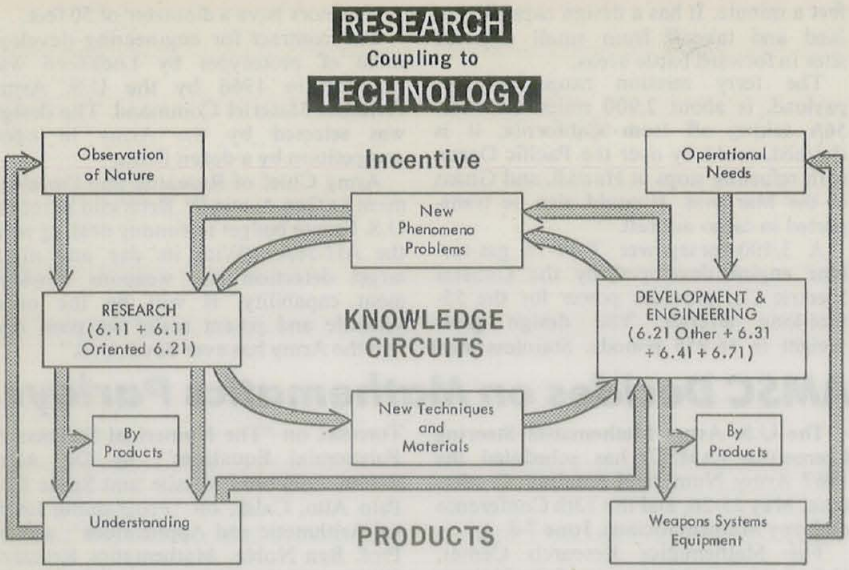
His appointment followed service as chief of the Technical Services Division since October 1965, chief of the Engineering Division from 1961, and chief of Development Laboratory 3 from 1958.

Campagna, now 51, began his government service career in the U.S. Navy from 1935 to 1941. He was employed as a radio and electronic engineer at the Naval Research Laboratory in Washington, D.C., from 1942 until 1949. Then he became an employe of the National Bureau of Standards group which was transferred in 1953 to the Army's new Diamond Ordnance Fuze Laboratories, redesignated the Harry Diamond Laboratories in 1962.

Joseph H. Campagna

Among a number of commendations for outstanding performance, the new associate director received the Department of the Army Decoration for Exceptional Civilian Service in 1964 for his supervisory direction in development of the first proximity fuze for the Terrier guided missile.

He is a member of the American Ordnance Association, the Armed Forces Management Association and a senior member of the Institute of Electrical and Electronics Engineers.



ment in science and research, the report states that a major purpose is "to assure that all technological areas important to the Army are exploited." Among those of particular concern to the Army, or in which the Army has a dominant role, are explosives, ground mobility, tropical medicine, and chemical and biological warfare.

The report holds that "the Army must be the leader and actually perform the bulk of the research in these areas or the work would not be done." Mentioned as other areas of prime Army interest are investigations in electronics, materials, medicine and meteorology.

"Active involvement of the Army in science and research," it is stated, "should assure that the results of research, where done, are applied to solve Army problems. Individuals are needed who are experts both in scientific and military fields. They bridge the gap between research results and ideas and practical military applications.

"Such experts minimize the lead time between the generation of a scientific concept and its Army application. They must continually make critical evaluations of new ideas or research results to determine their applicability to Army problems."

The report states that one of the general misconceptions regarding innovations of dramatic new ideas is that they come about as a logical, time-sequenced progression from research to engineering according to the budgetary ordering from basic research (6.11 budget category) to exploratory development (6.21) to advanced development (6.31) to engineering development (6.41).

"Cases where this happens do exist," the report states, "but they are extremely rare. A pictorialization for the process is not a trivial task; however, the activities involved would be better represented by an adaptation of the idea of R.E. Gibson (Applied Physics Laboratory, The Johns-Hopkins University)." Figure above.

Under the heading of "Criteria for Distribution of Resources," the report comments, in part:

"It might be considered desirable to establish very specific criteria, together with appropriate priorities or weighting factors, so that decisions could be completely quantified and made on an absolute basis. Unfortunately, this is impracticable. The criteria cannot be sharply defined and made clearly independent. Rather, each can have varying degrees of importance and many shades of meaning.

"The best that can be hoped for is to identify the more important factors as a guide to the decision maker, and to emphasize those things which should be deliberately considered in the evaluation. A suggested sequence or order of importance for consideration which will simplify the task can be provided, but the final decision must be made on the basis of value judgments which cannot be realistically mechanized or quantified.

"These judgments must reflect the decision maker's broad backgound of scientific, technical and military experience. Nor can any list of criteria be considered preemptive or exhaustive. As Lord C.P. Snow said to the Panel on Science and Technology of the House Committee on Science and Astronautics:

" 'You watch what other countries are doing and fill the gaps; you rely on a man, or a group, who knows what he wants; you are influenced, as we all are, by the scientific fashions of the time; you even back a hunch.' "

The very nature of research is mentioned as a major factor in the inability to quantify the value judgements required for proper distribution of research resources—making it impossible to predict beforehand specifically what will result from a research program.

The report observes, however, that it is possible to assess roughly the probability of achieving some worthwhile results from basic research and exploratory development efforts. Generally it is conceded that in research "high potential payoffs and low risk are unfortunately incompatible — just as they are in the stock market or at the gambling tables."

The wide diversity of goals of Army research must be borne in mind in considering distribution of resources, the report notes. The basic purpose is to support the Army in its functional missions, including not only the production of materiel, but also the assurance that Army needs in the long-range future will be anticipated and met. The report comments as follows:

". . . This requires the development and maintenance of a scientific and technical staff capable of recognizing scientific developments of potential value, guiding the application to practical purposes, evaluating the performance of contractors, and recognizing science-related operational needs and potential applications. This requires support of a scientific research staff in-house because such a staff can best perform the objective assessment required.

"It must be accepted that the goals of the Army are quite broad in some respects, but are basically limited. The expansion of scientific knowledge for the overall culture, or even practical benefit of mankind, cannot be considered as the sole goal. Army research must be at least indirectly related to the solution of some Army problem."

Polk to Take Command Of U.S. Army, Europe

Lt Gen J. H. Polk will become a 4-star Commander-in-Chief, U.S. Army, Europe, June 1, replacing General Andrew P. O'Meara when he retires.

Currently Deputy Commander-in-Chief, U.S. Army Europe and Seventh Army, General Polk served previously as CG of the 4th Armored Division, U.S. Commander in Berlin, and CG of the V U.S. Corps. From 1959 to 1961, he was Director of the Policy Planning Staff in the Office of the Assistant Secretary of Defense for International Security Affairs. He is a 1933 U.S. Military Academy graduate.

Lt Gen J. H. Polk

Cheyenne Prototype Tested As Speedy Combat Helicoptor

(Continued from page 1)

the Department of Defense contract definition concept.

Designed to escort troop-carrying helicopters in airmobile operations, the AH-56A can provide direct fire support in combat landing zones. It is built to carry wire-guided antitank missiles, rockets, a grenade launcher and a turret-mounted machinegun with a 360-degree field of fire.

The 2-man crew — pilot and copilot-gunner — will be protected from ground fire by built-in armor.

The AH-56A reportedly has quick turnaround capability in its design, permitting crews to rearm and ready the aircraft for return to combat in 10 minutes. A complete engine change reportedly could be accomplished in 30 minutes.

Lockheed has employed its own rigid-rotor system development in the AAFSS. The rotor blades are fixed to the mast instead of being hinged or tethered as on most helicopters. The short fixed wing combines with a forward-thrusting propeller on the tail and a tail rotor to provide continuous forward propulsion and complete directional control throughout the speed range.

The weapons carrier aircraft will have a maximum speed of more than 250 miles an hour, cruise at 240 miles an hour and be capable of stopping quickly to hover in midair. Climb rate is estimated at 3,420 feet a minute. It has a design capability to land and takeoff from small unpaved sites in forward battle areas.

The ferry mission range, without payload, is about 2,900 miles. An AH-56A taking off from California, it is claimed, could fly over the Pacific Ocean with refueling stops at Hawaii, and Guam in the Marianas. It could also be transported in cargo aircraft.

A 3,400-horsepower T-64-16 gas-turbine engine developed by the General Electric Co. provides power for the 55-foot-long aircraft. The design gross weight is 16,955 pounds. Stainless steel main rotors have a diameter of 50 feet.

The contract for engineering development of prototypes by Lockheed was awarded in 1966 by the U.S. Army Aviation Materiel Command. The design was selected by the Army in open competition by a dozen firms.

Army Chief of Research and Development Lt Gen Austin W. Betts said in recent U.S. Senate budget testimony dealing with the AH-56A: "With its day and night target detection and weapons employment capability, it will be the most versatile and potent aerial weapons system the Army has ever developed."

AMSC Decides on Mathematics Parleys

The U.S. Army Mathematics Steering Committee (AMSC) has scheduled the 1967 Army Numerical Analysis Conference, May 25-26, and the 13th Conference of Army Mathematicians, June 7-8.

The Mathematics Research Center, U.S. Army, on the campus of the University of Wisconsin, will be host to the numerical analysis conference. The purpose is to exchange information of interest to Army scientific and technical staffs and technical managers of "other-than-business" computers.

The conference will provide the AMSC Subcommittee on Numerical Analysis and Computers with information on the Army's current needs in numerical analysis and related fields.

Invited addresses will be given by Prof. William M. Kahan, University of Toronto, on "The Numerical Solution of Polynomial Equations"; by Dr. Allen Reiter, Lockheed Missile and Space Co., Palo Alto, Calif., on "Programing Interval Arithmetic and Applications"; and by Prof. Ben Noble, Mathematics Research Center and the University of Wisconsin, on "Roundoff Errors."

The 13th Conference of Army Mathematicians at Fort Monmouth, N.J., will be highlighted by a presentation on "Geometric Programing" by Prof. Richard Duffin, Carnegie Institute Technology.

Geometric programing is described as an approach to optimum engineering designs which is "amenable to digital computer usage and is especially well suited to problems where constraints are involved."

The AMSC will hold its 23d meeting at the Army Research Office, Arlington, Va., May 11-12, to develop recommendations for the AMSC annual report to the Chief of Research and Development.

Dr. S. Kleene, acting director of the Mathematics Research Center, and Dr. Francis J. Murray, director of MRC Special Research in Numerical Analysis, will report on activities and obtain guidance from the committee on future projects.

USAF Asks Army to Cohost Weather Meet

Broadening the scope of joint environmental science meetings initiated in 1965, the U.S. Air Force has invited the U.S. Army to co-host the 1968 Joint Meteorological Technical Exchange Conference.

Air Force Environmental Sciences Director Dr. Robert D. Fletcher, HQ Air Weather Service (AWS), Scott Air Force Base, Ill., extended the invitation informally during the Apr. 4-7 meeting, cosponsored for the first time this year by the U.S. Naval Weather Service and AWS at the Naval Postgraduate School, Monterey, Calif.

Purpose of the technical meetings is to exchange information between the military weather forecasters and between the military and civilian activities performing meteorological research.

Kenneth M. Barnett, acting chief of the Army Atmospheric Sciences Laboratory, Fort Monmouth, N.J., chaired one of the technical sessions.

Attending the sessions were approximately 150 environmental scientists from the Military Services; Department of Commerce Environmental Science Service Administration (ESSA); National Center for Atmospheric Research, Boulder, Col.; Canadian Meteorological Service, Montreal; and private firms.

Army papers presented and the authors are: The Onset of Widespread Rain During the Southeast Asia Summer Monsoon, Marvin Lowenthal of ECOM; Annual versus Daily Rainfall: Southeast Asia, Ruth L. Wexler of NLABS; A Mathematical Model for Air Flow in a Vegetative Canopy, Ronald M. Cionco, Fort Huachuca; Surface Observations of Snow and Ice for Correlation with Remotely Collected Data, Michael A. Bilello of CRREL; and Real Time Pre-Launch Missile Impact Prediction Techniques. Louis D. Duncan of WSMR.

Although the U.S. Army does not have a designated weather service such as the Air Force and the Navy it has an extensive meteorological research and development program.

Environmental R&D is being conducted at a number of Army installations, including the Army Electronics Command (ECOM) Laboratory at Fort Monmouth, N.J., Fort Huachuca, Ariz., White Sands (N. Mex.) Missile Range (WSMR), and Dugway (Utah) Proving Ground. Environmental R&D also is conducted by the Natick (Mass.) Laboratories (NLABS), Fort Detrick, Md., Ballistics Research Laboratory at Aberdeen (Md.) Proving Ground, and the Cold Regions Research Laboratory (CRREL), Hanover, N.H.

The Army also provides special meteorological support to various Army testing activities in continental U.S., Alaska and the Panama Canal Zone.

Army Drafts Management Plan For Information Career Field

Army civilians in the information and editorial fields have been added to the 12 existing career management programs designed to stimulate development of top-caliber executives in all fields.

Specialized training and mandatory referral requirements are the principal features of the program. Described in Civilian Personnel Regulation 950-22, the program designates the Chief of Information as functional chief.

Inventory files of personnel in the program will be maintained at Army, command, and activity levels. Vacancies will be filled from these lists.

The master training plan for employes in the public information series is described in the regulation. Training plans for other editorial personnel will be published at a later date.

Three Nations Join Communications Net

(Continued from page 1)

the focal point for the international project. Simultaneous announcements were made in Canada and Australia.

Objective of the Mallard Project is a system that will handle all modes of message and data transmission, ranging from simple written messages and voice-radio links to automatically switched digital systems and possibly communications satellites.

The schedule calls for a five-to-seven-year research and development program. The follow-on phase for equipment production is slated to provide the system for the participating armies in the 1975-77 time frame.

In the initial development phase, competitive system design studies will be solicited from U.S. industry. Participation by industrial organizations of all three countries will be encouraged in the conduct of supporting technique efforts.

Groundwork for the project was established over the last two years and stabilized during a series of recent international meetings. Operational and technical requirements were defined and agreement was reached on a development plan, management organization and the financial, legal and other matters pertaining to this shared-cost, joint development effort.

U.S. manager for the project is Brig Gen Paul A. Feyereisen, former deputy commanding general for Plans and Programs at the U.S. Army Electronics Command. Lt Col Douglas C. Coughtry and Lt Col Lisle G. Moore are program managers for Canada and Australia, respectively.

Selection of Fort Monmouth as the focal point for managing the development of Mallard was based on the installation's existing resources and competency in all phases of tactical communications-electronics.

The U.S. Army Electronics Command, with 13,000 scientists, technicians, and administrators, is responsible for development, procurement and fielding of virtually all major tactical electronic systems for the Army.

The system approach to the Mallard Project will incorporate the building-block or modular principle of equipment construction to ensure flexible interoperation between field armies of the three countries.

Subsystems will provide comprehensive communications, ranging from front-line fighting units through major echelon headquarters to interoperation with worldwide strategic systems.

State-of-the-art technology will be employed fully to reduce the size, weight and reaction time of system components and to incorporate the concepts of mobility, versatility and high reliability into the Mallard system.

Lt Col Douglas C. Coughtry

Lt Col Lisle G. Moore

Preliminary Mallard work was carried out under the guidance of the U.S. Army Office of the Chief of Communications-Electronics, now headed by Maj Gen Walter E. Lotz Jr., former Director of Army Research, in Washington, D.C.

As the project now stands, the Program Management Board, comprised of the project manager from each country, will provide guidance for the international undertaking.

General Feyereisen is serving with Mallard on two levels. As U.S. program manager, he represents the nation on the international aspects by authority of U.S. Army Chief of Staff General Harold K. Johnson. In directing the U.S. part of the work, he is project manager for the U.S. Army Materiel Command headed by General Frank S. Besson Jr. in Washington, D.C.

An International Joint Engineering Agency also has been set-up to provide technical and engineering coordination of the program.

U.S. Army Electronics Command (ECOM) elements and the U.S. Army Combat Developments Command's (USACDC) Communications-Electronics Agency will provide major support to the project during the next decade.

Among the tasks of the USACDC Agency, commanded by Col E. V. Vestal, is determination of technical requirements and operating characteristics of equipment that will be employed in the system in terms of practical usage by combat troops.

Among the heaviest contributors to the program will be three of ECOM's seven labs — the Automatic Data Processing Lab, directed by Col George M. Snead Jr.; the Electronics Components Lab, directed by Dr. Eduard A. Gerber Jr.; and the Avionics Lab, headed by Col Leslie G. Callahan Jr.

Walker to Take Command of Rocky Mountain Arsenal

Rocky Mountain Arsenal, Denver, Colo., will receive Lt Col John W. Walker as its new commander in June when Lt Col Martin J. Burke Jr. departs for a new assignment as assistant professor of military science at Georgia Institute of Technology.

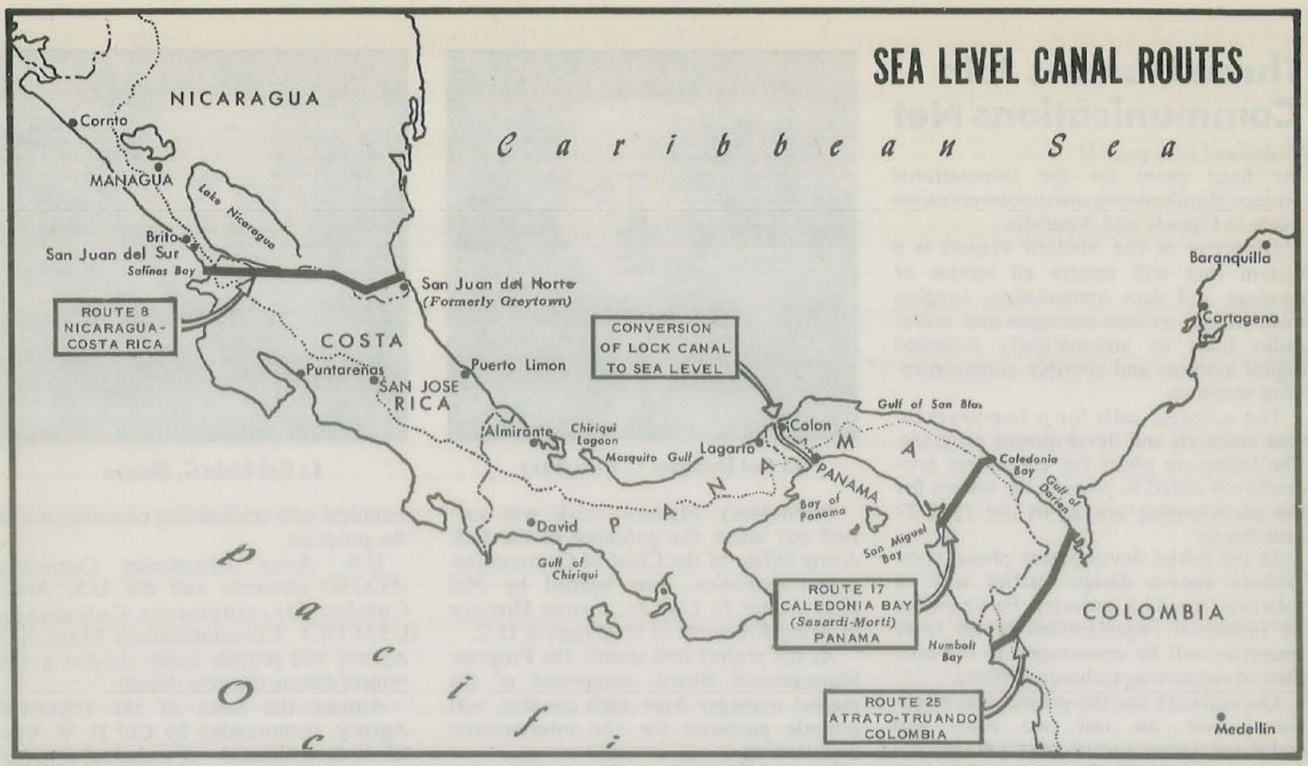
Lt Col Walker is completing studies at the Industrial College of the Armed Forces in Washington, D.C. He has a BS degree from Pennsylvania State University, an MA degree in education from Iowa State University, and an MS in biochemistry from the University of Wisconsin.

Lt Col Walker (left) and Lt Col Burke

Commissioned in the Regular Army in 1957, he has attended the Chemical Officers Advanced Course at Fort Mc Clellan, Ala., and the Command and General Staff College, Fort Leavenworth, Kans.

His military career began in the Chemical Corps following completion of ROTC training in 1942. He participated in five campaigns in Western Europe during World War II, reverting to Active Reserve status in 1946. Recalled to active duty in 1951, he served in Korea and in 1953 was assigned as a CBR instructor for U.S. Forces in Japan.

Other assignments include assistant professor of military science and tactics at Wake Forest College; member of the CBR Briefing Team; personnel officer, Office, Deputy Chief of Staff for Personnel; CO of the 83d Chemical Battalion at Fort Bragg, N.C.; and manpower control officer, J1, MACV, Vietnam.



Scientists, Engineers Study Colombian Canal Site

In a multiagency, multidisciplinary scientific quest for a sea-level canal site, U.S. research and engineering outposts have been set up for the first time in the South American jungle of Colombia. Similar work began more than a year ago in eastern Panama.

The U.S. Army Corps of Engineers used the December-April dry season to establish access roads, base and line camps, and meteorological stations along the previously charted Choco jungle route in Colombia. Located more than 150 miles east and south of the Panama Canal, the Choco route is about 100 miles long. The Panama Canal is 46 miles long.

President Lyndon B. Johnson appointed the 5-man Atlantic-Pacific Interoceanic Canal Study Commission (ICSC) in 1965. The Commission-invited Advisory Council for the study consists of the U.S. Secretary of State, the Secretary of the Army (representing the Department of Defense) and the chairman of the U.S. Atomic Energy Commission (AEC).

The ICSC is chaired by Robert B. Anderson, who has served since 1964 as Special Representative of the United States for U.S.-Panama Relations. He is a former Secretary of the Navy, Deputy Secretary of Defense, and Secretary of the Treasury.

Brig Gen Harry G. Woodbury Jr., as Engineering Agent of the ICSC, is directing the activities of more than a dozen major U.S. agencies participating in the study of the engineering feasibility of constructing a sea-level canal at each of four locations including the one in Colombia. Brig Gen Woodbury is Director of Civil Works, Office, Chief of Engineers.

In addition to seeking the best possible site for excavating a sea-level canal by either nuclear explosion or conventional techniques, the ICSC is also exploring the feasibility of converting the Panama Canal to sea level. The complicated lock canal, completed in 1914, is being outgrown by the ever increasing size of new ships and by steadily mounting traffic the volume of which is expected to continue to increase for many years.

Upper-air data collection was started late last year in the Canal Zone by an Army meteorological team from Fort Huachuca, Ariz., by firing rockets from the Battery MacKenzie site at Fort Sherman.

An Air Force team from the 6th Weather Wing, Andrews Air Force Base, Md., has joined the Army team for a 2-year stint of daily firings of Loki and Judi-Dart meteorological rockets. Army Maj Keith E. McCall Jr. is in charge of the joint team.

This aspect of data collection is under the direction of the AEC Nevada Operations Office and is concerned with safety studies involving acoustical wave effects relating to nuclear excavations.

Overall atmospheric studies are conducted by the U.S. Environmental Science Service Administration (ESSA). An extensive bioenvironmental data collection program and supporting troposphere meteorology studies are needed to predict transport and deposition of radioactivity.

The minimum 2-year observation sequence will allow analyses of various cyclic weather changes, including biennial, annual, semiannual and shorter-period waves which may occur in the equatorial ozonosphere.

The weather data will be used to predict periods when high yield excavation bursts may be fired without causing damage in inhabited areas. Rocket observations are being furnished to the Meteorological Rocket Network (MRN) collection system and weather teletype service.

Meteorological, seismic, blast, biological, ecological and other environmental studies will serve as a basis to determine — after nuclear cratering and nuclear engineering studies are coordinated — whether the remote routes in eastern Panama and northwestern Colombia can be safely excavated with nuclear explosives. The data being collected on the geology, topography, hydrology and hydrography are needed to determine technical feasibility.

Among the studies conducted by the ICSC to provide a comprehensive foundation of factual data, estimates and expert opinions upon which to base its ultimate findings and recommendations are:

- Foreign policy considerations related to the construction and operation of an Atlantic-Pacific sea-level canal.
- National Defense aspects.
- Canal finance.
- Interoceanic and intercoastal shipping.
- Engineering feasibility.

Several Isthmian canal studies have been made since World War II and the advent of the atomic bomb which made any lock canal "highly vulnerable." One report by the Governor of the Canal Zone in 1947 included investigations made of 30 different routes from the Isthmus of Tehuantepec, Mexico, south to northwest

Colombia. There investigations did not include on-site data collection.

The governor concluded then that "a sea-level canal constitutes the only means of meeting adequately the future needs of interoceanic commerce and national defense, and such a canal can be obtained most effectively and economically by converting the present Panama Canal to sea level." Estimated cost was $2.3 billion.

Updated studies by the Panama Canal Co., the U.S. Army Corps of Engineers and the U.S. Atomic Energy Commission have narrowed the choice of routes for nuclear excavation to Routes 17 and 25 (see map) in the unpopulated jungles.

Excavation by conventional methods still is being considered for converting the lock canal to sea level. The Nicaragua-Costa Rica border (Route 8) area has been mapped for conceptual studies.

During the past dry season, geological cores from several hundred feet deep have been extracted for the first time in the Darien jungle of Panama as part of the below, on, and above the ground study.

Although completion of feasibility studies originally was planned for 1968, the Commission recently asked the Congress for an extension to 1970.

Delays in obtaining survey agreements with both Panama and Colombia postponed the start of site studies. Field work on Route 17 did not begin until late February 1966. Full-scale work in Panama and Colombia (Route 25) did not start until January 1967.

Several comparative studies of costs for conventional and nuclear excavation have been made since 1947. The latest, in 1964, puts the cost of nuclear construction of a canal at the Sasardi-Morti site in Panama at $747 million versus a "possible" minimum of $1.8 billion for conventional conversion of the present lock canal (see chart).

The existing Panama Canal accommodates some 12,000 ships annually and, with supporting services, employs about 14,000 persons. Approximately 3,800 are U.S. Citizens. Considerably fewer persons would be required to operate a sea-level canal, according to current estimates.

Some 500 existing ships cannot transit the Panama Canal fully loaded and the locks are impassable for some 70 other ships built with the knowledge that they exceeded the canal's dimensions.

Table 1

Comparative Studies of Costs For Conventional and Nuclear Excavation

Route	Conventional Length (miles)	Conventional Construction Cost (Millions)	Conventional (Est. year)	Nuclear Construction Cost (Millions)	Nuclear (Est. year)
Panama (Canal Zone)	46	$2,176*	1964	Not feasible	
Panama (Sasardi-Monti)	48	5,132	1947	$ 747	1964
Nicaragua (Greytown-Salinas Bay)	140	4,135**	1964	1,850	1960
Colombia (Atrato-Truando)	100	5,261	1949	1,440	1964

**1964 studies indicate a possible reduction to approximately $1.8 billion through latest techniques and elimination of many items not directly connected with canal operations.*

***1964 estimate for lock canal only. No estimate has been made for conventional construction of a sea-level canal through Nicaragua.*

Army Library Lists New R&D Publications

Recent acquisitions of the Army Library in the Pentagon, Washington, D.C., include the following publications of interest to R&D personnel (code numbers in parentheses):

Abstracts of U.S. APRO Research Publications — FY 1966, Emma E. Brown (U 408.3 .U582 v. 177).

Analysis of Major Scheduling Techniques in the Defense Systems Environment, An, J. N. Holtz (Q 180 .A1 R18 no. 4697).

Combating Subversively Manipulated Civil Disturbances, Adrian H. Jones (JC 494 .J77).

Computers and the Law: An Introductory Handbook, American Bar Association (KC 55 .C73 A51 1966).

Defense Against Biological Weapons, Morton Reitman (UG 447.8 .R37).

Design of Instructional Systems, The, Robert G. Smith (G 15 .G34a 66-18).

Detection of a Broadband Target in Nonstationary Noise by a Non-directional Hydrophone, Franz B. Tuteur (Q 180 .A1 R18 no. 5101).

Economics of Automatic Data Processing, Papers Presented at the International Symposium Organized by the International Computation Center, Rome, 1965, A. B. Frielink (HF 5548.2 .F91).

Estimating the Importance of Individual Radionuclides in Fission and Induced Product Mixtures, Philip D. LaRiviere (QC 795 .L31).

Fluid Dynamic Aspects of Space Flight, The, proceedings of AGARD-NATO specialists' meeting, 1964, vol. 1 (TL 500 .A26 No. 87).

Generating Random Information for Experimental Decision Problems, Robert F. Boldt (U 408.3 U582 v. 171).

Genetic Effects of Radiation, The, Norman Arnheim (Q 180 .A1 R18 no. 5096).

Henry's Law Constants for Dissolution of Fission Products in a Silicate Fallout Particle Matrix, John H. Norman (QC 790 .N84).

Human Factors Considerations of Undergrounds in Insurgencies, Andrew R. Molnar (U 240 .M72).

IFIP-ICC Vocabulary of Information Processing, International Federation of Information Processing (QA 76.15 .I61).

Instrumentation for High-Speed Plasma Flow, A. E. Fuhs (TL 500 .A26 no. 96).

Management Uses of the Computer, Irving I. Solomon (HF 5548.2 .S68).

Manager's Guide to Making Changes, A, Arnold S. Judson (HD 38 .J93).

Master Directory for Latin America, Containing Ten Directories Covering Organizations, Associations, and Institutions, Martin H. Sable (F 1046.5 .S11 1965).

METRIC: A Multi-Echelon Technique for Recoverable Item Control, Craig C. Sherbrooke (Q 180 .A1 R18 no. 5078).

Motivational Factors Affecting Army Research and Development Personnel, Dale W. Dysinger (US 173 .A25 v. 1149).

Multiple Access Techniques for Communication Satellites, C. R. Lindholn (Q 180 .A1 R18 no. 4997).

On the Construction of a Mathematical Theory of the Identification of Systems, Richard E. Bellman (Q 180 .A1 R18 no. 4769).

On the Dynamic Programing Treatment of Discrete-Time Variational Problems, Stuart E. Dreyfus (Q 180 .A1 R18 no. 5159).

Organization and Presentation of Image Interpreter Reference and Auxiliary Information, Arthur Nelson (U 408.3 U582 v. 173).

Physics and Technology of Ion Motors, Proceedings of a Technical Meeting of the AGARD Combustion and Propulsion Panel, 1963, Frank E. Marble (TL 500 .A26 no. 88).

Proceedings, International Conference on the Physics of Semiconductors, (QU 612 .S4 161 1966).

Programing by Questionnaire: How to Construct a Program Generator, Paula M. Oldfather (Q 180 .A1 R18 no. 5129).

Programing Language LISP; Its Operation and Applicaions, Edmund C. Berkeley, ed. (QA 76.5 .B51).

Pulse Trains in Lateral Geniculate and Retinal Ganglion Nerve Cells, R. J. MacGregor (Q 180 .A1 R18 no. 4870).

Soviet Cybernetics Technology: VIII, Report on the Algorithmic Language ALGEC, Wade B. Holland (Q 180 .A1 R18 no. 5136).

South Vietnam, D. Pike (DS557.A6 P63).

Gunners Down Target Drones With Shoulder-Fired Redeye

The U.S. Army's Redeye infrared, heat-seeking missile system "bagged" five out of a possible six target drones when fired by 101st Airborne Division gunners graduating from a course at Fort Bliss, Tex.

Troops demonstrated the effectiveness of the 30-pound shoulder-fired weapon against low-flying aircraft. Direct hits previously have been made on a variety of aircraft targets, including unmanned jet fighters.

Development of Redeye has been funded jointly by the Army and U.S. Marine Corps. which will share in the output of production hardware.

Simplicity of Design Stressed in Electronic Equipment

By Col Morris W. Pettit

Without an important replacement part, we may lose the capability of one of our "first line of defense" missile units. A commander strives to avoid a situation in which he must report his missile battery out of action due to the failure of equipment. Serious impact of the loss in combat readiness is a blow to his pride and that of the battery with respect to ability to maintain equipment.

The fact that the equipment is highly complex is not an exonerating factor; with its tremendous capabilities, one could expect it to be complex. The battery, however, must have its full complement of highly skilled maintenance personnel and plenty of spare parts. Unfortunately, many factors can cause the supply of both to lag behind the demand.

One of the greatest burdens on the Army today is the requirement to maintain vast quantities of complex equipment at the necessary level of materiel readiness. Constantly, we are challenged to find ways to reduce the maintenance load and its related logistics demand. This challenge can be met only if we place the proper emphasis on simplifying our equipment.

Simplification does not mean that we must give up our requirements for important complex functions within respective items of equipment or systems. Complex functions can still be performed by hardware designed with a high degree of emphasis on simplicity in modes of operation and maintenance.

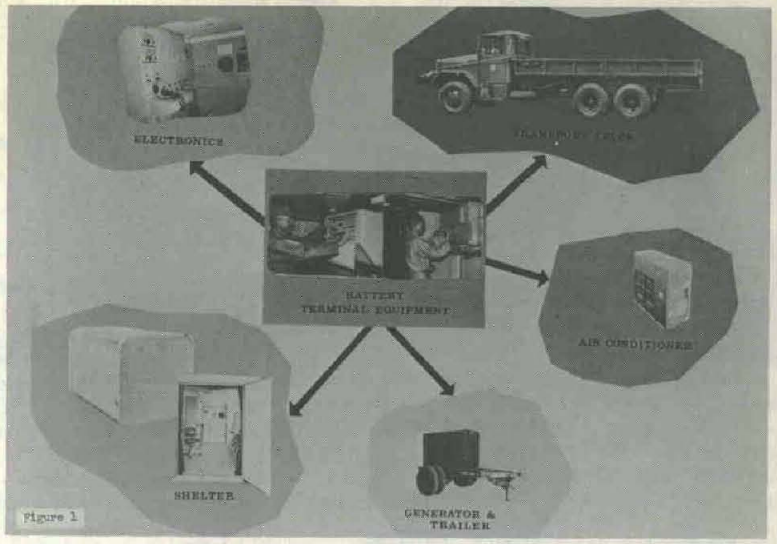
The ultimate objective would be the development of military hardware which is simple to operate, yet has a low probability of failure or requirement for maintenance during its useful life. It is now possible to approach this objective, particularly in the field of electronic equipment, by use of current technology in microelectronics.

Significant increases in reliability have been demonstrated by applications of microelectronics in production-type military hardware. This permits us to simplify our logistic support problems and change our existing maintenance support philosophy.

The present philosophy in military electronics maintenance of locating failures and replacing the smallest removable part such as resistors, transistors, tubes, capacitors, etc., is no longer practicable with current microelectronic packaging techniques.

Exhibited reliability of microelectronics is sufficiently high to warrant packaging of many circuits into individual functional units or modules. The resultant small number of different replaceable parts, and the low cost per unit of microelectronic integrated circuits, makes a self-test, discard-at-failure maintenance concept entirely practicable.

A fine example of the Army's current military application of this technology is the new Data Converter, Battery Terminal Equipment (BTE). This system, which provides an instantaneous data processing link between Army surface-to-air missile batteries and their Army air defense command posts, is expected to yield the highest availability and lowest mainten-



ONE OF THE BTE MODELS produced by Martin Marietta Corp. and by Litton Industries (center) will replace all equipment in the surrounding pictures.

Weapons Command Announces 3 Commodity Managers

Three commodity managers for Army Weapons Command (AWC) systems were appointed recently by Brig Gen William J. Durrenberger, commanding general.

Frank X. Connolly has commodity management responsibility for Automatic Data Systems within the Army in the Field (ADSAF), which includes the M18 computer and associated electronic maintenance equipment.

Backed by 18 years combined military and civilian government service, he has been with the AWC Comptroller and Programs Directorate as a program analyst project officer for various artillery and fire control items. He was employed at Watervliet (N.Y.) Arsenal for 13 years.

George N. Burdick, manager of the M102 howitzer system, a new lightweight 105mm weapon designed for air mobility, has 15 years of government service. Once emplaced, the M102 can be fired in any direction from a single position and is now in use in Vietnam.

Lowell B. McClain is commodity manager for the Commando V100, 4-wheel drive, armored car, capable of land speeds up to 60 miles miles an hour. The V100 features a twin-weapon cupola and 11 gun ports for small arms firing. Used primarily for antiguerrilla warfare and convoy escort, it has specially designed run-flat tires which allow the commando to remain in action if the tires are hit by enemy fire.

During the past year, McClain has been acting commodity manager for the V100 and has been a program management specialist and coordinator of principal and major secondary item programs for the Army Weapons Command since 1964.

Frank X. Connolly

George N. Burdick

Lowell B. McClain

ance cost yet achieved in equipment used for this purpose.

In a comparison with the systems being replaced, such as the Coder-Decoder Group or Fire Unit Integration Facility, the contrast is astounding. Reductions of more than 90 percent in weight, size and power requirements have been achieved in the new system.

Less than four cubic feet in size, the new BTE can be installed in the existing control centers of the Hawk and Nike Hercules missile batteries. This eliminates not only the truckload of electronic equipment which it replaces. Eliminated also is the requirement for the separate truck, shelter, air conditioner, generator and generator trailer. (Figure 1).

The commonality of components within the system has resulted in at least a 10-to-1 reduction in the number of replacement parts when compared with existing equipment. No external test equipment is required since a built-in "self-test" feature permits isolation of trouble to the throw-away part level.

Notwithstanding its small size, a complete load of replacement parts is packaged within the basic system when it is deployed. This will permit reduction in numbers and overall skill level of personnel trained to meet maintenance requirements.

The use of microminiaturized integrated circuitry with proven reliability provides operational time between failures approximately 100 times longer than that provided by present systems in the field.

Under a competitive R&D development program, two contractors, Litton Industries and Martin Marietta Corp., have developed preproduction models of the BTE. The results of tests and evaluation of these models by the Army will determine which one will be selected for production.

Many commercial applications of microelectronics are appearing on the market in TV sets, hi-fi stereo equipment, phonographs, clocks and radios. Microelectronic circuits, modules and subassemblies are now being mass produced by at least a dozen manufacturers to meet both industrial and military requirements. Some companies are predicting that all their consumer electronic products will use microcircuits by the end of the decade.

Achievement possibilities with this new technology are limited only by our ability to make use of the opportunities at our disposal. It is entirely possible that by 1970 the microcircuits may do to transistor-type electronic equipment what transistors have been doing to radio tubes.

Artillerymen have long advocated a so-called "wooden round" concept. It is now possible to approach this concept in electronic systems.

If we are to have this simplicity, however, we must resist the temptation to add on refinements which tend to overcomplicate the systems, increase cost, stretch out programs, and reduce their competitive position for funding.

Add-on requirements, in the interest of achieving perfection, can sometimes result in the death of a program. Rapid changes in technology, point up the need for giving the developer more latitude in selection of techniques for meeting equipment requirements.

Current state-of-the-art permits production of equipment which provides wide flexibility without overcomplication, thus allowing the user to change concepts dictated by the place and type of war being waged.

Equipment must be designed to accommodate changes in concepts rather than dictate or limit concepts. For the sake of all those concerned with its operation and maintenance, "Let's keep it simple."

Col Morris W. Pettit, chief, U.S. Army Missile Command Air Defense Control and Coordination Systems Office, Redstone Arsenal, Ala. . . . Texas A&M and U. of Southern California, MS degree, mechanical engineering . . . formerly assigned to Office, Chief of R&D, as military advisor Operations Research Office and Research Analysis Corp., Hart Committee for Civil and Air Defense of CONUS, Committee on Army Requirements for Scientific Support, and Project 80 Committee on Reorganization of the Army . . . commanded 69th Artillery Group, Wurzburg, Germany . . . deputy assistant CofS, P&A, Stuttgart, and IG, U.S. Army Communications Zone, Europe

BESRL Reports on 2 Analysis Tasks

Various aspects of human performance as gauged in two data analysis tasks are discussed in two recent reports of the U.S. Army Behavioral Science Research Laboratory. Redesignated recently, the BESRL was formerly the U.S. Army Personnel Research Office (USAPRO), consisting of five laboratories.

A study conducted by the Support Systems Research Division shows that alpha-numerical and graphical presentation of information result in equally efficient decision-making for certain tasks.

The study is described in Technical Research Note 178, *Decision Making with Updated Graphic vs Alpha-Numeric Information,* by Frank L. Vicino and Seymour Ringel.

Subjects were shown series of slides depicting buildup of three enemy forces and asked which was preparing to attack. Two different rates of updating, 7 slides and 14 slides, were used.

The fact that no differences were found in efficiency of decision-making based on the four combinations, the report states, raises a question concerning the utility of introducing elaborate symbol generation and display devices in future information processing systems.

If graphic presentation is deemed necessary for specific tasks, it can be plotted manually without the attendant costs and problems of supporting elaborate automated symbol generation devices, the report suggests.

The study was conducted as part of BESRL's Command System Task, which determines how human abilities can be utilized to enable command information processing systems to function with maximum efficiency.

Relative Effectiveness of Different Viewing Devices for Photo Interpretation, Technical Research Note 179, by Boyd L. Mather, observes that the light table method yields significantly better performance than rear projection. Researchers also found that performance on higher quality and larger-scale imagery are significantly better.

The report indicates that findings are not broad enough in themselves to warrant rejection of rear projection systems for tactical image interpretation facilities. The study was conducted jointly by the System Development Corp. and BESRL.

"TURN IT IN FOR A NEW ONE," a command not taken seriously by paratroopers nor by many helicopter pilots hit by a Viet Cong .50 caliber "slug," is taken literally by WO Larry L. Benne (center) as he exchanges the life-saving armored vest he wore in Vietnam for a new, improved model at the U.S. Army Natick (Mass.) Laboratories. Brig Gen William M. Mantz, CG of the Laboratories where military body armor is developed made the presentation. Col C. T. Riordan, deputy commander, holds the fragmented bullet. Returned from Southeast Asia duty, Benne is now assigned to the 5th Infantry Division, Fort Carson, Colo.

OCRD Personnel Slated for Advanced Schools

Eight officers and two civilians in the Office of the Chief of Research and Development, Department of the Army, will enroll in August in advanced U.S. military service schools.

The students will be distributed in the National War College (NWC) and the Industrial College of the Armed Forces (ICAF), both at Fort McNair, Washington, D.C.; Army War College (AWC), Carlisle Barracks, Pa.; Command and General Staff College (CGSC), Fort Leavenworth, Kans.; and the Armed Forces Staff College (AFSC), Norfolk, Va.

NWC students are Lt Col John W. Lauterbach, Lt Col Leon L. deCorrevont, Dr. Allan L. Forbes and Lt Col Thomas U. Greer. Lt Col Lauterbach has been an OCRD staff officer since October 1966 in the Air Mobility Division. A 1947 graduate of the U.S. Military Academy (USMA), he completed CGSC in 1956.

Lt Col deCorrevont graduated from the USMA in 1949 and served as an assistant professor in the Department of Physics and Chemistry for three years. He was assigned to the Research Plans Office of the Army Research Office, OCRD, in the fall of 1966 after serving at Fort Sill, Okla., and in Vietnam.

Dr. Forbes is a medical officer assigned since 1963 to the Scientific Analysis Branch, Life Sciences Division, Army Research Office. Graduated with a BSc degree from McGill University in Montreal, Canada, in 1949, he earned an MD degree in 1953 from the Medical College of Virginia (MCV) and an MS in biochemistry in 1964.

He interned at MCV and the University of Colorado and from 1954 to 1958 served at the U.S. Army Medical Research and Nutrition Laboratory, Natick, Mass.

Lt Col Greer is assigned as a staff officer in the OCRD Combat Materiel Division and served formerly as G-3, 25th Infantry Division in Vietnam. He has an MS degree in theoretical and applied mechanics from the University of Illinois, and has completed courses at the CGSC and AFSC.

ICAF students will include Lt Col Grayson D. Tate Jr. and Richard A. Ballard. Currently chief of the Nike-X and Space Division, OCRD, Lt Col Tate was assigned to the staff in March 1967, following a 2-year tour as commander of the 3d Battalion, 38th Artillery, Fort Sill.

A 1950 graduate from the U.S. Military Academy, he received BS and MS degree in aeronautical engineering from Georgia Institute of Technology in 1957 and 1958. He is a 1962 CGSC graduate and has completed the AFSC.

Richard Ballard is an aeronautical engineer with the Physics, Electronics and Mechanics Branch and has been assigned to the Physical and Engineering Sciences Division, USARO, since 1960. He graduated with a BS degree in aeronautical engineering from Virginia Polytechnic Institute in 1950 and in 1954 received a master's from New York University.

Scheduled to enroll at the Army War College are Lt Col Walter O. Bienke and Lt Col Ralph T. Tierno Jr. Since 1964, Lt Col Bienke has been a staff officer with the Combat Arms Branch, Combat Materiel Division, OCRD. He is a 1948 graduate of the U.S. Military Academy and completed the CGSC course in 1960.

Lt Col Tierno Jr. is chief of the Military Adviser Branch, Studies and Analyses Division of USARO. He was assigned to OCRD in 1964 as a member of the Operations Research Advisory Group at Research Analysis Corp. A 1945 graduate of the USMA, he has an MS degree in electrical engineering from Oklahoma University (1959) and is a CGSC graduate.

Lt Col Patrick W. Wilson, who will attend the AFSC, has been a staff officer with the OCRD Nuclear-Chemical-Biological Division since 1965. He is a 1950 graduate of the USMA and in 1959 received an MS degree in physics from the U.S. Navy Postgraduate School.

Lt Col Frank A. Hemming III will attend the CGSC after serving in the OCRD International Office since last fall. He is a 1950 Military Academy graduate where he taught Portuguese after a year at the U.S. Army Language School.

Bennett Assigned to Head Army R&D Group (Europe)

Few Army R & D officers can surpass the record of almost continuous service since 1954 that Col Robert B. Bennet will take to an assignment July 31 as commander, U.S. Army Research and Development Group (Europe).

Except for a year in Korea as chief, Plans Division, Quartermaster Section, HQ U.S. Army, he has served steadily with the Office of the Chief of Research and Development in Washington, D.C., since July 6, 1959.

After serving with the U.S. Army Standardization Group in Canada on an R&D assignment from 1954 to 1957, Col Bennett was chief, War Plans Division, Office of the Quartermaster General in Washington, from 1957-59.

Currently chief of the Studies and Analyses Division (formerly the Human Factors and Operations Research Division) and also acting chief of the former Social Science Research Division, U.S. Army Research Office, Col Bennett will succeed Col Charles L. Beaudry as CO of the Army R&D Group (Europe).

Col Beaudry succeeded Col Charles D. Y. Ostrom Jr. as commander of the Army R&D Group (Europe) in July 1963 upon completion of Col Ostrom's 3-year tour. Col Ostrom is Director of Army Research.

Col Bennett was assigned to the Combat Materiel Division, Office of the Chief of Research and Development, in 1959 and was chief of the Division in 1961-62, prior to assignment to Korea. Upon his return, he served as staff officer in the Life Sciences Division, Army Research Office, until he became chief of the Social Science Research Division in August 1965.

Col Robert B. Bennett

While assigned to the Army Research Office, he has served as the representative of the Office of the Chief of Research and Development on the TECSTAR (Technical Career Structure Army) Study Group. He also chaired the OCRD Planning Group for the recent reorganization.

Col Bennett was graduated from Mount Union (Ohio) College in 1938 with a BA degree in education and social sciences, did graduate work at Ohio State University and earned a BA degree in management from New York University in 1948. He has completed courses at the Army Command and General Staff College, Industrial College of the Armed Forces, the Army Special Warfare School, and Army Management School; also, the Radiological Defense Course and the U.S. Civil Service Commission course in research management.

Col Bennett's new assignment makes him responsible for maintaining scientific liaison and monitoring research contracts with universities and various research organizations in 14 European nations pertinent to the mission of the U.S. Army.

He will coordinate the Army's support of research with the European offices of the U.S. Department of State, Department of Argiculture, Office of Naval Research, Air Force Office of Aerospace Research, National Institutes of Health of the U.S. Public Health Service, & other agencies.

Cook Becomes AFIP Executive

Lt Col Dudley P. Cook, U.S. Army Medical Service Corps (MSC), recently succeeded Col Ralph G. LeMoon, MSC, as executive officer of the Armed Forces Institute of Pathology (AFIP).

Formerly the AFIP personnel officer, Lt Col Cook has served in Germany, Japan, Korea, California, Kentucky, Ohio and Texas, as well as in Europe during World War II. In 1953, he was adjutant of the Walter Reed Army Medical Center. He has studied at DePauw, Baylor and Maryland Universities.

Lt Col L. S. Bomar Jr.

Lt Col P. R. Feir

Lt Col D. H. Money

4 Officers, 3 Civilians Take OCRD Posts

Seven newcomers to staff officer or key civilian assignments in the Office of the Chief of Research and Development, Department of the Army, include four officers and three civilians.

LT COL BOMAR (Lesil S. Jr.), assigned as a staff officer in the Life Sciences Division, U.S. Army Research Office (USARO), served until recently in Vietnam as Quartermaster adviser and deputy senior adviser, II Area Logistical Command, Vietnamese Army.

Lt Col Bomar has served in Alaska as chief, Services Division, HQ, Wildwood Station, and chief, Self Service Center and troop supply officer (S-4), U.S. Army, Alaska Support Command.

He holds a BS degree in textile manufacturing from Clemson University (1952) and an MS degree in textiles from the Georgia Institute of Technology (1956). His military schooling includes the Command and General Staff College, the Advanced Quartermaster Officers' Course, and the procurement management course at the Army Logistics Management Center, Fort Lee, Va.

Among his decorations are the Bronze Star Medal and Presidential Unit Citation.

LT COL FEIR (Philip R.) is a staff officer in the Special Warfare Division, OCRD. Last assigned to Vietnam, he was Battalion Commander of the 2d Battalion, 35th Infantry, 3d Brigade, 25th Infantry Division since May 1966.

Lt Col Feir was an assistant professor in the Department of Electricity at the U.S. Military Academy from 1960 to 1963. Earlier, he was a G-3 action officer with HQ Third U.S. Army in Atlanta, Ga., and 7th Infantry Division, Korea.

A 1949 graduate of the U.S. Military Academy, he earned an MEE degree from Georgia Institute of Technology in 1960. He completed the Infantry Officers Advanced Course at Fort Benning, Ga., in 1956 and the Command and General Staff College course in 1964. He holds the Silver Star, Legion of Merit, Bronze Star with "V" device, and the Air Medal.

LT COL MONEY (David H.) comes to the Air Mobility Division, OCRD, from the U.S. Army Concept Team, Vietnam, as project officer for field evaluation of the armed Chinook helicopter and a branch chief in the Aviation Division.

From 1963 to 1966, he was with the U.S. Army Aviation Test Board, Fort Rucker, Ala., as a project officer with the Armament Test Division and chief of the Aircraft Test and Logistics Evaluation Divisions.

Lt Col Money has served with the U.S. Army Advisory Group, Alaska, 1st Eskimo Scout Battalion; instructor in the Airborne-Air Mobility Department, U.S. Army Infantry School, and company commander, 1st Battle Group, 29th Infantry, Fort Benning, Ga.; and with the Army Aviation Training Team, Military Assistance Advisory Group, Germany.

Graduated from the Command and General Staff College, Liaison Pilot, and Helicopter Flight Schools, he holds the Soldier's Medal, Bronze Star, with Oak Leaf Cluster, Air Medal with seven Oak Leaf Clusters, and the Army Commendation Medal.

CW/3 SISCO (Bobby Joe) is backed for his new assignment as a staff systems analyst in the Nike-X System Office, OCRD, by long experience in the Nike program. His last assignment was as Nike-X special study project officer on temporary duty to the Office of the Deputy Chief of Staff for Military Operations, Washington, D.C.

While stationed for 38 months at Fort Bliss, Tex., he was Nike-X Special Study project officer with the U.S. Army Combat Developments Command (USACDC) and Nike-X project officer with the USACDC Air Defense Agency. He has been Nike-Zeus Liaison Officer to the Bell Telephone Laboratories and a Nike-Hercules Research and Analysis project officer at the U.S. Army Air Defense School, Fort Bliss.

Sisco has taken several Army engineering and missile maintenance training courses. He holds the Legion of Merit and Army Commendation Medal.

PHILIP A. DILLABER, a civilian administrative officer in the Nike-X System Office, comes from HQ U.S. Continental Army Command, where he was a program analyst with the comptroller since 1962. Prior to that he was a management analyst with the comptoller, HQ Fifth Army, for eight years.

Dillaber holds a BA degree in economics from the American International College, an MBA degree in finance from Indiana University, and has done graduate work in economics at the Universities of Michigan and Indiana. He has completed Army courses in finance, comptrollership, and data processing.

PAUL A. TURNER is a budget analyst in the Programs and Budget Division, OCRD. He has been a budget analyst with the Harry Diamond Laboratories since graduating from American University with a BS degree in business administration in 1958 and has done graduate work in public administration at American University.

He has attended the middle management and financial management institutes sponsored by the U.S. Civil Service Commission, and a variety of management courses sponsored by the Army.

JOHN A. WHITMAN, an electrical engineer in the Nike-X System Office, worked with Raytheon Corp. on ballistic missile defense radar and techniques in the Missile Systems Division since 1964.

From 1961-64, he worked with defensive systems in the Office of the Director of Defense Research and Engineering, Washington, D.C. He has also worked in the Advanced Research Projects Agency Division of the Institute for Defense Analyses, 1959-61, and with a variety of missile systems with the Raytheon Corp. 1947-59.

Whitman graduated from the Massachusetts Institute of Technology in 1942 with a BS degree in electrical engineering communications. He served in the Signal Corps during World War II.

Paul A. Turner

Philip A. Dillaber

CW/3 B. J. Sisco

NAS Publishes Volume on Research in Rock Mechanics

Federal agencies, industry and academic institutions in the U.S. and Canada contributed to the first compendium of research and training in rock mechanics published recently by the National Academy of Sciences (NAS).

Rock-Mechanics Research, a report on research in the U.S. with a partial survey of work in Canadian universities, points up the need for better understanding of the relatively new geological field affecting mining operations, engineering construction and scientific investigations.

Federal agencies supporting the NAS Committee on Rock Mechanics were the Office of the Chief of Research and Development, Department of the Army; Office of Aerospace Research, U.S. Air Force; Division of Research, U.S. Atomic Energy Commission; Bureau of Reclamation, U.S. Department of the Interior; and the National Science Foundation.

Fifty-three private companies also assisted the Committee financially and with data response, and about 45 others contributed to the findings.

Established in 1963, the NAS Committee on Rock Mechanics consisted of distinguished professors, scientists and engineers in the disciplines of geology, physics, geophysics, and civil, mechanical, mining and petroleum engineering. It was chaired by internationally known engineering geologist William R. Judd of Purdue University.

During the 3-year in-depth exploration of the field, the Committee focused attention on rock mechanics as "interdisciplinary in scope." It recommended for general use this definition:

"Rock mechanics is the theoretical and applied science of the mechanical behavior of rock; it is that branch of mechanics concerned with the response of rock to the force fields of its physical environment."

The Committee reported that the first symposium devoted wholly to rock mechanics was held in 1956 at the Colorado School of Mines and, through 1965, at least 50 U.S. and international conferences and symposia dealt entirely or significantly with the new field.

Under the aegis of the NAS Committee, several meetings of representatives of professional societies were held and a permanent Inter-society Committee for Rock Mechanics was set up Nov. 1, 1965.

Excluding projects related to national security, the Committee surveyed 186 federal projects directly concerned with rock mechanics. Of the 86 projects in the Department of Defense, 41 were being supported by the U.S. Army, 41 by the U.S. Air Force and 4 by the U.S. Navy.

The Army Corps of Engineers had 24 ongoing projects, the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL), Hanover, N.H., had 13; Office of the Chief of Research and Development, 3; and Office of Civil Defense, 1.

The U.S. Department of the Interior has 49 projects; National Aeronautics and Space Administration, 11; National Science Foundation, 25; U.S. Atomic Energy Commission, 9; and the Department of Commerce, Bureau of Public Roads, 6.

The Committee determined that more than 40 percent of federal research projects in rock mechanics is for military purposes. Projects funded by military agencies investigating effects of nuclear explosions account for about 50 percent of the basic research on rock properties.

Federal projects in rock mechanics, listed with the number in each category, are: effects of nuclear weapons, 54; civil engineering works, 39; basic research on rock properties, 37; mining operations, 33; earthquake seismology, 7; nuclear detection, 4; and lunar studies, 6.

The Committee's survey indicated "that government research in rock mechanics is small in amount, but diversified and relatively well balanced." It recommended the establishment of a coordinated system of information collection, retrieval, and dissemination of publications and progress reports in cooperation with the Science Information Exchange of the Smithsonian Institution, National Referral Center for Science and Technology of the Library of Congress, and the Defense Documentation Center.

Recommendations also included establishment of federal and university jointly sponsored projects and an increase in federal research in rock mechanics, especially applicable to construction work.

The Committee reported that 188 university departments offer courses in rock mechanics and 30 universities have graduate research assistants in the field. Masters and doctoral theses on rock mechanics produced in all related disciplines are increasing.

Based on its national appraisal of present and potential use of rock mechanics, the Committee concluded that the total effort needs to be accelerated — by increased contracts, grants and fellowships to universities, increased cooperative projects among industry, universities and government, and increased in-house research.

AUSTRALIAN INTERESTS in desalination have brought Maj Desmond J. Binney, Royal Australian Engineers, to the United States to study the water purification and desalination research and development program at the U.S. Army Engineer R&D Laboratories (USAERDL), Fort Belvoir, Va. Under a Corps of Engineers officer exchange program, the Australian is conducting his study at the USAERDL Sanitary Sciences Laboratory. His American counterpart, Maj Theodore Bishop, is attending the Royal Australian Engineer School. In the photo above, Richard P. Smith, chief of the Sanitary Sciences Laboratory, briefs Maj Binney on evaporator used in sea-water distillation unit developed by USAERDL.

Fort Monmouth Marks 50th Year of Service

"Fifty years of service to the nation, 50 years of partnership in the community."

On this theme, Fort Monmouth, N.J., one of the world's foremost centers for communications-electronics, will mark its first half century with a 5-day celebration ending with the traditional Armed Forces Day open house on May 20. Senator Clifford P. Case (R-N.J.) will give the climactic address.

Since May 16, 1917, when the establishment of the post (then called Camp Little Silver) was authorized by the U.S. Army Adjutant General, Fort Monmouth has moved into national prominence as the Army's principal center for research, development and training in communications-electronics.

Over the 50-year period, it has trained some 300,000 U.S. and allied military men. It is the birthplace of U.S. radar, satellites for communications and weather, radio relay, the walkie-talkie, closed circuit television for large-scale training and scores of other scientific, technical and educational achievements.

Known traditionally as the "Home of the Signal Corps," Fort Monmouth is now headquarters for the Army Electronics Command, Signal Center and School, Satellite Communications Agency, Combat Developments Command Communications-Electronics Agency, an element of the Strategic Communications Command, and several Army Materiel Command project managers.

Lt Col Kehrer to Become WAC Deputy Director Aug. 1

Lt Col Marie Kehrer will become deputy director of the Women's Army Corps Aug. 1, replacing Lt Col Mary E. Kelly, who will retire.

A WAC since 1942 and a graduate of the Command and General Staff College, Col Kehrer is currently assigned to the Office of the Special Assistant for Congressional Affairs at HQ, U.S. Army Materiel Command. She holds a BA degree in English from Mankato State College, Minn.

Eifler to Succeed Zierdt As MICOM Commander

Maj Gen Charles W. Eifler has been appointed commanding general of the U.S. Army Missile Command (MICOM) to succeed Maj Gen John G. Zierdt, who will retire June 30 after a 30-year military career.

General Eifler now heads the First Logistical Command in Vietnam and is not expected to report to MICOM HQ at Redstone (Ala.) Arsenal until later this summer. Brig Gen Clarence C. Harvey Jr., deputy CG of Air Defense Systems at the Arsenal, will assume command in the interim.

General Eifler served as MICOM deputy CG, Land Combat Systems, from April 1963 until he left for Vietnam in December 1965 and was promoted to 2-star rank Apr. 1, 1966. He was commander of the U.S. Army Ordnance Guided Missile School at Redstone from July 1959 to August 1961, then took command of Frankford Arsenal, Philadelphia, Pa.

General Eifler served with ground forces in Europe during World War II and became ordnance officer of the XVIII Corps. He earned a master's degree in electrical engineering from Massachusetts Institute of Technology in 1948 and was then assigned to White Sands (N. Mex.) Missile Range.

After a tour of duty in the Office of the Chief of Ordnance, Washington, D.C., General Eifler became CO of the 57th Ordnance Group in Germany before his first assignment to Redstone. He is a graduate of Pennsylvania State College (BS, civil engineering) and the Industrial College of the Armed Forces.

Since September 1963, General Zierdt has commanded the 10,000 civilians and more than 1,000 military personnel responsible for all phases of research, development, production and support of Army rockets and guided missiles.

Between 1956 and 1962, General Zierdt, then a colonel, played a key role in development of the Jupiter intermediate range ballistic missile and directed development work on the Nike Zeus antimissile-missile system.

Maj Gen John G. Zierdt

Maj Gen Charles W. Eifler

A 1937 graduate of the U.S. Military Academy, he earned his first star in 1960 when he became commander of the Army Rocket and Guided Missile Agency. He later was named deputy CG of the U.S. Army Ordnance Missile Command, predecessor of MICOM.

Fergusson to Command Fort Ord Training Center

Maj Gen Robert G. Fergusson, commanding general, U.S Army Training Center, Fort Ord, Calif., will succeed Maj Gen John F. Franklin Jr. as U.S. commander, Berlin, and commanding general, U.S. Army Berlin, June 3.

General Franklin will become deputy CG of the Sixth U.S. Army, Presidio of San Francisco, Calif.

A 1936 graduate of the U.S. Military Academy, General Fergusson previously served as assistant division commander, 24th Infantry Division in Germany and as chief of staff, HQ Central Army Group (NATO).

General Franklin, a 1934 graduate of the U.S. Military Academy, served in Germany as commanding general 4th Armored Division and chief of staff, Seventh U.S. Army.

Golden Knights Demonstrate Parawing

Precise maneuverability of the parawing — an air-to-ground delivery concept differing radically from the normal parachute — was demonstrated recently by two of the Army's famed Golden Knights parachute team at Yuma (Ariz.) Proving Ground.

The parawing is an aerodynamically stable device shaped like two semiconical sections fastened together horizontally to form a winglike structure. It is controllable much like a normal parachute through control lines or it can be directed by radio command from the ground.

Various concepts of the parawing (based upon the flexible wing concept) have been tested by the Army since 1961. The original "paraglider" was conceived in 1948 by Francis M. Rogallo, an aeronautical engineer at NASA's Langley Research Center. Among these were Light Utility Glider (LUG) and Towed Universal Glider (TUG) cargo vehicles.

In the recent Yuma tests, S/Sgt Richard Morgan flew a 20-foot model, the first time the compact version of the parawing was flown by a man; S/Sgt Bryce Swindle flew a 24-foot model. Both models were formerly tested with instrumented full-scale dummies to record drop and ground-impact forces.

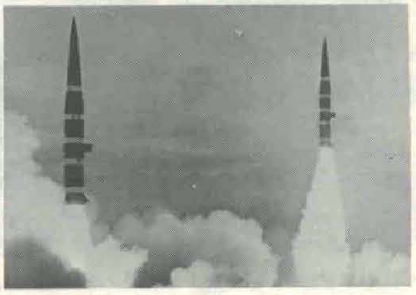
Sgt Morgan said the wing has a capability of flying into a wind of about 25 miles per hour. This compares with an upwind speed of around 10 miles per hour for the special Paracommander parachutes used by the Golden Knights.

Normal Army parachutes have little ability to fly into the wind and the jumper must be content to maneuver in a downwind direction. With the capability to move into the wind, the jumper no longer finds himself at the mercy of the elements; he may select his own landing spot within the area covered by the glide ratio of the parawing.

The jumpers reported that the 20-foot wing glides in dead air at a ratio of approximately 2.5 to 1. On a calm day, it should be able to land anywhere within a 10-mile circle if dropped from 10,000 feet.

Winds change the picture somewhat, but these may be predicted by weather observers and used to advantage by the jumpers. Conditions could shorten the distance traveled upwind, but would lengthen the distance if the jumper chose to ride with them.

A bonus of the parawing is its landing ease. A normal 'chute puts its jumper on the ground with a jar of 18 to 20 feet per second. The Paracommander is a little more gentle at 14 or 16 feet per second. The parawing comes comes in at about nine feet per second. Sgts Morgan and Swindle report this is about like jumping off a 2-foot-high step.



ANOTHER FIRST for Pershing occurred recently when two of the Army's long-range missiles were launched simultaneously from the Blanding Test Site in Utah. Firings were conducted by Seventh Army troops. Both missiles impacted accurately on target at White Sands Missile Range, N. Mex.

Army RDT&E, Procurement Contracts Exceed $441 Million

Army contracts exceeding $1 million each for research, development, testing, evaluation and procurement totaled $441, 601,964 since the April issue of the Newsmagazine.

Western Electric Co. received a $100 million contract for continuing R&D on the Nike-X antiballistic missile defense system and a $3,200,000 contract definitization for FY 1967 Nike Hercules and improved Nike Hercules engineering services.

A $29,807,500 definitization with Boeing Co. is for CH-47A (Chinook) helicopters. Federal Cartridge Corp. will provide ordnance components, and operations and maintenance activities for $29, 037,902.

Eight contracts with General Motors Corp. will buy components for guns, helicopter engines, vehicles and projectiles for $25,550,833. Hercules Inc. received two modifications totaling $15, 261,137 for propellants, rocket motors, and 2.75-inch rocket components. The Kaiser Jeep Corp. was awarded a $12,640, 044 modification for 5-ton trucks with government-furnished multifuel engines.

The Raytheon Co. will receive $11, 328,595 for bomb fuzes and components, magnatron tubes for the Nike Hercules, and continued work on the improved Hawk. Five contracts totaling $10,934,-972 with Bell Helicopter Co. are for UH-1 helicopter support equipment, work on a composite aircraft program, and AH-1G helicopters.

Allis-Chalmers Manufacturing Co. will supply loaders for $10,911,625, and International Harvester Co. will furnish school buses and diesel tractors for $10,456,333.

White Motor Corp. received a $10,433, 090 modification for 2½-ton trucks, and Continental Motors Corp. will receive $9,045,390 for 0-1 aircraft engines, 5-ton trucks and tanks.

Caterpillar Tractor Co. won a $7,941, 917 initial increment on a contract for tractors. For $6,494,376, the Philco-Ford Corp. will continue research and development on and test equipment for the Chaparral Missile System.

A first-year increment of $6,406,774 to Memcor, Inc. is for receivers and transmitters for the AN/VRC-12 family of vehicle communication sets. Remington Arms Co., Inc., gained a $5,920,211 modification for miscellaneous small arms ammunition and components and operations and maintenance activities.

A modification of $5,463,674 will purchase explosives from Silas Mason Co., Inc. Johnson Corp. will supply ½-ton cargo trailers and chassis on a $5,295,448 contract. Two contracts totaling $5,192,641 with the Chamberlain Manufacturing Corp. will procure 106mm projectiles and high-explosive warheads for 2.75-inch rockets.

The Davey Compressor Co. will furnish rotary diesel engine compressors and self-contained shop sets for maintenance of construction and automotive equipment on two contracts totaling $4,954,192. The A. O. Smith Corp. won a $4,905,516 modification for metal parts for 750-pound bombs.

Contracts totaling $4,894,797 with General Electric Co. will purchase 20mm automatic guns, gun pods and 7.62mm aircraft machineguns. Harvey Aluminum Sales, Inc., will supply ammunition for $4,852,422 and Westinghouse Air Brake Co. will furnish earth-moving scrapers and road graders for $4,790,486.

Norris Industries, Inc., received modifications totaling $4,083,717 for 105mm cartridge cases and metal parts for mine canisters. National Presto Industries was awarded a $3,966,802 modification for metal parts for 8-inch M106 projectiles and for lifting plugs.

Cessna Aircraft Co. received a $3,352, 500 modification for bombs and canisters. FMC Corp. won contracts totaling $3,318,440 for road wheels and differential assemblies for M113 vehicles. The Packard Bell Electronics Corp. is being issued a $3,267,201 definitization for AN/ATM-123 equipment, a special electronic test set used for airfields and aircraft carrier decks.

Contracts totaling $3,236,416 will procure from AVCO Corp. engines for the CH-47 aircraft and exhaust diffusers for T-53 engines. Lockheed Aircraft Co. will provide range-only radar systems for the XM163 Weapons System and work on a composite aircraft program for contracts totaling $3,125,445.

Contracts totaling $3,092,124 with Honeywell Inc. are for fuzes and metal parts for bomblets. United Aircraft Corp. was issued a contract for propeller assemblies for U-1A and OV-1 aircraft and a delivery order for component armor kits for CH-54A helicopters for a total of $2,942,119.

The Grumman Aircraft Engineering Corp. gained a $2,914,900 contract for modification of four Mohawk aircraft. Hol-Gar Manufacturing Corp. will receive $2,793,546 for 60-cycle, diesel-engine generator sets. Litton Systems, Inc., received a definition on the Tactical Fire Direction System (TACFIRE) and a modification for collecting data on high-speed aircraft against various Army ground weapons for a total of $2,659,136.

Koehring Co. will receive an initial increment of $2,650,349 for ditching machines, and the Eureka Williams Co. received a $2,592,817 modification for bomb fuzes. TEMCO, Inc., received a $2,520,386 modification for metal parts for 105mm illuminating projectiles.

The Chrysler Corp. received contracts totaling $2,474,239 for telephone utility maintenance trucks and installation kits and shelters for field communications. The American Machine and Foundry Co. will provide metal parts for 750-pound bombs for a $2,382,574 modification.

Bell Aerospace Corp. was issued a $2,248,565 definitization for AH-1G hel-

CHAPARRAL guided missile system undergoes 100-mile road tests to determine shock and vibration effects at the Naval Ordnance Test Station, China Lake, Calif. Recently selected by the Army as one of two major forward-area weapon systems, Chaparral is an infrared, heat-seeking system consisting of launcher and mount. It fires modified air-to-air Sidewinder missiles in a ground-to-air configuration. The unit can be mounted on self-propelled tracked vehicles, railroad flatcars, flatbed trucks or trailers, or it can be ground-mounted. The system is managed by the U.S. Army Missile Command's Chaparral Management Office at Redstone (Ala.) Arsenal and is being produced by Aeronutronic Division of Philco Corp.

icopters for qualification testing. Gibbs Manufacturing and Research Corp. received modifications totaling $2,322,356 for metal parts for rocket fuzes and fuze adapters for 81mm mortar cartridges. Bell and Howell Co. won a $2,126,950 contract for grenade fuzes.

Batteries for 2½-and 5-ton trucks will be supplied by the Eltra Corp. on a $1,867,799 modification. Holston Defense Corp. will furnish propellants and explosives on a $1,672,544 modification.

Varo, Inc., received a $1,657,475 modification for electronic equipment, and Hughes Tool Co. received a $1,643,941 definitization for armament subsystems for OH-6A helicopters. Computer Sciences Corp. will formulate an automatic data processing program on a $1,625,325 definitization.

Borg-Warner Corp. won a $1,603,291 contract for 30-caliber, 8-round cartridge clips. Amron Corp. will supply metal parts for bomblets for $1,569,573. The Airtronics International Corp. will provide component parts of the fire control assembly for the M60 tank on a $1,560,777 contract.

Other awards: Outboard Marine Corp., $1,456,428 for outboard motors for assault boats and rafts; Cadillac Gage Co., $1,394,793 for armored cars; University of Wisconsin, $1,300,000 for continued operation of the Mathematics Research Center, U.S. Army; Studebaker Corp., $1,258,632 for generator sets; and

L. E. Mason Co., $1,253,522 for fuzes for 60mm ammunition; Dynamics Corp. of America, $1,232,578 for repair parts for 60-cycle generator sets; Wilkinson Manufacturing Co., $1,229,440 for 60mm fin assemblies; Farmers Tool and Supply Co., $1,217,657 for fin blades for 2.75-inch rocket motors; Burroughs Corp., $1,216,841 for contract definition on TACFIRE; and

American Air Filter Co., Inc. $1,179,789 for engineering development for a pressurized POD system, a transportable steel shelter system designed to provide collective protection for combat and support personnel; URS Corp., $1,154,741 for developing an automatic data processing system dealing with software for the Seventh Army; Bouligny Co., $1,154,342 for mounts for 106mm rifles; and

Thermo King Corp., $1,081,590 for trailer-mounted air conditioners; International Business Machines, $1,065,969 for contract definition on TACFIRE; Electro-Mechanical Corp., $1,032,990 for electrical equipment shelters; and the Dirilyte Co. of America, $1,027,500 for fin blades for 2.75-inch rocket motors.

Stationary Radar Tracks Multiple Targets

To the untrained eye, a new 30-foot diameter antenna face peering at a 30-degree angle from a squat structure at White Sands Missile Range (WSMR), N. Mex., might easily be mistaken as part of a modern aluminum dairy barn.

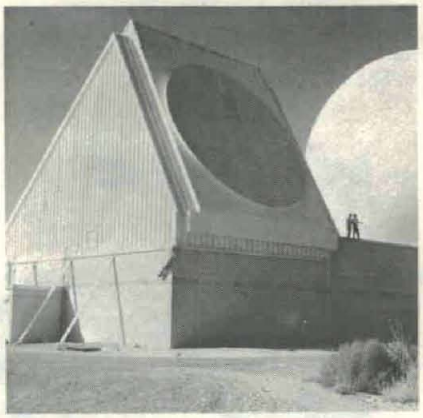
Behind the flat, circular antenna, Army scientists and technicians are gathering data through a new radar developed for detection and tracking of widely dispersed multiple targets.

Called HAPDAR (Hard Point Demonstration Array Radar), the experimental radar has demonstrated its capability to track simultaneously several aircraft spaced many miles apart and going in different directions.

Instead of the familiar rotating antenna, HAPDAR employs a stationary structure containing thousands of electronic "elements" which steer the radar beam according to commands from a high-speed Univac 1218 computer. The beam is switched in a few millionths of a second as the radar searches for, acquires and tracks each target through electronic scanning.

Termed a significant development, the scan techniques may have application to antimissile defenses, future equipment for studying vehicles reentering the atmosphere, air traffic control, battlefield surveillance and satellite tracking and communications stations.

HAPDAR was developed by the U.S. Army Missile Command, Redstone (Ala.) Arsenal, for the Advanced Research Projects Agency of the Department of Defense. The lens technique, called TACOL (Thinned Aperture Computed Lens) was developed by the Sperry Rand Corp.,



DEVELOPED for the Advanced Research Projects Agency, HAPDAR employs a structure containing thousands of electronic "elements" that steer commands from a high-speed Univac 1218 computer. The dome to the right houses the old Nike Zeus antenna.

R&D Reservists to Attend Pasadena, Detroit Seminars

Selected members of U.S. Army Reserve Research and Development Units will be addressed by top Army R&D leaders at two summer science seminars.

The Sixth U.S Army Research and Development Scientific Seminar at Pasadena, Calif., July 30 through Aug. 12, will be conducted by the 6159th USAR R&D Unit. Presentations and discussion will deal with the materials, resources, and tools being used for research in the Pacific Southwest.

"Mobility Research and Development" will be the topic of the July 23 to Aug. 4 seminar conducted by the 5001st U.S. Army Reserve R&D Unit, Detroit, Mich., for the commanding general, Fifth U.S. Army.

Assistant Secretary of the Army (R&D) Dr. Russell D. O'Neal and Chief of Research and Development Lt Gen A. W. Betts are scheduled to address both seminars. At Pasadena, they will speak on "The Challenge of Research and Development" and "Nike-X Development."

Dr. L. DuBridge, president of the California Institute of Technology, will give the keynote talk at Pasadena. Brig Gen Thurston T. Paul Jr., Director of Plans and Programs, Office of the Chief of Research and Development (OCRD); and Dr. John B. Phelps, Assistant to the Director, Advanced Research Projects Agency, Office of the Secretary of Defense, are among the principal speakers.

Army R& D leaders who will address the Detroit seminar include Dr. Jay Tol Thomas, Deputy for Research and Laboratories, U.S. Army Materiel Command; Maj Gen W. W. Lapsley, commanding general, U.S. Army Tank-Automotive Command; and Brig Gen John R. Guthrie, Director of Developments, OCRD.

Col Sheppard Delivers Keynote At Biomechanics Symposium

Col Harvey E. Sheppard, U.S. Army Materiel Command Acting Deputy Director for Research and Laboratories, keynoted the opening session of a Biomechanics Symposium Apr. 5-6 at Augustana College, Rock Island, Ill. He spoke on behalf of AMC Deputy for Research and Laboratories Dr. Jay Tol Thomas, who was unable to attend.

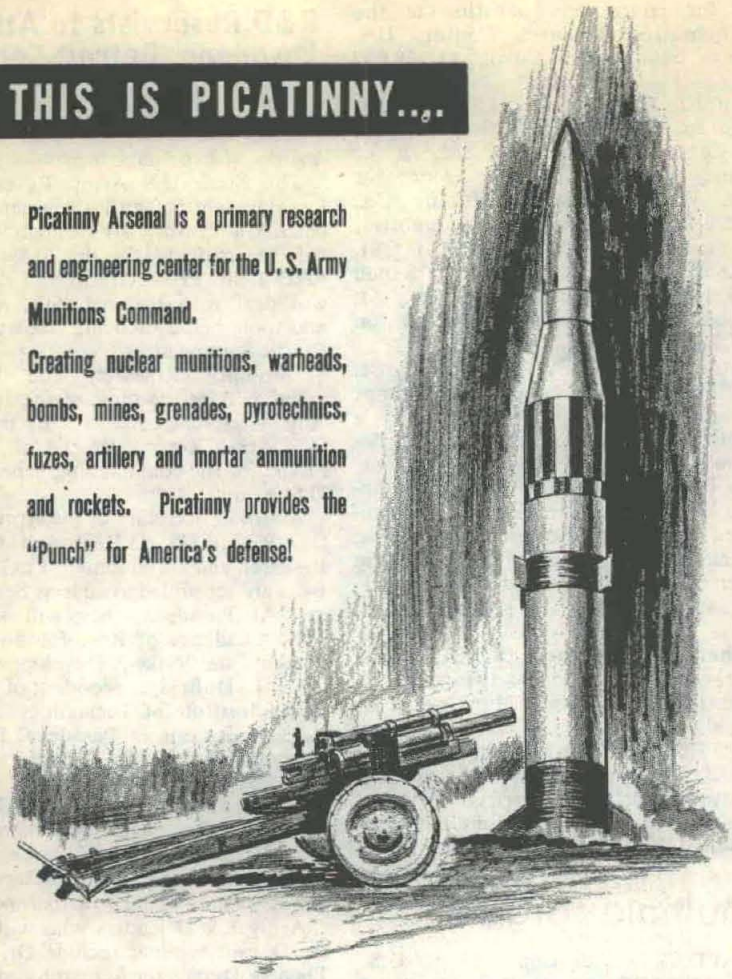
In "The Army Looks at Biomechanics," Col Sheppard expressed the Army's interests in how biomechanics can serve Army weapon needs through exploration of the relationship between life sciences and engineering.

Dr. C. W. Sorensen, president of Augustana College, and Brig Gen William J. Durrenberger, CG of the U.S. Army Weapons Command, also addressed the Symposium, sponsored by the Weapons Command, the U.S. Army Research Office at Durham, N.C., and Augustana College.

THIS IS PICATINNY...

Picatinny Arsenal is a primary research and engineering center for the U. S. Army Munitions Command.

Creating nuclear munitions, warheads, bombs, mines, grenades, pyrotechnics, fuzes, artillery and mortar ammunition and rockets. Picatinny provides the "Punch" for America's defense!



Col John S. Chambers Jr.
Picatinny Commanding Officer

Ammunition requirements in Vietnam are again spotlighting the special capabilities of one of the most historic of the U.S. Army research and development installations — Picatinny Arsenal at Dover, N.J.

How historic? As historic as the beginnings of our nation, for when George Washington needed cannon shot for his forces, he turned to a blacksmith shop at Middle Forge, N.J., the forerunner of Picatinny Arsenal.

Two hundred years later when the United States was forced into the greatest war in world history, Picatinny Arsenal was the only plant in the country capable of producing munitions other than small arms. It was the only plant capable of providing the "know how" to industry for the manufacture of such ammunition in World War II.

Picatinny, which is primarily a research and engineering center for the U.S. Army Munitions Command, is today providing many of the special firepower requirements for the war that is being fought in the plains and jungles of Vietnam.

Located 40 miles from New York City, Picatinny Arsenal is a city within a city. It has two lakes, bus transportation, rail lines, a hospital, post exchange, modern housing for the military, cafeterias, swimming pool, golf course, theater, and a teen club as well as officers and NCO clubs.

Picatinny covers 6,500 acres and its activities are conducted in over 1,400 buildings which are serviced by 75 miles of roads and 40 miles of railroad. Within its boundaries are several widely separated test-firing ranges and two remote areas for hazardous activities.

The real estate, utilities and equipment are valued at more than $300 million. During FY 1966, the Arsenal spent over $106 million throughout the country in contracts and purchase orders. About $80.6 million was used for production of hardware and miscellaneous items and $25.2 million for research and engineering at the Arsenal.

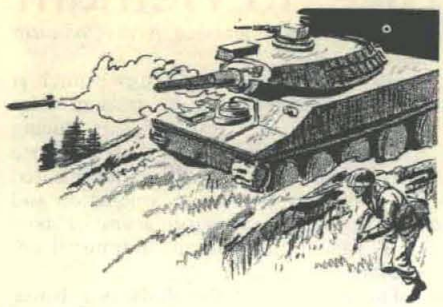
Approximately 95 percent of the Arsenal's operations involve research, design and engineering. The remaining five percent is concerned with the testing of new products before the production of the items is contracted out to private industry.

Picatinny products include warheads, bombs, grenades, pyrotechnics, fuzes, artillery, mortar ammunition, rockets, propellants and explosives.

Emphasis is constantly on finding ways to reduce the size of shells and still make them more effective. Engineers enjoy comparing the feat of developing a powerful punch for one of the new artillery shells with "squeezing the Queen Mary into a cigar box." Picatinny played a major role in compacting nuclear power in an 8-inch shell!

Typical of current effort at Picatinny Arsenal is the standardization of the M24

JACOB FAESCH, a Swiss ironworker, took over forerunner of Picatinny Arsenal during the Revolutionary War. Using Hessian prisoners of war, he manufactured the cannon shot used by General George Washington.



PICATINNY is involved in the conventional round, missile warhead section and propulsion system for Shillelagh.

unmanned, antitank mine system which attacks a target from the side rather than underneath. The M24 supplements standard vertical exploding mines.

The now famous Claymore M18 mine, about which much has been heard in the Vietnam war, is a development of the Arsenal. So is the ammunition for the M79 grenade launcher, which also is playing a key role in the battle against the Viet Cong.

Another Picatinny development that is being used effectively in Vietnam is the improved warhead and fuze for the 2.75 rocket, a very-high-density item used by Army and Air Force helicopters.

In recent experiments, scientists at this installation have been experimentally "pumping" lasers with the light from gaseous detonations to replace conventional electric power sources for specialized applications.

Picatinny is not satisfied with producing new and better munitions. Its trouble-shooting engineers check malfunctions of its munitions in the field. If an item misfires in Vietnam, a team of experts is quickly dispatched to the scene to determine the cause.

If the trouble is technical, the items in the lot are returned to the Arsenal for modification or discard. There can be no room for guesswork in the use of deadly explosives and Picatinny "follows through" in an effort to reduce the possibility of malfunction accidents.

Although today Picatinny Arsenal is an R&D center, it started as a production plant. Following the Revolution, the blacksmith shop operated by Jacob Faesch, a Swiss liberty-loving ironworker who had come to help the revolutionary cause of the American colonists, continued activity in civilian pursuits, as well as military.

Except for booming activity during the War of 1812 and the Civil War, the plant operated obscurly until 1880. Then Congress purchased 1,866 acres in Picatinny Valley and established a depot for the production of gun powder.

In World War I, Picatinny was the embodiment of the slogan the "Arsenal of Democracy," providing all types of ammunition for the Allied Armies.

During the hard-pressed days of the Korean War, when North Korean tanks were proving every effective against South Korean and American forces, Picatinny engineers designed and produced a rocket shell for the new 3.5 Bazooka. It stopped the powerful invading tanks in their tracks.

One of the most dramatic achievements credited to Picatinny Arsenal engineers is the development in May 1953 of the first atomic shell capable of being fired from an artillery gun.

Since then, Picatinny Arsenal has played a key role in developing such missile warhead sections as those used for the Nike family, the Hawk, Corporal, Pershing, Honest John, LaCrosse, Redstone, Sergeant, Jupiter and Little John. Also it was instrumental in the development of atomic demolition munitions and nuclear shells.

The Arsenal presently is involved in work on the warhead and propulsion system for the Shillelagh gun-launched guided missile, conventional ammunition for light antitank weapons and the development of pyrotechnics for illumination, smoke screening and missile tracking.

The man behind this vast installation that employs some 8,500 civilians and about 120 military personnel, and has an annual payroll of about $68 million, is Col John S. Chambers Jr. Assigned as deputy commander in June 1965, he took command last August.

A native of Marfa, Tex., and the son of the late Col John S. Chambers Sr. (USA, Ret.), he was commissioned a second lieutenant in 1938.

Graduated from Rice Institute with BS degrees in mechanical and electrical engineering, he began active duty in the U.S. Army at the San Antonio Arsenal in 1941.

After serving with distinction in the European Theater of Operations with the First, Third, and Sixth Armored Divisions from 1941 until 1946, he was assigned as Ordnance Officer to the Military District of Washington.

From 1948 to 1950, he served in the Office, Chief of Ordnance. His extensive Ordnance background qualified him for service with the Ordnance Board at Aberdeen Proving Ground, Md.

In 1952-53 he attended the Command and General Staff College, and in 1953-54 commanded the Ordnance Training Center at Red River Arsenal, Texarkana, Tex.

Following service with the Military Advisory Assistance Group in Athens, Greece (1954-57), Col Chambers attended the Armed Forces Staff College.

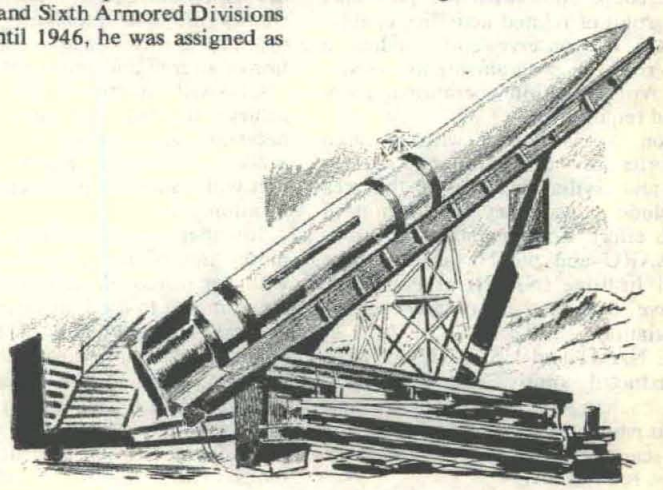
He was chief of the Special Weapons Unit Training Division, Field Command, Defense Atomic Support Agency, Sandia Base, N. Mex., (1957-61) and from 1961 to 1963 commanded the North Depot and Seneca Army Depot, Romulus, N.Y.

Upon return from Korea, where he was Ordnance Officer, First Corps, he attended the Industrial College of the Armed Forces in 1964 at Fort McNair, Washington, D.C.

Picatinny Engineer Becomes Arsenal's Only Super Grade

Robert W. Vogel, listed in the March 1962 issue of the *Army R&D Newsmagazine* as one of Picatinny Arsenal's outstanding young scientists, has reached the level of GS-16 and the distinction of being the installation's only super grade employe.

Vogel, who joined Picatinny as a GS-7 project engineer in 1950, is chief of the Ammunition Development Division in the Ammunition Engineering Directorate. The division is responsible for the design and development of most major conventional ammunition systems, including artillery and mortar ammunition, tank gun ammunition, mines, missile warheads, bombs and grenades.



NUCLEAR and nonnuclear warheads for the Honest John were designed at Picatinny when the missile was first fielded in the 1950s.

Aeromedical Research Unit Responsive to Vietnam

This is the eighth in a series of articles on U.S. Army Medical Service laboratories. Five features were published in 1966. Missions of the U.S. Army Research Institute of Environmental Medicine at Natick, Mass., were explained in the January 1967 issue and the U.S. Army Medical Equipment Research and Development Laboratory, Fort Totten, N.Y., in March.

Dramatic, history-making employment of the helicopter as an effective weapon and all-purpose mobility vehicle in Southeast Asia, resulting in exponential increases in Army aviation, has justified the preparatory foresight leading to establishment of the U.S. Army Aeromedical Research Unit (USAARU) in 1962.

Created as a U.S. Army Medical Research and Development Command Class II activity, the USAARU provides medical research support for Army aviation and airborne activities. Studies are concerned with fundamental research problems, immediate and anticipated. USAARU's mission is relevant to aviation and airborne personnel — physical standards, medical aspects of selection, retention, training, operations, performance and equipment.

Located at the U.S. Army Aviation Center, Fort Rucker, Ala., in close proximity to numerous activities concerned with aviation research, USAARU is commanded by Lt Col Robert W. Bailey, Medical Service Corps (MSC).

Included among the nearby installations are the Combat Development Command Aviation Agency (USACDCAVNA), the Board for Aviation Accident Research (USABAAR) and the Army Aviation School. The School's Department of Aeromedical Education and Training is particularly involved with USAARU.

Close cooperation with the personnel of this group of related activities enables USAARU to conceive and conduct a specific research program highly responsive to Army aviation operational problems and requirements.

Liaison is maintained with research laboratories of other military, governmental and civilian agencies in the area to preclude unnecessary duplication of research effort. Complementary missions of USAARU and the Naval Aerospace Medical Institute (NAMI) at Pensacola, Fla., have stimulated a mutually beneficial association.

Some NAMI and USAARU activities are conducted jointly, and there is a limited exchange of research personnel and equipment. Information interaction among scientists and technical personnel, however, is unlimited.

Currently, three USAARU researchers are doing work at NAMI and one NAMI investigator is at USAARU. Lt Col Stanley C. Benbrook and Maj Steven P. Pakes, both of the Army Veterinary Corps, are studying the development of pulmonary lesions during prolonged altitude exposure. Capt Roy H. Steinberg, Army MC, is studying visual adaptation processes utilizing electrophysiological responses in the retinal ganglion cells and optic nerve of vertebrates. NAMI's Lt Daniel J. Thomas, MC, is doing research at USAARU.

Lt Col Robert W. Bailey

ORGANIZATION. USAARU is a mission-oriented research unit, organized into the divisions of Headquarters, Research Library, Aviation Medicine Research, Basic Sciences and Administration, and Technical Support. Each of the scientific elements is concerned with a specific discipline, but many tasks cross division and branch disciplinary lines through integrated effort.

CURRENT RESEARCH. Directed primarily to the solution of immediate operational problems, the USAARU program also is based solidly in fundamental research projects influenced by long-range requirements. The program is developed through in-flight observations, studies of field problems reported by aviation agencies, and technical evaluation of aircraft and personnel equipment.

USAARU administrators endeavor to achieve the balanced research program necessary to marshal and maintain the academic, scientific and technical skills that will insure adequate support of Army aviation.

Investigations currently range from the more immediate problems associated with the helicopter and airplane cockpit environment to the long-term fundamental studies in problems of hearing loss, color vision and other physical factors.

AVIATION MEDICINE. Under the direction of Lt Col William P. Schane, MC, the Aviation Medicine Research Division investigates and develops theoretical bases for field and laboratory research projects concerned with physical standards and aircraft specifications. Interaction of personnel and the effects of unusual environments of Army aviation also are studied.

One study of the Cardiology Branch is measuring and comparing cardiac rates and rhythms of Army aviators during flying and non-flying duties. Experience with Mercury astronauts has demonstrated the possibility of unusual conduction and rates in the electrocardiogram of normally functioning humans in unusual environments.

The objective of the study is a better understanding of the mechanisms and meaning of cardiac arrhythmias, which could lead to liberalization of the retention and selection criteria for Army aviators and, thus, significant savings in money and critical manpower.

Similar ECG recordings are being obtained on free-fall parachutists. Data are obtained continuously — before egress from the aircraft, during free fall and landing, and through a nominal period after landing. Very high ECG rates often are associated with parachute jumping.

Telemetry is being used for collection of standard physiologic parameters and acceleration data. Stress hormone studies also are being conducted. When the results of these studies can be correlated with ECG information, a precise description of the physiological events of free fall may be possible.

Problems related to the armed helicopter are being investigated by Capt George L. Hody, MC, chief of the Environmental Medicine Branch. In armed helicopters, unknown quantities of noxious and potentially hazardous gases and particulate matter are forced into crew compartments during weapon firing. Aerodynamic considerations in placement of weapons expose the crew to exhaust and require the helicopters to fly through the exhaust cloud generated by rocket firing.

Accurate evaluation of the problem necessitates measurement of the contaminants present. Techniques currently available are either too slow in tracking the rapidly changing gas levels or they require instruments which are too sensitive to vibration for use in Army helicopters.

A new approach being developed by Capt Hody permits calculation of toxic exposure from knowledge of weapons exhaust composition and in-flight measurements specifically directed to the determination of a single identifying component of the exhaust.

Conventional infrared and mass spectrometric measurements are being performed in cooperation with the Air Force Rocket Propulsion Laboratory at Edwards Air Force Base, Calif., in order to ascertain the weapons' exhaust composition.

Theoretical and instrumentation support is being further developed with the help of the Naval Aerospace Medical Institute.

Ammonia, nitrogen dioxide, carbon

monoxide and hydrogen cyanide have been identified thus far as potentially hazardous agents in the weapons exhaust.

BASIC SCIENCES. Investigations in the aeromedical aspects of biophysics, physiological optics, experimental psychology and aviation physiology are the function of the Basic Sciences Division, directed by Robert T. Camp Jr.

Biophysics studies deal primarily with basic and applied research in physiological acoustics. The potential loss of hearing associated with high-noise levels common to aircraft and weapons is a source of continuing hazard to the aviator and expense to the Army. Four complementary programs, designed to meet the needs of Army aviators, are under study.

In the first, the acoustical environment of Army aviation personnel is being measured with techniques which provide a better resolution of frequency than was available when most Army aircraft in the current inventory were evaluated. On the basis of these noise measurements, the evaluation of protection devices has assumed importance.

Information being provided by this study is constantly requested by laboratories, agencies and physicians responsible for specifications, prescription and testing of the devices. Highly accurate instruments and rigid adherence to American Standards Association procedures insure the usefulness of the results.

Communications also are under investigation. A common complaint of pilots, particularly pilots of armed helicopters, is that they are unable to understand critically important directions radioed to them in combat or other maneuvers.

A current study is intended to show theoretical limits of communication as a function of noise level in ideal systems, and to evaluate existing system efficiency related to these calculations.

Preliminary results indicate that, in addition to the effects of high noise level, the type and linearity of the microphone and distortion in the electronic equipment have contributed significantly to the poor intelligibility of even the better Army aviation radios in high ambient noise levels.

Importance of vision in flying, even with modern instrumentation, is difficult to overestimate. USAARU investigators are providing new information in the critical areas of color vision, dark adaptation and refractive error.

Army aviation urgently requires an accurate method of assessing color vision. Dichotomous tests in use now often reject normals, pass defectives and do not permit matching of the degree of impairment with the requirements of the job. The problem is complicated by a large number of variable experimental conditions, such as intensity and visual field which must be specified.

Using a specially developed tristimulus colorimeter, which permits variation of field size without significant changes in field brightness, Lt Col Robert W. Bailey is developing a quantitative color vision measurement, based on the principle of detection of "just noticeable differences."

Rapid methods of measuring dark adaptation are being evaluated. A promising technique is the sensitive electroretinographic recording of the transition between scotopic and photopic vision during dark adaptation.

At the Naval Aerospace Medical Institute, Capt Roy H. Steinberg, MC, is providing basic science support by studying the detailed electrophysiological responses of animals during dark adaptation at anatomical sites not accessible in intact human beings.

The changes in refractive error occurring with age are a cause of attrition of aviators. Using automated data processing, pertinent visual statistics obtained through the courtesy of the U.S. Army Hospital, Fort Rucker, Ala., are recorded and compiled for future aid in the prediction of aviator training requirements.

Other visual studies at USAARU concern the effects of unusual accelerations and those of involuntary eye movements on the acquisition of visual information. The latter are investigated by Capt G. W. Beeler Jr., MSC, chief, Physiological Optics Branch, who is measuring eye position with a photoelectric detector.

The detector output, position of a moving target and the subject's observation of the target movements are recorded on magnetic tape and correlated by a digital computer.

RESEARCH ACCOMPLISHMENTS. Investments of time and scientific capability required for the solution of aviation medicine problems vary directly with the depth of the scientific knowledge which can be applied to the problem. In the nearly five years of USAARU's existence, several investigations have provided operational solutions to major problems.

Included are development of casualty prediction tables for evaluation of experimental airborne operations, and physiological training techniques for HALO parachutists.

In addition, numerous consultations have been provided to Army agencies on aviation medicine problem cases, evaluation and recommendations concerning the medical aspects of equipment affecting sensory modalities, survival equipment, protection of aircrew members, and special devices for combat employment.

Many USAARU staff members serve on the National Research Council Vision Committee, the Committee on Hearing and Bioacoustics, Department of Defense Aircrew Station Standardization Panel, the NATO Advisory Group for Aerospace Research and Development, and the planning and advisory groups of numerous professional and scientific associations.

FUTURE PROGRAM. Future research problem areas in which USAARU is certain to be involved will be derived from the medical and physiological aspects of the man-aviation system relationship. Aviation and airborne personnel are exposed not only to enemy action, but also to the additional hazards of altitude, terrain avoidance, extremes of photopic and scotopic visibility, hazardous sound pressure levels, heat, cold, toxic materials and vibration.

Improper control or response to these operational factors always has the latent potential of trauma from a crash landing or ejection from the aircraft.

USAARU is alert in its research response to the requirement for continuous medical review of personal and protective equipment, survival methods, physiological training, emergency warning systems, cockpit and aircrew station design, and heating and ventilating systems.

Future USAARU efforts will involve many interrelated programs directed toward conserving the fighting strength of Army aviation personnel through results of research and development.

Brig Gen Mallory Succeeds Kendrick as WRAMC CG

Brig Gen Philip W. Mallory, CG of Walter Reed General Hospital (WRGH) since November 1965, assumed command of Walter Reed Army Medical Center (WRAMC) Apr. 28. Maj Gen Gouglas B. Kendrick, WRAMC CG since December 1965, retired from the Army after 32 years of service.

General Mallory commanded the 97th General Hospital, U.S. Army Europe, from 1963 to 1965. Other assignments in recent years include: deputy commander, 9th Hospital Center, U.S. Army Europe (1962-63); post surgeon, hospital commander, and professor of military hygiene, U.S. Military Academy (1959-62); and chief outpatient service, WRGH, 1955-1959, a position he had also held from 1946 to 1951. He also has served in Africa, Italy, France and Brazil.

General Mallory completed his premedical studies at the University of Texas in 1930 and received his MD degree from Tulane Medical School in 1934. He began military service in October 1934.

Brig Gen Philip W. Mallory

Report Discusses Vietnam Tunnel Problem

A review of the present state of research on detection, destruction and denial of Viet Cong tunnels and underground installations is presented in a comprehensive report recently completed by the U.S. Army Research Office.

The breadth of the tunnel problem was evidenced by sophisticated tunnel bunker complexes encountered recently in the war zones. As part of the "fortified village," these tunnels combine underground security of personnel and supplies with an integrated defensive system of fighting bunkers.

Possible solutions to the problems of detecting, destroying and denying access to these tunnels are being tested under direction of the U.S. Army Materiel Command, the U.S. Limited War Laboratory and the Office, Chief of Engineers.

The report is based on information furnished by these activities, by the Advanced Research Projects Agency, and by the U.S. Bureau of Mines. Lt Col Henry F. Magill, Physical and Engineering Sciences Division, U.S. Army Research Office, compiled the report.

In the effort directed toward tunnel destruction, consideration is given to dissemination of a combustible mixture into the mouth of the tunnel, dispersing this by means of a blower, and detonating the mixture by means of an explosive charge.

Other approaches to destruction considered include water or foam flooding; collapse through explosive layouts on top of the tunnel; and internal rupture from explosive solids, liquids, mists, or dusts.

Future concepts for tunnel destruction include investigation of the response and failure mechanisms of earthen tunnels subjected to internal blast loads. Objective of the studies would be to develop methods for predicting tunnel failure in different soils and tunnel configurations. Picatinny Arsenal, the principal laboratory for tunnel destruction research, will continue to explore new approaches in addition to providing support to the combustible mixture explosive systems.

Research in tunnel denial includes development of suitable irritants that will persist in tunnels for a long time, along with dispenser systems. Initial efforts at Edgewood Arsenal have led to a portable blower used in conjunction with bulk CS or pyrotechnic CS grenades for tunnel flushing and short-term denial. A modified form of the riot control agent CS presently offers the most potential for a relatively persistent denial agent, but other techniques are being considered.

Although a number of field studies involving the tunnel concepts furnished in the report are currently being conducted and evaluated, the basic problem of tunnel detection by remote means remains without a present solution.

New ideas and approaches are constantly being sought to provide a solution to the age-old problem of tunnel detection, destruction and denial, compounded by the sophisticated complexes encountered in the war zones of Southeast Asia.

Lunger Succeeds Sylvester As Army Research Executive

Lt Col Raymond R. Lunger, formerly of the Environmental Sciences Division, U.S. Army Research Office (USARO), has succeeded Lt Col Allan T. Sylvester II as executive in the Office of the Director of Army Research, Office of the Chief of Research and Development (OCRD).

Col Sylvester has been reassigned to the OCRD Systems Analysis Division.

Col Lunger was assigned to USARO in 1966, following a year as engineer adviser to the Saudi Arabian Army. From 1961-63, he was with the New Orleans Engineer District, Baton Rouge, La., following service with the 24th Infantry Division, Augsburg, Germany. A 1950 graduate of the United States Military Academy, he also holds an MS degree in civil engineering from Iowa State Univ.

Col Sylvester served a year as a staff officer in the Human Factors and Operations Research Division, USARO, before becoming executive to the Director of Army Research in 1966. Other recent assignments include tours with the III Army Corps, HQ. First U.S. Army, as a company and battalion commander at Fort Knox, Ky., and with the Military Assistance Advisory Group in Saudi Arabia. He holds a BS degree from the Virginia Military Institute and an MS degree from Stanford University.

Tiny Alarm May Save Lives Of Combat Men in Outposts

Combat problem: How to keep alive on outpost duty after dark with only one pair of eyes and ears, particularly in the deep undercover of a jungle or forest. Possible solution: A battlefield "burglar alarm" now under test.

The Surveillance Division of the Test Directorate at the U.S. Army Electronic Proving Ground (USAEPG), Fort Huachuca, Ariz., is hopeful that the anti-intrusion device will prove the answer to how to detect an enemy before he gets too close.

The alarm consists of a buzzer, a signal light, a flashlight battery, and a spool of almost invisible double-strand wire the operator strings around his position.

Like a delicate spider web, the wire tells the sentry that something is moving toward him when the wire is broken by as little as 3½ ounces of pressure.

A break in the wire will sound the alarm through the buzzer, which can be adjusted for loudness, or flash the signal light. Each spool contains 3,200 yards of wire, and each alarm is furnished with three spools. Breaks in the wire can be repaired by melting the strands together with a match.

Anti-intrusion Alarm Set

Army Slates Symposium On Operations Research

"Operations Research and Counterinsurgency" is the theme of the Sixth Annual Operations Research Symposium, May 24-26, at the U.S. Army Research Office, Durham, N.C., sponsored by Chief of Research and Development Lt Gen A. W. Betts.

General Betts will deliver the opening address. About 220 military and civilian personnel representing the Department of Defense, the U.S. Army, Navy, Air Force, Marine Corps and principal contractors are expected to attend. Representatives of the armies of Great Britain, Canada and Australia also have been invited.

For the first time this year, designated chairmen organized their own sessions and invited speakers on assigned subjects. Twelve sessions are scheduled, including two on "What Are You Doing?" Representatives of various agencies will deliver 10-minute speeches on current and planned OR studies. Five minutes of discussion will follow each presentation.

Among the principal speakers programed at press time is former Assistant Director of Army Research Brig Gen Wallace L. Clement. Now Director of Personnel Studies and Research, Office of the Deputy Chief of Staff for Personnel, he will lead off the opening general session May 24 on "Managing OR/SA (systems analysis) Efforts."

Director of Army Research Col Charles D. Y. Ostrom Jr. will chair a panel discussion May 25 on "Uses of OR in Developing Countries."

Approximately 35 papers on various aspects of operations research will be presented. Among the general unclassified topics are: Models for Resource Allocation; Helicopters in Limited War; Force Planning; Effectiveness of Antiaircraft Systems; Large-Scale Nonlinear Simulation; and Aircraft Requirements for the Army.

Scheduled as the principal speaker at the symposium banquet May 25 is R. S. Weinberg, vice president of Anheuser-Busch, Inc., who will be introduced by General Betts. Maj Gen (USA, Ret.) Chester W. Clark of Research Triangle Institute is banquet chairman.

Bill Proposes Exchange of Federal, State, Local Personnel

Proposed legislation that would authorize exchange of personnel among federal, state and local governments, beginning July 1 under a $25 million budget request made by President Johnson, has been submitted to Congress by the U.S. Civil Service Comission.

Supported by the President's message to Congress Mar. 17 on "The Quality of American Government," the proposed Intergovernmental Manpower Act of 1967 is similar to a bill on which Congress held hearings in 1966. Senator Edmund S. Muskie authored the first proposal.

CSC Chairman John W. Macy Jr. said the new proposal "is designed to help assure qualified and trained administrative, professional and technical employes for state and local governments and enable them to play their full roles in the years ahead."

In elaborating on the objectives of the proposed bill, Chairman Macy said, "President Johnson has indicated that federal money alone is not adequate to cope with the administrative, management and scientific problems encountered by the various jurisdictions of government.

"This bill's intent is to upgrade the quality of manpower and to insure that people in the state and local governments receive the best of training courses and the finest of administrative procedures that the federal establishment can share with them. . . . The end result, I believe, will be that people who are charged locally with the administration of federal funds will have the capacity to assume maximum responsibility in the administration of these funds."

Federal aid to state and local governments, it was pointed out, has risen from $4.1 billion in 1957 to an estimated $15.3 billion this year. From 1955 to 1965, state and local government employment, Mr. Macy said, has increased from 4.7 million to 7.7 million persons. It is estimated that local government employment will rise to approximately 11.4 million by 1975.

An Education for the Public Service Act of 1967 proposed by the Department of Health, Education and Welfare is being submitted to Congress as a companion measure to the Intergovernmental Manpower Act of 1967.

Summarized, the principal provisions of the manpower act include:

Title I authorizes federal agencies to provide for the training of state and local employes by admitting them to training programs for federal employes, and to provide or conduct training for those who are engaged in grant-in-aid programs. It authorizes the Civil Service Commission to make grants, up to 75 percent of costs, for in-service training of state and local government employes. It allows the Commission, under certain conditions, to make grants up to 75 percent of costs directly to local governments to train their employes. It establishes a plan for Government Service Fellowships for state and local employes, for periods of full-time graduate-level study not exceeding two years. It directs the Civil Service Commission to coordinate training provided to state and local employes under federal grant-in-aid programs.

Title II authorizes the President to extend the requirement for state and local programs that are federally financed to follow standards of personnel administration that are based realistically on merit principles. It directs the Civil Service Commission to make grants, up to 75 percent of costs, to states to strengthen personnel administration for state and local governments.

Under certain conditions, it allows the Commission to make grants, up to 75 percent of costs, directly to local governments to strengthen public personnel administration. It allows the Commission to join with state and local governments in cooperative recruiting and examining activities on a shared-cost basis. It authorizes the Commission to furnish technical assistance to state and local governments in strengthening their public services and personnel administration. It authorizes states to enter into compacts for improving personnel administration and training for their employes.

Title III allows federal agencies to arrange for the assignment or detail of their employes to state or local governments for periods up to two years with full protection of job rights and benefits and with provision for extension of the 2-year time limit. It allows federal agencies to arrange for the ready assignment or detailing of state and local employes to federal work.

Title IV authorizes the President and the Commission to establish appropriate advisory committees to assist in establishing policy and in implementing the programs.

The President has allocated $25 million in his budget request for the first fiscal year, beginning July 1, to be used for placing the Intergovernmental Manpower Act into effect. None of the grant portions would become effective until six months after passage of the law.

Austrian Defense Head Visits Army Installations

AUSTRIAN MINISTER OF DEFENSE Dr. Georg Prader reviews honor guard at Phillips Army Airfield as he arrives for a short visit and briefing on U.S. Army Test and Evaluation Command activities at Aberdeen (Md.) Proving Ground. Maj Gen John M. Finn, chief of Foreign Logistics, U.S. Army Materiel Command (far left of photo), accompanies the Defense Minister, who also was briefed on new surveillance and communications equipment at Fort Monmouth, N.J., during a 10-day tour of defense and industrial centers.

Signal Units Go Under STRATCOM-Alaska

STRATCOM-Alaska was established recently as the seventh major subordinate command within the U.S. Army Strategic Communication Command's global complex organized to operate and maintain the Army's portion of the Defense Communications System.

Headquartered at Fort Richardson, the new agency took command of all U.S. Army Alaska (USARAL) signal units and facilities that provide communications to the Yukon Command, the 171st and 172d Infantry Brigades, USARAL Support Command, 19th Aviation Battalion and other units designated by Maj Gen J. T. Folda Jr., CG of USARAL.

Elements involved in the consolidation and transfer are the 33d Signal Battalion, the 60th Signal Detachment and the Signal Elements at Fort Richardson, Fort Wainwright and Fort Greely.

Maj Gen Richard J. Meyer, CG of STRATCOM, also serves on the USARAL staff. Col Duane Davis heads STRATCOM-Alaska, with Lt Col John A. Marksteiner serving as deputy. Other STRATCOM subcommands are headquartered in Suitland, Md., Fort Monmouth, N.J., and in Panama, Germany, Hawaii and Vietnam.

STRATCOM-Alaska is responsible for the operation and maintenance of garrison and field communications required by USARAL, and operation and maintenance of air defense, post, camp and station communications systems within the Alaska Command.

STRATCOM-Alaska will engineer and install fixed-plant facilities and provide cryptologistic support for USARAL, as well as operate the USARAL MARS stations, and provide audio-visual and photographic support.

General Folda will exercise operational control of STRATCOM-Alaska, and also will retain command of the USARAL element of the signal staff.

Army S&TI Plan Outlines Objectives

Accomplishments, objectives, ongoing systems-establishment projects, concepts and operational guidelines for the U.S. Army Scientific and Technical Information Program are presented in a newly published report.

"U.S. Army Scientific and Technical Information Program, FY 1966-1972" is a comprehensive review and summary prepared by the Scientific and Technical Information Division, U.S. Army Research Office, Office of the Chief of Research and Development.

Basically, as cited in the new report, the purpose of the Army S&TI Program is "to improve the cost effectiveness of transfer of scientific and technical information from source to user in support of scientific, technical and related activities."

Presented in the report is a projection of the urgent requirement for research and development to improve information handling methodology and to train personnel more rapidly and effectively in use of the new techniques.

Presently, it is pointed out, about $2 million annually — less than four percent of the total cost of Army-wide S&TI activities — is being spent for research and development to improve data handling techniques and training methods.

Current annual costs for transferring scientific and technical information from source to user throughout the Army, as reflected in a survey made by Army peronnel assisted by a contract agency, total about $55 million annually, not including cost of technical personnel search time as users.

Listed as benefits of the S&TI Program are reduction in the time required to get needed information and improvement in reliability; continuing improvement in methods of collection, storage, retrieval and dissemination of information; reduction of language difficulties impeding information transfer through adoption of standard terms; and delivery of information in proper form as desired by the user.

Indirect benefits mentioned in the report are the shortening of the lead time in the research, development, test and evaluation cycle through more rapid and effective exchange of information; reduction of false starts in RDTE activities; improvement of RDTE technical management; and improved information support of logistics and other Army programs.

Three of the major projects in the S&TI Program are managed by the U.S. Army Munitions Command, a part of the U.S. Army Materiel Command. The projects are the Chemical and Information Data System (CIDS), the Engineering Data and Information System (EDIS), and the Information and Data Exchange Experimental Activities (IDEEA). The Army Technical Library Improvement Studies (ATLIS) project is managed by the U.S. Army Corps of Engineers.

Technical Information Functions and Activities (TIFA) Data Bank, the Technical Effort Locator and Technical Interest Profile System (TEL/TIPS), and a number of other tasks for establishing S&TI data banks and retrieval systems for the management of the Army S&TI Program are described in the report. The data banks will provide information on operational personnel, facilities, funding and other resources related to the overall conduct of the program.

TEL/TIPS provides data on education, experience, assignments and scientific interests of professional personnel. The bank serves as a basis for improved distribution of technical information. It also augments the personnel manpower resources data bank of the Deputy Chief of Staff for Personnel in furtherance of career advancement considerations and advanced training requirements.

Research and Technology Resume. The DD (Department of Defense) Form 1498

DoD Issues S&TI User Survey Report

Procedures used by technical personnel in gathering scientific information and data related to their work are described in a new Department of Defense report on a study performed under contract as Phase 2 of a determination of user requirements.

Phase 1 was completed in 1965 and concerned the information requirements of Defense personnel engaged in research, development, test and evaluation efforts. Phase 2 examines the flow of information inherent in satisfying the needs of users, and how they use information in their work.

Performed by the Autonetics Division of North American Aviation, Inc., the latest study involved querying some 1,500 individuals from 83 organizations within the defense industry. It was conducted in cooperation with the National Security Industrial Association and the Director of Technical Information, Office of the Director of Defense Research and Engineering.

Major conclusions are presented in the form of guidelines for management decisions bearing on the direction and scope of Department of Defense-related information programs. Stressed is the need for priority effort to satisfy information needs in the development phase of the research, development and production cycle.

Emphasized also are the importance of the local work environment as a source of information and the need to publicize more effectively the availability and offerings of Department of Defense information centers.

Volume 1 of the Phase 2 study is a nontechnical summary (AD 647 111). Volume 2 (AD 647 112) describes the technical approach used, the findings and the recommendations. Volume 3, not currently available, will present the computer-produced frequency distributions and models for use in extending the study of the information flow process.

Copies of Volumes 1 and 2 are available to U.S. Government organizations and to registered contractors from the Defense Documentation Center. Public sales are handled by the Clearinghouse for Federal Scientific and Technical Information, 5285 Port Royal Road, Springfield, Va. 22151.

Dow Succeeds Elliott as AVLABS Commanding Officer

The U.S. Army Aviation Materiel Laboratories (AVLABS), Fort Eustis, Va., are now commanded by Lt Col Eugene W. Dow.

Formerly chief, Operations and Logistics Office, AVLABS, Col Dow succeeds Lt Col John W. Elliott, who took command of the U.S. Army Aviation Test Activity, Edwards Air Force Base, Calif.

Before coming to AVLABS in 1965, Col Dow was senior aviation adviser of the Korean Military Assistance Advisory Group, then commander of the Army Aviation Detachment, Korea. Other assignments have included commanding officer, Army Aviation Support element, STRICOM, MacDill Air Force Base, Fla., 1962-64; aviation officer, HQ U.S. Army, Germany, 1959-61; and duty with a logistical unit in Turkey, 1956-58. He served in Italy during World War II.

Lt Col Eugene W. Dow

Col Dow received a BS degree in military science from the University of Omaha in 1964 and was graduated from the Command and General Staff College in 1961.

A rated pilot in helicopters, fixed-wing and jet aircraft, he holds the Army Commendation Medal, Army Occupation Medal of Germany, American Campaign Medal, European-African-Middle Eastern Campaign Medal, World War II Victory Medal, National Defense Service Medal with Oak Leaf Cluster, Armed Forces Reserve Medal with Clasp, and the Master Army Aviator Badge.

Research and Technology Resume was adopted effective July 1, 1965, for reporting ongoing research and exploratory development at work-unit level.

Supplemented by DD Form 1473, which reports the results of work, the 1498 system is one of the specialized data banks of the S&TI Program that will be integrated into the recently initiated RDTE management information system (ARDIS), i.e., the Army Research and Development Information System.

Under the ARDIS concept, separately designed by integrated data banks will provide information support for the RDTE functions of planning, programing, budgeting, accounting, and review and analysis so as to provide management with timely information to assist in making RDTE program decisions.

Incorporated in ARDIS will be integrated subsystems that will handle data concerning requirements for work, planned work, ongoing work, results of work, manpower, technical information activities, budget and finance, and facilities and equipment.

Technical Information Analysis Centers. As assigned responsibility by the Department of Defense, the Army is responsible for operation of 5 of the 21 DoD Technical Information Analysis Center, namely: Counterinsurgency Information Analysis Center, Washington, D.C.; Military Entomology Information Service, Washington; Human Engineering Information and Analysis Center, Medford, Mass.; Nondestructive Testing Information Service, Watertown, Mass.; and Plastics Technical Evaluation Center, Dover, N.J.

Army S&TI Program Approach. In each of the major projects currently listed in the Army S&TI Program, the three major avenues of approach to the solution of problems are data and information resources, data operations and data representation.

The resources approach focuses attention on the scientific disciplines, technology, mission-and/or materiel-related fields. The data operations approach deals with the data processing required, such as indexing, cataloging, storing, translating, abstracting, etc.

Representation examines problems related to data forms, formats, languages and media, e.g., technical reports, journals, engineering drawings, microfilm, magnetic tapes, optical readers, combinational logic circuitry, and other data media and devices yet to be developed.

Each of the major elements of the Army S&TI Program is termed an exploratory development project. The goal is to lay a basis for effective systems.

Chemical Information and Data System (CIDS). This project deals with the feasibility of handling chemical and related information by automated techniques. Involved are determination of user requirements for the system, studies of resources available or needed, establishment of experimental data interchange, and evaluation of various types of equipment. CIDS will include a common pool of digitally stored chemical structures and associated technical data organized for efficient retrieval.

Engineering Data and Information System (EDIS). This project is intended to provide for the design and development of an engineering information and data system that will be responsive to Army requirements. All Army engineering data and information requirements will be considered in the ultimate design, to insure that the system provides what is needed in the proper form to facilitate work in the most expeditious manner.

Information and Data Exchange Experimental Activities (IDEEA). This project seeks to provide an environment for conducting experiments in the transmission, exchange, and dissemination of technical data. Involved are development of advanced techniques for data acquisition, storage, retrieval and processing.

Consideration is being given to solving interdisciplinary linquistic problems in query-type data systems; also to problems created by differing notations, codes, ciphers and storage modes and media as related to operating an effective information network.

Army Technical Library Improvement Studies (ATLIS) is directed to improving the management and technical direction of libraries through advanced technology involving automated methods. Feasibility studies are being made in the conduct of central cataloging operations and in initial distribution procedures, as well as in training requirements for users and operational personnel.

Symposia and Conferences. This aspect of the Army S&TI Program is concerned with the Army Science Conference, the nationwide Army Junior Science and Humanities Symposia (JSHS) Program, and other scientific conferences or symposia in which the Army has an interest or which are beneficial to the Army.

High-Speed Message Transmitter Tested

Test and evaluation of an electro-optical device which automatically converts typewritten copy to punched tape at a maximum speed of 4,200 words a minute are taking place under working conditions at the Pentagon, Washington, D.C.

The AN/FST-6 High-Speed Message Entry Equipment was developed for the U.S. Army Communications Systems Agency, Fort Monmouth, N.J. It eliminates all manual typing except the original page prepared on regular typewriters.

Installed in an Army message center, the machine actually transmits and receives at not more than 2,400 words a minute, the maximum rate of other equipment with which it is being used.

Normally, the advanced development model would have been delivered to the U.S. Army Electronics Command Communications and Data Processing Laboratory, Fort Monmouth, for technical evaluation. However, it performed so well in early tests that it is handling regular message traffic during this checkout period

The device recognizes five type fonts — upper and lower case standard elite, upper and lower case standard pica, and the American Standards Association (ASA) type. It can handle either single-or double-spaced typing.

Original typed pages are handled automatically one at a time from a hopper. The scanning element of 150 photocells converts the recognized characters into electrical signals which are stored in a digital computer. The computer directs the output to the selected communications terminal for transmission.

Messages are received either as printed copy or message tapes. Time studies have indicated that the reader can handle messages up to 60 times faster than conventional transmission methods.

Woolnough to Succeed Freeman as CONARC Commander

Lt Gen James K. Woolnough will succeed retiring General Paul L. Freeman as commanding general of the U.S. Continental Army Command, effective July 1.

Presently U.S. Army Deputy Chief of Staff for Personnel, General Woolnough served from 1963 to 1966 with the U.S. Army Pacific as Deputy Commander-in-Chief and Chief of Staff. From December 1960 until July 1961, he was assigned to HQ Department of the Army as Assistant Deputy Chief of Staff for Military Operations, and then took command of the 1st Cavalry Division in Korea.

Graduated from the United States Military Academy in 1932, he served in World War II, with the 1st Infantry Division. He wears the Distinguished Service Medal, the Silver Star, Bronze Star Medal with Oak Leaf Cluster, the Purple Heart, and the Combat Infantry Badge.

Following the Eniwetok nuclear tests, he joined the Joint Staff of the Commander-in-Chief, Pacific in Hawaii and remained until June 1949. After a year as commander of the 1st Regiment, Corps of Cadets, U.S. Military Academy, he served with the 1st Cavalry Division in the Korean War until moved to NATO Standing Group, Washington, D.C.

Lt Gen James K. Woolnough

Kudos

LEGION OF MERIT. Maj Gen Edwin H. Burba, program manager for the U.S./Federal Republic of Germany Main Battle Tank Program at the U.S. Army Materiel Command, recently was awarded the third Oak Leaf Cluster (OLC) to the Legion of Merit (LOM).

Recognizing his services during a previous tour as chief, Joint Military Assistance Advisory Group, Korea, the citation reads:

"The exemplary ability, diligence and devotion to duty of General Burba were instrumental factors in the resolution of complex problems of international significance and of major importance to the U.S. His efforts resulted in a major contribution to the deployment of approximately 41,000 ROK troops in Vietnam."

Col Andrew A. Aines received the Legion of Merit upon his recent retirement as executive secretary of the Federal Council of Science and Technology's Committee on Scientific and Technical Information (COSATI).

Col Aines was the first director of Army Technical Information and chief of the Scientific and Technical Information Division, Army Research Office, 1962-64.

After leaving the Office of the Chief of Research and Development, Col Aines was on the staff of the Defense Director of Technical Information until the COSATI chairmanship was shifted to the Executive Office of the President in 1966.

Col Philip L. Hooper, currently assigned to the Defense Communications Agency, received the third OLC to the LOM for his service as commanding officer, U.S. Army Combat Developments Command Infantry Agency, Fort Benning, Ga., from July 1965 to November 1966. He developed the U.S. Army Infantry position for presentation to the 7th Quadripartite Infantry Conference in Australia and guided three weapon studies.

Two LOMs were presented at HQ U.S. Army Automatic Data Field Systems Command, Fort Belvoir, Va. Col George T. Metcalf, deputy commander, was cited for distinguished service while assigned to the Office of the Joint Chiefs of Staff. Lt Col Thomas G. Blair, Interim Systems Division, was honored for distinguished service as a U.S. Army adviser in the Delta, South Vietnam.

Two officers received LOMs for outstanding research contributions while assigned to the Walter Reed Army Institute of Research (WRAIR), Washington, D.C. Col William Hausman (USA, Ret.) was cited for his service as deputy director of the Division of Neuropsychiatry. He successfully applied modern concepts of psychiatry to combat situations in Southeast Asia and to the adviser-counterpart problems in Vietnam.

CHIEF OF R&D Lt Gen Austin W. Betts pins Legion of Merit on Col Andrew A. Aines upon retirement from the Army May 5. Col Aines was the first director of Army Technical Information (1962-64) and at retirement was executive secretary, Committee on Scientific and Technical Information Committee, Federal Council of Science and Technology, Executive Office, President.

Lt Col Kevin G. Barry, former chief, Renal-Metabolic Service and director, Division of Medicine, WRAIR, was cited for investigations in the prevention and management of renal failure and work providing basic information to improve malaria treatment.

Lt Col Louis E. Harman, Dermapathology Division, Armed Forces Institute of Pathology, received the LOM, the Bronze Star Medal, and the first OLC to the Army Commendation Medal for his accomplishments while in Vietnam.

CONTRACTOR ENGINEER Louis F. Heilig receives Certificate of Appreciation for Patriotic Civilian Service in development of the Shillelagh missile system. Maj Gen John G. Zierdt, CG of the U.S. Army Missile Command at Redstone (Ala.) Arsenal, presents the award. Heilig has served as chief engineer for Shillelagh activities since 1962 and has been with the Aeronutronic Division of Philco-Ford (prime contractor for Shillelagh) since 1958.

Lt Col Charles E. Preble Jr., Office of the Director of Army Research, Office of the Chief of Research and Development, Department of the Army, received the LOM for prior service with the U.S. Army Pacific Command.

BRONZE STAR. A Bronze Star Medal (BSM) and two air medals were presented to Col George L. Lovett, commanding officer of Davison U.S. Airfield, Fort Belvoir, Va. Lt Col Carl A. Colozzi, newly assigned deputy CO of Davison, also received the BSM for "meritorious achievement in group operations against hostile forces in Vietnam."

Col John T. O'Keefe, special assistant to the commanding general, U.S. Army Missile Command, received the BSM for leadership in developing and refining a responsive evaluation system which furthered the war effort in Vietnam.

Lt Col David H. Money, Air Mobility Division, Office of the Chief of Research and Development, received the first OLC to the BSM and the eighth and ninth OLCs to the Air Medal. He recently returned from a tour with the U.S. Army Concept Team, Vietnam.

Lt Col Richard B. Pedigree, adjutant at Walter Reed General Hospital (WRGH), received the BSM for his service as executive officer with the 17th Field Hospital in Saigon.

Maj Thomas V. Brooks, HQ U.S. Army Combat Developments Command (CDC), received the BSM and 1st OLC to the Air Medal in recognition of his recent service in Vietnam.

Maj Peter G. Cei Jr., U.S. Army CDC liaison officer to the Army's Tank Automotive Command, received the BSM for service as an area specialist in the Revolutionary Development Division, Military Advisory Command, Vietnam (MACV).

Maj Milferd T. Guibor, MSC, new assistant chief of the Purchasing and Contracting Office, U.S. Army Medical Research and Development Command, has been awarded the BSM for service in Vietnam.

The BSM presented to Capt Roger A. Berg, U.S. Army Engineering Center, Fort Belvoir, and to SFC Harry W. Coates, 20th Engineer Photo Company, Fort Belvoir, honored them for duty in Vietnam.

AIR MEDAL. CWO Archie Harrell, a pilot in the Rotary Wing Division, Davison Airfield, has received the 13th through the 22d OLC to the Air Medal for service with the 48th Aviation Company in Vietnam from June until September 1966. Sp/4 Talmadge A. Mayes, Davison Airfield, received the Air Medal for flight with the 121st Aviation Company in Vietnam.

ARMY COMMENDATION MEDAL (ACM). Lt Col Cowan J. McFarland, The Surgeon General's Office, received a 1st OLC to the ACM. Lt Col William R. Howard also was honored with the ACM for his work as assistant chief, Walter

Reed General Hospital (WRGH) Dermatology Service. Lt Col Vernon H. Wold, assistant chief, Supply and Services, Armed Forces Institute of Pathology, received the 1st OLC for services at the U.S. Army Hospital, Ryukyu Islands.

Lt Col Donald A. Vantine, chief, Administrative Services Division, U.S. Army Combat Developments Command, received the ACM for distinguishing himself in the field of staff and military personnel management. Maj Hazel L. Evans, ANC, WRGH, was awarded the medal for supervisory work at Tripler General Hospital, Hawaii. Maj John N. Follansbee, WRGH, received the award for altitude studies at the U.S. Army Research Institute of Environmental Medicine, Natick, Mass.

Lt Dorothy A. Fowler, ANC, WRGH, was awarded the ACM for service in Vietnam, as was Sp/4 David C. Reed, 537th Engineer Survey Company, Fort Belvoir.

MERITORIOUS CIVILIAN SERVICE. MCS Awards were presented by Chief of Research and Development Lt Gen A. W. Betts to OCRD employes, Austin L. Duncan and Mrs. Betty F. Kleindienst. Duncan was cited for his work as chief, Budget Branch, Programs and Budget Division.

Mrs. Kleindienst was cited for "outstanding contributions to the research and development program" and to the "quality and sustained quantity of work" produced by the Communications-Electronics Division, in which she is chief clerk.

CERTIFICATES OF COMMENDATION for Outstanding Performance were awarded to Benjamin S. Goodwin, U.S. Army Test and Evaluation Command, Aberdeen (Md.) Proving Ground; Mrs. Cathleen R. Durkin, OCRD; and Mrs. Virginia M. Richards, OCRD.

MISCELLANEOUS. Dr. John C. Hayes, Scientific and Technical Division, U.S. Army Research Office, OCRD, was recently appointed a Fellow of the American Association for the Advancement of Science. An AAAS member for 14 years, he has been chief of the Programs and Concepts Branch, S&TI Division, since August 1965.

Two scientists of the U.S. Army Electronics Command (ECOM), Fort Monmouth, N.J., were elected Fellows of the Institute of Electrical and Electronics Engineers (IEEE) for outstanding contributions.

John J. Egli, chief of the Electromagnetic Environment Division of the ECOM R&D Directorate, was cited for contributions to wave propagation, electromagnetic compatibility and advanced radio communications.

Frank A. Brand, chief of the Microwave and Quantum Electronics Branch, Electronic Components Laboratory, was selected for his work in the field of microwave solid state and quantum electronic devices employed in such equipment as microwave radios and lasers.

THE GOLDEN ATOM AWARD for the top motion picture in the 1966 International Electronics, Nuclear, Telecommunication and Motion Picture Ressegna, held annually in Rome, was presented to the Army Materiel Command for the picture "Laser — Miracles with Light."

Produced by Morton D. Lewis of the U.S. Army Pictorial Center, the 24-minute color film explains the laser, how it works, and how it is being used by the Army.

FORMER ARMY CHIEF of Transportation, Maj Gen Paul F. Yount (Ret.) recently received the Secretary of the Army's Outstanding Civilian Service Award for "his direction and outstanding contribution to the success of Powerfloat—a project to provide an offshore source of electric power for Vietnam." General Frank S. Besson Jr., CG of the U.S. Army Materiel Command, presented the award to General Yount for service as consultant and adviser to the Army Materiel Command. Since retiring from the Army in 1958, General Yount has been affiliated with Consolidated Freightways, Inc., Menlo Park, Calif., and has been consultant to the Agency for International Development.

Army Places 21 on CSC Economy Honor Roll

Twenty-one employes at 11 Army installations were among U.S. Government personnel named to the Civil Service Commission's Honor Roll of Economy Champions for March, based on Incentive Awards Program suggestions.

For saving the government an estimated $694,800 through adoption of their proposals, the 21 received a total of $15,335 from their individual agencies.

The March group is the third to be honored in the 6-month project initiated by the Commission to boost the President's cost-cutting campaign. Each champion's name is placed on the Honor Roll in the lobby of the CSC building.

Each one also gets a citation from the President, saying in part, "I welcome you to partnership with me in the imperative task of cutting the costs of government. I commend your example to every employe at every level of government."

Top Army winner was Lawrence B. Forari, a production controller at Rock Island (Ill.) Arsenal. He split $1,165 with Orie Beal, an industrial engineering technician, for suggesting a modification to the design of the 50-caliber machinegun cover, and received $920 for a magazine covering for the M60 machinegun.

Lt Col Donald L. Shaneyfelt, Office of The Judge Advocate General (TJAG), Washington, D.C., won $1,500 for suggesting that candidates for TJAG Corps submit preliminary applications. Only those approved rather than all applicants would receive physicals and National Agency checks.

Mrs. Marjorie N. Reed, a military personnel clerk with the Army ROTC Instructor Group, Kansas State College of Pittsburg, Kans., received $1,165 for suggesting that the ROTC Qualifying Examination be given only to applicants for the advanced course rather than to all Military Science II students. The suggestion saved 67,740 man-hours, and, $110,416.

At Rock Island Arsenal, Donald W. Arp received $810; Mrs. Noreen Rice, $540; and Richard M. Hatlett and Francis E. Macklin, $395 each.

Winners at Fort Hood, Tex., were Joe S. Wilson, $945; Charles F. Marley Jr., $760; Elmer J. Mosley and Robert W. Starks, sharing $645; and Ordria B. Nieman, $505.

Edwin L. Campbell and Robert C. Harbin of the Army Primary Helicopter Center, Fort Wolters, Tex., received $505 and $890 respectively. The U.S. Army Electronics Command, Fort Monmouth, N.J., awarded Frank J. DeMarco $710.

Other Economy Champions are Mrs. Edith C. Kahl, Army Armor Center, Fort Knox, Ky., $535; Robert L. McDaniel, Sacramento Army Depot, $785; SFC Joseph L. Monteilh, Army Air Defense Center, Fort Bliss, Tex., $550; Manuel P. Grana, the Military Traffic Management and Terminal Service, $750; and CWO James W. Smith, the U.S. Army Forces Southern Command, Canal Zone, $865.

2 Researchers at ECOM Coauthor Technical Book

Two scientists of the U.S. Army Electronics Command (ECOM), Fort Monmouth, N.J., are coauthors of a recently published technical book, "Spectroscopic Calculations for a Multielectron Ion."

Dr. Hans H. Theissing and Philip J. Caplan are employed in the ECOM Institute of Exploratory Research. Interscience Publishers, New York, N.Y., has published their work.

The book is described as "a readily available introduction to aspects of atomic physics which were previously available only from scattered and abstract sources." It is directed to scientists working in the fields of atomic spectroscopy and optical properties of crystals and lasers.

Woman, 2 Men Win ERDL CO Awards

Scientific achievement honors in the Tenth Annual Commanding Officer's Awards for science, technology and leadership at the U.S. Army Engineer R&D Laboratories (ERDL), Fort Belvoir, Va., will for the first time be presented to a representative of the fair sex.

Principal Deputy Director of Defense Research and Engineering Dr. Finn J. Larsen is scheduled to present the scientific medal to Dr. Maxine L. Savitz, a 30-year-old scientist, at ceremonies May 19. The award will recognize her outstanding work on the Army fuel-cell R&D program.

Winner of the medal for technological achievement is Richard W. Helmke, civil engineer with the ERDL Marine and Bridge Laboratories. The medal for leadership will be awarded to William C. Hall, chief of the ERDL Research and Development Procurement Office.

George E. Burk, immediate past president of the Society of Automotive Engineers, will present the technology award and Col. Frank Milner, ERDL commander, will present the leadership award.

Brig Gen Edwin I. Donley, CG of the ERDL parent command, the U.S. Army Mobility Equipment Command, St. Louis, Mo., is programed as principal speaker.

Each of the winners will receive a commemorative wall plaque and each of the 12 nominees will be presented special certificates of achievement and a $50 honorarium. Nominees were announced on page 36 on the April edition of the *Army R&D Newsmagazine.*

DR. SAVITZ, a graduate of Bryn Mawr College with a doctorate from the Massachusetts Institute of Technology, is a research electrochemist in the Energy Conversion Research Laboratory at ERDL. She was a chemistry instructor at Hunter College, New York City, before joining the Laboratories in 1963.

HELMKE, a 1956 graduate of Clarkson College of Technology, Potsdam, N.Y., was chosen for his concept, development, design, fabrication and test of an experimental marginal-terrain bridge.

HALL, an employe of ERDL since 1956, was chosen for outstanding leadership in reorganizing the R&D Procurement Office and managing it to achieve significant improvement in productivity. He attended Benjamin Franklin University and Strayer College of Accountancy.

Army Schedules Conference On Design of Experiments

Clinics on troublesome design problems and presentations of technical papers are programed for the Thirteenth Conference on the Design of Experiments in Army Research, Development, and Testing at Fort Belvoir, Va., Nov. 1-3.

Sponsored by the U.S. Army Mathematics Steering Committee, the conference will be hosted by the U.S. Army Engineer Research and Development Laboratories and the Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Corps. of Engineers.

Clinical papers will deal with experiments in the predesign stage and with unsolved problems in the areas of probability and statistics. Army authors will state the troublesome problems and panel members will discuss the papers. Whether or not each author presents an analysis of the problem is optional.

Invited speakers will discuss regression analysis, maximum likelihood estimation of reliability, data analysis, and information storage and retrieval.

One of the highlights will be the annual presentation of the Samuel S. Wilks Award, honoring the memory of the renowned Princeton University statistician who made outstanding contributions to advancing the methodology of statistics for Army needs.

The Wilks Award is made to a statistician for "ingenious application of such knowledge, or successful activity in the fostering of cooperative scientific matters which coincidentally benefit the Army, the Department of Defense and the U.S. Government."

Nominations for the Wilks Award should be addresed to Francis G. Dressel, Mathematics Division, U.S. Army Research Office, Durham, N.C., who also should be contacted by those desiring to present papers or attend the conference.

Submission of proposals for papers from Army authors are solicited. Proposals should include the title, short abstract, name of person (s) making the presentation, and the form desired by the sponsoring organization; also, the type of paper (clinical or technical), presentation time (about 20 minutes for clinical and 30 minutes for technical), security classification, and needed equipment.

GIMRADA Tests New Map-Making Device

Rugged, van-mounted highly mobile mapping equipment capable of producing high-quality orthophotos and altitude-line-drop charts has been developed.

Results of tests and the developmental role of the U.S. Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency (GIMRADA), Fort Belvoir, Va., are described in a paper by project engineer Anthony W. Stoll. The paper was presented before the 1967 American Society of Photogrammetry-American Congress on Surveying and Mapping convention.

Part of the U.S. Army Rapid Combat Mapping System, the equipment can be transported by ground or air to the field for production of military maps for use by ground forces.

In 48 hours, it will produce all the orthophotos and altitude-line-drop charts required for mapping a 900-square-mile area, if the scale of the photography is approximately 1:50,000 and the camera position and attitude data are recorded.

Orthophotographs are photographs in which the images have been individually rearranged into scaled horizontal positions, showing lines of elevation.

Altitude-line-drop charts show successive altitude contour intervals by means of gray, white and black shadings. The interval in feet between shadings corresponds to any contour interval entered into the computer prior to starting the exposure

Under control of a computer, the system scans similar object points on various photographs. Electronic correlation circuitry then analyzes the scanned information to determine the height error.

The computer analyzes the information and uses it to control the altitude printout while the video signal from one of the photos is used to produce a new photograph with distortions removed. The equipment will operate with vertical, convergent, or panoramic-stereo photographs covering a range of focal lengths and flying heights.

Designed primarily for the compilation mode of operation, the equipment can be used as a precision comparator. Aircraft position data can be used in lieu of normal ground control for compiling outputs.

Engineer R&D Labs Name New Fuels Handling Equipment Chief

John D. Grabski

More than 15 years of experience with fuels handling, fire fighting and water purification equipment at the U.S. Army Engineer R&D Laboratories, Fort Belvoir, Va., back John D. Grabski in his new position as chief of the Fuels Handling Equipment Laboratory.

Grabski received a BS degree in mechanical engineering from Colorado A&M in 1943, and a master's degree from the University of Pittsburgh in 1953. Shortly before his new assignment, his performance as chief of the Combat Support Equipment Branch earned him an Outstanding Performance Rating.

The Fuels Handling Equipment Laboratory is responsible for research, design, development, engineer design testing and evaluation of bulk and retail liquid hydrocarbon fuels transport and handling equipment and techniques; fuels decontamination; and quality surveillance equipment.

Rocket Propulsion Technology, Management Center Unifies Effort

By John L. McDaniel

Unification of all U.S. Army rocket propulsion efforts has become a reality with establishment of the Army Rocket Propulsion Technology and Management Center at Redstone Arsenal, Ala.

Requirements for such a center became increasingly urgent with greater demands for sophisticated advances in rocket-propulsion technology which, of course, meant higher cost. Approximately $70 million was spent in fiscal year 1965 on 175 propulsion programs, mainly on exploratory and advanced development activities. Realistic estimates indicated that both demand and cost would continue to increase, making it mandatory that the greatest possible value be realized from each propulsion research dollar.

The mission to establish a Propulsion Technology and Management Center was assigned to the Research and Development Directorate, Army Missile Command (MICOM) in August 1965. Charged with responsibility for the primary mission for Army research and development of missiles, and holding a position of leadership in the Army's propulsion program, MICOM was the logical location for the Center. Edward B. Dobbins was named director.

The Propulsion Laboratory, one of eight laboratories in the Missile Command's R&D Directorate, was assigned the task of establishing the Center. Its purpose is to coordinate effort in all Army research, exploratory and advanced development propulsion programs, and to maintain an effective relationship with weapon system developers.

A prime responsibility of the Center is to monitor and evaluate propulsion activities of organizations throughout the Army. To perform a meaningful evaluation on any aspect of propulsion research, it is necessary to have comprehensive knowledge of all advances in the state-of-the-art. This task is facilitated by the fact that a large portion of the Army's rocket propulsion research is done at Redstone.

When an agency desires to let a contract for engineering development, the Center assists in formulating specifications and requirements and furnishes performance records of potential contractors.

After the contractor completes his work, the Center is responsible for organizing the resulting material with other propulsion data and providing detailed information to appropriate agencies, whether they be Government organizations, universities, industry or selected foreign countries.

John L. McDaniel, technical director of the Army Missile Command's R&D Directorate, Redstone Arsenal, Ala., since January 1962, has been with the Arsenal since 1942, except for 2-year tour of duty with the Navy during World War II. He has a BS degree in chemistry from Berry College, Mt. Berry, Ga., and taught school in LaFayette, Ga. (1939-42). His honors include the Army R&D Achievement Award, Meritorious Civilian Service Award, Decoration for Exceptional Service.

EDWARD B. DOBBINS, director, Army Rocket Propulsion Technology and Management Center, R&D Directorate at Redstone Arsenal, Ala., has a BS degree in mechanical engineering from Purdue University (1954). He was an Army officer (1954-57); research engineer, Lockheed Missile Space Division, Palo Alto, Calif. (1957-58); and unit chief, Structures and Mechanics Laboratory, until promoted to branch chief in the Propulsion Laboratory.

The Center must constantly keep in mind the technical requirements, budgetary and schedule limitations, available manpower and feasibility of concepts to ensure the best overall Army propulsion program. Resolution of propulsion problems for existing Army systems is highly significant, as well as the prediction of difficulties before they occur on fielded systems. On the local level, the budgetary cycle of the Future Missile Systems Division must be coordinated with the whole R&D Program.

The Center plays a key role in stimulating the full and knowledgeable participation of industry in the Army R&D propulsion program by informing interested firms of specific areas in which the Army has potential problems or requirements. This increases the possibilities of individual effort on the part of the contractor, and enables him to make unsolicited proposals on a firmer basis.

The Center encourages submission of proposals, and an Army propulsion expert will be present at each briefing when the proposal is of sufficient interest to the Army. Industrial organizations planning to present briefings at Redstone Arsenal are urged to notify the Center on any topic which may be of interest.

The Center is responsible for the timely exchange of rocket propulsion technical data between all agencies to prevent duplication of effort which could involve enormous expenditures of money, time and manpower.

When importance of research in a specific area justifies duplication of effort, planned duplication is coordinated to achieve optimum results.

To facilitate coordination, a centralized data bank and retrieval system has been established. The entire concept of the Center would be impossible, or at least much more difficult, if it were not for the comprehensive centralization of Army propulsion information and the automated procedures employed by the data bank and retrieval system.

Inputs to the data bank come from Army agencies any time a propulsion research or development project is in progress. Completed project information is cross-reference cataloged so that any person desiring results of research on any propulsion system, subsystem or component can rapidly locate available data. "Blue sky" projections of the future are included for the benefit of agencies contemplating projects in a new area.

Increasing advances in propulsion technology certainly will result in more stringent demands for services of the Army Rocket Propulsion Technology and Management Center, encouraging an optimistic outlook concerning its future role in meeting Army requirements for sophisticated missile systems.

CE Floating Plant to Power Kwajalein Nike-X Facility

Work is nearing completion on a 20,000-kilowatt floating power plant to provide precise power to the U.S. Army's Nike-X test facilities under development on the Kwajalein Atoll in the mid-Pacific Ocean.

Under the direction of the Honolulu Engineer District, U.S. Army Corps of Engineers, the construction project is being accomplished for the Nike-X Project Office. Installation of the power plant is under contract with General Electric Co.

Scheduled to be completed late this summer, the plant will include both diesel and gas-turbine engines to provide the precisely controlled power required for the Nike-X radar and other research and development facilities at the Kwajalein installation. Precise power is high-quality power that does not fluctuate in voltage or frequency.

The diesel engine will provide base load power for extended operations. Gas turbine generators will be used to meet the large peak demands of the Nike-X system during tests. It is reported to be the first precise power plant developed in this country featuring both diesel engines and gas turbines.

The power plant is being installed in a World War II floating drydock at the Bethlehem Steel Corp., Sparrows Point, Baltimore, Md. When the plant is completed, it will be towed to the Kwajalein site for final testing and acceptance by the Army.

Military Significance of Mountain Environment Studies

By Dr. Will F. Thompson

The United States Army is presently organized to fight to greatest advantage in terrain other than mountains. In recent decades, however, it has fought in mountains in Italy, then in Korea, and now in Vietnam.

Since the mid-thirties, other nations have fought in mountainous terrain in Spain, Algeria, Albania, Greece, Cyprus, Sinai, Yemen, Ethiopia, Kurdistan, Ladakh, Kashmir, Tibet, Assam, Laos, Malaya and in the interior of Borneo.

These mountain areas are of such varied size and character that one does not easily think of them as a single class of terrain, yet the steepness, ruggedness and high relief they have in common are of great military significance. Such terrain occupies the whole southern frontier of Communist power from Central Europe to Vietnam.

Consequently, the U.S. Army must know more about mountains, how regions differ, and how each kind is likely to present peculiar problems for successful operations.

Limitations of Technical Solutions. When faced with a problem, it is our custom to seek a gadget to solve it. The great usefulness of the helicopter at moderate altitudes in the mountains of Vietnam demonstrates the virtue of that reflex. Many problems of mountain warfare are likely to be solved for us simply by continued expansion and improvement of our VTOL capacity. That being so, however, we must give more thought to the mobility and effectiveness of our troops once they are landed in mountains.

The problem of ground movement in mountains will not be solved by gadgets. Experience suggests that most items really helpful to men on foot in mountains (except for trained alpinists on especially difficult ground) are general-purpose things useful to soldiers in combat anywhere: light and effective weapons and equipment; light and versatile clothing and tentage; rations which are light, simple, compact, easily prepared, and break down easily for issue to small units; and light, comfortable and efficient load-carrying devices. Lug-soled boots for maximum traction are of critical importance in mountains, but are also a good item for foot soldiers anywhere.

Most items especially designed for use in mountains are less useful, except in special circumstance, than an equivalent weight and bulk of general-purpose gear.

The 10th Division found during World War II that skis are an incredible nuisance to foot soldiers except in the particular circumstances where they are needed. Snowshoes are less awkward, but one would prefer to wade through quite a bit of snow rather than carry them in combat in difficult terrain.

Crampons for summit ice fields, and pitons and related equipment for cliff climbing are less bulky, but even they displace the food and ammunition in men's packs which represent mobility and force. It seems better to issue specialized mountain gear only to a few trained alpinists — by airdrop when needed.

Except for VTOL transport and a minimum of the most basic items of materiel, one cannot expect to supply troops committed to mountain warfare with anything which will increase their effectiveness, relative to that of mountain-bred irregular forces, as much as will an improved understanding of the kind of terrain in which they will be fighting. Providing such an understanding will not always be easy.

Military Studies. The Earth Sciences Division of the U.S. Army Natick Laboratories (NLABS) has been concerned for some years with the characteristics of mountains and mountain regions. Mountains can be defined as terrain which is steep and rugged, and has roughly 2,000 feet of local relief.

Hills with local relief of about 1,000 feet often have the same kind of forest or other vegetation at their base as on their crests. A farmer might plant much the same crops at the two levels, and be comfortable in the same clothes in the same weather. Some differences in drainage, erosion or windiness might be expected, but no really important environmental differences would exist simply because of altitude.

Terrain with 3,000 feet of local relief, on the other hand, usually has two different kinds of forest at different levels, distinctly different soils even on similar slopes, and many other climate-related contrasts due to altitude.

If the mountains rise 10,000 feet, as Mount Whitney does above the Owens Valley, the climatic contrast should be three times as great and produce corresponding contrasts in characteristic phenomena at the two levels.

Even within small areas, high mountains are an extremely diverse environment. Small groups of people live and move about without undue difficulty, but armies find themselves hedged within uncomfortably restricted areas of trafficable terrain. Except on prepared roads, which are always vulnerable, they can move only by constantly threading defiles.

Large forces might push through merely difficult terrain as easily as small ones. In terrain which is both difficult and diverse, people who know how to move easily through or among the less trafficable elements can readily immobilize larger forces which have fewer options.

Diversity does not imply randomness or unpredictability, however. Analyses at NLABS have shown that the characteristic alpine and subalpine landscapes of mountains in northern New England and of the northern Cascades in Washington State, which are very different in character, are each an integrated distinctive system.

Even where summit and valley altitudes are irregular, particular levels on mountainsides often have a consistent aspect, indicating regionally consistent climate. However, a great many mountain regions even have high peaks which all rise to roughly the same level, and major valleys similarly excavated to about the same depth.

In moist ranges of considerable height, valleys generally have been excavated to great depth by vigorous streams, glaciers, or both. Longitudinal gradients of the floors of larger valleys are uniformaly moderate, considering the terrain, but gorge walls are steep. The opposite is true with similar consistency in relatively dry mountains, such as the eastern and interior parts of the central and southern Rockies.

Flying over such a region, one sees that peak after peak and valley after valley have much the same aspect, at least till one enters another climatic region. High alpine summits in such a region may almost all be sharp, or they may almost all be broadly domed. Glaciers and the cirques they have excavated usually occur in characteristic sites which differ from region to region.

Timberlines may consistently be a

Dr. Will F. Thompson

Dr. Will F. Thompson, geographer in the Earth Science Division, U. S. Army Natick (Mass.) Laboratories, has published a number of studies on aspects of mountains which are of concern to the Army. His mountain experience includes a number of years of climbing before World War II; four years with the 10th Mountain Division with service in the Aleutians and Italy; short periods in the Alps during and after the war; and expeditions and field studies in Alaska, the Aleutians, and western ranges. He studied biology before World War II at the University of Washington; took a master's degree in geography there after the war, and wrote a doctoral dissertation in 1960 at Clark University on the regionally characteristic environment of the higher mountains of New England.

zone of gradual thinning and stunting of the forest, or may with equal consistency be an irregular trim line, cut in vigorous forest by avalanche action and other effects of heavy snow.

Mountain Environment. The U.S. Army problem does not stem primarily from a shortage of environmental information about mountains, but rather from uneven distribution. For example, we know a great deal about environments on Mount Blanc or Mount Everest, or even around Camp Hale in Colorado. But we have not yet determined what part of that information applies to certain vast regions in which we might have to fight.

NLABS mountain studies cited above are really of less interest as compilations of fact than as advances in geographical methodology which may allow us to say more about little-studied mountains. Many people have traveled in mountains where precise environmental data are scarce. They have overcome the characteristic climatic and terrain problems of those regions, and the published record of their travels usually at least suggests the stresses which people, animals and equipment have encountered.

The situation is like that in mountaineering, where mere knowledge that a previous ascent has been made renders a second ascent of a mountain less fomidable than the first. Another resource in little-known mountains is aerial photography, by means of which one's own experience even along narrow tracks, as well as scientific data even from sites of very limited extent, becomes a basis for interpretation of analogous situations throughout broad regions, even in remote parts of the world.

For many years to come, we will have to rely on such interpretations where local information about mountain terrain is lacking, and we must be able to do so with some degree of confidence.

Even in the few mountain localities where point data such as that from climatic instruments is relatively abundant, it can specifically represent only a certain kind of topographic situation, with a certain direction of exposure, at a certain height, in a climatic region like that from which the data came.

Stresses critical to men, equipment and operations are usually complex; in mountains they generally involve various important unmeasured elements of climate or terrain, even where considerable pertinent data are available.

Furthermore, mountains in many strategic areas will be barred to us for study purposes. In such cases it will often be necessary to find an accessible mountain range in which environment seems quite similar, and study the nature and dimensions of such stresses there.

Patterns of icefields, snowfields, cliffs, forest, meadows, avalanche tracks, landslide scars, forest fires and floods — the form of slopes and many other climate-related features of any mountain landscape — indicate its climate and general character, and are clearly seen on aerial photographs.

If the whole complex of climate-related terrain features is really much alike in airphotos of two regions, the two climates should be quite similar, and in many respects the terrain will be also, even though the mountains may differ in scale. Forested fiord coasts and desert mountains are examples of such distinctive climate-related mountain landscape types, seen in many parts of the world.

The main sources of significant differences between mountain landscapes in similar climates are geology and human activity, which can to a considerable extent also be seen in aerial or other photographs and thus allowed for.

Indicated Direction for Studies. Only a few of the many phenomena characteristic of a mountain region have been dealt with explicitly in the scientific literature. For example, glaciers have been studied quite intensively, but the effects of perennial soil frost in mountains have not. That does not prevent recognition of similarity in the characteristic aspect of two mountainsides, possibly due to perennial soil frost, in any two climatically analogous regions in mountains.

Lack of certain studies, however, does leave one seriously short of the concepts and technical terminology needed to discuss such situations. Furthermore, important environmental implications of such phenomena may not be readily seen either in photography or in the field, yet may well be made evident by careful analysis of phenomena.

A great deal of work therefore needs to be done, not only in various scientific disciplines, but also in broad interdisciplinary areas of research to provide the understanding needed if one is to deal adequately with mountain environments.

Mountain studies completed so far have not been tried out as a basis for extensive practical military training and item testing. Consequently, neither the formats so far developed for them, nor their content, are entirely satisfactory.

When deliberate training and testing in such terrain are again undertaken on a large scale, it seems especially desirable that they should be based on physical geographic treatments of regional environments considered as whole systems, rather than as a complex of factors and phenomena considered separately.

Reports prepared as a basis for training and testing in mountains should talk about landscapes there as whole entities, as they might be seen and fought in by the soldier. A few well-chosen photographs are often a good basis for discussion of the characteristic features of a particular kind of mountain. They should be discussed, not in terms of abstract values such as mean or extreme temperature, mean wind velocity, soil strength or soil moisture, but in terms of characteristic operational problems likely to be encountered. which are generally due to a combination of circumstances. Furthermore, enough mountain regions should have been treated in that manner to cover most potential problem areas.

U.S. Army Mountain Experience. Mistakes have been made in the past for lack of properly organized physical geographic information about mountains. During World War II much training and testing took place in mountains at Camp Hale, Colo. The terrain has only modest local relief, but it lies so high that the activity and training rate of the troops were significantly reduced. Really rugged terrain nearby was little used, apparently because the safety of troops could not be assured.

Physiological acclimatization acquired in sites like Camp Hale is quickly lost when men return to sea level. If an understanding of the nature of really rugged mountains had been obtained, it would have been retained indefinitely by the troops involved.

Such an understanding, and the skills needed to operate in such terrain, would be very useful in rugged and strategically important ranges even though they do not reach levels where scarcity of oxygen becomes a problem. Furthermore, the psychological impact of altitude sickness will presumably be much less on troops accustomed to mountains than on those who find such terrain altogether unfamiliar.

Mountain landscapes quite closely analogous to those near Camp Hale are widespread in Asia. Where similarly moderate local relief exists in parts of the Hindu Kush of Afghanistan, Russian Turkestan, Mongolia, or eastern Tibet, the training given at Camp Hale would have been quite useful. If training had taken place in higher ranges near Camp Hale, such as the Gore Range, it would have been applicable in the higher mountains of those regions.

The 10th Mountain Division was trained at Camp Hale, however, specifically for possible combat in the Alps. These are much steeper, more rugged, and have much more local relief than the training area used, but reach high altitude only locally and have a much less continental climate.

Fortunately, it was possible to use the 10th Division in the less rugged Appenines, and unnecessary to employ them in combat in the Alps proper. Today, using the large amount of helicopter support available, our troops could move into terrain like the Alps very quickly, overpassing any but the most massive defenses. However, they would have a great deal to learn about such terrain once they got there.

Troops should be trained in mountain terrain as closely analogous as is conveniently possible to that in which they will fight. Combat officers should understand

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Military Significance of Mountain Studies

(Continued from page 31)

mountains well enough to deal with them confidently. Personnel responsible for long-or short-range operational plans for mountain warfare should be able to deal with such terrain in terms of cartographic, photographic, and verbal abstractions made vivid by field experience in appropriate localities.

Such considerations apply to some extent even in mountains of modest height and ruggedness, such as those of Korea or Vietnam. Though there are no full-scale American analogs of the Himalayas, tests and training in our higher ranges would nevertheless be valuable preparation for operations in very high mountains.

A contract study has just been completed by the University of Colorado in valleys, basins, and adjacent mountains along U. S. Route 40 in western Colorado and eastern Utah. It provides fairly detailed observations of many militarily significant aspects of the landscapes of several distinctive regions there, comparable to certain regions in Eurasia, and relates them to many earlier scientific studies in the Rockies

The extent of those regions in mid-latitude North America was concurrently established by a broad photointerpretive reconnaissance of our western mountains carried out by NLABS.

It is hoped that the Route 40 study can eventually be extended westward to the Pacific Coast. An environmental transect will then have been established which will lie, in terms of Old World analogs, along a line from northern Afghanistan and Russian Turkestan through the Near East to Mediterranean Europe. Further study of those Old World regions will add greatly to the value of comparisons.

Along Route 40, troops thus might train, and equipment might be tested, in mountains known to be reasonably similar to many of those listed in the first paragraph of this note as recent trouble zones. Studies similarly organized in other kinds of mountains should eventually apply to most of the rest of the areas listed there.

However, the U.S. Army still has a great deal to learn, not only about the character of particular mountain regions as it might affect military operations, but even about ways of gathering such information and presenting it usefully.

Tobyhanna Depot Cleans with Ultrasonic Sound

High-frequency sound beyond the range of human hearing does a superhuman job of cleaning electrical and electronic devices at the Tobyhanna Army Depot in northeastern Pennsylvania.

Called "hi-fi" by those who work with it, the dirt destroyer is the ultrasonic cleaner used by the supply and maintenance depot to "bombard" foreign matter from diode tubes, teletype machines and other devices.

Dipped into a solution of detergent and water, a piece of equipment caked with dirt comes clean in seconds to resemble, in many cases, a unit fresh off the assembly line.

Bubbling in the cleaning solution, the sound waves in the 20-to 25-thousand kilocycle range cause an implosion (inward bursting) of whatever scale or foreign matter they touch.

Foreman Myron Potash of the Ultrasonic Cleaning Shop at Tobyhanna claims that with hi-fi one person can do what 25 did before. Among the items cleansed to shiny newness are transmitters, power-supply units, radio equipment and projectors.

USAEPG T&E Tower Eludes Radar Surveillance

From the flat Arizona desert at Fort Huachuca, Ariz., an electronic test and evaluation tower rising 114 feet cannot be detected on airborne or ground radarscopes. Explanation: No metal in the structure.

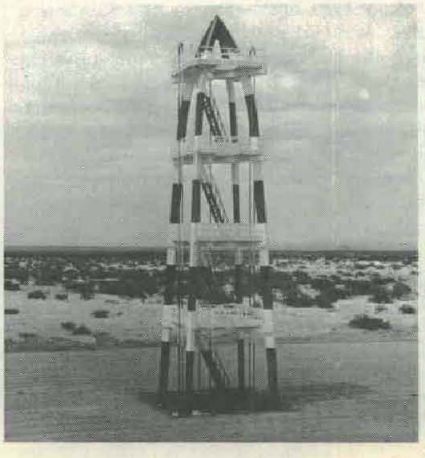
Believed unique in the United States, the sturdy 4-level 10-story-high tower is made of Douglas fir held together by "densified" wood and nonmetalic phenolic nuts and bolts. It can withstand winds up to 125 m.p.h.

Not a scintilla of metal is present in the tower to alter — by reflection or radiation of magnetic signals — the "free space" needed by the U.S. Army Electronic Proving Ground for precise testing and measuring of antenna patterns, electronic devices and VT (variable time) fuze simulators.

Brightly striped in red and white, the tower is part of a $350,000 complex built in 1958. Other elements include a 300-foot-square ground-plane grid of ½-inch galvanized mesh.

The system is grounded to subsurface rods surrounding the tower and to the steel of the concrete pit walls on which the structure stands.

Tower platforms for placement of test equipment are at 25, 50, 75 and 100 feet. An elevator is used to hoist heavy gear.



GIMRADA Opens S&TI Center

The U.S. Army Engineer Geodesy, Intelligence and Mapping Research and Development, Agency, Fort Belvoir, Va., has opened a Scientific and Technical Information Center for the collection and dissemination of scientific and technical data and information.

Subjects handled include optics, electronics, automatic data handling, space sciences and related technologies for the development of new equipment and techniques in the fields of geodesy, intelligence and mapping.

SCIENTIFIC CALENDAR

6th Army Conference on Tropical Meterology, sponsored by AMC, AEC and the University of Miami, Coral Gables, Fla., June 8-9.

50th Chemical Conference and Exhibition, sponsored by CIC, Toronto, Ontario, Canada, June 4-7.

Symposium on Lubrication in Nuclear Applications, sponsored by ASME, Miami Beach, Fla., June 4-11

Armed Forces Communications-Electronics Conference, Washington, D.C., June 6-8.

2nd Solid Propulsion Conference, sponsored by AIAA and IRPG, Anaheim, Calif., June 6-8.

13th Conference of Arm y Mathematicians, sponsored by ARO-D, OCRD, Fort Monmouth, N.J., June 7-8.

12th Air Force Office of Scientific Research Science Seminar, Albuquerque, N. Mex., June 7-14.

Annual Meeting of the American Nuclear Society, San Diego, Calif., June 11-15.

International Communications Conference, sponsored by IEEE and CTG, Minneapolis, Minn., June 12-14.

International Symposium on Radiation Dose Measurements, sponsored by the Swedish Atomic Energy Co., Stockholm, Sweden, June 12-17.

Symposium on the Chemistry and Internal Structure of Synthetic High Polymers, sponsored by the International Union of Pure and Applied Chemistry, Louvain, Belgium, June 12-17.

International Conference on Vacuum Metallurgy, sponsored by the American Vacuum Society and AIME, New Haven, Conn., June 13-15.

Tri-Service Radar Symposium, sponsored by AF Avionics Laboratory, Seattle, Wash., June 13-15.

Symposium on Catalysis, sponsored by CIC and McMaster University, Hamilton, Ontario, Canada, June 14-16.

Conference on High Energy Therapy Dosimetry, sponsored by ONR, N.Y.C., June 15-17.

International Conference on the Kinetics of Reactions of Ionic Solids, sponsored by ARO-D, OCRD; ONR and Alfred University, Alfred, N.Y., June 18-23.

2nd Annual AVCOM Advance Planning Briefing for Industry, sponsored by the Army Aviation Materiel Command and the Army Aviation Association of America, St. Louis, Mo., June 19-21.

13th International Conference on Spectroscopy, sponsored by NRC, Ottawa, Canada, June 19-23.

1st International Conference of the Center for High Energy Forming, sponsored by AMC, Estes Park, Colo., June 19-23.

Meeting of the Data Processing Management Association, Boston, Mass., June 20-23.

Annual Meeting of the American Society for Testing Materials, Boston, Mass., June 25-30.

International Conference on High Energy Accelerators, Cambridge, England, June 26-30.

International Conference on the Physics Problems in Thermal Reactor Design, sponsored by the Institute of Physics and the Physics Society, London, England, June 27-29.

Fundamental Physics of the Magnetosphere, sponsored by AFCRL, OAR and Boston College, Boston, Mass., June (date undetermined).

National Electronics Conference, Long Beach, Calif., June (date undetermined).

ECM Proves Feasible for Cannon Parts

By Charles H. Rose

Early tests conducted by outside contractors on electrochemical machining of cannon components have proved that, through proper machine and application techniques, the ECM process is a feasible and economical method of producing cannon components.

The breech face of the 105mm M68 gun tube was selected for electrochemical processing due to the intricate shape and expensive machining costs. Since no commercial equipment would accommodate this component, and unusual flow problems would be encountered, it was decided the best approach would be to develop the prototype equipment for the design and manufacture of production equipment.

Prototype equipment was designed and constructed, using an electrolyte system with a 40-gallon capacity and an electrolyte pump capable of supplying electrolyte at 40 g.p.m. at 60 p.s.i. The feed used is electromechanical, with variable feed rates from 0 to .150 inch per minute.

The highest feed was kept relatively low to allow for the use of an existing variable-speed drive unit. The power source was a 7,500 ampere, 0-15 volt rectifier available at Watervliet (N.Y.) Arsenal and a current overload device was added to the rectifier unit.

Tooling was designed to utilize a center-flow electrolyte pattern and provisions were made to maintain a back pressure on the electrolyte discharge. The tool was constructed so that all surfaces of breech face detail on the 105mm M68 gun tube were machined simultaneously.

Tests resulted in these observations:

- ECM is an economical and practical method of machining the breech face of the 105mm M68 gun tube.
- High-pressure, high-volume electrolyte pumps should be used on all ECM applications (100 g.p.m. at 300 p.s.i.).
- Adequate electrolyte clarification should be provided through the use of an adequate capacity centrifuge.
- Adequate spark sensing circuits must be incorporated in the rectifier unit to prevent tool damage while operating.

Savings in actual machining time will be $40 per component when machining the 105mm breech-face detail. In addition, handling and set-up time will be reduced, since all machining will be accomplished on one machine rather than the five machines used conventionally.

Testing disclosed that electrolyte concentrations in excess of one pound sodium chloride per gallon of water did not result in improved machining conditions. Future electrochemical machining at Watervliet will be accomplished using the one pound electrolyte-to-gallon of water concentration.

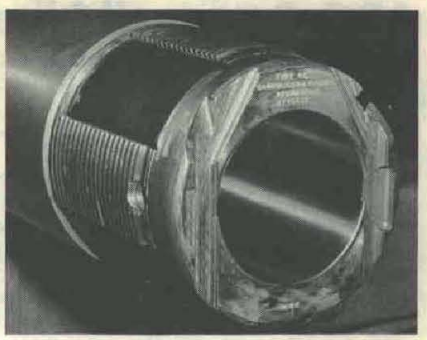
Utilizing the information obtained through use of the prototype equipment and considering the savings by the use of ECM equipment, it was decided that production-line equipment should be designed and manufactured at Watervliet.

Production equipment will be manufactured with a rigid base, utilizing a surplus Le Blonde boring lathe bed. The electrolyte system will have a 600-gallon capacity and a pump capable of supplying 100 gallons per minute at 300 p.s.i.

A centrifuge capable of clarifying 50 g.p.m. will be incorporated in the system. The rectifier will have a 10,000 ampere, 0-20 volt capacity and will incorporate spark-sensing controls capable of sensing a potential spark condition and stopping all machine functions in five milliseconds.

The drive system will be a variable-speed hydraulic, having a feed rate of from .020 to .750 inch per minute. The tool will be the same one used on the prototype equipment.

This equipment is scheduled for completion in the fall of 1967 and is expected to result in savings of $30 to $50 per machined component.



BREECH FACE detail on 105 mm gun tube, electrochemical machined.

Charles H. Rose is an industrial engineering technician with the Engineering Laboratory, Benet Research and Engineering Laboratories, Watervliet (N.Y.) Arsenal, U.S. Army Weapons Command.

Maj Gen Latta to Address 6,000 at AFCEA Convention

Keynote speaker at the Armed Forces Communications and Electronics Association (AFCEA) 21st annual convention, June 6-8 in Washington, D.C., will be Maj Gen William B. Latta, CG, U.S. Army Electronics Command.

More than 6,000 leaders of Department of Defense, civilian agencies, industrial and educational research activities are expected to attend. "Dedicated to the military-civilian partnership concept," the AFCEA has engaged 62,000 square feet of space for 225 exhibits.

General Latta will speak at the June 6 luncheon. Robert W. Galvin, chairman of the board, Motorola, Inc., is scheduled for the banquet address June 7. Leonard Jaffe, director of Space Applications Programs, NASA, will speak at the June 8 luncheon.

Air Force Lt Gen Harold W. Gram, director of Telecommunications Policy, Office of the Secretary of Defense, will introduce the panel presented by Philco-Ford Corp., "Defense Communications Satellite Systems — Present and Future."

The Radiation Inc. panel on "Digital Communications — The Challenge" will be introduced by Maj Gen Walter E. Lotz Jr., Army Chief of Communications-Electronics and former Director of Army Research. Brig Gen Paul A. Feyereisen, deputy CG of the Army Electronics Command, will be a panelist in discussion of the Mallard Project of which he is manager.

The U.S. Navy panel discussions on "Global Naval Communications and Vietnam — Challenge and Response" will be opened by Rear Adm (Ret.) Joseph R. Redman, former consultant to Western Union.

"A Key to the Future — Electronic Switching," final-day technical panel discussion, will be opened by Maj Gen Dayton W. Eddy, director for Communications-Electronics, Joint Chiefs of Staff.

In March, an advanced-planning briefing was presented by the Army Electronics Comman and AFCEA at Fort Monmouth, N.J. The U.S. Navy and Air Force participated in "Combat Surveillance, Night Vision and Target Acquisition."

Attending were representatives of the Department of Defense Office of the Director of Defense Research and Engineering, and the Office of the Chief of Research and Development.

The AFCEA, organized in 1946, is an outgrowth of the post-Civil War U.S. Veteran Signal Corps Association. Membership is approximately 14,000.

Tests Prove Reliability Of New Cable Connector

Tests simulating heat, cold, moisture and vibration extremes of the military environment have proved the reliability of a new connector for electrical flat cable designed and developed at Picatinny Arsenal, Dover, N.J.

Designed to attach to flat cable by soldering, welding, or crimping, the connector is adaptable also to round cables. Contacts are rated at 7.5 amp and 1 kvde, and five layers of 10-conducter circuitry can be accommodated.

Robert Van Ness, project engineer in the Nuclear Engineering Directorate at Picatinny, designed and developed the connector. It is made from aluminum shells, inserts for contact positioning, contacts molded in strips, silicon rubber interfacial and grommet seals, and an aluminum compression back shell.

Modification of the rear grommet from slots to round holes permits the termination of round wires to either side of the connector.

ARO-D Council Gives Scientific Expertise

Whenever honors are accorded some of the more notable achievements of the U.S. Army Research Office at Durham, N.C., the ARO-D Advisory Council merits special recognition.

Since it was organized in 1961, the Advisory Council quietly and efficiently has gone about its business of providing guidance to the ARO-D commander in planning and appraising the Army basic research program in the mathematics, physical engineering and environmental sciences.

Composed of top scientists of the U.S. Army Materiel Command, the AMC Central Laboratories, other Army agencies and academic organizations, the Council provides a balanced blend of seasoned talent in these sciences.

Since the Army-wide reorganization in 1962 substantially altered the Council's function, it has been convened as necessary to evaluate various basic research proposals, coordinate with the Army's in-house research program, discuss transfer of projects between laboratories, review the ARO-D Military Themes Program, discuss policy on allowance of overhead costs on academic grants, Army-university relationships, and review many other matters.

Council's meetings have afforded ARO-D an opportunity to report the status of its operations and pending policy decisions to a wide representation of top scientists. ARO-D Chief Scientist Dr. John W. Dawson serves as chairman and the Deputy Chief Scientist Dr. Hermann Robl is secretary. Members are:

John R. Beall, chief, Engineering Branch, Medical Materiel Development Division, U.S. Army Medical Research and Development Command; Dr. Reinier Beeuwkes Jr., chief scientist, U.S. Army Materials Research Agency; Dr. John P. Hallowes Jr., director, Physical Sciences Laboratory, HQ, U.S. Army Missile Command; Dr. Henry P. Kalmus, chief scientist, Harry Diamond Laboratories; Dr. J. V. Richard Kaufman, chief scientist, HQ Army Munitions Command; and

Norman Klein, chief, Chemistry and Materials Branch, Research Division, Research and Development Directorate, U.S. Army Materiel Command; Dr. Curtis W. Lampson, technical director, U.S. Army Ballistic Research Laboratories; Dr. J. Fred Oesterling, deputy scientific director for research, U.S. Army Natick Laboratories; Dr. Ernest N. Petrick, chief scientist, HQ, U.S. Army mobility Command; Gerald Reinsmith, chief, Research Office, HQ, U.S. Army Weapons Command; and

Dr. Hans K. Ziegler, chief scientist, HQ, U.S. Army Electronics Command; Dr. Jesse W. Beams, Department of Physics, University of Virginia; Dr. Marcus Hobbs, Department of Chemistry, Duke University; Dr. John E. Vance, Department of Chemistry, New York University; and Dr. W. M. Whyburn, head, Department of Mathematics, University of North Carolina.

Army Adopts 'Cayuse' as Name For Record-Breaking Helicopter

Cayuse has been adopted as the official popular name for the U.S. Army's OH-6A light observation helicopter (LOH). This name was first given to a breed of Indian horses that became famous more than a century ago for exceptional speed and stamina.

The Cayuse is a 4-passenger (including pilot), highly maneuverable aircraft designed to accomplish the missions of visual observation, reconnaissance, and command and control. Development of the Cayuse is completed and production models are being delivered for operational use.

Produced for the Army by the Hughes Tool Co., the OH-6A established 23 world records during 1966 — more world records than held by any other helicopter — in various time, distance and altitude categories.

The Cayuse is a project manager item at Headquarters, U.S. Army Materiel Command. AVLABS contributed to development of the OH-6A by analyses of drag and performance tests.

ECOM Explores New Battery Separators

In the search for materials with extremely low electrical resistance for use in high-rate, non-reserve Army missile batteries, the U.S. Army Electronics Command is investigating inorganic separators formulated from alkali — alkaline earth aluminosilicates.

Tests have proved the materials are inert to the alkaline electrolyte and effectively restrict silver and zinc ion migration for long periods. Indications are that batteries using these and comparable materials still under investigation will have an activated shelf life of three to five years.

Use of the new separator materials is expected to result in substantial weight savings for Army missile applications by eliminating the external electrolyte reservoirs. Eliminated also would be the special means for automatically adding the electrolyte to the central battery stack just prior to use.

The thin film composites of inorganic materials and organic substances aid in control of pore size and eliminate the brittle structure of the inorganic materials, thus yielding a capability to withstand high missile environments. Development work is being performed by ECOM under contract with the Missiles and Space Systems Division of Douglas Aircraft Co.

Dr. Tucker of IBM to Succeed Rogers as DDDR&E

Dr. Gardiner L. Tucker will succeed Thomas F. Rogers July 1 as Deputy Director of Defense Research and Engineering (Electronics and Information Systems). Rogers will become director, Office of Urban Technology, Department of Housing and Urban Development.

Dr. Tucker is currently director of research for International Business Machines Corp. and has been with IBM since 1952. He became manager of the research analysis and planning staff at Poughkeepsie, N.Y., in 1957, was advanced in 1959 to research laboratory manager at San Jose, Calif. In 1961, he was promoted to director of development engineering for the IBM World Trade Corp. and has served in his present position since 1963.

In August 1962, he was appointed to the Advisory Committee for Economic and Manpower Studies of Science and Technology, National Science Foundation. Since August 1964, he has served on the Committee on the Economic Impact of Technology, U.S. Department of Commerce. He was elected a member of the Directors of Industrial Research in 1964.

Dr. Tucker is member of Phi Beta Kappa, Sigma Xi, the American Physical Society and the Institute of Electrical and Electronics Engineers.

INGENUITY in building a homemade "atom smasher" recently earned John Sofia the special award presented annually by the Watervliet (N.Y.) Arsenal Society of Engineers at the Eastern New York Science Congress at Albany. He received a handbook of physics and chemistry for displaying a device judged the best in the senior physics division. "Boiling off" particles from a hot tungsten filament and accelerating these in a vacuum through a high potential, the device produced mutations when used to radiate a radish seed flat. John will represent the Eastern Zone in the State Science Congress.

Battelle Building New Plutonium Lab

Plutonium research needs of industrial and government sponsors will be served by the most modern equipment in a new $2 million laboratory nearing completion at Battelle Memorial Institute, Columbus, Ohio.

Located at Battelle's Nuclear Research Center 17 miles west of Columbus, Ohio, the plutonium laboratory more than triples the size of the original facility — the first privately financed plutonium research laboratory in the United States when it went into operation in 1960.

Current research projects include fabrication of mixed uranium-plutonium oxide fuels in support of a gas-cooled breeder reactor, evaluation of the compatibility of plutonium dioxide microspheres with pyrolytic carbon coatings, development of mixed uranium-plutonium nitride fuel for breeder reactors, study of plutonium dioxide's compatibility with standard fuel-cladding materials, and fabrication studies of metallic alloys.

Another research program in support of breeder reactor fuels involves development of mixed carbonitrides that would combine certain advantageous properties of both carbides and nitrides. It is easier to fabricate carbides with uniform properties, while nitrides are more compatible with cladding materials.

Approximately one-half of the equipment is in place, and installation of the remaining equipment will be completed before the end of the year. New equipment in the research facility includes:

- A spectrograph with laser microprobe that can make rapid spectra analysis of plutonium-containing materials, and specific analysis of areas as small as 25 microns.
- Low-level alpha caves with remote control manipulators and a vacuum hot-press system that incorporates a 30-ton hydraulic press and a 15 KVA induction heater capable of attaining 2,000 degrees centigrade. These alpha caves will be used to study plutonium-238 as a radioisotope source for thermoelectric generator systems.
- A vacuum glove-box complex for plutonium carbide, nitride and carbonitride research, with additional capability for providing recirculating inert atmospheres, and incorporating a 100-ton press and 2,500-degree centigrade vacuum and hydrogen furnaces.
- Conventional glove-box facilities for plutonium oxide research, with powder preparation, characterization, and fabrication equipment, including a dilatometer, a continuously recording microanalytical balance for measuring oxygen-to-metal ratios, and an X-ray diffraction apparatus.

HumRRO Installs New Computer

A new computer installed at the Army-contracted Human Resources Research Office (HumRRO) in Alexandria, Va., is expected to increase the HumRRO research and development capabilities.

The IBM 360, Model 40 replaces the smaller 1620 computer system that was no longer adequate to handle the organization's increasing data processing and simulation requirements.

HumRRO Director Dr. Meredith P. Crawford says the machine will be used "to break new ground in training and educational technology."

AVCOM Establishes Aviation Plant Activities at Lockheed

Establishment of the Army Aviation Lockheed Plant Activity at Van Nuys, Calif., and elevation of the Army Bell Plant Division, Fort Worth, Tex., to subordinate activity status recently was announced by the U.S. Army Aviation Materiel Command (AVCOM), St. Louis, Mo.

A division of AVCOM's Directorate of Procurement and Production since 1963, when plant cognizance for U.S. Government business was transferred from the Navy to the Army, the office at Bell Helicopter Co. now is redesignated the Army Aviation Bell Plant Activity.

Coincidentally, AVCOM assumed cognizance of procurement of rotary-wing aircraft manufactured at the Van Nuys Lockheed plant for all U.S. Military Services, the National Aeronautics and Space Administration (NASA), Federal Aviation Agency and foreign nations. This formerly was a function of the U.S. Navy.

The AVCOM field plant activities perform contract and property administration, engineering, flight acceptance, inspection and acceptance and other related duties.

The Lockheed-California Co. is the prime contractor for development of the Army Advanced Fire Support System (AAFSS) aircraft.

Army's Modern 'Dragon' Packs More Punch Than Medieval Namesake

"Beware the Dragon!" might sound like a warning dating back to medieval days, but it is updated by the new name of the U.S. Army's one-man medium antitank assault weapon formerly MAAW.

Light enough to be carried and fired by one man, the Dragon is powerful enough to destroy tanks and other large infantry targets. Since 1965 it has been under development with McDonnell Co.

Highly accurate against moving or stationary targets, the 27-pound Dragon is superior in range, accuracy and lethality to the current medium antitank assault weapon it is designed to replace, the 90mm recoilless rifle.

Successful test firings of an exploratory development configuration of the Dragon have been conducted at Redstone (Ala.) Arsenal, headquarters of the U.S. Army Missile Command which directs the program.

Dragon employs a command-to-line-of-sight guidance system that requires no ranging or leading of the target. It can be employed by field troops without extensive training; all the gunner has to do is keep the sight crosshairs on the target.

Army Approves Development To Extend Lance Missile Range

Development of an Extended Range Lance (XRL) missile system was approved by the Department of the Army in mid-April, following a test demonstration of the range extension concept by minimum modification to the existing missile.

The Army authorized test demonstration of the XRL concept to determine suitability of existing Lance components for the extended range mission. Work was done under a $500,000 contract modification.

Lance, in advanced production engineering, is being developed to fill the Army need for a highly mobile weapon system that can be transported by air, driven anywhere on land, and have a swim capability.

Equipped with a new simplified inertial guidance and control system developed by the U.S. Army Missile Command's R&D Directorate at Redstone (Ala.) Arsenal, Lance can carry a nuclear or conventional warhead.

Management of the program Lance is controlled at the Missile Command. Ling-Temco-Vought Aerospace Corp. is prime contractor, with Rocketdyne Division of North American Aviation as principal subcontractor for the engine.

AUTODIN System Adds Hawaii Switching Center

The first Defense Communications System Automatic Electronic Switching Center outside the United States mainland, located at Wahiawa, Hawaii, was accepted Apr. 13 by the U.S. Navy for the Defense Communications Agency.

The Automatic Digital Network (AUTODIN) is planned to accept, relay and deliver data for teletypewriter and computer communications between various types and combinations of transmitting and receiving equipment. It supports DoD in areas of supply, inventory control, personnel, finance, intelligence, medicine, operations and budget.

Eight centers are located on the United States mainland. Eight centers will be installed in the Pacific area and three are planned for Europe.

AUTODIN is a high-speed, computer-controlled, common-user, secure data system. It is comprised of the Automatic Electronic Switching Centers and a variety of subscriber terminals to meet specific requirements for handling perforated tape, machine cards and magnetic tape.

Army's First Military Aviator Dies at 87

Retired Maj Gen Benjamin D. Foulois, 87, one of the last of this country's pioneer aviators who for more than a year was the U.S. Army's — and the nation's — "one-man air force," died Apr. 25 at Andrews Air Force Base, Md.

As an Army lieutenant in 1909, he was a passenger with Orville Wright on the historic first "cross country" 5-mile flight from Fort Myer, Va., to Alexandria, Va., in the first airplane bought by the Army.

From November 1909 to April 1911, history records that he was the Army's only heavier-than-air pilot, navigator, instructor, observer and airplane commander in the yet-to-be-established U.S. Army Air Corps.

In this embryonic era of aviation, Lt Foulois was the enthusiastic champion of military aviation. Much of his flying skill was learned through personal correspondence with the Wright Brothers, until they finally sent an instructor to help him with the fine points.

General Foulois, with many aviation "firsts" in his career, retired in 1935 as the first Chief of Staff of the Army Air Corps to be an aviator. He had served 37 years.

Soon after Sept. 18, 1947, when the present U.S. Air Force was established, General Foulois was transferred to the new service — as were many Army Air Corps officers — and spent his active retired years flying throughout the country speaking on U.S. airpower and its future.

From 1955 to 1964, he was president of the Air Force Historical Foundation and during the last four years flew thousands of miles on Air Force speaking tours.

He was once described as "the living link between the age of the Wright Brothers and today's astronauts."

In a way, the General was a part-owner of the Army's first plane. Congress appropriated only $150 to maintain the craft in those days and he spent some of his own money to keep the 40-mile-per-hour "flying machine" repaired and operating. (See the *Army R&D Newsmagazine*, October 1966, page 26.)

Maj Gen Benjamin D. Foulois

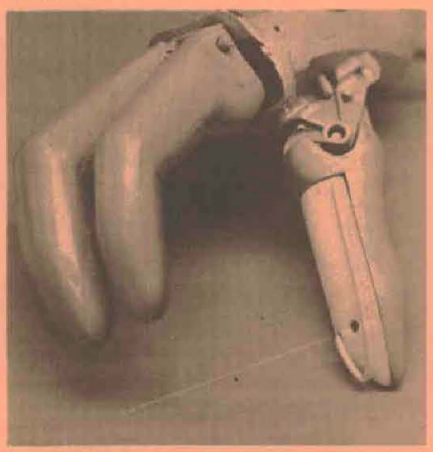
In "Military Aircraft No. 1." General Foulois made his first takeoff, first solo flight, first landing — and had his first crackup. The tail of the canvas-wood-and-wire plane was demolished, but the pilot was flying again in a week.

The crash prompted his invention of the first seat belt. He had already made a score of mechanical improvements in the aircraft — some were later incorporated in airplane design — and he developed and used the first radio receiving set in an Army plane.

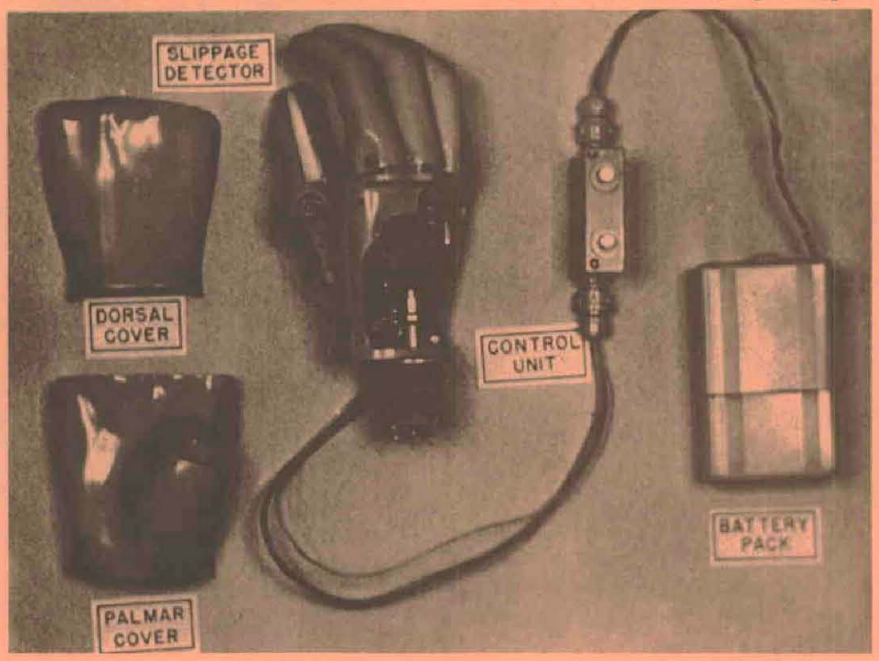
Other firsts include: First military man to teach himself to fly; first military test pilot; first to fly more than 100 miles nonstop; first to use an aircraft in combat (Mexican Expedition, 1916); and he became the first Chief of the Air Service (American Expeditionary Force) in 1918.

General Foulois spent the last six years of his life in a bachelor apartment at Andrews Air Force Base (his wife died in 1961). He joined the Army in 1898, served in Puerto Rico and Cuba, and saw action in the Philippines.

He held numerous decorations and citations, including campaign badges for service in the Spanish-American war, the Philippine Insurrection, the Army of Cuban Pacification, the Mexican Punitive Expedition and World War I.



AUTOMATIC CONTROL of grasping power has been incorporated into a life-like electromechanical artificial hand developed at the Medical Biomechanical Research Laboratory of Walter Reed Army Medical Center. Considered a major advance in prosthetics, the hand has a built-in piezoelectric sensing device in the thumb (shown at left) which mimics the human hand in ability to sense and apply the required grasp to lift and hold an object. Component parts of the Army's artificial hand are shown in the photo below. For further details on development of the electromechanical hand, see December 1966 issue of Army Research and Development magazine, p. 6.



Army Engineers Develop Site For Air Force Giant Telescope

Construction of the site for the "largest solar vacuum telescope in the world" is being performed by the U.S. Army Corps of Engineers, Albuquerque (N. Mex.) District, near Sunspot, N. Mex.

Costing $3.3 million, the 200-ton 328-foot-long telescope will be 193 feet below the earth's surface and 135 feet above ground at the U.S. Air Force Sacramento Peak Observatory, 9,200 altitude. Completion is expected in 1968.

Among other uses, such as research on solar phenomena, the telescope is expected to predict more accurately and over longer periods of time the proton showers from the sun which men in space must avoid in order to survive.