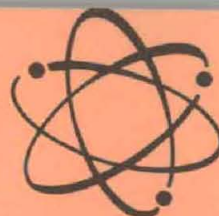




# ARMY

## RESEARCH AND DEVELOPMENT



MONTHLY NEWSMAGAZINE OF THE OFFICE OF THE CHIEF, RESEARCH AND DEVELOPMENT  
Vol. 8, No. 2 February 1967 • HEADQUARTERS, DEPARTMENT OF THE ARMY • Washington, D.C.

## Defense Department Initiates Project to Spur Academic Science

### Nike-X System Office Centers Developmental Effort

Responsibility for directing and coordinating all development of the Army's Nike-X Ballistic Missile Defense System and planning for its deployment is centered now in a new office managed by Chief of Research and Development, Lt Gen A. W. Betts.

The Nike-X System Office moved, effective Feb. 13, from temporary quarters in the Pentagon office of General Betts to the fifth floor of the City Bank Building, 206 North Washington Street, Alexandria, Va.

In his additional role of Nike-X System Manager, General Betts will have a staff of approximately 35 military and civilian personnel by mid-summer. Nominated for promotion to brigadier general, Col George Mayo, Jr., is his deputy and Col B. A. Griffin is assistant manager. Dr. Charles M. Johnson, well-known industrial scientist, has assumed duties as Scientific and Technical Director.

The Nike-X Ballistic Missile De-  
(Continued on page 6)

### Approved Plan Provides Revised Concepts for 12 Career Management Fields

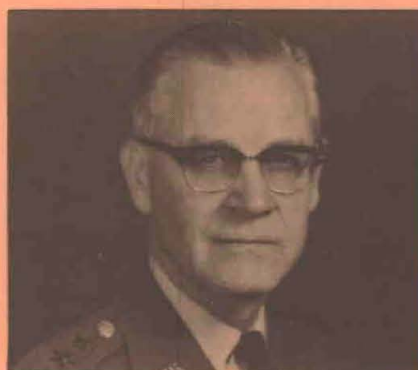
Federal Civil Service development of top-caliber executives is to be stimulated in each career field, including that for scientists and engineers, by new concepts to provide more effective career management.

Recommended by an Army Chief of Staff study group and signed by Under Secretary of the Army David E. McGiffert, the revised concepts will be phased into the 12 career fields by May 1968. Recommendations follow an 11-month pilot test in the comptroller field.

In addition to improved administrative procedures, such as use of placement and promotion lists in place of single-case ad hoc screening, the new program will give more emphasis to employee training and development. One of the objectives is to keep careerists much better informed about the nature and operation of the program.

Other changes designed to give management a stronger role in career devel-

(Continued on page 5)



Lt Gen A. W. Betts

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### DoD Leaders Join AMC Chiefs in Talks on Vietnam



R&D LEADERS at U.S. Army Materiel Command (AMC) conference for laboratory commanders, technical directors and chief scientists included (from left): Director of Defense Research and Engineering (DDR&E) Dr. John S. Foster, Jr.; General Frank S. Besson, Jr., CG of AMC; AMC Deputy for Research and Laboratories, Dr. Jay Tol Thomas; Dr. Finn J. Larsen, Principal Deputy DDR&E; and AMC Director of Developments Maj Gen K. M. Bayer. (See story on page 8)

### \$20.5 Million Programed in 1967 In Response to President's Call To Broaden Effort in Universities

Creation of additional centers of excellence in science and technology within the Nation's institutions of higher learning was initiated this past month with an FY 1967 program funded at \$20.5 million, as approved by the 89th Congress.

Project THEMIS, developed by and under the leadership of the Office of the Director of Defense Research and Engineering (ODDR&E), represents results of a careful study and a plan for solution of a complex problem in response to President Johnson's request in mid-September 1965.

*EDITOR'S NOTE: In Greek mythology, Themis was a Titaness concerned with the law and harmony of physical phenomena, wife of Zeus and mother of Prometheus. Some who swam the troubled waters in resolving variances of philosophy regarding Project THEMIS might have small reservations on the aspect of the harmony that prevailed in the evolutionary process, now that Prometheus is unbound, so to speak.*

Seeking to broaden the Nation's base of highly advanced competence for scientific investigations, the President

(Continued on page 4)





Vol. 8, No. 2 February 1967

Editor..... Clarence T. Smith  
Associate Editor..... George J. Makuta  
Assistant Editor..... Read Wynn

Published monthly by the Army Research Office, Office of the Chief of Research and Development, Department of the Army, Washington, D.C. 20310, in coordination with the Technical and Industrial Liaison Office, OCRD. Grateful acknowledgment is made for the valuable assistance of Technical Liaison Offices within the U.S. Army Materiel Command, the U.S. Army Combat Developments Command, U.S. Continental Army Command, Office of the Chief of Engineers, and Office of The Surgeon General. Publication is authorized by AR 310-1, as extended by the Army Publications Board on Sept. 15, 1964.

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

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**OTHER GOVERNMENT AGENCIES'** requirements should be submitted directly to the Army Research Office, OCRD, Department of the Army, Washington, D.C. 20310, ATTN: Scientific and Technical Information Division.

**ALL NON-U.S. GOVERNMENT agencies,** firms and organizations must obtain this publication through the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Single copies sell for 20 cents. Subscription rates (12 issues annually) are: Domestic, APO and FPO addresses, \$2.25; Foreign, \$3.00.

# A New Propulsion Age on the Horizon

By Col Frank Milner

A new age is on the horizon for Army vehicles, an age that will fulfill a dream engineers have had for nearly 100 years — electric propulsion of vehicles.

As far back as the late 1800s, electric automobiles operated on batteries. Thomas A. Edison, in fact, made a prediction in 1905 that the "gas buggy" wouldn't stand a chance against an electric automobile.

Unfortunately for Mr. Edison, his battery energy density — the basic problem that has faced engineers — limited the speed and range of the electric automobile. It failed to compete with the noisier and faster gasoline engine automobile.

Many encouraging developments in gas turbines, coupled with high-speed high-frequency generators and in fuel cells, have occurred to make it appear feasible that electrically propelled automobiles may have a bright future, both for commercial and military vehicles.

Automobile manufacturers — Ford, General Motors, Chrysler — spurred on by the growing problem of air pollution, are active in research leading toward a modern revival of the electric automobile. The major electric companies, such as General Electric, General Dynamics and Westinghouse, are spending fortunes in the quest for practical, electrically propelled automobiles.

Impressive research programs are also underway at the U.S. Army Mobility Equipment Command's Engineer Research and Development Laboratories (ERDL) at Fort Belvoir, Va.

In the military application of electric propulsion, short-term interest is not necessarily in preventing air pollution. Rather, it is based on the resulting conversion efficiency of the fuel, the potential of reduced maintenance and simplicity of vehicle controls.

Elimination of the need for axles, drive shafts, differentials and transfer gearing also affords design freedom and decreases maintenance problems.

Control simplicity would mean considerable savings in training military personnel to drive and handle all types of vehicles. Conceivably, it could result in prolonged vehicle life because the operator cannot do "anything wrong." He will have simple forward and reverse throttle, brake pedal and steering functions.

In the military arena of intensive research, efforts employing new and imaginative concepts and approaches are being undertaken to vindicate Mr. Edison. Already, ERDL has established that it is possible to overcome the energy-density problem with today's technology.

The key is to use the high-energy density gas turbine coupled directly to a high-speed high-frequency electrical generator. This power source can be produced at the rate of 2 1/2 pounds per horsepower, with a potential rate of 1 pound per horsepower in future development.

Developed with the turbine-generator was the adaptation of a solid-state gate-controlled switch, commonly called a silicon-controlled rectifier. This switch can handle tremendous amounts of

(Continued on page 24)

Col Frank Milner, 50, has been commanding officer of the U.S. Army Engineer Research and Development Laboratories (ERDL), Fort Belvoir, Va., since June 1965.

Previously, he served two years as chief of the Technical Liaison Office, Office, Chief of Engineers, and was awarded the Legion of Merit for his accomplishments. From 1960 to 1963, he was Deputy Chief of Staff for Logistics and Administration with Allied Land Forces Southern Europe (NATO), Verona, Italy. For this service, he received the decoration of Officer Cavalier of the Order of Merit of the Italian Republic.

Col Milner was director of the Combat Developments Group of the Engineer School at Fort Belvoir from 1956 to 1959.

Commissioned in the Corps of Engineers in 1938, he holds a bachelor of science degree in civil engineering from Purdue University (1937) and an MSCE degree from the University of California (1941). He has attended the Command and General Staff College, Fort Leavenworth, Kans., the Armed Forces Staff College, Norfolk, Va., the Industrial College of the Armed Forces, Washington, D.C., and is a registered professional engineer in the State of Illinois.

At Pearl Harbor at the time of the Japanese attack, he later commanded the 841st Engineer Aviation Battalion in the Southwest Pacific and the 1178th Engineer Construction Group in the Philippines.

Other assignments include Headquarters Third Army, Atlanta, Ga.; Chicago and North Engineer Districts; Engineer Organization and Training Division, Office, Chief of Engineers; and Fort Leonard Wood, Mo.





# Flight Tests of Self-Destructive Rockets Predicted in 2 Years

Exploratory research for a self-destructive meteorological rocket entered a significant new phase this month and Army missile engineers predict a flight feasibility demonstration within two years.

Bids from industry seeking contracts to fabricate rocket components of consumable material have been received by the U.S. Army Missile Command (MICOM). Contract awards are expected to be made soon.

James F. Howison, general engineer of the AMC Missile Command Research and Development Directorate, Redstone Arsenal, Ala., is preparing to present a technical paper on "recent developments" in neutralizing falling mass hazards (FMH) to the American Institute of Aeronautics and Astronautics (AIAA) meeting, Feb. 27-Mar. 1, at Williamsburg, Va. Howison will speak to the AIAA Sounding Rocket Vehicle Technology Specialists' Conference, Feb. 28.

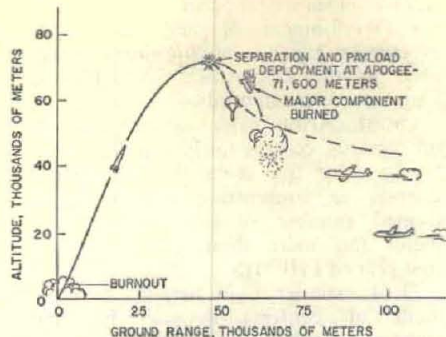
As early as 1947, studies were conducted to determine what could be done to eliminate FMH, primarily for air defense. In 1963 a concerted joint Federal effort aimed at meteorological rockets was initiated.

The U.S. Army, Navy, Air Force, Federal Aviation Agency, Weather Bureau and all Government agencies known to have interest in the FMH problem were consulted. In September 1964, after mid-1964 proposals by industry had been evaluated as holding promise, the National Aeronautics and Space Administration (NASA) joined AMC with funds and technical assistance for the project.

Sol Cohen, project engineer at HQ AMC, has staff cognizance of the Army Meteorological Rocket Program and the FMH problem. He termed the quest for neutralized met rocket FMH "an extremely well-coordinated effort" between AMC, its commands, and all agencies concerned.

Because of the danger of "spent motors" or other hardware falling back to earth, sounding rockets with instrument packages to obtain high-altitude data can be launched only from specified ranges where air lanes are controlled and large tracts for impact are available. With elimination of the FMH, researchers of the earth's stratosphere and troposphere would have greater latitude for obtaining more general coverage at sites not having large ranges.

Current efforts are focused on a consumable rocket, expended components of which will be burned after reaching apogee. This concept can be traced to several Government-contracted studies in the past. Among them are a Boeing Aircraft Co. study in 1947, one by the Martin Co. in 1953, Allegheny



**Concept of Meteorological Rocket Falling Mass Hazard Neutralization.**

Ballistic Laboratory for the Navy in 1963 and AMCEL Corp. for the Army in 1965.

Consideration of earlier techniques employing the parachute or explosives as a means of combating FMH has been virtually abandoned for the potentially more promising consumable concept.

In mid-1965, the Plastics Technical Evaluation Center (PLASTEC) at Picatinny Arsenal, Dover, N.J., was asked to conduct a materials investigation and recommend to AMC the best materials for exploratory research.

PLASTEC developed for the joint effort a plan for test and evaluation of state-of-the-art materials and processes for fabrication of disposable rocket motors. A report in September 1965 indicated two promising approaches to consumable rocket cases: a homogeneous composite and a "sandwich" composite.

Using such materials as paper, nitrocellulose fibers, E-glass, Fortisan, HM-2 rayon, nylon and polypropylene, structures with various percentages of these materials were ignited at simulated 200,000 feet altitudes and the percentages of residue recorded.

The sandwich structure, a pyrotechnic core between layers of fibers of various combustibilities, was similarly ignited and residues measured. Both techniques "hold promise," according to engineers, but considerable development — exploratory as well as refinements — must be accomplished. An important consideration is keeping the cost of future rockets within the price range of existing meteorological systems.

The FMH neutralization effort at Department of Army level is monitored by the Environmental Sciences Division, Army Research Office, Office of the Chief of Research and Development. Technical direction is assigned to H. O. Griffith and J. F. Howison of the Small Arms Development Division, R&D Directorate, Army Missile Command.

Other scientists and engineers currently

involved in the FMH neutralizing effort include James Youmans, acting chief of the AMC Missile Office; John Copeland, chief of the AMC Environmental Sciences Branch, Scientific and Technology Division; William C. Spreen, program chief, Meteorology and Sounding, and George Tennyson, NASA HQ;

Also, H. T. Baber and H. B. Tolefson of the NASA Langley Research Center; Harry E. Pebley, PLASTEC director; and from the Feltman Research Laboratories, Picatinny Arsenal, J. D. Matlack, director, and Plastics Application Branch chief Jack Scavusso and engineer John Nardone of the Plastics and Packaging Lab; and Dr. J. Picard, director, and engineer Kenneth Henrich of the Propellants Laboratory.

## MICOM, MSFC Schedule Computer Graphics Meet

About 400 invited engineers and scientists are expected to participate in a joint Army Missile Command-Marshall Space Flight Center Symposium on new uses of computer graphics in design and engineering, Mar. 1-3, at Redstone Arsenal, Ala.

Headline speakers announced to date include Prof. Steven A. Coons, Massachusetts Institute of Technology; Dr. Sullivan Campbell, vice president of Xerox Corp.; and W. L. Frank of Informatics, Inc.

Displays and clinics conducted by manufacturers and service companies will be featured one day of the meeting. Presentations are programed in three major categories:

- National renowned scientists who spurred the breakthrough in new techniques that permit man-machine communications;
- Engineers who are developing hardware and software necessary to apply the new techniques; and
- Pioneers in the development of applications.

Cochairmen of the Steering Committee for the symposium are Dr. Helmut Hoelzer, chief, MSFC Computation Laboratory, and Horace Lowers, chief engineer, Missile Command.

## McCarrell Heads Directorate

Lt Col Charles B. McCarrell, deputy director of Plans and Operations Directorate, U.S. Army Electronic Proving Ground, Fort Huachuca, Ariz., since 1965, moved to the position of director upon the retirement of Lt Col William J. Ayub from active service.

A veteran of three campaigns in Korea and one in Vietnam, Col McCarrell also served in Germany during the Berlin Crisis in 1962.



## DoD Initiates Project to Spur Academic Sciences

(Continued from page 1)

asked all Federal agencies engaged in research and development to examine existing practice and policies to explore the possibilities of providing new opportunities for participation in agency-related research tasks.

Project THEMIS calls for submission of preliminary proposals for participation in the program by Feb. 15. It is being implemented in line with procedures outlined in a brochure. In addition, a series of seven regional briefings were given by ODDR&E spokesmen at major academic institutions, Jan. 21-28.

Brochures mailed out by ODDR&E in January detail objectives of the project, emphasizing that it is an addition to existing university research programs, not a substitute for them. THEMIS will support Federal research tasks at universities presently not heavily engaged in such activities.

President Johnson's call for action stated, in part:

"Our policies and attitudes in regard to science cannot satisfactorily be related solely to achievement of goals and ends we set for our research. Our vision in this regard is limited at best. We must, I believe, devote ourselves purposefully to developing and diffusing — throughout the Nation — a strong and solid scientific capability, especially in our many centers of advanced education. Our future must rest upon diversity of inquiry . . ."

Director of Defense Research and Engineering Dr. John S. Foster, Jr., in a foreword to the brochure, states that DoD "has compelling reasons to achieve these objectives" outlined by the President, explaining:

"... Clearly, the history of the last 30 years demonstrates that our national security depends upon the quality of our advanced research. Equally important, many notable scientific achievements have emerged in the past from university research sponsored by the DoD . . ."

"The Department is both a producer and a consumer of research results in many fields of science and technology. Accordingly, we have a vital stake in the Nation's resources of scientific talent and ideas. We believe that opportunities to participate in research should be available on a broad basis to scientists and engineers, and should not be restricted to a few locations and organizations . . ."

Dr. Foster's Deputy Director for Research and Technology, Dr. Donald M. MacArthur, discussed the scope and plan of procedure for Project THEMIS in a December 1966 address to the National Council of University Research Administrators in Washington, D.C., citing as complementary objectives:

- A wider geographical distribution of defense research funds, favoring in-

stitutions and areas that do not now receive substantial support.

- Development of new centers of excellence capable of improved assistance to the Department in achieving long-term research needs.

Dr. MacArthur explained that to develop research centers fairly rapidly, possibly in about five years, the Department intends to concentrate funding in a limited number of university departments (no more than 50) during the first year of THEMIS.

DoD experience in helping development of centers of scientific and technical excellence, he said, shows that they must have a "critical size" to make a significant contribution toward "effective assistance to the DoD in solving complex problems." Minimum critical funding is currently estimated at about \$200,000 annually.

Self-determination by local university management of objectives of participation in THEMIS is basic to the project, but efforts must be responsive to clear, long-term Defense research requirements.

Progress of each center will be evaluated continually and a critical review after three years will determine those deserving of continued support.

Centers that achieve less than acceptable DoD standards for progress will be phased-out over the following two years to allow the university and graduate students to make necessary plans.

Contracts with the new centers will provide advance funding to include a 3-

year-step formula, as currently planned. The initial contract will obligate funds for payment of full annual operating costs for the first year, two-thirds of annual costs for the second year, and one-third of annual costs for the third year. Contract extensions will provide for additional one-third increments of the annual costs for the following three years, thus permitting institutions to make firm commitments on a continuing 3-year basis.

Institutional goals of participating academic institutions are recognized clearly by the policy guidance for Project THEMIS. The DoD is committed to support only those programs that contribute to long-range educational goals of each university or college. Satisfactory assurance on this point must be given by each school's top officials to proposal-evaluation teams.

Project THEMIS is soundly based in DoD recognition of the need for full understanding of mutual interests of the DoD and the contract centers to achieve complete support of academic administrators. THEMIS programs must span areas of science and technology in which the DoD and the institution have a

### WECOM Wins AMC Safety Award

The U.S. Army Weapons Command has been awarded, for the second consecutive year, the Army Materiel Command (AMC) Award of Honor for the best safety program of the AMC major subordinate commands during FY 1966. This is the top award provided by AMC for control of accidental manpower and monetary losses.

### Weapons Advisory Group Meets With AWC R&D Leaders



R&D TOPICS ranging from living organisms to metallurgy were discussed by members of the Army Weapons Command (AWC) Weapons Advisory Group (WAG) during a recent 2-day meet with AWC leaders at Rock Island, Ill. From the left, bottom row, are Dr. Chester W. Clark, Maj Gen USA (Ret.), vice president for research, Research Triangle Institute; Dr. Colin Hudson, AWC deputy for research and engineering and chief scientist designee; Brig Gen William J. Durrenberger, AWC commanding general; Martin Golland, WAG chairman and president, Southwest Research Institute; and James A. Reid, manager, Research Division, Phillip Petroleum Co. Standing (l. to r.) are Dr. Maurice J. Zucrow, retired professor of engineering, Purdue University; Col Fred Kornet, Jr., Watervliet Arsenal co; Col H. A. Snyder, Rock Island Arsenal co; Col A. H. Sweeney, Jr., Springfield Armory co; Col Leonard M. Orman, chief, AWC Research and Development; Errol J. Gay, technical consultant, and Dr. Arthur A. Burr, dean, RPI School of Engineering.



strong mutual concern.

Support will be given on a broad program basis — not through the small contracts and grants typical of much federally supported research at academic institutions. The THEMIS concept is that a group or cluster of related tasks, involving different disciplines in many cases, will be planned to produce a coherent attack on several facets of a major scientific or engineering problem.

Another point of emphasis is that special efforts will seek to achieve "good coupling" between THEMIS programs and the DoD research and development requirements. Closer relationships will be encouraged between university scientists and DoD in-house laboratory researchers and engineers concerned with analysis of long-term military problems and missions.

In furtherance of the closer working relationship desired, THEMIS-supported faculty members will be asked occasionally to provide advice to DoD laboratory leaders as part of the project, rather than as separate consultants. University researchers may be encouraged to use Government facilities as necessary.

The DoD recognizes that in many

developing institutions able scientists and engineers may have no clear channel through which they can learn about research problems, exchange views on advanced topics, and apply for Defense-supported research.

Stated clearly in the policy guidance for THEMIS is that the DoD believes support of existing centers of scientific and technical excellence "should not be intentionally reduced to provide a new regional or geographic balance." The role of existing centers is considered an integral part of THEMIS objectives in developing new centers of comparable stature.

The DoD brochure on THEMIS lists the many areas of scientific and technical effort in which the Department has a continuing interest. Included is a brief description of some of the long-term requirements for research geared to meeting planned military materiel objectives.

Briefings on Project THEMIS were given by top-level officials of the Office of the Director of Defense Research and Engineering, the U.S. Army Research Office of the Office of the Chief of Research and Develop-

ment, and the Office of Naval Research, as follows:

Jan. 21: Georgia Institute of Technology, Atlanta, Ga.; University of Missouri, Kansas City, Mo.; Southern Methodist University, Dallas, Tex.

Jan. 28: Carnegie Institute of Technology, Pittsburgh, Pa.; Marquette University, Milwaukee, Wisc.; University of Denver, Denver, Colo.; University of Portland, Portland, Ore.

## 270 Army Dentists Take Course In Principles of Oral Surgery

A 5-day class in oral surgery for 270 dentists was presented last month at the Walter Reed Army Medical Center, Washington, D.C.

Directed by Col Charles C. Allin, chief, Oral Surgery Service, Walter Reed General Hospital, the course provided a comprehensive review of the principles and practices of oral surgery. It emphasized major maxillofacial surgery required for wartime injuries.

Among distinguished participants was Dr. Carl Erik Molin, consultant and assistant professor at the Royal School of Dentistry, Stockholm, Sweden.

## Approved Plan Provides Revised Concepts for 12 Career Management Fields

(Continued from page 1)

opment include increasing responsibilities of functional chiefs in each career field, and assigning major commands more active leadership in career management.

In the scientists and engineers career development program, responsibilities of the functional chief are divided between the Chief of Engineers (limited essentially to those in the construction field) and the commanding general of the U.S. Army Materiel Command. The functional chief is the highest level official who has primary technical responsibility for the functions employees in a given occupation.

Strengthened responsibilities for functional chiefs will include forecasting long-range manpower requirements, controlling and monitoring entrance-level recruiting, and delineating patterns of career progression.

Functional chiefs will control assignments in Career Executive Groups, a small number of employees in each occupation characterized by a high degree of competence and mobility. In return, the group will get special consideration in terms of challenging assignments, opportunities for training, and tenure.

The functional chiefs also will be charged with keeping careerists informed about the nature and operation of career management, particularly employee advancement and development opportunities.

Major commands will conduct active recruitment and assignment of junior-level employees; afford opportunities for advancement, training, and devel-

opment; and assure appraisal and advice.

Career Planning Boards, composed of high-level representatives from commands and General Staff agencies of the Army, will advise the functional chiefs on career management policy. Career Screening Panels will develop promotion and placement lists and identify members of the Career Executive Groups.

The Department of the Army Career Program for Scientists and Engineers has been in effect as a prescribed management responsibility since 1965.

The Chief of Engineers has a central inventory of 10,000 careerists in 24 occupational specialties, primarily construction types. From this list, OCE has drawn up 265 referral lists since October 1965 at the mandatory referral level (GS-14 and above) and provided requested recruitment assistance for 82 positions at lower grades. The Army Materiel Command has compiled 2,830 referral lists since October 1965 from its personnel data bank on 13,000 careerists in 37 nonconstruction scientific and technical fields.

At the GS-14 level, referral must be made on an Army-wide basis; at the GS-13 level, command-wide; and at lower grades, installation-wide. An ad hoc committee of professionals narrows the list for final choice from a roster of all generally qualified candidates selected by computer.

To achieve full effectiveness in using scientific and engineering career program talent, the Army is experimenting, in conjunction with DCSPER, on the TEL/TIPS (Technical Effort Locator/

Technical Interest Profile System). TEL/TIPS was developed as part of the Army Scientific and Technical Information Program administered by the Army Research Office, Office of the Chief of Research and Development.

Using technical descriptions and technical categories to provide detailed work experience information, TEL/TIPS has demonstrated that it can automatically refer careerists according to extremely rigorous technical criteria. The system narrows the list to a few candidates in the order of their qualifications to meet specific requirements of employers who exercise the right of final selection.

The Army Materiel Command recently formed a Career Development Program policy panel of top officials and representatives from key areas such as R&D, program management, administration and laboratory work.

Key managers and personnel technicians with responsibility for training and development met last fall to develop uniform policies for encouraging Army scientists and engineers to seek further graduate-level training in pursuance of their career objectives.

Under a Corps of Engineers program, 29 professional engineers are attending graduate school full time with salary, tuition fees and moving expenses paid.

Another program initiated recently provides for employment of students who have completed all course work for an advanced degree and who will write the thesis during the term of employment on a topic of interest and benefit to the Corps of Engineers.





Col George Mayo, Jr.



Col B. A. Griffin



Dr. C. M. Johnson

## Nike-X System Office Centers Developmental Effort

(Continued from page 1)

fense System, as currently being designed, draws on technology advances resulting from more than \$2.5 billion of Army and Advanced Research Projects Agency (ARPA) ballistic missile defense efforts during the past 10 years.

In recognition of the increasing complexity and importance of the developmental program, the Army General Staff and leaders of major commands involved agreed that centralized control was essential. The Nike-X System Office absorbs the functions and personnel of existing U.S. Army Materiel Command activities and various Nike-X *ad hoc* groups.

Initially under control of the Army Ordnance Corps, the Nike-X program was transferred to the Army Materiel Command in the Army-wide reorganization, effective in August 1962. The AMC assumed R&D materiel operations except for those assigned to The Surgeon General and Chief of Engineers.

Development of the Nike-X Ballistic Missile Defense System is an outgrowth of the Nike-Zeus, a third-generation command control air defense missile system produced under Army contract with the Western Electric Co.

Initial work on the Nike system dates back to 1948 with the Nike-Ajax single aircraft defense missile. The Nike-Hercules for defense against multiple aircraft was the next evolutionary phase.

Under AMC administration, the Nike-X has been advanced as a project-managed system, providing vertical management with Project Manager Brig Gen I. O. Drewry reporting directly to General Frank S. Besson, Jr., AMC commanding general.

Announcement of establishment of the Nike-X System Office explained that the Nike-X Project Manager Office at Redstone (Ala.) Arsenal will continue as a field organization under operational control of the Nike-X System Manager.

Likewise, the U.S. Army Nike-X Engineering/Service Test Office, established in 1962 at White Sands (N. Mex.) Missile Range for independent evaluation of the system, is now supervised by

the Nike-X System Manager. Formerly, it was under the Army Test and Evaluation Command.

General Betts also is charged with staff supervision over all Army commands and agencies pertaining to their participation in and support of the Nike-X developmental program.

Biographical information about key staff members of the Nike-X System Office as presently assigned follows:

COL MAYO is recognized as one of the Army's thoroughly trained Staff Officers. Graduated from the U.S. Military Academy in 1940 with a commission in Field Artillery, he added an MA degree in international affairs from George Washington University, Washington, D.C., in 1965.

Upon his return from G-3 and G-4 assignments with U.S. Forces in Germany from March 1944 to November 1947, he did graduate work at Massachusetts Institute of Technology and served as an instructor and assistant professor in mechanics at the U.S. Military Academy. He also has served as a faculty member in the Department of Military Affairs, National War College.

During the Korean War, Col Mayo commanded the 204th Field Artillery Battalion and later was senior military adviser, III Corps, Republic of Korea Army. Upon return to the U.S. in February, 1956, he served until 1959 as assistant chief, War Plans Division, Office of the Deputy Chief of Staff for Military Operations, Washington, D.C.

Col Mayo was commander of the 35th Artillery Group, U.S. Army Europe (1960-61); deputy chief of staff, VII Corps, U.S. Army Europe (1961-63); staff officer and then deputy chief, European Division, J-5, Office of the Joint Chiefs of Staff, Washington, D.C. (1963-66).

DR. JOHNSON brings to duties he assumed Feb. 1 as Nike-X System Office Scientific and Technical Director a broad background of industrial research and development experience. He has specialized in the areas of radar, communications, lasers, spectroscopy,

optics and semiconductors.

Since 1961, he has been with International Business Machines as manager of the Applied Research Department, Federal Systems Division. His responsibilities have included generation and development of new modulation, detection and antenna techniques for optical and micro wave regions.

Born May 31, 1923, in Nashville, Tenn., he was graduated in 1945 from Vanderbilt University *summa cum laude* with a bachelor's degree in electrical engineering and awarded the Founder's Medal. He earned a PhD in physics in 1951 from Duke University, Durham, N.C., under a graduate study fellowship.

Prior to joining the IBM staff, he was director, Advanced Systems and Microwave Department, Emerson Research Laboratories, Silver Springs, Md., for two years. From 1956-59, he was manager of the Microwave and Physics Section, Research Division, Electronics Communications, Inc., and for the five years previous was a research scientist and group supervisor at the Radiation Laboratory, Johns Hopkins University, Baltimore, Md.

Dr. Johnson's experience as an industrial consultant includes work with Sperry Gyroscope Co. in 1954 and the Atlantic Research Corp. in 1959. He is the author of 27 technical papers, publications in professional journals, holder of several patents in his fields of specialty and is listed in *American Men of Science*. He is a member of the American Physical Society and senior member of the Institute of Electrical and Electronics Engineers.

COL GRIFFIN's qualifications for his duties as assistant manager of the Nike-X System Office include graduation from the U.S. Military Academy with a BS degree in 1943, special studies at the University of New Mexico in 1947, and an MS degree in mechanical engineering from the University of Southern California in 1960.

Prior to his present assignment, Col Griffin was chief of the Nike-X and Space Division. Other recent assignments include chief, Manpower and Personnel Division, Eighth U.S. Army, Korea (1964-65); student, Industrial College of the Armed Forces, (1963-64); and chief, Zeus Test Branch, U.S. Army Air Defense Board, Fort Bliss, Tex. (1960-63). He was graduated from the Army Command and General Staff College in 1955, and completed the U.S. Army Artillery School course in 1951.

Col Griffin has served as an instructor at the Army Artillery School, Fort Sill, Okla.; special project officer with the 8460th and 8452nd Special Weapons Commands, Armed Forces Special Weapons Project, Sandia Base, N. Mex.; assembly team officer and special duty with the Los Alamos Laboratories; and in Europe with Field Artillery units during and after World War II.



COL WILLIAM J. NELSON heads the Plans Division and has served with the Project Manager's Staff Office, Nike-X Project Office in Washington, D.C., since 1965. He is a 1944 graduate from the U.S. Military Academy, has BEE and MEE degrees from Rensselaer Polytechnic Institute, and is a graduate from the Command and General Staff College, and Army War College.

Among his major assignments have been work in missile development at Kwajalein Test Site in the Pacific, at Redstone (Ala.) Arsenal, Aberdeen Proving Ground, and at Pasadena, Calif. He has served as an ordnance officer at HQ Eighth U.S. Army in Japan, ordnance maintenance and supply adviser with the Military Assistance Group in Korea, and with HQ 51st Ordnance Group in Germany.

LT COL R. T. WAGNER is acting chief of the Technical Development Division and was formerly assigned to

## Officers Taking Course In Operations Research

Approximately 30 senior and staff officers of Department of the Army staff agencies will attend the fifth Operations Research Familiarization Course, Feb. 13-17, at the Army Research Office, Arlington, Va.

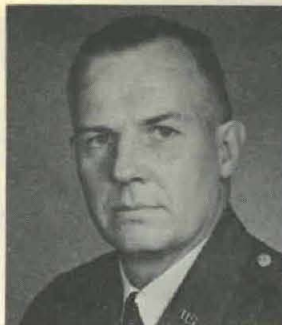
Sponsored by the Human Factors and Operations Research (HF & OR) Division, U.S. Army Research Office, Office of the Chief of Research and Development, the course was first held last fall. Similar courses were conducted during the winter and spring.

Instructor for the winter-1967 class is Eugene E. Newnam, head of the Department of Applied Mathematics and Statistics, U.S. Army Management Engineering Training Agency (META), Rock Island, Ill.

ARO project officer Maj Johnny J. Churchill of the HF&OR Division said the week-long course will be a combination of podium instruction and class workshop. Next course is scheduled to begin May 22.

Purpose is to familiarize officers with operations research techniques and applications as they pertain to special studies, including cost effectiveness, methodology, simulation and gaming, logistics and modeling. Since the course series began, 155 officers have attended.

NEWNAM's background as instructor includes a BS degree in mathematics and MS in administration from Northern State College, Aberdeen, S.D. He has presented guest lectures on operations research at the Army Finance School and the Ordnance School. He also has given short courses in managerial statistics at various colleges, and he developed the continuing program of Operations Research Familiarization for Department of the Army staff officers.



Col W. J. Nelson



Lt. Col R. T. Wagner



Lt Col M. H. Singleton

the Space Branch of the Nike-X Space Division, Office of the Chief of Research and Development, Department of the Army.

Graduated from the U.S. Military Academy in 1946, he has a PhD in physics from the University of Virginia (1955) and has attended the Industrial College of the Armed Forces (1961) and Command and General Staff College (1964).

Prior to his OCRD assignment, he was a research physicist at the Los Alamos Scientific Laboratories in New Mexico, and a physics professor at St. Mary's College, Winona, Minn.

He has contributed numerous articles to the technical literature of nuclear physics and weapons effects. He is a member of the American Physical Society, American Society for the Advancement of Science, Sigma Xi, and

Sigma Pi Sigma, and is listed in *American Men of Science*.

LT COL M. H. SINGLETON is acting chief of the Requirements and Resources Division, established to assume complete control in FY 1968 of budget and program authority for the Nike-X Ballistic Missile Defense System.

He is a 1950 graduate from the U.S. Military Academy and has an MS degree in mechanical engineering from the University of Michigan (1958). He has completed the Armor Advanced Course (1956) and Command and General Staff College course (1962).

His military experience includes tours with the Nike-X System Office cadre (1965-66); Redeye Project Engineering Division, Redstone (Ala.) Arsenal (1964-65); Kwajalein Test Site (1962-64); and the Nike-Zeus Project, White Sands (N. Mex.) Missile Range (1958-62).

## Woman Yields to Man in Claiming PhD Laurels

Dr. Ann Lowe is still secure in her distinction of being the youngest woman in the Department of the Army with a PhD degree, as well as the first PhD representative of the fair sex to join the Office of the Chief of Research and Development, but she no longer is the youngest PhD.

That claim to fame has been taken over by Lt Anthony J. Graffeo, three months younger than Dr. Lowe and also the first lieutenant with a PhD degree ever assigned to the Office of the Chief of Research and Development.

Born Nov. 19, 1940, he is assigned to the Physical and Engineering Sciences (P&ES) Division, where he assists in monitoring Army research programs in the area of energy conversion.

Lt Graffeo joined the Army Research Office staff Dec. 18, 1966, and one month later received his PhD degree in chemistry from the University of Houston, Tex., which he attended on a predoctoral traineeship from the National Aeronautical and Space Administration.

He also holds a BS degree from Loyola University, New Orleans (1962) and an MS degree from Florida State University (1964).

Lt Graffeo was enrolled in the Chemical Officer Basic Course No. 3 at Fort McClellan, Ala., when he was interviewed by Col G. H. Drewry, deputy chief of the P&ES Division. Born in New Orleans, La., he lived there 22 years. He entered the Army on a Reserve Officer's Training Course commission and is considering a military career.

At present he doesn't miss the laboratory. "I've been working in one for four years, and the change is interesting," he told a reporter.

"Working at ARO is a good opportunity for a young scientist. Most scientists don't get to see the management end of research until later in their careers."

Lt Graffeo particularly likes the broad view his work gives him, especially after concentrating on a very specialized subject for his dissertation, "A Kinetic Study of Fast Reaction of Lanthranide Elements in Aqueous Solution."



Lt. A. J. Graffeo



## DoD Leaders Join AMC Chiefs in Talks on Viet Nam

Ways of providing more effective R&D support for U.S. Armed Forces in Southeast Asia were high on the agenda when top Defense leaders convened Jan. 8-10 with chief scientists, technical directors and commanders of 31 Army Materiel Command laboratories.

Director of Defense Research and Engineering (DDR&E) Dr. John S. Foster, his Principal Deputy Dr. Finn J. Larsen (formerly Assistant Secretary of the Army (R&D)), and Dr. Donald M. MacArthur, Deputy DDR&E (Research and Technology), headed the Department of Defense representatives.

Assistant Secretary of the Army (R&D) Russell D. O'Neal led a group that included Chief of Research and Development Lt Gen A. W. Betts, Deputy CRD Maj Gen William C. Gribble, Jr., Chief Scientist of the Army Dr. Marvin E. Lasser and Dr. K. C. Emerson, Dr. O'Neal's assistant for research.

General Frank S. Besson, Jr., CG of the Materiel Command, and his Deputy for Research and Laboratories, Dr. Jay Tol Thomas, were backed up by Deputy CG Lt Gen William B. Bunker, Director of Developments Maj Gen Kenneth M. Bayer and all key members of Dr. Thomas' staff.

Additional dignitaries included Dr. Gerald W. Johnson, Director of U.S. Navy Laboratories, and Seymour Berlin, U.S. Civil Service Commission Director of the Bureau of Executive Manpower.

Dr. Thomas conducted the conference as the second of the semiannual meetings he inaugurated to improve knowledge of how closer integration and coordination of effort can be achieved to advance R&D objectives as expeditiously and economically as feasible. He said all available resources must be exploited to the fullest in strengthening the combat posture of the Army,

with emphasis on Viet Nam problems.

Dr. Foster acknowledged the many notable contributions being made by AMC laboratories, working in close cooperation through direct tie-up with land forces, to meet combat requirements. He cited particularly the work of the Natick Laboratories in successful development of lightweight clothing, equipment and compact food items.

The full weight of the scientific creative genius of the Nation is needed to resolve the Viet Nam war, Dr. Foster said. Normal cycling of R&D must be shortened by accelerated programs to meet more urgent requirements for specialized equipment needed for jungle and guerrilla warfare in Southeast Asia. Stressed also was the need for close working relationships with industry, academic institutions and nonprofit research groups.

Among problems requiring special effort, as cited by Dr. Foster, are ways of improving surveillance of the enemy from the air; better means of detecting the enemy, especially in night combat; and improved methods of detecting and disposing of mines and tunnels, which he described as a particularly formidable problem.

Dr. Foster suggested that at each of the 31 AMC laboratories a deputy for Southeast Asia be designated, with responsibility only for dealing with problems of that area. In this connection, he referred to his appointment of Mr. Leonard Sullivan as his Deputy DDR&E for Southeast Asia Affairs. Such an arrangement, he said, allows a man to "find out what is needed and to do something about providing it."

Seymour Berlin told the group about the Civil Service Commission's current programs in developing highly competent scientific and technical managers

by career fields. Most management problems, he said, result from a failure to isolate the issues that cause the problem and then take positive, aggressive action.

The over-all aim of the Government Executive Assignment System, he said, is that of encouraging career executives to develop broad management capabilities that can be applied to Government service as a whole, rather than to a single agency or program. He said this new approach is expected to provide the kind of flexible leadership needed for the many problems that cross agency lines.

Other seakers at the 3-day meeting, which opened at Walter Reed Army Institute of Research and continued the last two days at AMC Headquarters, included Dr. G. W. Johnson, who discussed how the U.S. Navy Laboratories carry out their mission; Col Harvey E. Sheppard, AMC's Acting Deputy Director of Research and Laboratories, who spoke on "Problems of In-House Laboratories and Possible Solutions"; and Norman L. Klein, chief of AMC's Physical Sciences Division A.

Dr. Thomas led a discussion of the Sheingold Report on management of in-house R&D Laboratories. Dr. Leonard S. Sheingold, vice president of Sylvania Corp. for electrical systems, was chairman of the study group.

### ARPA Sets Up Office Of Advanced Engineering

Establishment of an Office of Advanced Engineering, to support developments not within the charters of its other offices, has been announced by the Advanced Research Projects Agency, Office of the Director of Defense Research and Engineering (ODDRE).

The new office is concerned with activities which are not funded by the Army, Navy or Air Force, but which conceivably could have significant benefit to the Department of Defense. Tasks of the office will be self-generated or will result from ODDRE recommendations or other DoD elements.

Dr. Chiao Jen Wang, selected to head this office, has been serving as deputy director of Booz-Allen's Combined Arms Research Office at Fort Leavenworth, Kans.

Dr. Wang has been employed by the Aerospace Corp., the Space Technology Laboratories of Ramo-Wooldridge, and North American Aviation Co. Earlier in his career he taught physics and engineering courses at Johns Hopkins University and the University of Southern California. He received his PhD degree from Johns Hopkins University in 1953 in aeronautics.

Dr. Wang is a member of the Operations Research Society of America, the American Institute of Aeronautics, and the American Astronautical Society.

### MICOM Names McHugh Chief of Future Missile Systems

Reassignment of Lt Col William C. McHugh as chief of the Future Missile Systems Division was announced in mid-January by the Army Missile Command, Redstone (Ala.) Arsenal. Formerly, he was chief of the Combat Requirements Branch.

In World War II, he served as an enlisted man. Following graduation from Officer Candidate School in 1949, he was assigned to duty in Korea. The late King



Lt Col W. C. McHugh

Paul of Greece presented him with the Greek Cross of War for his Korean service. Among his decorations are the Army Commendation with two Oak Leaf Clusters and the Purple Heart with OLC.

Lt Col McHugh has completed the Surface-to-Air Missiles Battery Officers Course, Artillery Advanced Course, Nike Hercules Transition Course and the Nuclear Weapons Deployment Course, all at Fort Bliss, Tex.; Inspector General Course, Washington, D.C.; and the Command and General Staff College, Fort Leavenworth, Kans.

He has served on the staff and faculty at the U.S. Army Air Defense School, Fort Bliss; commander of a Nike Hercules Battery in Europe; and as inspector general of the 11th Air Assault Division, Fort Benning, Ga.





Melvin Miller



Dr. Peter D. Lenn



Melvin P. Marks

## Dr. Thomas Adds Miller, Marks, Lenn to AMC Staff

Dr. Jay Tol Thomas, Deputy for Research and Laboratories, has selected three additional members of his headquarters staff, as authorized under his expanded powers announced recently by General Frank S. Besson, Jr., CG of the Army Materiel Command.

Melvin Miller, a veteran of 32 years Federal Civil Service, is assigned as assistant to Norman L. Klein, chief of Physical Sciences A. Melvin Marks is acting chief, Science Support Division. Dr. Peter D. Lenn, a newcomer to Federal service, is acting chief of Physical Sciences B. Performing as acting chief, Earth Sciences Division, is Dr. Geoffrey E. H. Ballard, who joined Dr. Thomas' staff in July 1966 as physical sciences administrator.

Miller has handled ballistics, explosives and propellants and energy sources research for the Materiel Command since it became operational in August 1962. More recently he has been chief of the Chemistry and Materials Branch, following departure of Norman Klein to join Dr. Thomas' staff in August 1966.

After serving eight years with the Department of Agriculture Soil Conservation Service, Miller in 1943 joined the staff of the Army Chief of Ordnance in Washington, D. C. In 1948, he left to return to the Department of Agriculture as superintendent of the Plant Industry Section at Beltsville, Md., remaining there until he returned to the Office of the Chief of Ordnance in 1954. He stayed with the OCO until he joined the AMC staff.

### Huachuca Trains Investigators

Thirty-five military and civilian students completed the first 1-week course offered recently at Fort Huachuca, Ariz., to train military police investigators from Army Materiel Command (AMC) installations.

Future courses will be scheduled as the need arises. Instructors are drawn from investigators and legal experts from posts throughout the U.S. Army Test and Evaluation Command, AMC, and the Sixth U.S. Army.

DR. LENN was senior scientist with Electro-Optical Systems, Inc., from July 1964 until he accepted his new position, and was a member of the Northrop Space Laboratories research staff for two years. While doing graduate work in the University of Southern California Extension Division, he was an instructor in mechanical engineering from 1962 to 1964.

Trained in thermodynamics, aerodynamics and engineering analysis, Dr. Lenn has devoted most of his time in industrial R&D to plasma accelerators, including plasma diagnostics by spectroscopic methods and experimental and analytical investigations of crossed-field plasma accelerators. He is the author of several articles published in professional journals.

## ARO-D Commander Takes 3 Key Proving Ground Posts

Col John C. Raaen, Jr., ended duties as commander of the Army Research Office-Durham (ARO-D), Durham, N.C., to take on responsibilities of three jobs at Aberdeen Proving Ground, Md.

As successor to Col Charles D. Y. Ostrom, Jr., who departed to become the new Director of Army Research, Col Raaen is commander of the Army Ballistic Research Laboratories, the Human Engineering Laboratories, and the Chemical and Coating Laboratory.



Col John C. Raaen, Jr.

MELVIN MARKS is backed by 20 years of Federal service, including eight years each with the Army Materials Research Agency (AMRA), Watertown, Mass., and the Chemical and Radiological Laboratories (since redesignated) at the Army Chemical Center, Edgewood Arsenal, Md. Currently he is secretary of the Materiel Command Materials Advisory Group.

Graduated from Northeastern University, Boston, Mass., with a BS degree in chemistry, he did additional work in mechanical engineering at the University of Missouri and in chemical engineering at Massachusetts Institute of Technology. For four years prior to entering Federal Civil Service, he was employed as a chemist with the U.S. Rubber Co.

### FINAGLE'S LAWS:

- *If anything can go wrong with an experiment, it will.*
- *No matter what result is expected, someone will fake it.*
- *No matter what the result is, someone will misinterpret it.*
- *No matter what occurs, someone will believe it happened according to his pet theory.*

\* \* \*

**FINAGLE'S CREED:** *Science is truth; don't be misled by facts.*

**FINAGLE'S MOTTO:** *Smile! Tomorrow it will be worse.*

Selection of the new ARO-D commander had not been announced as this publication went to press.

Col Raaen joined ARO-D in September 1965 after assignment as commander of the U.S. Army Depot, Misau, Germany. He had served two years at Headquarters, Berlin Brigade, was an Ordnance officer and then assistant chief of staff, G-1.

With the 5th Ranger Infantry Battalion in World War II, he served in Normandy, Brittany and the Saar. Assigned to the U.S. Military Academy as an instructor after the war, he later attended the U.S. Naval Academy as a postgraduate student in military use of atomic energy.

Col Raaen is a 1943 graduate of the U.S. Military Academy, has an MS degree in modern physics from Johns Hopkins University, and is a graduate of the Industrial College of the Armed Forces and the Command and General Staff College.

In the Korean War, he had various Ordnance assignments. Transferred to the Ordnance Board at Aberdeen Proving Ground, he later served as staff officer for the Military Liaison Committee, Atomic Energy Commission.



## PSYOP Committee Preparing Report for DCSOPS

Results of six months of intensive research into the U.S. Army role in psychological operations (PSYOP) in the cold war environment — and Viet Nam — will be reported soon to the Office of the Chief of Research and Development, Deputy Chief of Staff for Military Operations.

The study is being conducted at the request of the Deputy Chief of Staff for Military Operations.

Chaired by distinguished psychologist Dr. Kenneth E. Clark, dean of the College of Arts and Sciences, University of Rochester, N. Y., the top-level ad hoc committee of eight conducted interviews with key Army personnel, examined documents of cognizant Federal agencies and listened to briefings by knowledgeable persons on some 20 topics.

Executive secretary of the committee is Murray Dyer, journalist, novelist, short story writer and veteran psychological warfare and operations research officer. Employed on the professional staff of the Research Analysis Corp. (RAC), McLean, Va., Dyer functions from the committee's offices at the Center for Research in Social Systems (CRESS) at American University, Washington, D.C.

The PSYOP committee study began in July 1966 and is monitored by the Social Science Research Division, Army Research Office, Office of the Chief of Research and Development.

Agencies which have contributed to the group's evaluation of the Army's past and present PSYOP efforts include the Continental Army Command (CONARC), Fort Monroe, Va., Special Warfare Center, Fort Bragg, N.C., U.S. Information Agency and the U.S. Department of State.

Qualifications of other committee members include:

Dr. George S. Pettie of RAC, a political science expert with baccalaureate and graduate degrees from Harvard University, has specialized in political sociology, the theory of social revolution and operations research. Among his published works are *Process of Revolution* and *Future of American Secret Intelligence*.

Dr. George K. Tanham of The Rand Corp., Washington, D.C., is a recognized authority on history, political science, and operations research. He received a BA degree from Princeton University, a master's degree from Stanford University and a PhD degree as a Fellow of the Belgian American Education Foundation. He has made an area study of Southeast Asia and has published *Communist Revolutionary Warfare: The Vietminh in Indochina*.

Prof. W. Phillips Davison, visiting professor of sociology at the Graduate School of Journalism, Columbia Uni-



Dr. Kenneth E. Clark

versity, received an AB degree from Princeton University and MA and PhD degrees in sociology from Columbia. He is a former editor of *Public Opinion Quarterly* and is considered an expert in public opinion and mass communications. He is the author of *Berlin Blockade* (1958) and *International Political Communication* (1965), and has served as editor or coeditor of *Public Opinion and Foreign Policy* (1949) and *West German Leadership and Foreign Policy* (1957).

Prof. Max F. Millikan, director, Center for International Studies, Massachusetts Institute of Technology (MIT), Cambridge, Mass., received BS and PhD degrees in economics from Yale University. He was principal economist for the War Shipping Administration in World War II and has since held top national and international posts in economics for Federal agencies and as a Presidential appointee to scientific groups. He is a specialist in economic development, theory and national income and is coauthor of *Income Stabilization for a Developing Democracy* and *A Proposal: Key to an Effective Foreign Policy*. He was coeditor of *Emerging Nations: Their Growth and United States Policy*.

Prof. Lucian W. Pye, senior staff member of the MIT Center for International Studies, is a political science specialist with a BA degree from Carleton College and MA and PhD degrees from Yale University. He is known as an authority on international politics, including the Far East, and political behavior. His publications include *Guerilla Communism in Malaya and Politics*, *Personality*, and *Nation Building*.

Prof. Wilbur Schramm is director, Institute for Communications Research, Stanford (Calif.) University. He is a graduate of Marietta College and received an MA degree from Harvard and PhD in American civilization from the University of Iowa, where he founded the Iowa Bureau of Audience

Research. His specialties are sociology and psychology.

He was an editor-director in the World War II Office of War Information, has been a director and professor of journalism and communications at Iowa and Illinois Universities, and is author of *Process and Effects of Mass Communications*; *Television in the Lives of Our Children*; and *Impact of Educational Television*.

Chairman Clark received BS, MA and PhD degrees in psychology from Ohio State University. He is president of the American Board of Examiners for Professional Psychologists and is a recognized authority on attitude and opinion measurement, measurement of interest patterns and prediction of vocational success.

## Rock Island Arsenal Seeks Engineers, Metallurgists

Rock Island Arsenal has an urgent requirement for mechanical and electrical engineers, metallurgists and physicists to fill positions in grades ranging from GS-13 to GS-7.

Located on an island in the Mississippi River near Rock Island and Moline, Ill., the Arsenal is an element of the U.S. Army Weapons Command.

The Arsenal has the Army research and engineering mission for artillery, less tubes and breech mechanisms; combat vehicle armament; and small arms, including aircraft weapons systems.

Application should be made on Standard Form 57 to the Secretary, U.S. Civil Service Personnel Office, Rock Island Arsenal, Rock Island, Ill. 61201. For further information, telephone Area Code 309-794-5342.

## Aviation Test Activity Shifts From TECOM to AVCOM

Transfer of the Army Aviation Test Activity (ATA) at Edwards Air Force Base, Calif., to the Army Aviation Materiel Command (AVCOM), St. Louis, Mo., was announced recently.

Commanded by Col Karl H. Zornig, the ATA has been a unit of the Test and Evaluation Command (TECOM), Aberdeen, Md., since the Army-wide reorganization eliminated most of the Technical Services in August 1962.

Engineering flight tests on helicopters, fixed-wing and experimental aircraft are conducted by ATA at the huge California base, considered one of the world's greatest flight-test centers. Approximately 200 military and civilian personnel are employed by ATA.

The Army element of the Tri-Service V/STOL (vertical short takeoff and landing) Team attached to ATA is currently testing the XC-142, Ling-Temco-Vought experimental cargo aircraft. Pilots of ATA and the V/STOL team include combat veterans of Viet Nam.



## Famed Polar Explorer Proving Fortitude in New Role

Fortitude is ingrained in the hardy explorers who venture into the vast mysteries of the coldest and most remote regions of the world, but one of the greatest of those living — a man bestowed with about every honor that might be conferred upon him — is calling upon it as never in his life.

When Dr. Paul A. Siple was sworn into office Jan. 25 as scientific adviser to the Director of Army Research, the very fact of his being there was more than a small miracle. It was living proof of the power of faith, in himself and in those who have stood steadfast in real trouble.

To some who experience the catastrophe of a partially incapacitating stroke, the prospect of many months of discouragingly slow recovery stifles the will to survive. Others say from their heart, "I'm lucky to be alive!" and resolutely turn to the task of fighting their way back.

Dr. Siple has come a long way on the road back to the goal of complete recovery he has set for himself. His faith in his ability to achieve that objective is supported by "will" power. It shows in his unflinching good humor, the ready wit for which he is renowned, the quick smile flashed to friends and associates. His speech is lucid, his mind still able to call rapidly upon the vast store of knowledge that has added to his fame.

Now he can be humorous in describing what happened to him on June 6, 1966. "I felt a bit tired after a somewhat strenuous series of conferences and I had another meeting scheduled, so I was sitting in my hotel room in Wellington, New Zealand, going over some papers. Suddenly I felt as if I wanted to sit down on the floor. And when I did, I just couldn't move."

Mrs. Siple, in whose honor an antarctic peak is named Mount Ruth Siple, was some 4,200 miles away at that time. She and daughter Mary were on vacation at Alice Springs in the middle of Australia, known as the driest part of that vast continent ("but it rained all the time we were there").

How they managed to be at Dr. Siple's bedside 30 hours later is a story in itself, reflecting great credit upon the American Embassy staff in Canberra and a sympathetically understanding, very efficient British Overseas Airways Corp. executive.

More than a month later, after responding encouragingly to physical therapy by specialists in Wellington, Dr. Siple was returned to Canberra. Since taking leave of absence from his position as scientific adviser to the Director of Army Research in June 1963, he had been assigned there with the Department of State as scientific attache for Australia and New Zealand.

Continued progress led doctors to de-

cide that Dr. Siple could be returned to the U.S. and he and Mrs. Siple arrived in Los Angeles, Calif., Sept. 16. Then Ruth learned that her 79-year-old mother, whom she had looked forward eagerly to seeing again, had died the day before.

Under expert medical care in Washington, including daily treatment by a physical therapist who had accompanied him from Australia, Dr. Siple made further recovery. He began walking on his good right leg aided by a 4-legged crutch.

That started him to thinking about "getting back in the harness again." In this determination, he was encouraged by many friends of long standing familiar with the "power of mind over matter" as applied to the famed explorer.

Then came another setback, just when Paul and Ruth were looking forward to a visit from his 90-year-old mother and other relatives during the Christmas holidays. He came down with a severe cold and arthritis settled in his right leg.

The hollow of the sling of his disabled left arm was a convenient place to store a supply of Kleenex — until one was ignited by a spark from his cigaret lighter. He smothered the flame with his right hand, but not until his left sustained third degree burns.

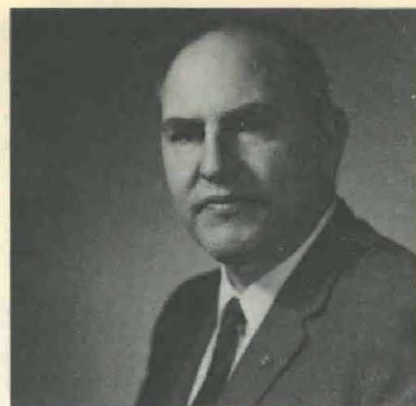
Another misfortune followed. While going to the mail box to post a letter, Dr. Siple's mother slipped on ice and broke her left ankle in two places shortly before she and Paul's sister and brother-in-law were to leave by car for the trip to Washington from Canton, Ohio. But neither that injury, bad varicose veins, nor a heart condition discouraged her from making the long-awaited trip.

"You should have seen her hopping around with her foot in a cast during the holidays," Dr. Siple chuckled. "She was the life of the party. We kidded a bit about making one really mobile person out of the both of us, but decided it was not feasible since both of us had bad left legs."

That quip is characteristic of Dr. Siple's present approach to his problems of regaining the vigor of physique for which he was noted. Never will you hear a faint hint of feeling sorry for himself, of bemoaning the fickleness of fate. Instead his attitude is: "I'm really mighty lucky!"

To his duties as scientific adviser to the Director of Army Research, Dr. Siple expects to be able to give the full value of his lifetime of experience as a scientist and explorer, and the keenness of intellect that characterizes his approach to problems. Physically, the way back still may hold a few bad curves, but he has a lifetime of training in coping with the rigors of the unknown.

Dr. Siple's sphere of service as an adviser will extend beyond research activities to development, testing and opera-



Dr. Paul A. Siple

tional functions, and beyond Army activities and programs in these areas into Defense-wide and Air Force and Navy programs of interest to the Army.

He also will be concerned with problems of establishing and maintaining more effective interfaces between the Army, industry and academic institutions — particularly as pertaining to substantially improved "coupling" of research and development, so as to achieve maximum benefit from new discoveries in their application to engineering design problems.

The job presents a real challenge to a man whose career reflects an ever-eager, highly successful response to challenge, starting as a 18-year-old Boy Scout selected in a nationwide contest for the honor of accompanying Admiral Richard E. Byrd on his first Antarctic Expedition (1928-30).

### Redstone Laboratory Studies Miniaturized Servo Actuator

Prototypes of one of the smallest electromechanical fin servo actuators developed for guided missile application are being evaluated by the Inertial Guidance and Control Laboratory at Redstone Arsenal, Ala. The unit fits in a 6-inch diameter envelope.

Because of the high level of flight trajectory accuracy and instant response time, the new unit is said to offer new horizons for the smaller family of missiles.

The miniature servo actuator was developed for the Army Missile Command under contract by the Cleveland-based Power Equipment Division of Lear Siegler, Inc.

### Watervliet May Be Historic Site

*Watervliet (N.Y.) Arsenal has been recommended by the Department of the Interior for designation as a national historic site. The 153-year-old U.S. Army weapons design and development center was recommended for its role in arms production and procurement during seven wars, and also for contributions to the Nation's commerce and industry.*



# New STAF Discusses Chemical Detection of Personnel

Detection of concealed personnel by instruments which "read" man's "signature" in some 400 chemicals normally emitted is discussed in a new Army Scientific and Technological Applications Forecast (STAF).

Being distributed to selected Governmental, educational, and research and development organizations, the STAF is an objective compendium of the state-of-the-art of "Chemical Detection of Personnel by Gaseous and Particulate Matter." It is a 20-year forecast of new technological applications based on an encyclopedic summary of known phenomena.

Sponsored by the U. S. Army Research Office (USARO), Office of the Chief of Research and Development, the STAF series of publications was designed to assist Army staff planners, research managers and laboratory technical directors in developing an Army-wide approach to planning appropriate research.

Supplementing the annual U. S. Army Long Range Technological Forecast, the STAF is intended to provide an insight into one specific field. The latest study was conducted under contract with Beckman Instruments, Inc., Fullerton, Calif.

Other STAF studies include "Excavation" (1964), "Electromyography" (1963) and "Stimulated Emission" (1962), each by a different contractor.

The report on chemical detection discusses the present state-of-the-art of three phases:

- Materials generation — the gaseous and particulate matter generated by both man and equipment;
- Atmospheric diffusion — the mechanisms by which these gaseous and particulate materials are dispersed in the surrounding environment; and
- Instrumentation — types and techniques used to detect these materials.

Included in the comprehensive Beckman report is a listing of established effluents which are unique to man and his equipment and readily distinguishable from background environment.

After determining which scientific substances may be useful for detection of concealed personnel and equipment, the contractor considered potentialities of various instrumentation techniques.

Discussed in detail are several types of spectrometry, gas chromatography, liquid crystals, condensation nuclei detectors, surface effects detectors and ionization techniques.

Following details of the state-of-the-art in each of the three phases, the contractor provides a technological forecast for each. Section 3 of the STAF summarizes the results of the study and data responses to information requests

from some 350 scientists and engineers. They listed in order of individual preference the areas of personnel detection demanding further research.

In a fourth section devoted to a "research plan," the contractor refers to a Directory of Institutions, Industries and Government Agencies included with Section 3. The directory indicates 23 or more institutions and agencies are performing or have recently — or in the immediate past — performed basic, applied or developmental research in materials generation.

Twenty leading universities are known for about 40 ongoing research projects on various aspects of atmospheric diffusion. Basic research also is being done by various military establishments, research institutes and private industry.

Detection instrumentation discussed in

## New Data Automation Panel Serves Staff Agencies

General staff agencies of the Department of the Army are represented on a Data Automation Panel established recently by the Office of the Chief of Staff. Col Walter C. Terry, chief, Systems Division, Office of the Special Assistant for Information and Data Systems, is chairman.

The panel will serve as an adjunct to normal staff coordination for expediting important ADP actions, for keeping staff agency representatives informed of plans and progress of selected major ADP projects, and for seeking the collective advice and recommendations of staff agency representatives on major ADP matters.

Members and the agencies they represent are: Col R. J. Steir, Deputy Chief of Staff for Personnel; Col Arthur Majeske, DCS for Operations; Col Joseph J. Strnad, DCS for Logistics; Col Dale L. Vincent, Office of the Chief of Research and Development; Col Jack C. Evans, Jr., Assistant Chief of Staff for Intelligence; Col Richard F. McAdoo, ACS for Force Development; Lt Col B. M. Pate, Comptroller of the Army; Neuman C. Kerndt, Chief of Reserve Components; Col Charles A. Stanfield, Jr., The Adjutant General; Ernest N. Wyrick, Chief of Communications-Electronics.

The recorder is Lt Col John E. Gray, Office of the Special Assistant for Information and Data Systems, Office of the Chief of Staff.

Army staff agencies without a regular panel member will be notified when matters pertaining to their functional areas are to be considered.

A tentative list of projects to be covered in panel briefings, the first of which was given Jan. 6, includes: Automation in Direct Support and General Support Units; the Personnel Management-Card Processor System; the AIDS

the STAF is broken down by individual techniques and the state-of-the-art of each as to its immediate and anticipated future applicability.

## U.S. Army Nurse Corps Marks 66th Anniversary of Founding

More than 4,000 members of the Army Nurse Corps all over the world celebrated the 66th anniversary of the oldest women's auxiliary service Feb. 2.

An all-officer corps consisting of registered professional nurses, the Corps includes 950 men among its 4,350 nurses. Col Mildred I. Clarke is the twelfth chief of the Army Nurse Corps.

The Corps reached its peak strength of 57,000 during World War II with almost half of this number serving overseas where U.S. forces were stationed.

Five-Year Planning Base; Centralization of Supply Management Operations; and the CONARC Class One Automated System.

Other briefings will cover the ADSAF Combat Service Support System; Administrative and Logistic Systems Relationships; the System Project for Electronic Equipment at Depots-Extension; the National ADP Program for ADP Logistics Management; and the Test, Evaluation, Analysis and Management Uniformity Plan.

Briefings also are planned on the Automated Army Budget System; Intelligence Data Handling System; PEMA Reporting System; Department of the Army Command and Control System; Automated Research and Development Information System; Resource Management System; and the ADP Situation in Viet Nam.

## 25-Year Defense Employee Transfers to Public Roads

After 25 years with the Department of Defense, Dr. Selig Starr transferred to the Department of Transportation Feb. 3.

Dr. Starr was with the Mathematics Branch, Physical and Engineering Sciences Division, Army Research Office, for five years. In transferring to the Bureau of Public Roads, he will return to "active" rather than "staff" research and development.

Except for three years at the Naval Propellant Plant, Dr. Starr's entire Federal experience has been with the Army.

In 1942, he served with the Air Service Command, then part of the Army. He also has worked for The Surgeon General, Diamond Ordnance Fuze Laboratories in Washington, D. C., and Office of the Quartermaster General.



## Economists Foresee Federal R&D Costs Leveling Off

Federal Government R&D spending will level off and a projected growth of \$500 million to a record \$23.8 billion in 1967 for the Nation's R&D effort will be 80 percent attributable to industry, universities and nonprofit institutions.

Predicted by economists at Battelle Memorial Institute, Columbus, Ohio, the estimate of a \$500 million increase represents a 2.2 percent rise over 1966 R&D spending—the smallest gain in the 13-year period national survey data have been compiled.

Government spending is expected to total \$16.2 billion, an increase of about \$100 million (0.6 percent) over 1966 R&D spending. Industry will account for \$6.8 billion, colleges and universities about \$480 million, and other nonprofit agencies \$326 million.

Industry is expected to increase R&D expenditures by about \$340 million, roughly two-thirds of the predicted national increase, marking the first time in a decade that Federal funds have not been the dominant factor in the R&D growth trend.

Battelle economists Ralph L. Craig, Joseph W. Duncan and Leonard L. Lederman are of the opinion, however, that the slowdown in Federal R&D spending is temporary. The cutback is believed attributable primarily to imbalance in the national economy and abnormal pressures upon the Federal budget.

Noted in the predictions is that research programs are "maturing" in the Department of Defense, Atomic Energy Commission, and the National Aeronautics and Space Administration—attributable partially to shifting of national research and development focus.

Federal funding in 1954 represented about 56 percent of all R&D expenditures and by 1964 had increased to nearly 70 percent of the national total. In 1967 the Federal funds will constitute less than 68 percent of the total.

Most of the Federal cutback in 1967, however, will be due to about 16 percent less spending for R&D facilities than in 1966, continuing a trend started in 1965. Basic research funding by the Army, Navy and Air Force will show some gain.

As interpreted by the Battelle economists, the longer-term outlook for Federal R&D spending will depend upon basic policy decisions currently taking shape with respect to development of an antimissile defense system, supersonic air transport, post-Apollo space explorations, and areas such as oceanography.

National research objectives, if shifted to social problems such as health, air and water pollution, urban transportation, and redevelopment of cities, could lead to increased Federal R&D spending in the decade ahead, the prediction observes.

Industry has since 1953 consistently performed 70 percent or more of the

total research of the Nation, the report states, although Federal spending has been the dominant funding source during this period.

Roughly 80 percent of all R&D performed by industry has been in five fields: aircraft and missiles, electrical equipment and communications, chemical and allied products, motor vehicles and transportation equipment, and machinery. These industries also account for about 75 percent of the total R&D supported by corporate funds.

Internally generated funds support the largest proportion of R&D in the chemical and allied products industry. More than \$1 billion worth of R&D in 1964 was funded internally, as compared to \$230 million of Federal funding. In contrast, the aircraft and missiles industry internally funded less than \$500 million worth of R&D, and received more than \$4.5 billion of Federal funds.

Data used by the economists in preparing their calendar-year forecast were drawn from many sources, including fiscal year figures of the National Science Foundation, U.S. Bureau of the Census, Federal budget reports, and analyses made by the Battelle Socio-Economics Research Group.

Analysis of corporate cash flow provided part of the basis for estimates of industrial R&D spending, since R&D funding is normally an increasing function of retained earnings and depreciation, the report explains.

The present cash-flow position of industry is viewed as supporting the belief that funds for industrially supported R&D will continue to grow. A large spectrum of research opportuni-

ties is available for future exploitation, in the opinion of the Battelle economists. The \$6.8 billion estimate for 1967 is a gain of 5.25 percent over estimated 1966 spending.

Academic and nonprofit institutions also have increased their share of R&D expenditures from 10 to 15 percent during the past decade, accounting for 3.4 percent of total R&D funding in 1966 as compared to 2.5 percent as recently as 1964. Contributing to this growth has been an increase in the availability of state and local funds for research by contracts and grants.

### SCIENTIFIC CALENDAR

2nd International Particle Accelerator Conference, sponsored by IEEE, Washington, D.C., Mar. 1-3.

Meeting of the American Association of Pathologists and Bacteriologists, Washington, D.C., Mar. 10-12.

Meeting of the National Association of Corrosion Engineers, Los Angeles, Calif., Mar. 13-17.

Meeting of the International Association for Dental Research, Washington, D.C., Mar. 16-19.

Symposium on the Topic of Modern Optics, XVII in a Series of International Symposia Organized by PIB, Microwave Research Institute, sponsored by AFOSR, ONR and ARO through JSEP, N.Y.C., Mar. 22-24.

Wideband Analog Recording Techniques Conference, sponsored by the Rome Air Development Center, Air Force Avionics Laboratory and industry, Griffith AFB, N.Y., March (date undetermined).

Meeting of the Electronics Industrial Association, Washington, D.C., March (date undetermined).

## Watervliet Metallurgist Gets SARS Fellowship

Under a Secretary of the Army Research and Study (SARS) Fellowship, Francis A. Heiser this month started a year of investigation of mechanical properties of gun-tube forging materials, and resistance to fracture.

Studying at Lehigh (Pa.) University, the Watervliet (N.Y.) Arsenal physical metallurgist is seeking to establish a relation between normal mechanical properties and toughness of gun-tube materials for potential use in design and fabrication.

At Watervliet, the Army's heavy weapons design and development center, Heiser has headed the metallurgical processes unit responsible for developing new materials, metallurgical processes and fabrication techniques. He also has directed the Arsenal's scientific experimentation and engineering studies associated with metallurgy.

Heiser received a BS degree in metallurgical engineering from Lehigh University in 1956 and earned a master's degree in the same field at Rensselaer Polytechnic Institute, Troy, N.Y., in 1962.

In November 1956, he entered the Army, and upon completion of the basic officers ordnance course at Aberdeen Proving Ground, Md., was assigned to Watervliet. After completing military duty, he joined the Arsenal's research and engineering staff as a civilian metallurgist. He was a supervisory metallurgist in the Arsenal's investment casting foundry until assigned to his present position in October 1964.

Heiser is the author of papers which have been published in *Modern Casting*, *Plating Magazine*, and the *American Foundryman Society Magazine*.



Francis A. Heiser



## Tri-Service Unit Gets Expert Aid in Forecasting

An Army-Navy-Air Force group studying technological forecasting techniques met recently for the first time with representatives of non-military Federal agencies and a recognized authority from Harvard University. The meeting was held at the Army Research Office, Arlington, Va.

Dr. James R. Bright, a professor in Harvard's Graduate School of Business Administration, was the only non-Government representative. Author of several books on planning, including *Re-*

*search, Development, and Technological Innovations*, published in 1964, he contributed his views on the state-of-the-art of technological forecasting and suggested possible areas for research.

In addition to a general discussion of methodology, each representative summarized techniques for research forecasting used within individual agencies.

Three methods of technological forecasting have been added to the seven categories which the tri-Service group began evaluating last November. (See

*Army Research and Development Newsmagazine*, December 1966, page 1)

- *Historical Analogy*. A study of the pattern that similar technological innovations have taken in the past.

- *Contextual Mapping*. The mapping, or charting, of interrelated parameters (technical and economic) which simplify recognition of cause-and-effect relationships.

- *Morphological Research*. An orderly way of looking at all possible means of performing the required functions of a given large-scale problem.

The study group reports that so far in its evaluation of forecasting techniques, the number of methods has been "narrowed down" and the practitioners of each method have been determined. The study is expected to be completed in March.

Visiting "futurists" in addition to Prof. Bright were Patricia Clines and C. O. Bunn, National Bureau of Standards, Gaithersburg, Md.; Stan Smolensky, HQ National Aeronautics and Space Administration (NASA); Arthur L. Webster, HQ Federal Aviation Agency; and Jack Kratchman, U.S. Atomic Energy Commission, Germantown, Md.

Members of the forecasting study group are James W. Sterling, Army Research Office, Arlington, Va.; Elma Henderson and Howard A. Wells, U.S. Air Force Systems Command, Andrews Air Force Base, Md.; Donald B. Keckler, Army Weapons Command, Rock Island (Ill.) Arsenal; H. T. Darracott, HQ Army Materiel Command; Edward Mackiewicz, Army Tank-Automotive Center, Warren, Mich.; Marvin J. Cetron, HQ Naval Material Command; Thomas I. Monahan, Naval Applied Science Lab, Brooklyn, N.Y.; and William A. McKenney, Naval Weapons Laboratory, Dahlgren, Va.

## Donley Heads Mobility Equipment Command

Brig Gen Edwin I. Donley, deputy commanding general of Land Combat System, U.S. Army Missile Command at Redstone (Ala.) Arsenal since April 1966, assumed duties in January as CG of the U.S. Army Mobility Equipment Command, St. Louis, Mo.

Successor to Brig Gen R. I. Simpson, who retired from military service, General Donley began his Army career in 1941 in the Industrial Division, Office, Chief of Ordnance, in Washington, D.C. He is a 1940 graduate of the U.S. Naval Academy.

Early in World War II, he attended the U.S. Army Command and General Staff College, was assigned to Europe and took part in the Ardennes, Central Europe and Rhineland campaigns with Patton's Third Army.

Since then assignments have included a 3-year tour with the U.S. Army, Caribbean Area; a year on loan to the State Department in the Office, Foreign Liquidation Commission; six years with the Office, Chief of Ordnance; and a tour at Picatinny Arsenal, Dover, N.J.

After graduating from the Industrial College of the Armed Forces in 1960, he was assigned to Korea as senior supply and maintenance adviser to the Deputy Chief of Staff (Logistics), ROK Army. Prior to joining Redstone Arsenal as Pershing project manager in 1963, he attended the Army Logistics Management School, Fort Lee, Va.

General Donley's decorations include the Legion of Merit for service as Pershing project manager, the Bronze Star Medal for service with the 76th Division during World War II, and the U.S. Army Commendation Medal.



Brig Gen E. I. Donley

## Sterner Serving MICOM Unit as Acting Deputy CO

Col Cyril D. Sterner is serving as acting deputy commander for Land Combat Systems at Redstone Arsenal, Ala., since departure of Brig Gen Edwin T. Donley to head the U.S. Army Mobility Equipment Command.

Col Sterner joined the Missile Command in 1963 as manager of the Antitank/Aircraft Weapons Commodity Office and directed the TOW, ENTAC and SS-11 systems. Development of additional systems such as Little John and Honest John came under his control in 1965 when AAWCO was redesignated the Land Combat Commodity Office.



Col Cyril D. Sterner

The Colonel attended the Universities of Nebraska, Georgia and Maryland and was graduated from the University of Southern Mississippi with a BS degree in mathematics. He has taken graduate work at the University of Alabama in Huntsville.

During World War II, he commanded the 2nd Battalion, 382nd Infantry of the 96th Infantry Division in assault landings at Leyte and Okinawa. His decorations and awards include the Silver Star, Purple Heart, Bronze Star with Oak Leaf Cluster, Army Commendation Ribbon, Combat Infantryman Badge and Philippine Presidential Unit Citation.

## Tyler Gets Executive Post With Joint Advisory Council

Gordon H. Tyler, the new executive secretary of the Defense Industry Advisory Council, was formerly assistant director of Procurement (Policy and Review), National Aeronautics and Space Administration (NASA).

Established in 1962, the council provides a forum for discussions between Defense officials and top representatives of industry to develop understanding of Defense objectives, operational procedures, and coordinated Government-industry relationships.

Tyler holds BA and LLB degrees from the University of Louisville. In 1960 he was a Sloan Fellow at the Massachusetts Institute of Technology, where he studied industrial management.

His career, devoted entirely to Government work, included several legal and procurement management assignments with the Air Force. He had been with NASA since 1961.



## Panel Evaluates Air Defense Mathematical Models

Mathematical models depicting operation of antiaircraft guns and free rockets were evaluated at a Feb. 1-5 meeting of a panel of the Working Group on Effectiveness Measures for Optically Directed Air Defense Weapons.

Considered were models provided by the United Kingdom, Canada and Australia as well as 10 U.S. models selected at a preliminary meeting of the panel in December. The panel is composed of representatives of the Federal Government, industry and academic experts.

Mathematical modeling is a rapidly developing technique for evaluating concepts of systems and theoretical operations. Objective of the Working Group is to select computerized effectiveness measurement models, or portions thereof, for application throughout the Department of Defense; also, to outline needed experiments to insure development of improved models for future use.

The panel aims to develop a building block model as a basis for a more realistically sophisticated method of evaluating various weapon systems. The task is restricted to include only guns and free rockets with fire control dependent on optically pointing the estimated or measured input, excluding those with guidance after launch.

Emory L. Atkins, assistant to the technical director of the R&D Directorate, U.S. Army Missile Command, Redstone (Ala.) Arsenal, and Robert Doane, technical director, Deputy for Engineering and Technology, Electronic Systems Division, U. S. Air Force Systems Command, Hanscom Field, Bedford, Mass., comprise the Working Group.

### MICOM Converts to 35mm Cards For Procurement Specifications

Contractors soliciting bids for missile work with the U.S. Army Missile Command at Redstone Arsenal, Ala., will receive 35mm microfilm aperture cards of engineering drawings and technical data on equipment beginning in April.

Conversion from the voluminous conventional paper prints to tab-size aperture cards will begin with individual components and progress to all items by July 1.

MICOM Procurement and Production Directorate officials pointed out that, in addition to easier handling and storage space savings, the new method will permit contractors to reproduce as many copies as they require for bid quotations, manufacturing purposes, or in soliciting from subcontractors.

Questions on technical aspects of the changeover should be directed to the Engineering Documentation Division of the Directorate.

Model Evaluation Panel members include Dr. George E. Nicholson, Jr., chief, Department of Statistics, University of North Carolina; Dr. Walter Wrigley, professor of Instrumentation and Astronautics, Massachusetts Institute of Technology; Dr. Robert M. Thrall, Department of Mathematics, University of Michigan; Dr. Jesse Orlansky, member of the technical staff, Institute for Defense Analyses; and Dr. Wilbur E. Payne, chief, Office of Operations Research, Office of the Under Secretary of the Army, suggested formation of the working group, which was established by memorandums to the Service chiefs from the Director of Defense Research and Engineering.

Staff focal points are Col G. H. Drewry, Jr., Army; Col Robert T. Miller, Air Force; and William J. Dichtel, Navy. Col Drewry succeeded Lt Col Allan T. Sylvester, II, who was assigned to the Office of the Director of Army Research as executive. The Army is the host agency.

Dr. Marion R. Bryson, director of Special Research in Statistics, Duke University; Dean Robert F. Rinehart, U.S. Naval Postgraduate School; Dr. A. L. Slafkosky, chief scientist, Headquarters, U.S. Marine Corps; Dean H. Wilson, Department of Industrial Engineering, University of Michigan; and Dr. John Hovorka, Physics Department, Hobart and Williams College.

Australia, Canada, and Britain will also furnish one member each.

## Dr. Martin, Metals Expert, Retires After 30 Years

More than 30 years of Federal service for Dr. James L. Martin, technical director of the U.S. Army Materials Research Agency, Watertown, Mass., ended with his recent retirement as one of the Army's internationally known leaders in metallurgical research and engineering.

Graduated from the United States Military Academy in 1933, he enrolled as a graduate student at Harvard University. In 1935, to help support his studies, he became a melter in the foundry at Watertown Arsenal. After receiving a doctorate degree, he was appointed foreman-metallurgist and superintendent of production at the Arsenal Gun Plant.

During World War II, Dr. Martin was civilian chief of gun tube production at Watertown and was responsible for successful application of centrifugal casting to mass production techniques.

The majority of gun tubes used by the U.S. Army during the early years of the war were produced under his supervision. Selected in 1945 by the Chief of Ordnance to survey German methods

of gun tube production, he was recognized for the results of this work with award of the U.S. Army's Meritorious Civilian Service Medal.

Appointed associate director for metallurgy, Watertown Arsenal Laboratories, in 1946, he was promoted to director in 1948. Under his leadership during the next five years, substantial progress was made in a number of areas of metallurgical research, most notably in titanium alloys.

Dr. Martin was appointed the first director of the Ordnance Materials Research Office at Watertown when it was established in 1954 by the Chief of Ordnance. Its mission was to plan and administer supporting fundamental research in materials within more than a dozen Army laboratories.

The Secretary of the Army appointed Dr. Martin in 1959 to a board comprised of two civilians and 11 military officers to make a study of the Army's research and development organization and philosophy of operation.

As part of the Army-wide reorganization in August 1962, the Army Materials Research Agency was created by combining the Ordnance Materials Research Office and the Watertown Arsenal Laboratories, with Dr. Martin as the first technical director. The Agency has gained recognition worldwide as a leader in research and development of structural materials.

Dr. Martin is a member of the American Society for Metals, the American Institute of Mining, Metallurgical and Petroleum Engineers, American Ordnance Association, and the American Management Association. Among his numerous assignments to special working and study groups was membership on the Advisory Committee on Materials for the National Aeronautics and Space Administration.



Dr. James L. Martin



## ATAC Builds Pilot Models of Vehicles for Viet Nam

Seven pilot models of an experimental U.S. Marine Corps vehicle developed for the swamps and rice paddies of Southeast Asia are being built by the U.S. Army Tank-Automotive Center (ATAC), Warren, Mich.

The Marginal Terrain Vehicle (MTV) is officially designated the XM759, 1½-ton Cargo Carrier (soft-tire tracked). It is specifically designed to negotiate areas comprised of water and mud.

ATAC developed the vehicle through an agreement between the Marine Corps and the U.S. Army Materiel Command, of which ATAC is a field command.

To speed the program, ATAC began building the pilot models in shops at Detroit Arsenal while at the same time requests for quotations were sent out to industry for an "advanced production engineering" and "limited production" contract. A contract award is expected in February.

The MTV has a gross weight of 11,500 pounds and will carry 3000 pounds of cargo or a fully equipped Marine squad of 14. A two-man crew operates it.

It looks like a tracked vehicle except that instead of conventional tracks it has a set of chains on each side resembling giant bicycle chains, with 17 wide-track, low-pressure terra-tires strung between them. The chains are driven by two large sprockets on each side at the front and rear. The rear sprockets are adjustable to exert tension on the chain.

The vehicle rolls over the wheels in contrast to the normal wheel-axle arrangement where the rolling of the wheels moves the vehicle.

Robert Nette, MTV project engineer in the ATAC Materiel Development Division, said in principle the MTV goes back to caveman days when heavy objects were moved by placing them on logs and rolling them. As the object rolled forward the logs in back were moved to the front to provide an unbroken rolling surface.

The light-weight aluminum construction in combination with the terra-tires will provide the MTV with excellent amphibious capabilities. The air pressure of the tires will be approximately three pounds per square inch. The wheels propel the vehicle at about seven miles per hour over inland waters. Top land speed is about 35 miles per hour.

The vehicle will be controlled in turning the same as any tracked vehicle by the slowdown or stopping of one side while the other wheels are accelerated.

First pilot model is scheduled to be completed and ready for testing in March. Four others will be finished by

### New Historical Volume Traces U.S. Army Logistics

*The Sinews of War: Army Logistics, 1775-1953* is the latest volume of the Army Historical Series being published by the office of the chief of Military History, Department of Army.

The 789-page book traces the logistical experience of the U.S. Army from birth through the Korean War. It contains photos, maps and charts to help the reader acquire perspective on logistical problems as a whole and to understand more fully this relatively neglected aspect of Army history.

### Texas A&M-Army Pact Provides Engineers

An agreement that assures the Army of a regular input of highly specialized engineers each year was negotiated recently between the Army Materiel Command's Red River Army Depot and Texas A&M University.

Believed the first contract of its kind ever signed, the agreement calls for the university to provide graduate engineers with eight months of specialized graduate level instruction at the Army Depot and four months at Texas A&M.

The Depot Logistics Intern Training Center began training potential managers in the science of maintainability engineering in 1965. Thirty-six students,

the first of May. Two models will be kept for use by ATAC and contractor personnel to develop training and operational programs.

Models will undergo intensive test programs at the Test and Evaluation Command (TECOM), Aberdeen (Md.), Proving Ground and at Fort Lee, Va.

The first five pilots will be equipped with the same power train used in the M114 armored reconnaissance vehicle and the M116 cargo carrier. It consists of a Chevrolet truck engine, automatic transmission, and Allison steer unit.

The last two vehicles will be powered by a compression ignition engine and an advanced hydromechanical power train. They will be designated XM759E1.

Prof. James A. Huston, author of *The Sinews of War*, is on leave this year from Purdue University to teach at the National War College. He is a combat veteran of World War II and an Infantry colonel in the U.S. Army Reserve. He received his doctorate from New York University.

He is also the author of *Combat History of the 134th Infantry, Biography of a Battalion* and *Across the Face of France*, as well as numerous articles on military and national affairs.

nearly all graduate engineers in the upper one-fourth of their classes from 26 universities across the Nation, are currently engaged in the 2-year study of this new field of engineering.

This program aims to provide the training necessary to produce a maintainability engineer of professional status. Its long-range objective is to end some of the problems of Army managers by providing trained personnel who will plan for and control activities aimed at designing maintainability into the products being used by the nation's Armed Forces.

The over-all maintainability engineering program includes six months of classroom study conducted at the Logistics Intern Training Center and six months of duty at an Army Materiel command where the students gain on-the-job training.

The second year of training will be provided by Texas A&M University. This graduate-level study will cover maintainability and reliability engineering, probability and statistics, operations research, computer science, metrology, and quality control.

The engineering student will accomplish the equivalent of some one year of graduate-level instruction through the Logistics Intern Training Center course. Sponsorship of the last phase of the course by an accredited university will make it possible for the student to attain a higher degree of maintainability engineering.



MARGINAL TERRAIN vehicle under development by the U.S. Army Tank-Automotive Center, Warren, Mich., for swamp and rice paddy travel will carry 3,000 pounds of cargo or 14 armed personnel and a crew of two.



## Defense Technical Information Director Resigns

Four years of wending his way through what many have termed the "pitfalls of the Pentagon" for key executives assigned to complex and highly controversial problems ended Feb. 1 for Defense Director of Technical Information Walter M. Carlson.

Announcement of his resignation was made by Mr. Carlson Jan. 26, with the statement that he has joined the staff of International Business Machines (IBM) Corp. on the staff of the chief scientist.

Prior to accepting the challenge of becoming the first Defense Director of Technical Information, he had been employed for 23 years with duPont Co., principally upon process improvement, development engineering, planning studies, operations analysis and computer applications.

Selection of Mr. Carlson for the difficult task of trying to establish some semblance of harmonious order to disparate, disjointed and widely scattered technical information handling activities of the Military Departments

## Methods Tested to Locate Underground Detonations

Field tests of methods of locating and identifying suspected underground nuclear explosions, designated Operation Cloud Gap IA by the U.S. Arms Control and Disarmament Agency, have started at Fort Huachuca and will be extended to other mountain areas in Arizona.

Experiments are designed to produce information about on-site inspection procedures necessary to monitor a comprehensive test-ban treaty — should such an international treaty be negotiated to prohibit nuclear tests in all environments.

The Limited Test-Ban Treaty of 1963 prohibits nuclear tests in the atmosphere, outer space and underwater, but does not prohibit underground tests.

Large-scale underground nuclear tests can be identified with reasonable certainty by distant seismometers, but small explosions may be confused with natural earth tremors. Cloud Gap I tests do not involve actual nuclear explosions, but are made as realistic as possible through use of "planted" evidence.

During January, about 150 military and civilian personnel were trained as inspectors and controllers for the project. For the next four months, the test controllers will plant evidence in three different areas. Inspectors will attempt to detect the radiation and report the information back to Cloud Gap Headquarters at Fort Huachuca.

Test operations are taking place in the Huachucas, Santa Ritas, Los Guijas and the Sierritas mountain ranges. Two additional test areas are along the California Nevada border, and near the Atomic Energy Commission's Nevada test site.

and other Department of Defense agencies was based upon his pioneering work in the field.

Congress, and particularly the then Senator Hubert H. Humphrey, had for more than two years been directing increasingly caustic criticism regarding the need for well-organized, integrated and carefully coordinated handling of scientific and technical information as a "national commodity." Mismanagement of this commodity, it was stated, was costing the Federal Government perhaps as much as \$1 billion annually.

Into that troubled environment stepped Mr. Carlson, fresh from eight years of intensive effort in helping to resolve the problems of duPont Co. pertaining to more effective utilization of scientific and technical information. In 1954, he had pioneered the use of large computers and set up the first operations analysis group in the Engineering Department of that firm.

That led to his appointment as laboratory technical coordinator in the Engineering Department, with responsibility for information storage and retrieval systems and new storage concepts.

When queried, prior to departure for his new position, regarding what he considered the significant advances toward achieving the objectives set when he joined the Defense Department, Mr. Carlson responded:

"Naturally, I feel we have made

## ARO-D Officials Present Program for Review

Department of the Army basic research program objectives in the physical, engineering, mathematical and environmental sciences, as recommended in FY 1968 budgetary proposals of the Army Research Office-Durham (N.C.), were reviewed this past month.

ARO-D is responsible for management of basic research contracts and grants in these disciplines under supervision of the Director of Army Research, one of four directorates in the Office of the Chief of Research and Development. Division chiefs of the Headquarters, U. S. Army Research Office (USARO), Arlington, Va., share supervisory responsibility.

ARO-D's commanding officer, Col John C. Raaen, Jr., Chief Scientist Dr. John W. Dawson and deputy, Dr. Hermann Robl, made the presentation on the FY 1968 program as proposed.

Reviewing officials included Acting Director of Army Research Dr. Richard A. Weiss, whose regular assignment is Deputy and Scientific Director; Assistant Director Col Thomas N. Chavis (also commanding officer, USARO); Dr. I. R. Hershner, Jr., chief, Physical and Engineering Sciences Division; Dr. Leonard S. Wilson, chief, Environmental Sciences Division; and key staff members.

encouraging progress. More properly, however, it would perhaps be presumptuous and certainly premature for me to try to evaluate the achievements. A special study currently is being made by the Defense Department. The report and evaluation of what has been done and needs to be done will be forthcoming in the near future."

## Rutgers, Industry, Army Join In 'Engineering Career Day'

Interested like other Army R&D installations in pointing to career possibilities in Army science, Picatinny Arsenal, Dover, N.J., will join with Rutgers University and some 30 New Jersey industrial firms in promoting "Engineering Career Day," Mar. 12.

Invitations to about 1,000 New Jersey high school students were extended under sponsorship of the program by the Essex County and Raritan Valley societies of professional engineers. Industrial exhibits and orientation tours of facilities at Picatinny Arsenal will highlight the program.

Dean Elmer C. Easton, Rutgers College of Engineering, is programmed for the principal address on "The Challenge of an Engineering Education." Industrial engineers will make a number of 10-minute presentations and selected students will give 5-minute talks in offering topics for open discussion.

Dr. Weiss had requested that the presentation describe a management procedure for determining basic research requirements relevant to the Army's mission, for establishing and evaluating a program to meet requirements, and assuring that significant results are disseminated more effectively for applied research needs.

The Army Research Office Headquarters staff also briefed ARO-D leaders on the over-all Army Research Program, including the very extensive and diverse activities of the Office of The Surgeon General, Army R&D Group Far East, Army R&D Group Europe and additional elements.

The proposed ARO-D basic research program calls for FY 1968 funding of \$11,780,000. It provides for research in experimental and theoretical physics, fundamental research in chemistry, exploratory research in mathematics, and work in experimental and theoretical electronics.

Other proposed projects involve intrinsic studies of materials, research in experimental and theoretical mechanics, and investigations in energy conversion, terrestrial sciences and atmospheric sciences.



# U.S. Army Advances in Laser R&D Cover Broad Spectrum

Army achievements in Laser research and development reported during 1966 include progress in communication links, increased power, experimentation with new materials, and applications to biology, meteorology and improved missile tracking.

One of the significant advances was the building and testing of a prototype of a *Portable Injection Laser Link* (PILL) by the U.S. Army Electronics Command (ECOM), Fort Monmouth, N.J. The system is based on a refined digital modulation scheme for transmission over an injection laser.

PILL consists of two portable field stations and a base station equipped with room-temperature injection Lasers driven by special circuits incorporating new switching devices. The field stations use only solid-state components and in design resemble a pair of binoculars — one side for transmission and the other for receiving.

The base station consists of an 8-inch telescope and photomultiplier for receiving and seven Lasers driven electrical-

ly in series and optically in parallel for transmitting.

Noise at the receiving stations has been reduced almost to the "theoretical minimum" by exactly matching photodiode and preamplifier characteristics. Tests with two field stations verified the calculated signal-to-noise ratio of 35 decibels for 10-km range and carried a full duplex audio channel.

*High-Data-Rate Communication Link.* A Laser communication link capable of transmitting 10 million pulses per second was put into operation by ECOM. Driven by a high-current pulse amplifier, the transmitter employs an injection Laser cooled to 77° K.

Operational tests over a range of eight miles with two receivers, 3½-inch and 12-inch Cassegrain telescopes with background suppression and photomultiplier, show the larger has a better signal-to-noise ratio and less signal fluctuation due to fog, haze or rain.

If used to transmit multiplex pulse code modulation, the link can carry 192 audio channels.

*Stimulated Emission — Organic Dye.* The first example of a true organic optically pumped Laser (stimulated emission from the dye chloro-aluminum phthalocyanine) was reported by International Business Machines under a contract with the Army Research Of-

fice-Durham (ARO-D).

Other recent research indicates that many photosensitizing dyes may be used to generate diffraction-limited multi-megawatt coherent light beams for a variety of wavelengths.

In addition to the implications for optical radar, the technique may lead to new understanding of fundamental energy processes in large organic molecules, researchers believe.

*Room Temperature Operation.* A development expected to have an impact on Laser communications, range finders, and night-vision programs is the Radio Corp. of America (RCA) fabrication, under contract, of injection Lasers for room-temperature operation, using a double liquid epitaxy technique. New diode structures for better heat conduction and reducing of series resistance have been built experimentally, reaching a pulse power of over 80 watts at 25° C.

*Multiply-Doped Materials.* An increase in Laser power efficiency from three to ten times is portended in recent theoretical studies of the effects of multiple doping of optically pumped Laser materials. Such an increase would make feasible certain proposed long-range and missile guidance night-viewing systems.

Multiple doping, when the combination of fluorescent ion and absorption-

## AFIP to Sponsor Course In Oral Regions Pathology

The Armed Forces Institute of Pathology (AFIP), Washington, D.C., will host the 14th annual post graduate course in "Pathology of the Oral Regions," Mar. 13-17.

Col William G. Sprague, U.S. Air Force, chief of the AFIP Dental and Oral Pathology Division, will supervise the course. It will be presented by specialists in oral and general pathology, oral surgery, periodontics and dental research.

Discussion will cover developmental disturbances of the head, neck, and oral regions; inflammatory diseases of the oral mucosa and jaws; oral manifestations of certain systematic diseases; and neoplasms of the oral cavity and related structures, with illustrations of their clinical, roentgenographic, and microscopic characteristics.

Special attention will be given to the current role of exfoliative cytology in oral cancer detection, current status of pulpal reactions to cavity liners and restorative materials, and diseases and tumors of the tongue.

The format will include lectures, case presentations, microscopic slide seminars, and panel discussions.

## XM571 Carrier Manager Named

John E. Klemmer, a program analyst associated with the U.S. Army Materiel Command's Army Weapons Command at Rock Island (Ill.) Arsenal for 12 years, was recently named commodity manager for the XM571 utility carrier.

Brig Gen W. J. Durrenberger, AWC commander, announced the appointment.

## Wagner Follows Kellogg as Director of CRREL

Lt Col John E. Wagner has assumed duties as commanding officer and director of the U.S. Army Cold Regions Research and Engineering Laboratory (USA CRREL), Hanover, N.H., succeeding Col Dimitri A. Kellogg.

The cold regions R&E Laboratory is one of nine Central research laboratories under Dr. Jay Tol Thomas, Director of Research and Laboratories, U.S. Army Materiel Command. USA CRREL is engaged in research and investigation of snow, ice and frozen ground, and photographic interpretation research on a global basis.

Col Kellogg has been serving also as commander and technical director of the Army Materials Research Agency (AMRA), Watertown, Mass., and will now devote full attention to AMRA responsibilities.

Until reassigned, Col Wagner was chief of the Engineering and Construction Section of the Defense Atomic Support Agency Test Command, Sandia Base, N. Mex. He began his military career with the 62nd Engineer Construction Battalion in Korea following graduation from the U.S. Military Academy in 1950.

Advanced studies in civil engineering at the University of Illinois earned him an MS degree in 1959 and PhD in 1961. He has completed military courses at the U.S. Army Engineer School, Fort Belvoir, Va., Navy Intelligence School, Washington, D.C., and the Command and General Staff College, Fort Leavenworth, Kans.

From 1960 to 1962, he was a military assistant to the director and project engineer for DASA's Nuclear Weapons Effects Research Task on Soil Structure Interaction, Waterways Experiment Station, Vicksburg, Miss. He then served a year in Viet Nam as senior engineer advisor with the First Corps, Military Assistance Advisory Group.

Upon return to the U.S., he was assigned as deputy director and project officer for Slope Stability Research, Army Corps of Engineers, Nuclear Cratering Group, Livermore, Calif.

Col Wagner is a registered professional engineer in Illinois, a member of a number of professional organizations and has authored articles on engineering in professional journals. He holds the Meritorious Unit Citation, the Seventh Corps Certificate of Achievement and the Army Commendation Medal.



Lt Col J. E. Wagner



enhancing dopants is properly chosen, increases the fluorescence efficiency of a material.

The Mithras Co., performing the research under contract with the U.S. Army Engineer Research and Development Laboratories, listed 37 potentially useful dopant combinations which should lead to more efficient Laser action in optically pumped solids. The most promising,  $Ce^{3+} : Mn^{2+} : Nd^{3+} : Borate$  Glass, is being studied in various combinations in order to obtain the most efficient.

**Shock Waves Produced in Semiliquid Medium.** Experimental data obtained in the U.S. Army Natick (Mass.) Laboratories indicate the presence of shock waves produced in semiliquid media, including biological specimens, by the absorption of Q-switched ruby Laser beams. The findings are considered pertinent to medical experiments using Lasers as a tool.

**Optical Probing of the Atmosphere.** Experiments at New York University under contract with ECOM have established the potential capability of a ruby Laser system for determining vertical water vapor profiles in the atmosphere by means of a spectral study of backscattered energy. The Laser system

includes provisions for thermal tuning of the operating wavelength of the Laser output.

Supplementary studies were performed on the water vapor line structure, the contribution of secondary scatter to the returned signal, and the techniques for constructing water vapor profiles from the data obtained.

**Gallium Arsenide Diode Array Fabrication.** New techniques have been developed which will permit the low-cost manufacture of a large number of gallium arsenide diodes into a module in a single operation. With the diodes automatically aligned, the module may be put into arrays exhibiting a projected source area of less than a square centimeter and delivering an output of 30 to 60 watts of radiant infrared energy.

Multiple-leg power supplies which will assure the operation of remaining diodes if one in a series should fail have also been developed by RCA for ECOM.

Other Army achievements in the Laser field during 1966 include a beam digital reflector, a new pumping method to increase the Laser's operating life, a Helium-Xenon Laser demonstrating the feasibility of long-path infrared chemical agent detection system, and ranging and tracking with the ruby Laser.

## NAS, SSRC Sponsoring Social, Behavioral Study

Strengths and weaknesses of the national effort in advancing the social and behavioral sciences are being evaluated in a 30-month survey scheduled for completion in mid-1969. Results will provide a basis for determining the degree of support required in specific areas to meet future needs.

Dr. Kenneth E. Clark, a member of the Army Scientific Advisory Panel (ASAP) and head of the College of Arts and Science, University of Rochester, is chairman of the psychology panel of the survey committee.

Other panels will study ongoing efforts and anticipated future needs for advancement of knowledge in anthropology, economics, political sciences and sociology. The survey also will deal with relevant aspects of geography, history, linguistics and statistics.

Sponsored jointly by the National Academy of Sciences (NAS) and the Social Sciences Research Council (SSRC), the survey group is chaired by Dr. Ernest R. Hilgard, professor of psychology at Stanford University. He also heads the 18-member Central Planning Committee (CPC). SSRC Vice President Henry W. Rieken is CPC vice chairman.

Other CPC members are Otis D. Duncan and Warren Miller, U. of Michigan; Fred Eggan, U. of Chicago; Charles Ferguson, Center for Applied Linguistics; Carl Kaysen, Institute for Advanced Study, Princeton; William Kruskal, U. of Chicago; David Lanes and George A. Miller, Harvard; Harvey

Mansfield, Columbia; Carl Pfaffmann, Rockefeller U.; William Sewell, U. of Wisconsin; Allan H. Smith, Washington State U.; Robert M. Solow, Massachusetts Institute of Technology; and Sherwood L. Washburn, U. of California (Berkeley).

The study will include the relevance and potential applications of the social and behavioral sciences to solution of major national problems; the organization and funding of research; and future needs in terms of manpower, education and training. It also will identify opportunities for use of these sciences and the means of exploiting them.

Considered timely because of the increasing public attention given the behavioral and social sciences, the survey will cover their increasing tendency to use empirical and quantitative methods, the growing body of data, and relationships with certain aspects of the physical and biological sciences.

Previous studies by the NAS and SSRC similar in scope to the social and behavioral sciences review covered astronomy, chemistry, physics, computers, and the plant sciences. Surveys of mathematics and the life sciences are in progress.

## McConnell Begins Second Term as Air Force C/S

General John P. McConnell began a second 2-year appointment as Chief of Staff of the U.S. Air Force Feb. 1. The oath of office was administered by Air Force Secretary Harold Brown.

## Worthley Peak in Antarctica Named for Edgewood Biologist



**WORTHLEY PEAK** in Antarctica was named recently for research biologist Dr. Elmer G. Worthley of Edgewood (Md.) Arsenal. He is shown pinpointing his namesake on a chart for Col William W. Stone, Jr., Edgewood CO. The honor—reserved for persons making significant contributions to science or exploration of Antarctica—was bestowed by the U.S. Board of Geographic Names of the National Science Foundation. During four months as senior biologist with Deep Freeze IV, Dr. Worthley studied life cycles of the Adelie Penguin, Antarctic Skua, and the Weddell and Crabeater seals. **Worthley Peak at 82 degrees south latitude and 161 degrees east longitude.**

## Professionals Offered Training In Electromagnetic Standards

Electromagnetic Measurements and Standards, a 2-week course for professionals, will be held at the University of Colorado, Boulder, Colo., Aug. 7-18. Registration deadline is July 15.

Offered by the Radio Standards Laboratory of the National Bureau of Standards, U.S. Department of Commerce, the course is intended for staff members of industry, academic institutions, military departments and other Federal Government agencies concerned with precision instruments, standards, and quality assurance and control.

Prerequisites for attendance include the educational equivalent of a BS degree in electrical engineering or engineering physics and a year's experience.

Further details and registration forms will be available Mar. 15 from The Bureau of Continuation Education, Room 328, University Memorial Center, University of Colorado, Boulder, Colo.

General McConnell will continue to serve as a member of the Joint Chiefs of Staff and will be responsible for managing Air Force resources.



# Army RDT&E, Procurement Contracts Exceed \$315 Million

Million-dollar or more U.S. Army contracts for research, development, testing, evaluation, and R&D procurement listed by the Department of Defense since reported in the January issue of this publication totaled \$315,372,043.

Contracts totaling \$53,281,915 with General Motors Corp. are for Phase III development of the U.S. Federal Republic of Germany main battle tank, metal parts for 195mm projectiles, vehicles, transmission assemblies, M114 A1 weapons system conversion kits, diesel engines, and reactivation of support utilities.

Holston Defense Corp. received a \$19,134,368 modification contract for production of explosives; National Gypsum Co., \$16,844,000 for reactivation of facilities for production of ordnance items; Continental Motors Corp., \$15,568,011 for engines and spare parts; and Norris Industries, Inc., \$12,863,086 definitization of a contract for 105mm cartridge cases.

AVCO Corp. will be paid \$9,435,149 for T-53-series engines and T-53 and T-55 technical publications work, and an-

other \$1,912,296 for 2.75-inch rocket fuzes. American Hoist and Derrick Co. was issued an \$11,076,371 modification for 20-ton, wheel-mounted cranes.

*Contracts under \$10 million include:* Grumman Aircraft Engineering Corp., \$9,427,102 for OV-1 aircraft and related items for the second increment period; Martin-Marietta Corp., three contracts totaling \$8,864,663 for mine systems and components and for continuation of industrial engineering support for the Pershing weapon system; Colt's, Inc., \$8,489,909 for M16/XM-16E1 rifles; Donovan Construction Co., \$7,918,125 definitization for 155mm projectile metal parts; to United Aircraft Corp., \$7,355,827 for propellers and propeller controls, and engine generators for aircraft; and Texas Instrument Co., \$7,000,000 first-year increment to a \$21,000,000 multiyear contract for classified electronic equipment; Sperry Rand Corp., \$6,293,098 modification for ammunition and components and for operation and maintenance activities; Hamilton Watch Co., \$5,106,443 definitization for 105mm cartridge fuzes; Chamberlain Corp., \$5,020,688

for 175mm projectiles.

*Contracts under \$5 million include:* Anthony Co., Streator, Ill., \$4,690,331 for diesel engine, forklift trucks; Hercules Co., \$4,537,763 modification for propellants, explosives and operation and maintenance activities; Firestone Tire and Rubber Co., \$4,231,854 modification for shoe assemblies for tank recovery vehicles; and National Union Electric, \$4,112,500 modification for bomb components and assemblies; Norris Industries, Inc., \$4,068,113 for mine system canisters; Canadian Commercial Corp., \$2,909,535 for helicopter engines and \$1,150,609 for ammunition propellants; Harvey Aluminum, Inc., \$3,973,900 for 20mm target projectiles.

Levinson Steel Co., \$3,860,025 for 105mm projectile metal parts; Fairchild Hiller Corp., \$3,412,836 for H-23 helicopter transmissions; Zeller Corp., \$3,370,932 for 20mm projectile metal parts; Honeywell, Inc., \$3,265,252 modification for M551 fuzes; Western Electric Co., \$3,200,000 for Nike Hercules engineering services; Cessna Aircraft Co., \$3,156,896 and Baifield Industries (Carrollton, Tex.), \$2,950,145 for bombs with dispensers and shipping and storage containers; Standard Container Co., \$2,774,250 for M2A1 ammunition boxes; General Dynamics Corp., \$2,594,312 supplement for AN/GRC-142 radio teletypewriter sets; Northrop-Carolina, Inc., \$2,440,971 for riot hand grenades; and Technical Operations, Inc., \$2,361,400 for 1,190 man-months of scientific and technical effort in support of studies, analysis and evaluations for the Combat Developments Command; Raytheon Co., \$2,222,000 for telephone signal converters and associated parts; Page Communications Engineers, Inc., \$2,054,770 modification for microwave interconnect links; Penland Paper Converting Corp., \$2,046,000 for 105mm containers; Grumman Aircraft Engineering Corp., \$2,007,500 for OV-1C aircraft related data, reports and ground support equipment.

*Contracts under \$2 million are:* Bendix Corp., \$1,971,255 for NB-1 altitude indicators; Pace Corp., \$1,756,785 modification contract for flares; Polaroid Electronics Corp., \$1,666,974 for radio sets; Goodyear Tire and Rubber Co., \$3,012,233 for pneumatic tires and 10,000-gallon, collapsible tank assemblies for petroleum; General Tire and Rubber Co., \$1,346,307 for assembly of 750-pound body parts, and fin assemblies for 1,000-pound bombs; and

Atlantic Research Corp., \$1,634,380 for mine canister parts; General Electric Co., \$1,626,650 for 7.62mm machineguns and components; Studebaker Corp., \$1,620,215 for generator sets; Sikorsky Division of United Aircraft Corp., \$1,617,099 for CH-54A trans-

## Clear Stamp of Champion Goofers . . . Editor Muffs Crediting O'Meara's Army R&D Role

In properly penitent defense, the editor can console himself in the fact that when he goofs the mark of quality is clearly that of a champion. General Andrew P. O'Meara, Commander-in-Chief, U. S. Army Europe, Commander of the Central Army Group, NATO, and CG of the Seventh U.S. Army, might rightfully attest to that:

Inadvertently, but nevertheless inexcusably, the Army R&D Newsmagazine did General O'Meara less than justice in the December 1966 edition. Page 11 carried an article about General Theodore J. Conway's promotion to 4-star rank as Commander-in-Chief, U.S. Strike Command and also of the Middle East, Southern Asia and Africa.

The article pointed proudly to the role of General Conway as the first Director of Army Research when the agency was activated in November 1955. It mentioned that he was the third former Army R&D leader to gain 4-star rank, the others being General Robert J. Wood (USA, Ret.) and General Dwight E. Beach, former Chief of R&D and now Commander-in-Chief, U.S. Army Pacific.

What the article *did not do* was to reflect the thoroughness in research of background materiel for which the editorial staff *likes to pride itself*. Had that been done, General O'Meara's

pioneering role in Army R&D would have been deservedly acknowledged.

Some small plea for pardon, however, appears justified by the rapid compounding of change during the period in which General O'Meara served, leading to establishment of the Office of the Chief of Research and Development, effective Oct. 10, 1955. Lt Gen James M. Gavin, later U.S. Ambassador to France and since then a top-level industrial leader, was the first CRD and General O'Meara was Deputy CRD.

The record shows that General O'Meara was Assistant Deputy Assistant Chief of Staff G-4 (R&D) in 1953. In September 1954, he became Assistant Director of R&D and Assistant Chief of R&D, Office of the Deputy Chief of Staff for Logistics (ODCSLOG). In November 1954, he was assigned as Director of R&D and Chief of R&D, R&D Division, ODCSLOG.

A month later, his title changed to Deputy Chief of R&D, ODCSLOG. On Aug. 1, 1955, he was named Chief of R&D, Office of the Chief of Staff, DA, and on Oct. 10, 1955, became Deputy CRD. On July 15, 1957, he was assigned as CG of the 4th Armored Division.

Now, may the editor hang his head in shame and be forgiven? Not excused!



mission assemblies and main rotor assemblies; and

LTV Electro Systems, Inc., \$1,591,100 modification for development, prototyping and manufacturing of modification kits for an Avionics Retrofit Project; Packard Bell Electronics Corp., \$1,553,000 modification for AN/APM 123 transponder test sets; General Instrument Corp., \$1,500,000 for classified electronic equipment; Farmers' Chemical Associates, Inc., \$1,468,781 modification for support services for manufacture of explosives; Hallicrafters Co., \$1,383,000 for engineering development service test models of AN/ALQ 80 (XE-4) countermeasure set; and

Scoville Manufacturing Co., \$1,350,000 for grenade fuzes; Catalyst Research Corp., \$1,342,671 for power supplies for rocket proximity fuzes; R. C. Can Co. (Hazelwood, Mo.), \$1,305,458 for 105mm ammunition containers; Redmanson Corp. (York, Pa.), \$1,263,298 for air conditioners; Piaseck Aircraft Corp., \$1,252,101 for cable assemblies; Philco Ford Corp., \$1,209,983 for M75 grenade-launcher repair parts; the City of Jacksonville, Fla., \$1,200,000 for a used floating power plant; and

Bulova Watch Co., \$1,120,500 modification for 81mm fuzes; Automatic Electric Co. (North Lake, Ill.), \$1,106,597 for Autovon PABX items; Stone Container Corp., \$1,081,125 for 105mm ammunition containers; United Ammunition Container, Inc., \$1,077,250 for 155mm ammunition containers; and

UMC Industrials, Inc. (Goodyear, Ariz.), \$1,038,960 for smoke grenades; Darragh and Lyda, Inc. (San Antonio, Tex.), \$1,027,201 for construction of a medical laboratory at Fort Sam Houston; Stewart-Warner Corp., \$1,022,958 modification contract for mine fuzes.

### Army Begins Test Operations On Floating Nuclear Power Unit

The U.S. Army 10-million-watt floating nuclear power station, first of its kind in the world, began operating Jan. 25 on a test basis at Fort Belvoir, Va.

Mounted in the hull of a modified World War II Liberty Ship, the *Sturgis*, the complete nuclear power plant can be towed to any port in the world to support military operations or provide electric power to communities hit by peacetime disaster.

The plant was designed for the U.S. Army Corps of Engineers by the Martin Co. The ship is named for the late Lt Gen Samuel D. Sturgis Jr., former Chief of Engineers, who was an early advocate of the development of nuclear power plants for military use.

Nuclear power enables the plant to produce 10 million watts of electricity for one year without refueling, a feat which would require a diesel power plant to use over 160,000 barrels of fuel.

## 16 Executives Serve Free as AMRA Council Advisers

In the role of unpaid consultants, 16 high-ranking industrial and academic leaders participated in the recent third meeting of the U.S. Army Materials Research Agency (AMRA) Council at Watertown, Mass.

The purpose of the council, formed in July 1965, is to advise AMRA research scientists and administrators in accomplishing AMRA's mission of research and development to improve and adapt materials for military weapons and equipment. Involved are metals, ceramics, cermets, graphite and plastics.

Discussion dealt with the effect of electron configuration on the properties of metals; deformation texturing; a study of yielding flow and fracture in metallic materials; correlation of microstructure with mechanical properties of pyrolite graphite; solidification and microsegregation in weld beads of binary alloys; and development of transparent armor.

Industry was represented by Porter R. Wray, general manager, Product and Service Metallurgy, U.S. Steel Corp.; Dr. Henry S. Rothrock, liaison manager, Central Research Department, DuPont de Nemours; Dr. Stephen Jeckovich, director of research, Glass Division, Pittsburgh Plate Glass Co.; Schuyler A. Herres, technical vice president, Titanium Metals Corp. of America; Dr.

Edward E. Reynolds, director of research, Latrobe Steel Co.; and Arnold S. Rustay, vice president and technical director, Wyman-Gordon Co.

Academic leaders who attended the meeting included Prof. Albert G. H. Dietz, Building Engineering and Construction, Massachusetts Institute of Technology; Prof. Daniel C. Drucker, Division of Engineering, Brown University; and Dr. John O. M. Bockris, director, Laboratory for Electro-Chemistry, University of Pennsylvania.

Dean Emeritus John F. McMahon represented Alfred College of Ceramics. Prof. Thomas J. Dolan participated as head of the Department of Theoretical and Applied Mechanics, University of Illinois. Carnegie Tech sent Harold W. Paxton, professor of metallurgical engineering, and Dr. Maurice Morton, director, Institute of Polymer Science, came from the University of Akron, Ohio. Prof. Stanislaw W. Mrozowski, director, Carbon Research Laboratory, University of Buffalo, completed the academic group.

Independent consultants included John J. Chyle of Milwaukee, welding specialist, and Adolph O. Schaefer, Norristown, Pa., metallurgy expert.

**AMONG 16 industrial and academic consultants to the U.S. Army Materials Research Agency (AMRA) Council during recent meeting at Watertown, Mass., were: At left (l. to r.) Professor Thomas J. Dolan, University of Illinois; Professor Harold W. Paxton, Carnegie Institute of Technology; Norman L. Reed, chief of AMRA's Materials Advisory Group; and John J. Chyle, independent consultant of Milwaukee. Lower left (l. to r.) Porter R. Wray, U.S. Steel Corp.; Professor Dolan; and Professor Stanislaw W. Mrozowski, University of Buffalo. Lower right (l. to r.) Dr. Edward S. Reynolds, Latrobe Steel Co.; Dr. John O. M. Bockris, University of Pennsylvania; and Norman Reed.**





## 7 Officers, 3 Civilians Join OCRD Staff

Seven officers and three civilians have been assigned recently to the professional staff of the Office of the Chief of Research and Development, Department of the Army.

The officers are Lt Col Roger W. Baker, Lt Col John W. Lauterbach, Lt Col James F. Workman, Maj George F. Germond, Maj John W. King, Maj James E. McDonnell and Capt Dwight B. Carlile. New civilians are Spence T. Marks, Robert L. Shauer and Miss Dorothy Beck. J. Brian Flesche transferred to a new assignment.

LT COL BAKER, a staff officer in the Medical and Biological Sciences Branch, Life Sciences Division, U.S. Army Research Office (USARO), holds a DVM degree (1957) from Texas Agricultural and Mechanical College and an MS degree (1959) in food technology from the Massachusetts Institute of Technology. He has studied at the Medical Field Service School and taken the Advanced Course at the Army Medical School.



**Lt Col R. W. Baker**

Since 1964, he has been a veterinary staff officer with HQ U.S. Army Medical R&D Command, Office of the Surgeon General, Washington, D.C. He has served as officer in charge of the U.S. Medical Laboratory, Hawaii, and had a tour of duty with the Quartermaster Food and Container Institute, Natick, Mass. Lt Col Baker holds the National Defense Service Medal with cluster and the World War II Victory Medal.

LT COL LAUTERBACH is assigned as a staff officer in the Combat Support Aircraft Branch, Air Mobility Division. Until recently he was in Viet Nam, as commanding officer, 11th Aviation Battalion. From 1963-65 he was with the



**Lt Col J. Lauterbach**

37th Air Transport Battalion, 10th Air Transport Brigade, following duty in the Army Aviation Section, HQ Fourth U.S. Army.

A graduate from the U.S. Military Academy in 1947, he has had key assignments with the Combat Developments Office, U.S. Army Infantry School, Military Assistance Advisory Group in Taiwan, and the HQ Fifth U.S. Army.

Col Lauterbach's military schooling includes Command and General Staff College courses and infantry and flight training. He holds the Air Medal with eight Oak Leaf Clusters and "V" device, the National Defense Service Medal with OLC, the Viet Nam Service Medal, the World War II Victory Medal, and the Army of Occupation Medal (Germany).

LT COL WORKMAN is assigned as a staff officer with the Nike-X and Space Division and will be on temporary duty with the Office of the Joint Chiefs of Staff on the JCS Alternative Strategic Force Applications until May 15.

Col Workman's last assignment was adviser in the social service department of the Psychological Operations Directorate, HQ, Military Advisory Command, Viet Nam. Other assignments have included duty with the Test Office of the Nike Zeus, Fort Bliss, Tex., and as a mathematics instructor at the U.S. Military Academy, from which he graduated in 1950.

Graduated with an MS degree in electrical engineering from the Georgia Institute of Technology in 1961, he has attended the Command and General Staff College, the Special Warfare School, and the Nike Zeus Training Program.

He holds the World War II Victory Medal, Bronze Star, Viet Nam Service Medal, and Viet Nam Campaign Medal.

MAJ GERMOND, Nike-X system officer in the Technical Developments Division, Nike-X System Office, has just completed a year as technical coordinator of Nike-X Project Office, Washington, D.C.

From 1964-65, he studied at the Air Force Command and Staff College, Maxwell Air Force Base, Ala. He has served as an operations officer with the 1st Cavalry Division in Korea, instructor at the Army Artillery and Missile School, Fort Sill, Okla., with the First Guided Missile Brigade at Fort Bliss, Tex., and in Germany as commander of the 73rd Antiaircraft Artillery Battalion.

Maj Germond received a BS degree in mechanical engineering from Texas A&M University in 1952 and an MS degree in public administration from George Washington University in 1965. He has completed the Artillery Offi-

cer's Advanced Course, and holds Certificates of Achievement from the Army Artillery and Missile Center and the First Cavalry Division.

MAJ KING, assigned as staff officer in the Programs and Budget Division, returned recently from Viet Nam where he was chief, Popular Force Motivation Indoctrination Branch. He was an instructor at the Infantry School, Fort Benning, Ga., from 1962 to 1964 and from 1958 to 1961, held command and staff positions with the 20th Infantry, Fort Kobbe, Canal Zone.

Maj King received a BS degree in industrial management from Howard College, Birmingham, Ala., in 1956 and an MS degree in business administration from George Washington University in 1965. He has completed the Army Armor Officer Career Course, the Infantry Officers Career Course, and is a graduate of the Air Command and Staff College.

He holds the Army Commendation Medal with Oak Leaf Clusters, Air Medal, Bronze Star, Combat Infantryman's Badge, and Viet Nam Gallantry Cross with Silver Star.

MAJ McDONNELL, a 1952 graduate of the U.S. Military Academy, is assigned to the Review and Analysis Division. He was with the 1st Battalion, 17th Artillery and I Corps (Gp.) Artillery in Korea for a year prior to his present duty.

Graduated with an MS degree in nuclear engineering from the University of Arizona in 1962, he then served three years as chief, Forward Area Weapons Branch, Missile Systems Test Division, U.S. Army Air Defense Board, Fort Bliss, Tex.

He has completed the Artillery Career Course at Fort Sill, Okla., and has received the Army Commendation Medal.

CAPT CARLILE is the new adjutant and chief of the Administrative Division, U.S. Army Personnel Research Office. His previous assignment in the Dominican Republic was commanding officer of the 524 Personnel Service Co., following duty as chief, Individual Training Branch, John F. Kennedy Center for Special Warfare, Fort Bragg, N.C.

Capt. Carlile received a BA degree from the University of Missouri in 1958 and has completed graduate courses



**Capt. D. B. Carlile**



at the University of Missouri at Kansas City. His decorations include the Armed Forces Expeditionary Medal, National Defense Service Medal and the Army Commendation Medal.

SPENCE MARKS is assigned to the Scientific and Technical Information Division, ARO as a physical sciences administrator in the Systems Research Engineering Branch.



**Spence T. Marks**

Backed by 17 1/2 years of Federal Civil Service experience, all at Aberdeen Proving Ground, Md., he has received awards for invention of a piezo-electric gauge, used in ballistic measurements, and a Commendation Certificate for his contributions to Project HARP.

While employed at the Ballistic Measurements Laboratory, BRL, he authored 22 publications, including one article on Project HARP, and one on an upper atmosphere meteorological study, published in *Ordnance* magazine.

Included in his professional experience are 13 years of teaching at the secondary and university level. He received a BS degree in physics from Gettysburg (Pa.) College and a master's degree in education administration from Temple University.



**Robert L. Schauer**

ROBERT SCHAUER also is a newcomer to the S&TI Division and, like Spence Marks, is assigned to the Systems Research Engineering Branch as a computer systems analyst.

Known as coauthor of 15 technical reports on VLF communications reliability predictions, Schauer served four years active duty with the Navy and was employed nine years at the U.S. Naval Research Laboratory, Washington, D.C. He was graduated from the University in 1960 with a BS degree in physics and mathematics.

MISS BECK, writer-editor on the *Army Research and Development News-magazine*, entered Civil Service through the Management Intern Program. She



**Dorothy E. Beck**

has worked as an editorial assistant for the Social Legislation Information Service and taught high school English and journalism. She has a BA degree in English from Western Maryland College (1964) and will receive an MA degree in journalism from the American University in June.

J. BRIAN FLESCHÉ transferred recently from the Review and Analysis Division to the Research Programs Office, ARO, as a program analyst. He also entered Federal Civil Service through



**J. Brian Flesche**

the Department of the Army Management Intern Program and was a management analyst with the R&A Division for three years. Graduated from the University of Minnesota with a BA degree in sociology, he is doing graduate work in public administration at George Washington University.

## New HumRRO Bibliography Lists 800 Publications

Brief descriptions of more than 800 research reports, journal articles, and professional presentations are listed in a new *Bibliography of Publications* issued by the Human Resources Research Office (HumRRO), George Washington University, Washington, D.C.

The 237-page listing includes all publications of HumRRO during the 15 years it has operated as an Army R&D contract agency in the fields of training, motivation and leadership.

The information is intended primarily for Army human factors R&D personnel and others who use such training research reports.

The volume includes abstracts with many entries and a listing of research results suitable for operational use by the Army, ranging from specific training programs and technical manuals to training items for new equipment.

An author index, a key-word-in-context index, and "AD" numbers indicate items available to qualified organizations through Federal Government distribution centers.

The volume may be obtained at no cost directly from the George Washington University Human Resources Research Office (300 North Washington Street, Alexandria, Va. 22314), the Defense Documentation Center or the Clearinghouse for Federal Scientific and Technical Information of the U.S. Department of Commerce.

\* \* \*

**GROUND RULE FOR LAB WORK:**  
*Experiments must be reproducible;  
they should all fail the same way.*

## Missile Command Laboratory Gets New Deputy Director

Backed by more than 20 years experience in Army missile research and development, Norman L. Comus assumed duties in mid-January as deputy director of the Ground Support Equipment Laboratory, U.S. Army Missile Command, Redstone (Ala.) Arsenal.

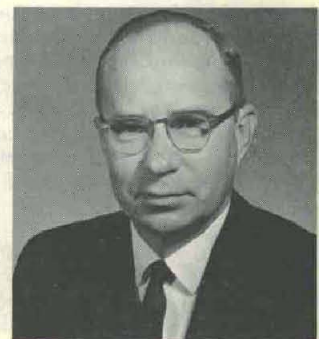
Formerly chief of the GSE Lab's Requirements and Analysis Branch, Comus succeeds W. W. Newman, now chief of the Research and Technology Office, Ground Support Equipment Laboratory.

Since 1951, Comus has been responsible for design, test requirements, and analysis of ground support equipment for Lance, Pershing, Sergeant, LittleJohn, TOW and MAW rocket and missile systems and a variety of aircraft armaments at the Arsenal. He also has been active in many exploratory research and advanced development efforts.

Before joining the Arsenal, he was a charter member of the Rocket Propulsion Division, Chief of Ordnance, the first group to begin development efforts on rockets for Army warfare. Early work was on the bazooka and other small caliber weapons.

Later, he was a design engineer with the Glenn L. Martin Co., where he contributed to the design of the air-to-air Oriole missile, the surface-to-surface Matador and the high altitude Viking missiles.

Comus is a graduate of Purdue University with a BS degree in Mechanical engineering.





# A New Propulsion Age on the Horizon

(Continued from page 2)

power with no more solid material than is found in a 10-cent piece.

The silicon-controlled rectifiers are arranged in a switching matrix, or electrical "black box," and by proper logic commands they perform the tasks of an infinitely variable power transmission. The use of the "black box" with electric motors has opened up a whole new field of technology.

The text books on motor control are being rewritten. One of the ERDL findings, for example, is directly applicable to electric-propulsion systems: The laboratories determined that no significant increase in size is necessary to make electric motors operate over a very wide speed range and a very wide torque range, contrary to the teachings of little more than ten years ago.

No longer to be considered are dual-speed, or pole-changing motors. The "black box" matches the power source at all times to the required motor speed-torque characteristic for a perfect propulsion system.

These findings are being applied to test-bed vehicles which almost have the capability to "think." In fact, the systems do modify a driver's command to save fuel, to keep a wheel from slipping and to apply the correct traction to match the type of surface upon which the vehicle is traveling.

Limitations of control are dependent only on the ingenuity of the military commander in establishing requirements — for example, radio or centralized computer control of a convoy and the cost of the system to implement the requirement. The technology to do these things is here.

On a longer-term basis, ERDL is pioneering in development of the hydrocarbon fuel cell, a more efficient power source for application to electric propulsion systems. Whereas the turbine generator's efficiency at a rated load would be approximately 25 percent, the fuel cell will have an efficiency of conversion approaching 40 percent.

When these efficiencies are applied to the amount of fuel used by a field Army to support all vehicles, it can be seen that the increase in range with a reduction in the logistic burden has a far-reaching impact. In addition, the fuel cell results in a noiseless power plant without noxious exhaust products.

Further savings in fuel energy also are inherent in the fuel cell. It does not "burn" fuel like an internal combustion engine when the vehicle is idling, estimated at about 40 percent of the time, or in standby status to provide power for radar and similar equipment.

The fuel cell is not affected by altitude pressure changes. At 10,000 feet, it does not have to be overrated, as required for internal combustion engines.

The major obstacle to applying a fuel cell to Army vehicles is the fuel-processing equipment required to obtain the hydrogen it needs from the Army's standard hydrocarbon fuels, such as JP4 and CITE. Another problem is cost, since "noble" metals are used for catalysts in this extraction.

Research under way at the Engineer R&D Laboratories shows promise of overcoming both of these difficulties in the near future.

The Laboratories, as well as commercial concerns, are actively pursuing programs to develop high-energy density, quick-charge and quick-discharge electrical storage systems and new high-energy batteries.

From a propulsion-system standpoint, it is expected that considerable savings can be realized by efficiently using the energy available through employment of hybrid systems. The hybrid systems under consideration are gas turbines and fuel cells, fuel cells and batteries, and fuel cells and magnetic-energy storage.

Proportioning of the power in a hybrid source depends upon the duty cycle and the mission of the vehicle. In certain cases, the prime source of power would be the gas turbine, with the energy storage system supplying the boost power. In other cases, the reverse would be true. A requirement for silent operation could modify or reverse the power proportioning situation.

Another reason for considering hybrid systems is the recovery of energy during deceleration of the vehicle by using the drive motors as generators in regenerative braking. In any event, the use of hybrid systems will offer another degree of flexibility.

One interesting finding in applying electric power to propulsion of vehicles is that the power requirement for equivalent vehicle torque is less than conventional internal-combustion engine-driven systems. Enthusiastic proponents have stated that the overall efficiency for an all-electric system is at least three times that of conventional drive.

The stall torque of an electric system can be made very high with zero and low vehicle velocity. This is important, since it is during the initial accelerating periods in the low-speed range that high torque is of greatest value to mobility.

In conventional systems, the torque is a function of engine speed, whereas in the electric system, with the infinitely variable transmission, the engine speed is completely independent of the vehicle and can be operated at maximum torque continuously during the period when high vehicle torque is required.

At other times, the prime mover can be operated at a speed compatible with maximum fuel economy. The only requirement on the power source in an

electrical system is the availability of energy when required.

Test systems are in operation to enable engineers to obtain badly needed data. One such system is a 26,000-pound earthmover using a 375-hp. gas turbine directly connected to a 39,000 r.p.m., 3200 Hertz generator.

The "black boxes" of this test system convert the voltage, current, and frequency of the power source to that required by 30,000 r.p.m. drive motors at each of the four wheels to produce the desired infinitely variable vehicle torque (traction) characteristics.

This system also has the capability, when the vehicle is not in operation, to supply 200 kilowatts of precise power at 50, 60 or 400 Hertz for operation of radar, communications and similar equipment.

Another system under test at the Laboratories has a hydrazine-air fuel cell as the power source. The fuel-cell output at 224 volts is connected to a "black box" and a series direct-current traction motor. The traction motor drives the vehicle through a rear differential. This system is experimental and is being operated to determine the effect of the "black box" control on the fuel cells.

Utilization and control of electrical power from the hydrazine fuel cell will be comparable to the electrical power eventually realized from hydrocarbon fuel cells. Data obtained from this test vehicle will form a base for future development.

The Laboratories are initiating a test and evaluation program on an advanced electrical propulsion system. This system will also use a hydrazine fuel-cell source, but the propulsion system will be the latest that technology can produce.

As part of this program, new vehicle concepts will be considered in conjunction with the Army Tank Automotive Command in order to optimize the future integration of fuel-cell electric-propulsion systems and vehicle design. The new concepts will take advantage of the modular nature of the fuel-cell systems to improve the overall mobility and usefulness of the vehicle.

The overall goal of the Laboratories in this area is threefold. Primarily, it is to develop a technological base for electric propulsion and to determine the best means to exploit this form of energy processing for better performance of the Army's mobility mission coupled with savings in fuel, maintenance and operator training requirements.

In addition, because of the growing demand for electric power by the field Army, ERDL aims to engineer electric-propulsion systems to produce precise electrical power that can be used for supplying power to critical loads to give another degree of freedom for advanced weapons systems.



The Laboratories also plan to incorporate future advances in the overall energy-density of electrical equipment suited to propulsion. Research programs under way at ERDL are using the techniques of cryogenics and superconductivity. Many advances being made in commercial laboratories have been revealed recently in the public press.

As in all advances, there will be splinter developments, such as machine tool control, which will have an impact on the military future and the national economy that is very difficult to predict at this time.

Since the electric propulsion system control is vested in the "black box" power-conditioning element — and this element can be coupled to computers with ease — the future of mobile weapons systems and other advanced systems reads like science fiction. Truly, there is a new propulsion age on the horizon.

### 'Walkie Talkie' Expert Retires

"Jack Hessel Day" recently was observed at the Army Electronics Command, Fort Monmouth, N.J., to honor the retiring communications engineer who directed development of the first Army "walkie talkie."

John Hessel, a World War II colonel, received the Meritorious Civilian Service Award for "design and development of superior communication equipment." He also helped develop the AN-PRC-10 of the Korean War and the AN-PRC-25 transceiver in use in Vietnam today. He completed 36 years of Federal service as an Army officer and civilian.

### ERDL Field Tests Fuel Cells

The U.S. Army Engineer R&D Laboratories, Fort Belvoir, Va., this year, will field-test more than 100 35-pound, 300-watt fuel cells that operate on oxygen taken from the air and hydrazine monohydrate as fuel. The units will be delivered under contract by Monsanto Research Corp.

### ERDL Lets Contract for New Cargo Unloader

Capability of rapidly unloading cargo from ships to lighters for movement to shore, even when the ship is in rough water, is the goal of a contract awarded recently by the U.S. Army Research and Development Laboratories.

The concept calls for suspension of the lighter alongside the ship to keep it above rough water while it is being loaded, by using cables hung from a portable device mounted on the ship's deck with supporting arms extended to water level.

Linked to the concept is a new cargo consolidation system designed for rapid release of multiple loads from the ship's hold into the lighter.

Being developed concurrently and scheduled for delivery late this year, the handling system is expected to offer more stability and maneuverability over the forklift and other means of positioning cargo.

When testing begins, performance data from the system will be fed into a computer to validate efficiency of the innovations on Logistics-Over-the-Shore (LOTS) operations.

Research and development of the system are being done under contract by Dortech, Inc., Stamford, Conn., with Drexel Dynamics Corp., Horsham, Pa., fabricating the device.

## \$43 Million Goes to RDT&E Construction Jobs

Construction projects involving expenditure of about \$43 million at 14 installations where Army research, development, testing and evaluation activities are conducted were authorized in a recent decision.

Secretary of Defense Robert S. McNamara rescinded a 1965 order deferring award of military construction projects totaling \$564 million.

Fort Detrick, Md., will get more than one-fifth of the total expenditure at facilities where RDT&E activities are in progress. A medical biological research laboratory (Phase I) will be built at a cost of \$9,254,000.

Aberdeen Proving Ground, Md., will spend \$2,881 million on an alternate headquarters building.

Next in line of R&D importance is a laboratory services support building at the U.S. Army Natick Laboratories that will cost \$1,371 million. Watervliet (N.Y.) Arsenal will spend \$1,713 million for improvements to the sewer system.

Fort Belvoir, Va., home of the U.S. Army Engineer R&D Laboratories, will benefit from four projects: addition to hospital, \$1,619 million; bachelor officers quarters, \$991,000; EM bar-

racks with mess, \$962,000; air conditioning of Humphrey Hall, \$137,000.

Other projects are: Fort Sill, Okla., \$2.187 million for a gymnasium, POL facility, administration building and barracks, and officers field ration mess; Fort Knox, Ky., two tactical shops and facilities, gymnasium, bachelor officers quarters, and EM barracks \$17,038 million; and

Cold Regions Research and Engineering Laboratories, Hanover, N.H., service support building, \$334,000; Fort Monmouth, N.J., HQ of the Electronics Command, \$586,000 for bachelor officers quarters; Dugway (Utah) Proving Ground, commissary, \$137,000; Panama Canal Zone, emergency power supply at Fort Clayton, \$387,000, and bachelor officers quarters, Fort Kobbe, \$343,000;

Kwajalein Atoll, super cinetheodolite facility, \$440,000, and refrigerated warehouse, \$398,000; Fort Greely, Alaska, \$580,000 for sewer plant addition; Fort Richardson, Alaska, \$368,000 for firing range facilities; Rock Island (Ill.) Arsenal, \$826,000 for remodeling a building for administrative use, paving and a guard house; Fort Huachuca, Ariz., \$320,000 for officers quarters.

## General Johnson Tells Why We Fight in Vietnam

U.S. Army Chief of Staff General Harold K. Johnson answered the question of why Free World forces are fighting in Vietnam in an address to Florida Southern College Students, Jan. 19, in the Faith and Life Convocation Series. Brief excerpts follow:

"... The Army is and will continue to be the basic military force around which this global effort to defend free men is built. . . . I am convinced that there is no more important vocation or profession than serving in the defense of the Nation—not just any nation, but a nation that is prepared to provide the dignity to man that God intended—our Nation.

"... Today's Army, your Army, is the conviction of Capt. Spruill, who wrote some inspiring lines home before he sacrificed his life. In a letter to his wife he said: 'There is no backing out of Vietnam, for it will follow us everywhere we go. We have drawn the line here and the America we all know and love best is not one to back away....'

"Your Army is a brigade of soldiers who stood guard in the fertile Tuy Hoa Valley while the local farmers harvested 30,000 metric tons of rice.

"Your Army is a unit medical officer who, during a security sweep into a Vietnamese village, holds 'sick call' for women and children who have not seen a doctor for months—even years.

"Your Army is an Engineer battalion which erects schools, churches and chapels for a people who have neither the skill nor the materials to do it themselves....

"To do this—to aspire to all these challenges—we must fight for a flame of light wherever freedom flickers. We must light candles of faith and hope and understanding wherever we go."







**OUTSTANDING CIVILIAN SERVICE.** In honor of 10 years service as director of a group organized for Special Research in Numerical Analysis (SRINA), Dr. Francis J. Murray recently was awarded the Outstanding Civilian Service Medal.

The SRINA staff at Duke University, Durham, N. C., is one of several agencies doing research and consultation on mathematically oriented problems for Army installations, without cost to them, under an Army-wide contract. SRINA services, like those of the Mathematics Research Center, U. S. Army, on the University of Wisconsin campus, are available upon request from any Army unit.

Among its accomplishments, SRINA has calculated the trajectory of an election in a specific magnetic field for Redstone (Ala.) Arsenal and provided logical structure of a data processing system for the administrative control of the research program for the U. S. Army Medical Research and Development Command (USAMRDC).

SRINA also has done logical analyses of war game programing and developed modern theories for large systems of equations.

Dr. Murray is on the faculty of Duke University. Before establishing SRINA, he was chairman of the Applied Mathematics Committee at Columbia University.

A Noted authority in the fields of differential equations, numerical analysis, and computer utilization, Dr. Murray has published three textbooks and more than 30 professional research papers.

**LEGION OF MERIT.** Lt Col John W. Lauterbach, who recently joined the Office of the Chief of Research and Development, Department of the Army, as a staff officer in the Air Mobility Division, is the recipient of two medals for services in Viet Nam.

He received the Legion of Merit for performance as commanding officer of the 11th Aviation Battalion, where he "displayed such a high degree of leadership and initiative that his battalion assumed its combat operational mission immediately upon arrival in Viet Nam."

The Eighth Oak Leaf Cluster to the Air Medal was awarded for "distinguishing himself by meritorious achievement while participating in more than 25 aerial missions in support of combat ground forces."



**CHIEF OF R&D Lt Gen A. W. Betts presents Outstanding Service Medal to Dr. Francis J. Murray for 10 years service as director of Special Research in Numerical Analysis, Duke University.**

Col Lauterbach also was instrumental in establishing the defense posture of Phu Loi Airfield, the construction of battalion headquarters, living and messing facilities, and the ultimate development of a pacification and self-help program for the local Vietnamese.

Col William M. Glasgow, Jr., nominated for rank of brigadier general and assigned as assistant commandant of the U. S. Army Engineer School, Fort Belvoir, Va., recently received an Oak Leaf Cluster to the Legion of Merit for service for two years as commanding officer of the 1st Infantry Division Support Command, and Chief of Staff for the same Division. The citation states:

"Largely due to his superb leadership and guidance, the 1st Infantry Division staged and deployed to forward bases in Viet Cong-dominated areas of Viet Nam without suffering a single casualty."

Col Glasgow was cited also for participating in numerous operations against the Viet Cong and for instituting "unique administrative and operational procedures" which permitted the Division to operate with immediate effectiveness.

Lt Col Charles G. Allison, former chief of the Management Division, Office of the Comptroller, Combat Developments Command, Fort Belvoir, received the Legion of Merit for demonstrating "rare foresight, accurate judgment and comprehensive understanding of organization, plans, policies, and procedures essential to the accomplishment of the Command" for the past two years. He has been assigned to the 193rd Infantry Brigade in Panama.

Lt. Col Lester C. Oanning, Sr., received the Legion of Merit for his work at the Stock Control Center, Presidio of San Francisco, prior to his retirement. He was cited for professional skill and resourcefulness in developing a multitude of various systems and procedures.

**THE BRONZE STAR** medal for "outstanding meritorious service" against

the enemy in Viet Nam was presented to S/Sgt Linsey H. Caison, formerly of the 1st Infantry Division and now with the Nuclear Power Field Office (NPFO), Fort Belvoir.

**ARMY COMMENDATION MEDAL.** Maj Warner D. McClure, MSC, of the U. S. Army Medical Research and Development Command (USAMRDC), received the Army Commendation Medal for his previous work at the Tripler Army Medical Center, where he was Deputy Comptroller and Chief, Management Assistance Branch, Office of the Comptroller, for two years.

Capt Duane E. Hilmas, VC, New chief of the Veterinary Medical Research Branch, Research Division, USAMRDC, received the Army Commendation Medal for distinguishing himself while serving as scientific assistant to the Associate Director for Food Radiation, Food Division, U. S. Army Natick (Mass.) Laboratories.

Commendation Medals also were awarded at Walter Reed Army Medical Center to Lt Col Nanette G. Keegan, chief, Physical Therapy Section, Walter Reed General Hospital (WRGH); 1st Lt Alan R. Giever, chief, Records and Reports Section, Personnel Branch; 1st Lt Randolph Manning, chief of Education and Training; and Sp6 George L. Shearer, Department of Surgery.

**THE ANDREW CRAIGIE AWARD** for distinguished service in the field of pharmacy in the Armed Forces Medical Service was presented to Col Jesse N. Butler, deputy director, Medical Materiel, Defense Personnel Support Center, Phila., Pa.

The award honors Col Butler's work in improving the quality and procedures of pharmaceutical products procured for the Department of Defense.

Established in 1959 by the Lederle Laboratories, N.Y., the award honors the memory of Andrew Craigie, first Apothecary General of General Washington's military forces during the Revolutionary War.

**EXECUTIVE AWARDS.** The last Army Missile Support Command's annual executive awards have been presented. Sherman Clay, chief, Maintenance Support Division, received the Senior Executive Award. Thomas Summers, industrial engineering technician for the Post Engineer, won the Junior Executive Award.

Honorable mention certificates went to Oscar Russell, assistant Post Engineer, and John Tyson, chief of the Reproduction Division. Cited also in the junior executive category were Charles Brown, of the Metrology Center, and Charles McMurray, Office of the Post Engineer.

The Support Command recently was redesignated the Arsenal Support Operations Directorate. Henceforth its staff will compete for the Army Missile



Command awards rather than for their own awards.

**SCIENTIFIC ACHIEVEMENT AWARD.** William T. Wyatt, Jr., winner of the fifth annual Scientific Achievement Award of the Belvoir Branch of the Scientific Research Society of America, is at 24 the youngest recipient of the honor.

A physicist with the U.S. Army Mobility Equipment Command's Engineer Research and Development Laboratories (ERDL), Fort Belvoir, he was recognized for his studies and investigations of nuclear effects. Cited particularly was his work "Internal EMP Strength and Time Dependence for an Idealized Problem." He is employed in the Combat Research Laboratory.

**COMMENDATION CERTIFICATES.** Office of the Chief of Research and Development personnel who recently received Commendation Certificates for outstanding performance of duties are Austin L. Duncan, Albert T. Finnell and Edith L. Birkle, Programs and Budget Division; Ruth L. Selmsler, Combat Material Division; and Sandra J. Whitson, Special Warfare Division.

ERDL personnel who received Commendation Certificates include Alonzo J. Vrooman, chief, Mechanical Engineering Division; Ben L. St. Jermaine, chief, Equipment Modification and Repairs Division; Harold H. Gillespie, chief, Production Engineering Division; Kenneth E. Hasle, chief, Operations Branch; and Alfred A. Chabert, chief, Facilities Planning and Maintenance Division.

Other recent recipients of Commendation Certificates at ERDL are Kennedy K. Harris, chief, Military Engineering Division; Edwin J. Dodd, Development Fabrication Division; Frederick DeFilippis, Military Engineering Division;

Herman Jacob, Administrative Services Division; and James A. Queen, Facilities Planning and Services Division.

John R. Beall, chief, Engineering Branch, Medical R&D Command, also received a Commendation Certificate.

**MISCELLANEOUS AWARDS.** Dr. Charles Colburn, head of the Physical Chemistry Group at Rohm and Haas Co., was awarded a Certificate of Achievement for Patriotic Civilian Service. The contract scientist was cited for R&D efforts toward achieving significant increases in propellant performance for the Army Missile Command at Redstone (Ala.) Arsenal.

Two ERDL inventors recently received cash awards. Manfred Gale developed a passive perimeter intrusion detection system using natural thermal radiation. Kenneth L. Treiber, Petroleum Equipment Laboratory, invented a fuel transport device.

Special Act and Service Awards to ERDL personnel honored Dr. James I. Bryant, Dr. Johann A. Joebstl, Miss Saranne Dix and Howard G. Lasser. S. M. Flippo and Frank J. Gillispie received awards for cost-saving suggestions.

Morris L. Budnick, chief, Standardization Branch, Air Drop Engineering Division, U.S. Army Natick Laboratories, received a Special Act Award for a value engineering study which saved an estimated \$47,000 in procurement costs.

The Institute of Electrical and Electronics Engineers recently elected as Fellows John J. Egli, chief, Electromagnetic Environment Division, Research and Development Directorate, and Frank A. Brand, chief, Microwave and Quantum Electronics Branch, Electronic Components Laboratory.

A. Radford Baker, Procurement and Production Directorate, Edgewood (Md.) Arsenal, received a cash award for a

suggestion dealing with an engineering order and contract modification that saved the Government an estimated \$24,000.

An Army Certificate of Achievement was presented to Chauncey W. Karstens, an authority on pipeline construction and fuel handling, upon his retirement from ERDL. He was chief of the Petroleum Equipment Laboratory.

Socrates P. Sotir, Army Materials Research Agency, Watertown, Mass., received an Army Commendation for his "excellent performance in preparation of a fire-retardant foam plastic specification for use in Army aircraft."

For their work in preparing an exhibit in anesthesiology, Certificates of Appreciation were presented to Col John A. Jenicek and Lt Col Max K. Mendenhall, chief and assistant chief, respectively, of the Anesthesia and Operative Service, Walter Reed General Hospital. Maj James A. Meyer, chief, Department of Anesthesia and Resuscitation, Walter Reed Army Institute of Research, worked with them and received the same honor.

The Nuclear Power Field Office, Fort Belvoir, was presented a Certificate of Merit for accident-free operation of the SM-1 Nuclear Power Plant during FY 1966.

## CSC Gives Pay Raises To Scientists, Engineers

Salary raises for 50,000 federal engineers, architects and scientists in grades GS-9 through GS-12 have been approved by the Civil Service Commission (CSC).

Increases will range from \$379 to \$945 yearly and in most cases were effective Feb. 12. The CSC acted under authority granted by Congress to adjust salary rates to meet competition of private employers.

The new rate covers all professional engineering and architecture positions in the middle grades. Physical science jobs affected include physicists, geophysicists, chemists, astronomers, meteorologists, oceanographers, actuaries, mathematicians and mathematical statisticians.

Patent advisers, classifiers and examiners are benefited as are those holding positions in health physics, hydrology, metallurgy, geodesy, industrial hygiene, forest products technology, photographic technology, and the physical science subseries of operations research.

New pay ranges will be GS-9, \$9,001 to \$11,350 (formerly \$8,479 to \$10,828); GS-10, \$9,573 to \$12,165 (formerly \$8,709 to \$11,301); GS-11, \$10,481 to \$13,316 (formerly \$9,536 to \$12,371), and GS-12, \$11,306 to \$14,717 (formerly \$10,927 to \$14,338).

## Two at WRAMC Earn Top Civilian Award

Presentation of the Decoration for Exceptional Civilian Service (ECS), the Army's highest civilian award, recently honored a surgeon and a pathologist at Walter Reed Army Medical Center, Washington, D. C.

Recipient Dr. Daniel J. Abramson, for more than 16 years chief of the Surgery Clinic, Department of Hospital Clinics, Walter Reed General Hospital (WRGH), is noted for research on gastrointestinal diseases.

He received his BS and MD degrees at the University of Baltimore. His accomplishments include developing a method for dissolving bladder stones in humans with acidifying solutions and developing a postoperative dressing which can be changed without removing the adhesive.

DR. FATHOLIAH K. MOSTIFI, ECS award winner, is chief, General and Special Pathology Division, Armed Forces Institute of Pathology, Washing-

ton, D. C., where he has been on the staff since 1948. He was cited for exceptional service and research in the field of genitourinary pathology.

As secretary-treasurer of the International Academy of Pathology for 15 years, he developed a worldwide post graduate education program in pathology.

He was instrumental in establishing at AFIP the World Health Organization's Reference Center for pathology of the genitourinary tract, and was one of three founders of the Joint Committee on Aviation Pathology. The committee investigated the human factors of aircraft accidents and recommended safety measures and design changes in air vehicles.

Dr. Mostofi has authored more than 40 professional publications and is on the faculty of the George Washington University Medical Center and the Johns Hopkins University Medical school.



# Report Discusses Protective Devices Against Head, Neck Injuries

Automobile and aircraft manufacturers and insurance companies may have prime interest in a new report published under an Army contract, titled "A Study of Military Implications of Protective Devices Designed to Prevent or Ameliorate Head and Neck Injuries."

Although directed to an increasingly acute problem of what can and should be done to minimize injuries in aircraft crashes, with emphasis on the current massive use of helicopters in Southeast Asia, the report deals with an over-all problem of vast significance.

Prepared by the Life Sciences Research Office, Federation of American Societies for Experimental Biology, Washington, D. C., the report is a summary of an intensive discussion of the over-all problem by a multidisciplinary ad hoc group of consultants.

Under the auspices of the Life Sciences Division Office of the Chief of Research and Development, the group of 75 representatives of the Army, Air Force and Navy convened Mar. 2-4, 1966, at the U.S. Army Research Office. Participants included many scientists and engineers distinguished for their work on head and neck injuries and protective devices.

In addition to the discussions and conclusions at that meeting, the report includes complementary background material from other sources. Considerable information was extracted by special permission from another summary, titled "Head Injury," published by J. B. Lipincott Co., on views and findings of a conference in February 1966.

The report is not intended to represent a comprehensive review of the scientific aspects of head and neck injuries. Rather, it directs attention to additional research which is urgently needed, and the

technological aspects of helmets and helmet assemblies related to protection and maintenance of performance of aircrewmembers in military aircraft.

Magnitude of the over-all problem of head and neck injuries in the United States is pointed out by statistics from the National Safety Council, showing 10,200,000 disabling injuries and more than 100,000 fatalities in 1964. Brain injury was the cause of death in 70 percent of the fatal motor vehicle accidents, and the head was involved in more than two-thirds of the injuries.

"Data from medical records of Aviation Safety Engineering Research since 1952," the report states, "showed 50 percent of civilian and military occupants of nonjet, fixed-wing aircraft and helicopters suffered head injuries in accidents considered potentially survivable."

Collaborative studies by engineers, physical and biological scientists, and clinicians are increasing knowledge of the mechanisms of damage in whiplash and in other types of injuries caused by impact, the report states, as related to design of the vehicle and the use of protective devices.

Studies by other groups are seeking a truly protective helmet for use in sports in which head injuries are a hazard. Results of these investigations are considered important and applicable, in part, to solution of problems of head and neck injuries among military aircrewmembers.

In summarizing the present status of research on mechanisms of head and neck injuries, the report cites the many and diverse complexities of the problem of accurately interpreting and effectively disseminating research findings, in mutually definitive terminol-

ogy; for collaborative programs of interdisciplinary investigators.

"This difficulty," the report notes, "raises the question of whether or not sufficient attention has been given to the public dissemination of information on the importance of research on head and neck injuries . . . their prevention . . . and progress reports on technical developments and on advances toward clearly described goals."

With respect to military aircraft and the problem of "man-machine compatibility," the report suggests the advantages gained by building protective devices into the aircraft to reduce the weight and complexity of the protective helmet assembly for the wearer.

The protective helmet, as viewed by participants in the tri-service conference in March 1966, would provide ballistic and crash protection to crewmen without impairing their alertness and physical efficiency in flight.

Further, the helmet would give comfort in terms of cooling and noise attenuation; compatibility with oxygen and gas masks, sun visor and voice communications equipment; and eye protection against nuclear weapons flash blindness. It also would serve for camouflage and a built-in capability of retention in crashes.

Among recommendations in the report are increased research on the pathophysiological aspects of head and neck injuries; design studies directed toward the ideal helmet; investigations of the role of aircraft design as related to head and neck injuries, and systematic recording and communication of data on crash injuries.

Copies of the report are available free from the Defense Documentation Center, Cameron Station, Va., or from the Life Sciences Division, Army Research Office, 3045 Columbia Pike, Arlington, Va. 22204.



**NEWCOMER** to the U.S. Army Special Forces inventory is the "Aircat," an airplane-engine-powered airboat. The 180-h.p. engine can propel a crew of two and five armed infantrymen across water and swamp grass at speeds up to 48 m.p.h. A 30-caliber machinegun is mounted on the bow.

## Hightower Named Acting Manager Of MICOM Hawk Project Office

Lonnie N. Hightower, Redstone (Ala.) Arsenal's first recipient of the Junior Executive Award in 1960, has been named acting project manager of the Hawk Project Office, Army Missile Command.

Employed at the Arsenal since 1951, he has been associated with the Hawk Project since 1960. In 1965, he was runner-up for the Missile Command's Senior Executive Award.

Hightower served with the U.S. Navy during World War II in both the north and south Pacific areas, the South China Sea, and the Yellow Sea. He was graduated in 1950 from Southern Technical Institute, Atlanta, with an Associate of Science degree in industrial technology.