ARMY RESEARCH AND DEVELOPMENT

MONTHLY NEWSMAGAZINE OF THE OFFICE OF THE CHIEF, RESEARCH AND DEVELOPMENT
Vol. 12, No. 4 • July-Aug. 1971 • HQ DEPARTMENT OF THE ARMY • Washington, D.C.

Joint Technical Staff Formulates DoD Food R&D Program Plans

Department of Defense Food Research and Development Program objectives announced recently for FY 1972 reflect, for the first time, joint Army, Navy, Air Force and Marine Corps participation in formulating the plan.

Sole responsibility for basic and applied research, as well as development, testing and engineering on food and related packaging, service equipment and systems analysis studies, is assigned to the Army Natick (Mass.) Laboratories. NLABS assumed this responsibility in mid-1969.

During a typical day at NLABS in pursuance of objectives of the DoD Food R&D Program, senior representatives of the Army, Navy, Air Force and Marine Corps—known as the Joint Technical Staff—work closely with the NLABS staff in execution of tasks involved in the program.

(Continued on page 8)

ISO Restructuring Keyed to User Requirements As Data Management Activity for Chief of R&D

The Chief of Research and Development has a newly structured Information Systems Office (ISO), supported by the U.S. Army Research and Development Information Systems Office (ARDISO), a Class II activity with a 4-divisional organization.

Aimed at improved information support services, the new structure is keyed to an increasing need for more effective scientific, technical and management information in support of the Army's research, development, test and evaluation program.

The restructured activity, it was explained, is in better position to satisfy (RDT&E) program management information requirements; also, the increased requirements for more effective distribution of scientific and technical information throughout the RDT&E community.

The realignment is designed to provide for improved transfer of research and technology information generated by the Army to higher executive echelons, the Congress, industry and the general public required under recent Congressional and Executive directives.,

(Continued on page 3)

Featured in This Issue . . .

BESRL Studies Internal Responses to Augment Human Performance ..... p. 13
U.S., Canada Review Development-Sharing Program at R&D Meeting ..... p. 16
R&D Program Offers Advancement Opportunities to Career Officers ..... p. 20
Army Atomic Energy Officer Program Actions Advance Membership ..... p. 22
HumRRO Reviews 20 Years of Progress in Training, Education R&D ..... p. 36
Reserve Officers Symposium Focuses on Role of Executive in R&D ..... p. 45
WRAIR'S Dr. Hahn Defends Army Medical Research Essentiality ..... p. 58

Call for ASC Technical Papers Slates Oct. 18 for Summaries

Calls for technical papers to be presented at the 1972 U.S. Army Science Conference, June 20–23, at the U.S. Military Academy, West Point, N.Y., have been sent to Army in-house laboratory and other R&D activities. Oct. 18 is the cut-off date for submission of narrative summaries.

Summaries will be reviewed by the major commands prior to submission to the Army Science Conference Advisory Group that will select 100 of the papers for presentation. Fifteen supplemental papers will be selected for presentation in the event that substitutions are necessary. Normally 550 to 600 summaries are considered by the ASCAG.

Deputy and Scientific Director of Army Research Dr. Richard A. Weiss is chairman of the ASCAG. Members are Dr. Gilford G. Quarles, chief scientific adviser, U.S. Army Corps of Engineers (OCE), with Robert F. Jackson as alternate; and

Chief Scientist Dr. Craig M. Crenshaw of the Army Materiel Command

(Continued on page 3)

R&D Leaders Break Ground for HDL Complex

Movement of shovelfuls of dirt by numerous dignitaries signified recently the start of a 3-phase, 3-year multimillion-dollar construction program necessitated by the continuing growth of the U.S. Army's Harry Diamond Laboratories, established in 1953 in Washington, D.C.

Assistant Secretary of the Army (R&D) Robert L. Johnson, Army Director of Research Brig Gen George M. Snead Jr., representing Chief of Research and Development Lt Gen William C. Gribble Jr., and Army Materiel Command Deputy for Labo-

(Continued on page 6)

PAST AND PRESENT commanding officers and technical directors of the Harry Diamond Laboratories shown at recent ground-breaking for future home of the laboratories include (from left) Billy M. Horton, technical director since 1962; Wilbur S. Hinman, Jr., first technical director (1953–62) and former Deputy Assistant Secretary of the Army (R&D); Col John A. Ulrich (1953–59); Col Robert W. McEvoy (1959–63); Col Milton S. Hochmuth (1963–67); Maj Gen Vincent H. Ellis (May–Oct., 1967); Lt Col Peter Hexner (1968–70); and Col David W. Einsel Jr., present CO. Col Leslie G. Callahan, 1967–68 CO, was absent.

Army R&D Newsmagazine

Vol. 12, No. 4 • July-Aug. 1971

Editor ----------Clarence T. Smith
Associate Editor-----George J. Makuta

Published monthly by the Information Systems Office of the Chief of Research and Development, Department of the Army, Washington, D.C. 20310, in coordination with the Technical and Industrial Liaison Team, OCRD. Grateful acknowledgment is made for the valuable assistance of Information Offices within the U.S. Army Materiel Command, U.S. Continental Army Command, Office of the Chief of Engineers, and Office of The Surgeon General. Use of funds for printing of this publication has been approved by Headquarters, Department of the Army, May 1, 1970.

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.

Picture Credits: Unless otherwise indicated, all illustrations are by the U.S. Army.

Submission of Material: All articles submitted for publication must be channeled through the technical liaison or public information officer at installation or command level.

By-lined Articles: Primary responsibility for opinions of by-lined authors rests with them; their views do not necessarily reflect the official policy or position of the Department of the Army.

DISTRIBUTION is based on requirements submitted on DA Form 12-4. Army agency requirements must be mailed to the U.S. Army AG Publications Center, 2800 Eastern Boulevard, Baltimore, Md. 21220.

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

CHANGES OF ADDRESS for AE and R&D Officer Program enrollees should be addressed to: TAGO Distribution & Dispatch Branch, Room 1B928, Pentagon, Washington, D.C. 20310. R&D Mobilization Designees should contact the CG, U.S. Army Reserve Components Personnel & Administration Center, St. Louis, Mo. 63132.

OTHER GOVERNMENT AGENCIES' requirements should be submitted directly to the Information Systems Office, OCRD, Department of the Army, Washington, D.C. 20310, ATTN: Publications Branch, Technical Data 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.

Maj Gen Sammet Outlines Executive Role in R&D

Deputy Chief of Research and Development Maj Gen George Sammet Jr. is scheduled to present one of the major addresses to the U.S. Army Reserve R&D Symposium at Fredericksburg, Va., Aug. 26—which normally would be too late to include in this edition. Since the address was cleared by Department of Defense Security Review just as copy was being sent to the printer, and since the message is important to the Army R&D community at large in its counseling and challenges to executives, the complete text follows.

* * *

When Col Humphreys invited me to talk tonight, I readily accepted. I enjoy getting out and talking with groups such as yours, for I find it is very much a 2-way street. From you I pick up ideas, attitudes and prevailing public climates that do not always enter the Pentagon doors. Hopefully, you may find some of my comments new and interesting.

So, tonight let me pose to you a few of my thoughts on the role of the executive in tomorrow's R&D. Then, if you care to when I'm through, I'll be glad to answer any questions or even debate with you for a few minutes over the views I have expressed.

Let me begin by saying that since we are going to be talking about the future, which covers everything from tomorrow on, let's take a look at the probable climate within which tomorrow's R&D executive will have to operate.

First, what do I see as the future attitudes of the Congress as they will impact on tomorrow's manager? I believe that Congress will continue to look at R&D with a very critical eye.

Times have changed drastically; R&D is no longer a sacred cow. We will be facing a continuing struggle to maintain adequate levels of R&D, as competition for the tax dollar grows.

We even see the Congress getting into the decision-making process, through the requirement that they be furnished reports on certain specified selected projects—the so-called selected acquisition reports (SARS).

Through these reports, Congress watches the progress of major programs and particularly notes cost overruns and schedule slippages. No longer does Congress learn about problems as a fait accompli. Congressmen now have a ringside seat and are prepared to assist in the demise of the stumbling performer.

Yesteryear, we were given a free hand to do research to gain knowledge; today, the word is relevancy or relatability.

Congress expects us to act like businessmen. They want a return for their investment and they want to see the prospect of a return before they invest. All of this says that we will not be able, politically, to endure costly mistakes.

They expect us to be right the first time—and every time. Sometimes we rationalize our mistakes by calling attention to failures in industry—like the Booz-Allen study which says only one new idea out of 58 pays off, inferring the other 57 are failures—or to the conference board findings that 40 percent of new products are failures.

These are erroneous comparisons. Industry failures generally stem from inadequate market research or over-estimating potential sales. Defense R&D failures generally stem from over-estimating our ability to push technology, from inadequate cost analysis, or from an inadequate determination of requirements.

Not only is defense R&D done in a "fishbowl," but many of the programs involve large dollar expenditures. Thus Congress is extremely reluctant to permit us to make mistakes.

For example, in the past 27 years, the Army has cancelled 17 major R&D projects at a cost of $580 million. The Navy dropped 29 at a cost of $2.3 billion, and the Air Force cancelled 25 projects upon which some $7.7 billion had been spent.

The attitude of the public in general may be somewhat less than enthusiastic, since their attitude will be tempered by (1) natural resistance, except in rare periods of national crisis, to large military expenditure, (2) what they read in the press (unfortunately, boo-boos seem to make the best news stories) and (3) a lack of understanding in depth of the inherent problems of R&D, the inherent risks and frequent long lead time.

What do I see as the future climate in the Office of the Secretary of Defense? I believe the best answer to this is to paraphrase some of Deputy

(Continued on page 48)

Information Systems Office Keys Restructuring to User Needs

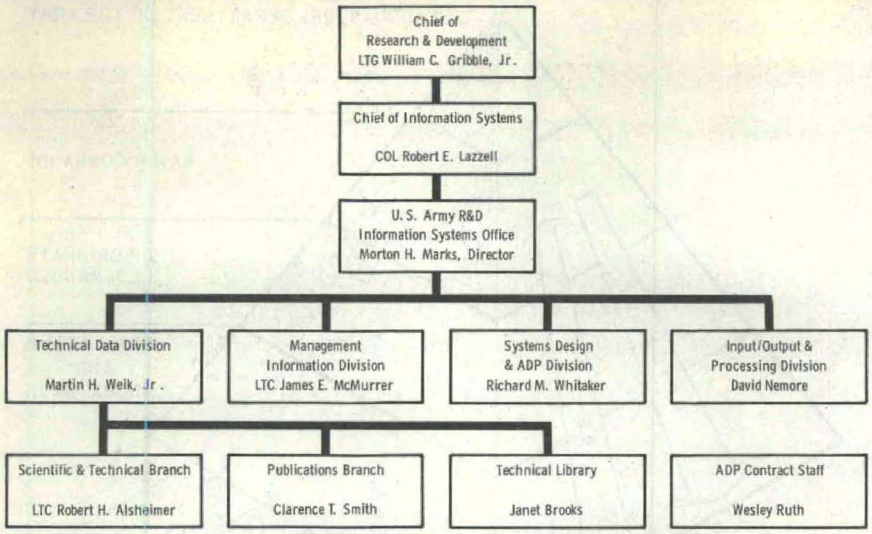


Fig. 1. ARDISO Organizational Structure

(Continued from page 1)

The ARDISO is collocated with other Army agencies in the Highland Building, 3045 Columbia Pike, Arlington, Va. 22204.

MISSION RESPONSIBILITY. The ISO chief, Col Robert E. Lazzell, with Morton H. Marks as deputy and director of the ARDISO, is assigned the functions of:

- Operating and maintaining the Army Research and Development Information System (ARDIS).
- Advising the CRD on information systems and automatic data processing (ADP) applications.
- Serving as Army Director of Technical Information.
- Planning, decision modeling and simulation in support of management planning and control functions.
- Designing and developing automated systems for planning and programing research, development, test and evaluation (RDT&E).
- Determining Department of Army and higher-level information requirements.
- Providing information reporting guidance to RDT&E activities.
- Providing liaison to the director of Management Information Systems, Office of the Assistant Vice Chief of Staff, Department of the Army.
- Providing liaison with Defense Director of Technical Information.
- Supervising operations of the ARDISO.
- Publishing the *U.S. Army Research and Development Monthly Newsmagazine.*
- Providing technical staff supervision of supporting RDT&E projects in chemical and engineering data, and in the library, computer and information sciences.
- Coordinating scientific and technical conferences and symposia.

Briefings presented recently to top-ranking Army officials on the ISO and its Class II ARDISO current status, ongoing projects, program planning, and the changes being effected under the divisional restructuring, reflected that substantial progress is being made in performing these cited functions.

ORGANIZATIONAL STRUCTURE. The ARDISO is divided into four divisions (Figure 1) to be more responsive in:

- Complying with guidance from the Office of the Secretary of the Army requiring that the Army develop in-house capabilities for handling its management information. (For example, the computer support for management information is now being provided by the U.S. Army Management Systems Support Agency, USAMSSA.)
- Effectively applying a more functional approach to the design, development, operation and maintenance of the Army Research and Development Information System (ARDIS); also, more specifically, handling both scientific and technical information and management information on a separate, distinct but interrelated basis.
- Facilitating the execution of several new functions earlier listed—providing more direct interface with the Chief and the Deputy Chief of R&D, including satisfying their management information requirements; and supporting remote data terminal operations in the Office of the Chief of Research and Development to improve information availability for more effective RDT&E management.
- Providing the CRD and DCRD with management information and the best possible scientific, technical and management information service for all echelons of Army R&D.
- Providing better visibility for more effective management of data services response, system design and development, and operational aspects, information gathering, and planning and policy determination. (Separation of these functions was not achievable with the earlier 2-division structure.)
- Exercising General Staff supervision of the Department of the Army

(Continued on page 4)

Call for ASC Technical Papers Slates Oct. 18 for Summaries

(Continued from page 1)

(AMC), and his deputy, Dr. Gordon L. Bushey, alternate; Col Dale E. Wycoff, MSC, associate director for Research Management, Walter Reed Army Institute of Research, Office of the Surgeon General (OTSG), and William R. Beisel, MD, as alternate.

Lt Col William T. King, Research Technology Division, U.S. Army Research Office, OCRD, is serving as ASC project officer and executive secretary of the Advisory Group.

Prestigious recognition will be given to the best paper presented at the 1972 conference in the form of the Dr. Paul Allman Siple Medallion, initiated in 1970 to memorialize the U.S. Army world-famed cold regions explorer and scientific adviser.

Six members of a Picatinny Arsenal team of researchers each received a Siple Memorial Medallion and shared a $1,000 honorarium. The paper, "Structure and Lattice Dynamics of Metal Azides and Their Relationship to Stability," was coauthored by Dr. Samuel F. Trevino, Dr. Henry J. Prask, Dr. Chang S. Choi, Dr. Zafar Iqbal, Dr. Krishnaro R. Rao and Richard D. Mical.

Under provisions of the Army Incentive Awards Program, cash honorariums will again supplement Certificates of Achievement that will be presented for exceptionally meritorious papers selected from 100 presented at the 1972 conference.

Authors of 9 technical papers shared $3,600 in 1970. Authors of 10 additional papers were chosen for meritorious and special awards.

Information Systems Office Keys Restructuring to User Needs

(Continued from page 3)

scientific and technical information program.

- Designing, developing, operating and maintaining the Army Research and Development Information System (ARDIS).

Established in mid-1969, the ISO and its supporting ARDISO are charged with responsibility for management information, technical information and data programs within the jurisdiction of Lt Gen William C. Gribble Jr., Army Chief of R&D.

The four ARDISO divisions (Figure 1) are Technical Data, headed by Martin H. Weik Jr., Management Information under Lt Col James E. McMurrer, Systems Design and ADP with Richard M. Whitaker as chief, and Input/Output and Processing headed by David Nemore.

The Technical Data Division has a Scientific and Technical Branch under Lt Col Robert H. Alsheimer, a Publications Branch headed by Clarence T. Smith, and an OCRD Technical Library headed by Janet S. Brooks.

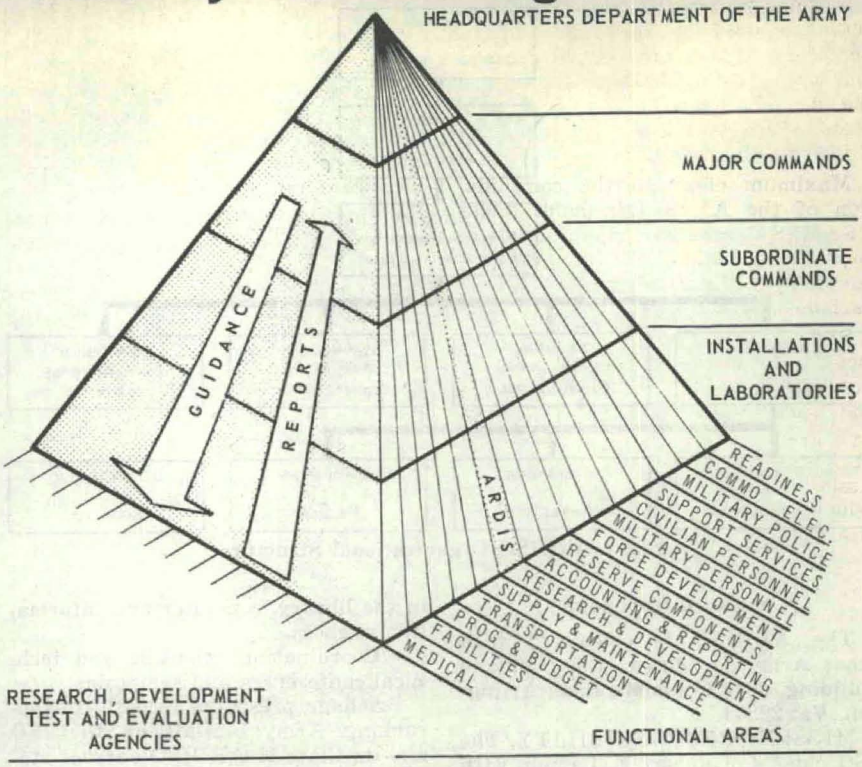
All of the responsibilities of the chief of ISO and director of ARDISO are viewed as being of paramount importance to the Army RDT&E program. However, the Army Research and Development Information System (ARDIS) is of particular interest.

Designed specifically to satisfy the scientific, technical and management information needs of Army RDT&E program scientists, engineers and managers, ARDIS also serves information demands of higher echelons.

MANAGEMENT INFORMATION. The Army Management Information System master plan envisions that guidance for data systems in all functional areas will be developed at HQ Department of the Army, by the responsible staff agency, and responsive summary information will flow back to HQ DA. These systems will be integrated at HQ DA level by a Steering Group representing all related staff sections and chaired by the director, Management Information Systems, Office of the Assistant Vice Chief of Staff, Army (Figure 2).

Summary information is provided to the Chief of R&D in various output media. Styles vary from concise presentations of selected information to rather voluminous lists and aggregations. To assist in program decision-making, various *trend data* indicate the direction of RDT&E over extended periods of time. *Exception data* focus attention on conditions or events that exceed predefined limits.

Consideration is also being given to the feasibility of developing suitable RDT&E program models to permit determination of impact resulting from program policy decisions, changes in military requirements, and changes in resources availability.



AMIS – ARDIS Relationships

Fig. 2. AMIS—ARDIS Relationships

Outputs of the ARDIS currently include information regarding Ongoing Work versus Requirements, with a correlation of activities and authorization documents. Lists of approved requirements for which no RDT&E work is under way is another ARDIS output product.

ARDIS also provides a report containing financial planning and execution data designed to help assess funding aspects of RDT&E projects as follows:

- A project listing that supports the OCRD program and budget at presentations to the Office of the Secretary of Defense and the Congress; it also furnishes funding guidance to R&D installations in the field.
- A "horseblanket," an over-all summary chart derived from the project listing used as a working tool for the annual sessions of the OCRD program and budget Review Board. (This includes priorities of the Army Strategic Objectives Plan and is soon expected to incorporate Assistant Chief of Staff for Force Development operational priorities.)
- An in-house laboratory status report prepared annually for the Office of the Secretary of Defense. (Established last fall, this reports the workload at each Army laboratory and activity engaged in R&D, in terms of funds and personnel strengths.)
- A contracts and grants report designed as an in-house tool to provide the current status of funding support to colleges and universities.
- A trend report reflecting the status of R&D funds in the unobligated/unliquidated categories.
- A test and evaluation file reestablished recently, under contract, to monitor selected milestones in the development of military systems.
- A special report reflecting systems development times, prepared for the Chief of R&D to compare development time for various categories of Army materiel.

ADP SUPPORT FOR MANAGEMENT INFORMATION. The financial management file, now operational on a contractor basis, will be replaced by an improved random-access-oriented capability—being developed by the U.S. Army Management Systems Support Agency (USAMSSA) to provide information in a variety of output formats required by users.

USAMSSA also is automating the R&D Planning Summary file, consisting of data extracted from DD Forms 1634—required by the Office of the Secretary of Defense for all projects and tasks in the R&D program—and the Army's Form 3664, which provides additional Army unique milestone and planning data.

Maximum effort in the consolidation of the AMIS data bank under USAMSSA computer capabilities will be directed toward avoiding data redundancy currently inherent in the various separate files operations.

Should additional R&D management information be required, as for example in regard to manpower, the policy will be to extract the information from existing Deputy Chief of Staff for Personnel (DCSPER) and Assistant Chief of Staff for Force Development (ACSFOR) system files, or other files, whenever possible.

Required R&D financial information is available to HQ DA level R&D management much more rapidly than heretofore. Financial data input also has been refined in recent months to produce reports of increased utility to the OCRD Review Board.

SCIENTIFIC AND TECHNICAL INFORMATION. The processing of scientific and technical information (S&TI) by ARDIS is being transferred this fall from a contractor operation to the Defense Documentation Center at Cameron Station, Va. Currently, some S&TI is being processed manually. Where appropriate, automation is being considered. S&TI processed by the ARDIS includes:

- Federal funds for S&TI activities, an annual report to the National Science Foundation. It lists obligations for activities for the previous, current and budget year—the 3-year breakout displayed in the President's Budget Message to Congress.
- Scheduled technical conferences and symposia, a series of reports to the Director of Defense Research and Engineering covering support of technical conferences and symposia.
- Inventory of scientific and technical information activities, used to insure identification and utilization of existing S&TI activities; also, to exercise control over initiation, changes and termination of these information activities.
- Army vocabulary of technical descriptors, a thesaurus containing the Army's basic research and exploratory development terminology for use in the DoD Research and Technology Work Unit Summary reporting system. This is used in conjunction with the DoD Thesaurus of Engineering and Scientific Terms to facilitate communication among scientists and engineers.
- A Metals Book, produced annually for a tripartite meeting of the Technical Cooperation Program Panel on metals, defining research and development results, work under way, and work planned in the area of metals.
- A Materials Book, produced for the U.S. Army Materials and Mechanics Research Center, Watertown, Mass., for use at tri-Service meetings devoted to coordinating R&D work in the area of materials other than metals.

The research and technology file (DD Form 1498) provides information on the nature and scope of work under way and planned in all areas of R&D throughout the Army. Effective this fall, the file will become the sole support responsibility of the Defense Documentation Center. Most federal agencies operate a file of this type.

The technical information resources file is an inventory of S&TI activities required by the Director of Defense Research and Engineering. It also is used by the chief of ISO, in his capacity as the Army Director of Technical Information, to coordinate effectively the scientific and technical information activities throughout the Army.

Other uses for this file include response to queries from the Office of the Secretary of Defense, the National Science Foundation, and the Office of Science and Technology, Executive Office of the President.

An information for industry file is being developed to match requirements of Army in-house laboratories and activities to proposals submitted by industry; also, to keep record of capabilities of various industries and laboratories. The Army Materiel Command is doing developmental work on this file, in line with its responsibility for providing Qualitative Requirements Information (QRI) to industry.

Additional files planned for development include a selective dissemination file, to distribute S&TI reports to scientists and engineers properly in need of the information, and the technical conference file, to provide for effective coordination of scientific and technical conferences.

SUMMARY. In summary, ARDIS serves as the Chief of R&D's scientific, technical and management information system. The system is run by the OCRD Information Systems Office in the Pentagon, supported by the U.S. Army R&D Information Systems Office. Organizations that provide scientific, technical and management information policy and ADP support to the ARDISO are shown at Figure 3.

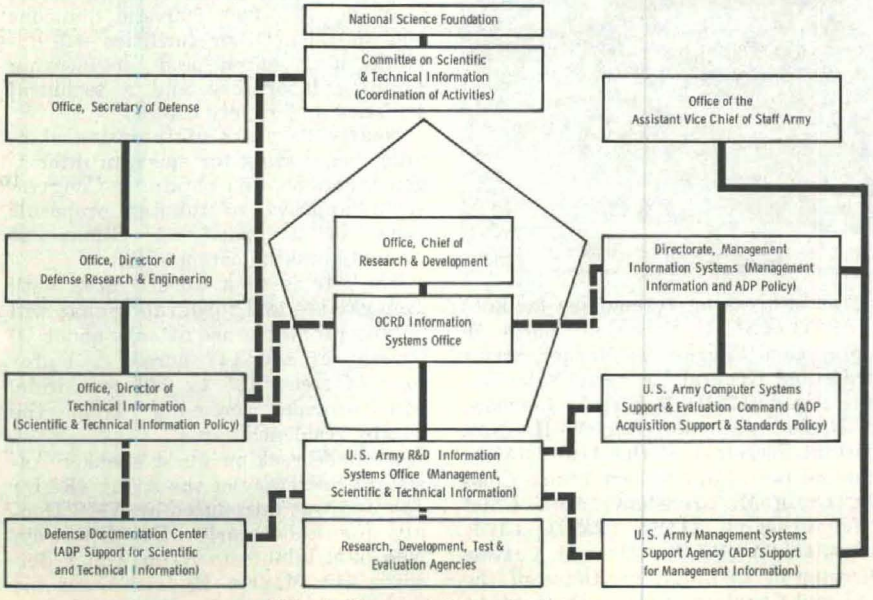


Fig. 3. Support Organizations

Operations Research Meeting Sets Dec. 1 Abstracts Deadline

Abstracts of papers proposed for presentation at the 11th annual U.S. Army Operations Research Symposium, scheduled May 16-18, should be submitted to the U.S. Army Research Office by Dec. 1.

In announcing that attendance will be by invitation and that participation is limited to U.S. Army organizations and their contractors, the U.S. Army Research Office-Durham, N.C., said papers must be on operations research or systems analysis.

Dr. George E. Nicholson Jr. of Duke University is the program coordinator for the symposium. Further information may be obtained by calling or writing the Executive Officer, Army Research Office, Durham, N.C. 27706, Tel.: 919 286-2285 or Autovon 935-3331.

Leaders Break Ground for Harry Diamond Laboratories Complex

(Continued from page 1)

ratories Dr. Robert B. Dillaway headed the array of R&D leaders at ground-breaking ceremonies.

Located on a 137-acre site adjoining the Naval Ordnance Laboratory at White Oak, Md., the future home of the Harry Diamond Laboratories will be occupied as each phase of the construction program is completed, beginning in 1973 and ending in 1975.

The complex of buildings will house about 1,350 scientists, engineers and supporting personnel engaged in research, development and engineering on electrical fuzes, ordnance electronics, ordnance specialties and numerous critical materiel components.

Known worldwide for pioneering development of the radio proximity fuze, one of the major ammunition breakthroughs of World War II, the Harry Diamond Laboratories are designated among the five central laboratories of the U.S. Army Materiel Command. The AMC also has assigned to HDL lead laboratory responsibility in both fluidics applications and in nuclear weapons effects.

HDL had its origin in the Ordnance Development Division of the National Bureau of Standards. About 150 NBS scientists and engineers provided the staffing nucleus of the HDL when it was established on the old grounds of the NBS on Connecticut Avenue at Van Ness Street, N.W., Washington.

Harry Diamond Laboratories *(Artist's Rendition)*

Phase I work on HDL's future home is being done by the Blake Construction Co., Washington, D.C., for $9,988 million. Phase II and III plans await appropriations action by Congress. Total estimated cost of the 3-year project is about $42 million, with Phase II at $9.035 million.

Plans drawn by Ellerbe Architects, Washington, D.C., provide for an H-type complex of facilities and interconnecting passageways designed for adequate security of classified laboratory areas. Total floor space will exceed 500,000 square feet.

About 140,000 square feet will be provided in Phase I construction scheduled for completion by July 1, 1973. The 3-story No. 1 building for general purpose laboratories in Phase I will accommodate labs designated as 400, 500 and 600, along with technical support organizations.

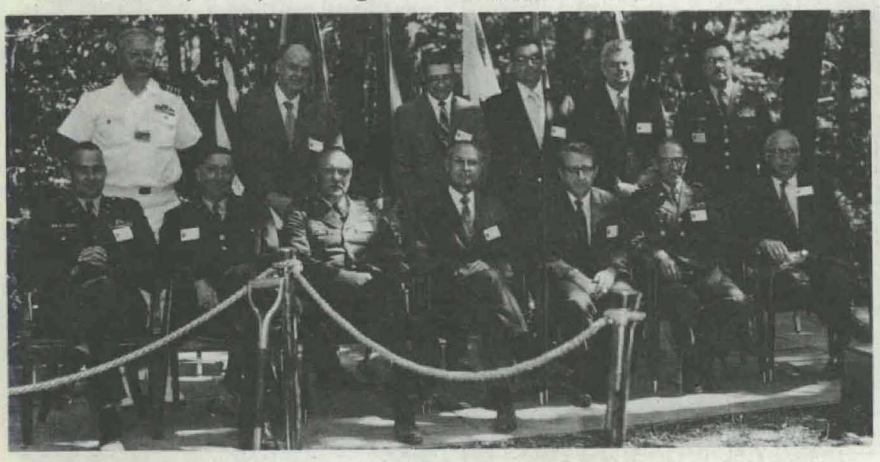
Phase II will provide the administration building, consisting of offices, library, cafeteria, auditorium and various other facilities in 115,000 square feet of space to be available by July 1, 1974.

Phase III construction will add about 259,000 square feet of floor space, including general-purpose laboratory building No. 2. This will house labs 100, 200, 300, 900 and divisions 700 and 800. Other facilities will include a research and engineering building laboratory and a technical logistics and supply center.

Nearly 10 years of intensive planning, negotiating for space in inter-agency actions, and obtaining Congressional approval of funding proposals came to a gratifying climax at ground-breaking ceremonies.

The site is in a wooded area with deep ravines and topography that will permit profitable use of only about 70 percent of the 147 acres. A buffer zone of trees, 185 to 230 feet wide, will provide screening from the nearby residential area.

Ground-breaking guest speaker Assistant Secretary of the Army (R&D) Johnson was introduced by AMC Deputy for Laboratories Dr. Dillaway, who paid tribute to Army Chief Scientist Dr. Marvin E. Lasser for his role in negotiating a suitable site. Sec-



DIGNITARIES who participated in HDL ground-breaking ceremonies include: Front row (l. to r.) Col David W. Einsel Jr., CO of HDL; Brig Gen George M. Snead Jr., Director of Army Research; Maj Gen Charles T. Horner, Army Materiel Command Chief of Staff who represented General Henry A. Miley Jr., CG of the AMC; Assistant Secretary of the Army (R&D) Robert L. Johnson; AMC Deputy for Laboratories Dr. Robert B. Dillaway; Maj Gen V. H. Ellis, Deputy for Procurement, Office of the Assistant Secretary of the Army (I&L); Billy M. Horton, HDL technical director. Second row: Capt Robert Ennis, Commander, Naval Ordnance Laboratory; Dr. Craig M. Crenshaw, AMC Chief Scientist; Dr. K. C. Emerson, Assistant for Research, OASA (R&D); Clyde Hardin, Assistant for Southeast Asia Matters, OASA (R&D); Allen M. Carton, representing Maj Gen Elmer P. Yates, Director of Installations, Office of the Deputy Chief of Staff for Logistics, HQ DA; and Chaplain (Col) F. O. Hunt Jr.

retary Johnson acknowledged the contributions of his predecessors, Dr. Finn J. Larsen, Willis Hawkins and Dr. Russell S. O'Neal, to this effort.

Appreciation also was expressed by Secretary Johnson to the U.S. Navy for assistance in providing a site that will locate the HDL, as one of the Army's most successful R&D organizations, in proximity to the Naval Ordnance Laboratory.

Envisioned in this relationship is cooperative and integrated R&D effort in line with the Department of Defense continuing goal of minimizing inter-Service overlapping research and development activities.

Secretary Johnson cited the long record of HDL in R&D achievements that have had a profound impact upon the national defense capabilities, with spin-off benefits that have contributed richly to the nation's civilian requirements. This record coupled with HDL's continual growth in R&D capabilities, he said, fully justifies the expense of providing adequate new facilities.

Maj Gen Charles T. Horner, speaking on behalf of AMC Commander General Miley at the luncheon following the ceremonies, reemphasized the importance of the R&D contributions of the Harry Diamond Laboratories.

In meeting numerous requirements related to materiel for Southeast Asia operations, in advancing technology in fluidics, and in responding successfully to numerous military requirements, General Horner said, HDL scientists and engineers have continuingly demonstrated that they are accepting the challenge of the future.

Other Army Materiel Command laboratories, he added, also are gearing their planning to the need of increasing the productivity of R&D programs with minimum resources, resulting from defense economies. Army R&D capabilities must be maintained, he concluded, to achieve the technological advances essential to future national security.

HDL Commander Col D. W. Einsel Jr. welcomed participants in the ground-breaking ceremonies and discussed briefly HDL's historical background and current capabilities.

HDL Technical Director Billy M. Horton introduced past commanders and his predecessor, William S. Hinman Jr., who served from 1953 until he departed in 1962 to become Deputy Assistant Secretary of the Army (R&D).

Ceremonies were concluded with a visit to the Aurora Gamma Simulation Facility now nearing completion of construction. HDL will operate this facility, largest and most modern of its kind in the world, for the U.S. Nuclear Defense Agency, known as the U.S. Defense Atomic Support until July 1, 1971.

Importance of the Harry Diamond Laboratories among the U.S. Army's in-house laboratories might be attested by listing, at considerable length, their notable achievements during the past 18 years, along with the ongoing activities (many eliminated by their high security classification), and areas of specialized capability.

Statistical data serve to pinpoint concisely HDL's significance: FY 1971 budget, $46 million; conducts about 200 technical projects annually, including some for the Navy and the Air Force; issues about 95 technical reports and publishes, on the average, about 70 papers in professional journals; personnel awarded 40 to 50 patents annually.

Army Sets 17th Conference on Design of Experiments

Applications of statistical design and analysis to medical research are programed for emphasis in technical papers presented at the U.S. Army 17th annual Design of Experiments Conference, Oct. 27–29, at Walter Reed Army Institute of Research. WRAIR is part of Walter Reed Army Medical Center in Washington, D.C.

More than 100 of the nation's ranking mathematicians, representative of the Department of Defense, industry, academic and nonprofit as well as Army agencies, are scheduled to exchange information on problem areas.

Sponsored by the U.S. Army Mathematics Steering Committee on behalf of the Chief of Research and Development, Lt Gen William C. Gribble Jr., the conference is arranged through the Army Research Office, Durham, N.C. Col Hinton J. Baker and Dr. Douglas Tang are the WRAIR sponsors.

Prof. Bernard G. Greenberg, chairman of the Department of Biostatistics at the University of Carolina, has accepted an invitation to give one of the featured presentations on "Randomized Response: A New Survey Tool to Collect Data of a Personal Nature."

Other invited speakers are Prof. Marvin Zelen of the State University of New York at Buffalo, Dr. John J. Gart of the National Institutes of Health in Washington, Dr. Geoffrey H. Ball of the Stanford Research Institute, and Prof. K. S. Banerjee, University of Delaware.

Dr. Zelen's topic is "The Role of Mathematical Sciences in Biomedical Research, Dr. Gart will present "The Comparison of Proportions: A Review of Significance Tests, Confidence Intervals and Adjustments for Stratification," and Dr. Ball is listed for "Classification and Clustering Techniques in Data Analysis." Prof. Banerjee will report findings on "Hotelling's Weighing Designs."

Technical and clinical sessions will provide an opportunity for questions and answers, with noted consultants serving as panelists. Dr. Frank E. Grubbs, U.S. Army Aberdeen (Md.) Research and Development Center, will be the presiding chairman. He is also head of the program committee.

Assisting him on the committee are Dr. Francis R. Dressel, ARO–D; Dr. Clifford J. Maloney and Dr. David Alling, National Institutes of Health; Dr. Walter D. Foster, Fort Detrick, Md.; Dr. Bernard Harris, Mathematics Research Center, University of Wisconsin; Dr. Boyd Harshbarger, Virginia Polytechnic Institute; Dr. Herbert Solomon, Stanford Research Institute; Dr. Fred Frishman, Army Research Office, Washington; Dr. Bernard Greenberg, UNC; Dr. Allyn Kimball, Johns Hopkins University; Dr. Douglas Tang, and Col Hinton J. Baker, WRAIR.

Earth Sciences Lab Relocates From Natick to Fort Belvoir

The Earth Sciences Laboratory (ESL), formerly assigned to the U.S. Army Materiel Command (AMC) and located at Natick, Mass., will relocate Sept. 1 with the U.S. Army Engineer Topographic Laboratories (ETL), Fort Belvoir, Va.

The ESL will continue to support AMC projects and remain under the direction of Dr. Lester W. Trueblood.

ESL was officially transferred to the Corps of Engineers last May but the physical move is just now being completed. The U.S. Army Topographic Command of the Corps of Engineers is the parent organization of ETL.

The stated mission of ESL is to perform research and development in the fields of environmental and geographic sciences. To carry out this mission, it is authorized 3 military and 31 civilian employes whose skills are in the fields of geography, geology, meteorology, climatology, geomorphology and cartography.

Joint Technical Staff Formulates DoD Food R&D Program Plans

(Continued from page 1)

The goal of this sustained, long-range effort is to improve support to members of all the U.S. Armed Forces, from the viewpoint of providing the highest standards of food service at the lowest practicable costs in manpower, equipment and capital investment.

Emphasis on joint service coordination of the food research, development, testing and evaluation activities began in 1968 when the Department of Defense established a single coordinated program. The Secretary of the Army was designated to formulate and execute the program.

Dr. Edward E. Anderson, a nationally known authority who was then head of the Plant Products Division at NLABS—with prior experience as research professor in the University of Massachusetts Department of Food, Science and Technology—was appointed in mid-1969 as special assistant to the NLABS scientific director regarding the DoD Food R&D Program.

Conversion of the Army food program to a DoD program was accomplished during FY 1971, thereby setting the stage for the joint effort in formulating the FY 1972 program, supported by a marked increase in the budget.

Programed expenditures for FY 1972 total $9.987 million as compared with $6.568 million in FY 1971. Military food service and subsistence technology exploratory development accounts for $.093 million.

Other items: military subsistence systems, $1.6 million; applied research in radiation preservation of food, $1.389 million; food and food service research, $1.175 million; wholesomeness tests of irradiated foods, $1 million; systems studies in military feeding, $980,000; exploratory development in packaging technology, $950,000.

Formulation of the DoD Food R&D Program annually begins with the military services and defense agencies forwarding their detailed requirements for research, development, test and evaluation activities for the target fiscal year (calendar FY + 2). Generalized requirements also are forwarded for out-years, in sequence of priority, to the Natick Laboratories.

Currently, about 300 scientists, engineers and food technologists are engaged in the NLABS' Food Laboratory, Equipment and Packaging Laboratory, and Pioneering Research Laboratory, in various aspects of the DoD program.

DoD FOOD R&D PROGRAM special assistant and joint technical staff members are Dr. Edward E. Anderson, Maj Jaime Sabater (Marine Corps), Lt Col Robert E. Pope (Air Force), and Col Maxene B. Michl (Army), at NLABS meeting.

Experience of the NLABS for execution of this responsibility actually dates to 1963 when functions and personnel of the Food and Container Institute at Chicago were transferred to the Natick installation.

In conducting the DoD program, Natick's performing laboratories in the respective mission areas evaluate the requirements submitted by the joint services. Detailed R&D planning summaries are prepared and submitted to the developing agencies—the U.S. Army Materiel Command and the U.S. Army Medical R&D Command—for further evaluation and comment.

Responses of the developing agencies are then submitted to the Joint Formulation Board, which provides the means for multiservice participation in shaping the DoD program. Five voting board members represent the Army, Navy, Air Force, Marine Corps and the Army Surgeon General. The Defense Supply Agency has a nonvoting member. HQ Army Materiel Command provides the board's executive secretary and the chairmanship is rotated annually among voting members.

The board reviews requirements submitted by the services, integrates them into a joint program, and assigns each item a priority. Requirements exceeding funding guidance are placed in order of priority as unfunded.

Following the established staffing procedures through Department of the Army channels, the proposed program is submitted to the Director of Defense Research and Engineering for approval, after which it is forwarded to the NLABS for implementation.

The Joint Technical Staff provides pertinent information peculiar to each of the military services, establishes coordination, and serves in the management and performance of the approved program.

Nutrition activities set up in the program are performed through the surgeon generals of the services working with the U.S. Army Medical R&D Command and the U.S. Army Medical Research and Nutrition Laboratory, as specified by the Army Surgeon General in his capacity as executive agent for nutrition.

The project on Systems Studies in Military Feeding will emphasize in FY 1972 the application of operations research/systems analysis methods. The goal is to define the scope of the DoD feeding system, identify its components, and pinpoint the potential for high payoff for improving the system.

A consumer study of garrison feeding is under way at Fort Lewis, Washington, to find out why personnel authorized to eat in Army dining halls, free of charge, choose to pay for nearly half their meals in outside food service establishments. Plans are being made to perform similar non-utilization studies in Air Force, Navy and Marine Corps feeding facilities.

A parallel feeding system study is defining the total cost and performance of the current system used at Fort Lewis. Results are expected to lead to a new feeding system and permit "before and after" cost comparisons.

An automated data processing study at NLABS is directed toward developing a new system for collecting head-count data for determining attendance at meals in Army dining halls. An automated inventory control system will follow and, ultimately, a computerized menu planning system.

Designed to produce complementary

results, these studies are intended to provide the basis for significant improvements in garrison feeding. Advances in radiation preservation of foods, in which the NLABS have pioneered, offer encouraging possibilities of ultimately minimizing or eliminating field refrigeration requirements.

The U.S. Food and Drug Administration has approved Army petitions for various irradiated foods. A wholesomeness test of irradiated beef was performed under contract during FY 1971 and the study is scheduled to continue through FY 1974. Experimentation involves tests of food on animals.

Irradiated beef also is being evaluated by analysis for nutrients, including protein, amino acid and vitamin contents. The NLABS cobalt 60 radiation source is serving this program.

Tasks in Military Food Service and Subsistence Technology planned at NLABS for FY 1972 are designed to improve the quality and variety of foods available in field and operational feeding situations. Examples are:

- Development of reversibly compressed freeze dried foods to reduce weight and volume and yet maintain high quality.
- Improvement of mobile field kitchens, including microwave ovens for rapid cooking (SPEED kitchen).
- Improved food service operations for shipboard to include disposable mess gear (Navy).

TABLE 1
DoD Food RDT&E Program, Fiscal Years 1970–72
(Thousands of Dollars)

Category	*Project*	*FY 70*	*FY 71*	*FY 72*
6.1	Food and food service research	1014	1038	1175
6.2	Systems studies in military feeding	0	450	980
	Radiation preservation of food	947	2039	1389
	Military food service and subsistence technology	1644	1057	2093
	Packaging technology	600	600	950
6.4	Military subsistence systems	842	1384	1600
	Wholesomeness test of irradiated foods	0	0	1000
	TOTAL	5047	6568	9987

- Initiation of studies of improved equipment for central food preparation and continuous automated food production equipment (Army, Navy, Marine Corps).
- Initiation of a study of an automated food dispensing operation (Air Force).
- Continuation of human factors studies in food acceptance.

Packaging material and systems are an important consideration in improving operational rations. Flexible packages for heat-processed foods have the advantages over the conventional rigid metal can of decreased space requirements in shipment and easier use in the field.

An important aspect of the FY 1972 DoD Food RDT&E effort on packaging is to establish the reliability of heat-processed foods in flexible packages under the different operational environments of the Services. A current effort to develop a lightweight insulated food container for helicopter delivery will be continued.

Tasks in the Military Subsistence Systems Project include:

Further development of meal, ready-to-eat, individual, to replace the present meal, combat, individual for all the military services.

Development of and procurement of prototypes of the meal, uncooked, 25-man for testing as an ultimate B-ration replacement for all Services.

The meal ready-to-eat, individual, is designed to provide highly acceptable food components under conditions which preclude preparation, except beverage reconstitution. It incorporates the advances made in flexible packaging systems for heat-processed foods and in dehydrated foods.

Gross weight of a 1,135-calorie meal is one pound as compared to 1.77 pounds for the meal, combat, individual, having the same calorie content.

During FY 1972, additional menus will be prepared and engineering studies will be initiated on potential detectors for microbial contamination in wet-pack products packaged in flexible containers.

The meal uncooked, 25-man includes menus for breakfast, dinner, and supper meals on a 10-day cycle. It consists of factory-assembled nonperishable foods, with a maximum use of dehydrated foods and lightweight packaging.

Current and projected studies involve continued development of improved components, preparation procedures and packaging, and initiation of procurement of prototypes for further testing.

The joint services DoD Food program is supported by basic research in chemistry, physics, life sciences and psychology. Results provide background information and principles for ultimate application in improving military feeding systems.

Concisely summarized, the objective is to provide the individual consumer, in all military services, high-quality, nutritious and acceptable foods under all military operational requirements.

Montgomery Named Picatinny Arsenal Commander

Command of Picatinny Arsenal, Dover, N.J., will pass to Col George M. Montgomery, who is ending three years as deputy director of Development, Test and Engineering, effective Sept. 1. An earlier announcement had scheduled Col Charles E. Conrad for this assignment.

Col Montgomery was graduated from the University of Arizona in 1948 with a bachelor's degree in electrical engineering, received his master's (EE) in 1956 from Purdue University and in 1966 earned another ME degree in industrial engineering from Columbia University.

Commissioned in the Cavalry Reserve, he entered active service in 1948 and in 1949 was commissioned in the Regular Army (Ordnance Corps).

He has held commands at the company and battalion levels and was a member of the cadre that established the U.S. Army Missiles and Munitions Center and School at Redstone Arsenal, Ala. Other assignments have included one year conducting engineering tests of ammunition and combat vehicles at Aberdeen (Md.) Proving Ground, and three years at Redstone Arsenal as an R&D staff officer with the Army Ballistic Missile Agency in the Army's Jupiter missile and early earth satellite and space programs. During four years as an instructor and associate professor at the U.S. Military Academy at West Point, he taught courses in production management and operations research.

Col Montgomery has completed courses in the Armor, Ordnance, Signal and Air Defense Schools, and is a graduate of the U.S. Army Command and General Staff College and the Armed Forces Staff College.

Col George M. Montgomery

Natick Labs List Sugar From Waste Paper Team

Development of an enzymatic process to convert waste papers into glucose food products, including sugar, or a clean-burning fuel (ethanol)—announced recently by the Army Natick (Mass.) Laboratories—was accomplished mainly by 9 researchers.

Acclaimed as one of the NLABS' "most significant achievements in 25 years," the process is envisioned as being potentially of major importance, in view of national and world concern about pollution control.

Conversion of waste cellulose products into various foods for humans and animals is achieved without generating air or water pollutants. (For a detailed description of the process, see feature article starting on page 1 of the April-June *Army Research and Development Newsmagazine.*)

Contributions were made over a period of several years by others than the nine researchers whose roles will be reported in this article. Natick Laboratories at first withheld information regarding the developmental team to avoid possibility of overlooking some deserving individuals.

Dr. Mary H. Mandels, known as one of the U.S. Army's most distinguished research scientists, was project leader and principal investigator. Credited with the culture work to produce mutation of the most potent concentration of enzymes, she also discovered that cellulose used in the process absorbs the enzyme. This eliminates the need for highly sophisticated and expensive filtering systems.

Dr. Gabriel Mandels, the other half of Natick's famed husband-wife research team, is associate director for Life Sciences in the Pioneering Research Laboratory. An eminent plant physiologist, he is "suspected" of making off-the-record contributions to success of the project although never officially identified with it.

Dr. Elwyn T. Reese, a research enzymologist acknowledged as the discoverer of this particular enzymatic process, also isolated the enzyme now being used to derive glucose products from cellulose. World renowned, he was invited by Pope Paul to attend the Vatican Scientific Conference in April 1968 and participated as the Department of Defense representative.

Dr. Reese is one of numerous Army in-house scientists whose outstanding career potential has been advanced through selection for a Secretary of the Army Research and Study (SARS) Fellowship in 1964–65.

Dr. Reese organized the American Chemical Society international symposium on cellulose in 1962 in Washington, D.C., and again in 1968 at Atlantic City, N.J. Numerous books and publications in professional journals have enhanced his reputation.

Two foreign investigators were drawn into the project as participants in Natick's continuing Visiting Scientist Research Associateship Postdoctoral Program. This permits a year of study similar to the SARS Program.

Dr. Tarun K. Ghose of India achieved recognition for a significant contribution as a senior visiting scientist sponsored by the National Research Council, U.S. National Academy of Sciences, 1967–69. Dr. Ghose is now head of the Department of Biochemical Engineering, Indian Institute of Technology at New Delhi.

Dr. Moshe Katz was a post-doctoral scientist at NLABS in 1966–67 and worked with Dr. Reese on enzymatic research. He is now a microbiologist at the Hebrew University Medical School in Jerusalem, Israel.

Dr. Frederick W. Parrish, who departed Aug. 27 for a year in Australia under a Secretary of the Army Research and Study Fellowship, is a naturalized U.S. citizen who served as a British officer in World War II. He "contributed significantly" to the crystallization and purification of the glucose syrup conversion to sugar. Dr. Parrish served six months with current Army Chief of Staff General William C. Westmoreland as a member of the Army Concept Team in Vietnam (ACTIV).

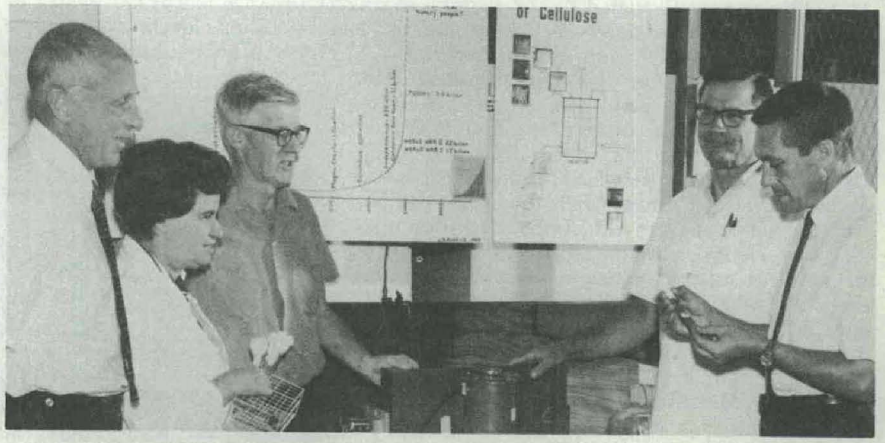
SYRUP, made by converting waste paper to glucose sugar, is poured over pancakes by Dr. J. Fred Oesterling.

John Kostick, educated as a physicist at Massachusetts Institute of Technology, works in the Natick Food Laboratory with Dr. Mary Mandels, who earned her doctorate from Cornell University. She has credited him with important contributions to the success of the research project that has demonstrated the feasibility of converting waste paper and other discarded cellulose products into glucose foods and a clean-burning fuel.

One of the many payoffs of the U.S. Army's long-standing Scientific and Engineering Assistants Program—which enables enlisted personnel to work alongside top Army researchers at in-house laboratories during military service—came in the contributions of former E5 James S. Weber and E4 Richard Parizek. Weber served at NLABS (1967–69) and Parizek succeeded him on the project (1969–71).

Weber graduated from Montclair (N.J.) State College prior to entry into military service and is working toward a master's degree at New York State University. Parizek has a master's degree in microbiology from the University of Illinois and is with Haverlock-Ellis Biochemical Co.

Dr. J. Fred Oesterling, deputy for research under NLABS Scientific Director Dr. Dale H. Sieling, earned a tribute from him for effective work as a "project pusher" in assisting the developmental team. Dr. Oesterling has served for many years as chairman of the Army panel of judges which annually selects about 20 outstanding entries in the International Science and Engineering Fair for trips to or summer work in Army laboratories. This event draws more than 400 finalists from regional high school science fairs.



From left: Drs. Gabriel & Mary Mandels, Dr. Reese, Kostick, Dr. Parrish.

BESRL Applies Computer Techniques to Officer Career Counseling

Application of computer techniques to officer career counseling was announced in July by the Behavior and Systems Research Laboratory as a 2-year project sponsored by the Office of the Deputy Chief of Staff for Personnel, Department of the Army.

DCSPER officials approached Dr. J. E. Uhlaner, Director of BESRL, an element of the U.S. Army Manpower Resources Research and Development Center, Arlington, Va., with a problem frequently voiced by the officers and those responsible for providing officers with career guidance. Maj Gen Franklin Davis, Jr., Director, Military Personnel Policies, stated the problem:

"There is not a central source of accurate, up-to-date career guidance information available to officers. Information is fragmented in many regulations, in officers' career branches and other sources not available to all officers, and tends to change rapidly."

The results were termed "inefficient personal career-goal decisions and poor use of officer capabilities and interests," with unquantifiable costs in terms of utilization of valuable resources and motivation.

In response to DCSPER's expressed needs, BESRL proceeded to design its proposed study of a computerized career counseling service and a future management information system that will both support and benefit from such a service.

The goal is to "capitalize maximally on individual differences to optimize assignment with respect to the desires of the individual and the needs of the Army . . . and to evaluate the use of interactive consoles by counselors to tap a data bank."

In striving for optimal matching of men and jobs, BESRL researchers will cope directly with the informational needs of officers concerning promotional and educational goals.

Cecil D. Johnson, Chief of BESRL's Statistical Research and Analysis Division, said the computer counselor will be equipped to inform officers regarding the mathematical probability of attaining a desired position.

The data bank will include information relevant to job requirements (educational, professional and experiential background, mental abilities and aptitude levels required for the position), as well as the counselee's personal qualifications.

By matching job requirements with officer potentials and ambitions, computer techniques will provide counselees with a realistic assessment of probable success or failure in aiming for a particular career goal.

Under the ongoing initial assignment system serving enlisted servicemen, computers already analyze: the number of persons vying for a specific position; job related preferences as perceived by an interviewer/counselor; and the counselee's personal qualifications (e.g., Army General Classification Test battery scores, employment history, education, health, etc.).

The role of the counselor, it was explained, could be greatly increased to the advantage of both the counselee and the Army if the counselor were to provide direct access to a data bank.

A human counselor mediates between the counselee and the computer in the above system. However, part of the BESRL Officer Career Counseling System (OCCS) study will explore the possibility of eliminating the human counselor from the process.

The OCCS study will investigate three counseling techniques: computer-counseling, computer-assisted human counseling, and unassisted human counseling.

In the computer-counseling system, the officer seeking promotional opportunities and requirement data would directly query the computer. Preferences of the counselee would be integrated into the data bank and become available to the assignment manager in OPO. The cost-effectiveness of this arrangement will be an integral part of the OCCS experiment.

Computer-assisted human counseling, as an alternative, is associated with several advantages. One is that the officer-counselee does not have to be taught how to query the computer; the counselor mediates for him. Secondly, the computer will require less software, since the counselor can supplement the data bank with information at his disposal. Finally, BESRL will consider the "humanizing" factor in person-to-person counseling.

After one year of preparatory experimental design, researchers will initiate a comparative evaluation of computer-counseling. The criteria for evaluation will be the actual amount of useful job information acquired by officer-subjects utilizing each counseling method, and the value of the information obtained from the counselors in making assignments.

Johnson outlined the prime advantages of computer counseling. Primarily, a computer-assisted or computer-run counseling service is constantly being updated on professional opportunities and requirements; its job data is much more current than a manual filing system.

Anticipated also as an advantage of computer counseling is an improved vantage point with regard to answering job information questions most frequently posed by career-oriented officers. The preferences of the officers can be more accurately pinpointed; the counselor can be asked to make choices between alternatives that are real possibilities for him. Hopefully, officers will feel more directly involved in determining their careers.

Finally, counselees with unrealistic career goals can be informed quickly of their relative standing with competitors and referred to more suitable position openings.

Upon completion of the study, the BESRL-developed computer counseling service will be considered for Army-wide implementation to aid officers seeking career information.

Col Spitler Directs Artillery Materiel Testing at TECOM

Responsibility as director of Field Artillery Materiel Testing at HQ U.S. Army Test and Evaluation Command (USATECOM), Aberdeen (Md.) Proving Ground was assumed by Col Joseph V. Spitler Jr. late in July.

Col Spitler served until recently with the Developments Directorate, Office of the Chief of Research and Development, HQ Department of the Army.

He has a 1949 bachelor's degree in civil engineering from Virginia Military Institute, a 1967 master's in mechanical engineering from the University of Arizona and is a certified professional engineer in Virginia.

His military training includes graduation from the basic and advanced courses for artillery officers at Fort Sill, Okla., Command and General Staff College, and Army War College.

A veteran of eight campaigns in Korea and Southeast Asia, he has received the Legion of Merit, Distinguished Flying Cross, Bronze Star Medal, Air Medal with 10 Oak Leaf Clusters, Meritorious Service Medal and Army Commendation Medal.

Col Joseph V. Spitler Jr.

2 USAETL Employes Honored With CO Awards

Commanding Officer's Awards for Scientific and Technological Achievement, and for Leadership, presented annually at the U.S. Army Engineer Topographic Laboratories (USAETL) since 1969, recently honored Franklyn Ray Norvelle and Oscar W. Bowker.

Application of mathematical techniques to programing concepts for the AS–11A Stereoplotter Program, thereby solving a problem that had resisted several earlier efforts, earned Norvelle the S&TA Award.

This accomplishment uses complex photography not heretofore directly usable in a plotting instrument; also, for the first time anywhere, 3-dimensional observation, measurements, and plotting of stereo side-looking radar photography.

Dissimilarities between the geometric relationships within a side-looking radar photograph and those of a picture obtained with a conventional camera are so great that adaptation of analog-type stereoplotters for use with the S-L radar was previously impossible.

Others had recognized that only by use of an analytical type plotter (such as the AS–11A) was there any chance of properly accommodating stereo radar photography. Norvelle was the first researcher able to derive the mathematics necessary for proper orientation and compilation from these slant-range photographs. The AS–11A computer now can be programed so that the operator has a parallax-free stereomodel to observe at all times.

Norvelle earned a BS degree in civil engineering from the University of Virginia in 1962 and has done graduate work at Syracuse University. He has been employed at USAETL since March 1962.

Bowker, chief of the Inertial Surveying Branch, Surveying and Geodesy Division, was honored for directing R&D programs for several top priority tasks. He was cited particularly for supervising development of the lightweight gyro-azimuth theodolite and the position and azimuth determining systems that have provided a new capability for artillery and the field army.

He served in the Army during 1944–45 and has been employed at the laboratories since 1946. He attended Iowa and Catholic Universities.

Dr. Pi-Fuay Chen, a nominee for the Scientific and Technology Award, and Dale E. Howell, a nominee for the Leadership Award, along with the two winners, were presented Certificates of Achievement.

LEADERSHIP Award is presented to Oscar W. Bowker by Lt Col George N. Simcox, deputy CO of U.S. Army Engineer Topographic Laboratories.

SCIENTIFIC AND TECHNOLOGICAL Achievement Award is presented to Franklyn R. Norvelle (left) by Gilbert G. Lorenz, USAETL technical director.

Watervliet Studies Unorthodox Grenade Concept

Doughnut-shaped projectiles fired from a grenade launcher might not be expected to achieve significantly increased range, but Watervliet (N.Y.) Arsenal, U.S. Army Weapons Command, claims the futuristic design gives the missile a "flying capability."

The unorthodox configuration has a built-in airfoil cross-section that acts like the wing of an aircraft to increase the range of the projectile over that of the normal bullet shape.

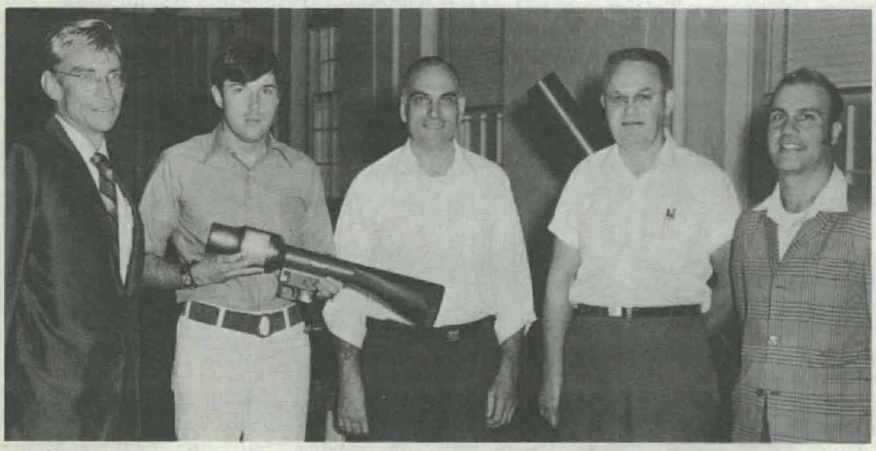
The concept of a ring airfoil grenade (RAG) was generated by Abraham Flateau, chief of the Aerodynamics Research Group of the Edgewood (Md.) Arsenal research laboratories. Initial studies and tests showed by early 1970 that the concept had sufficient promise to warrant a feasibility study of a launching device.

In mid-1970 the U.S. Army Small Arms Systems Agency, Md., chose Watervliet Arsenal to conduct the study and to provide feasibility demonstration hardware. Watervliet's Development Engineering Division, directed by Paul K. Rummel, conducted the study with the Edgewood group that had devised the projectile.

Essential prototype primer hardware was developed and supplied by Frankford (Pa.) Arsenal's Concepts and Exploratory Development Branch, directed by Emmanuel Weinstock.

Design and development of the launcher—as well as testing for muzzle velocity and spin—was carried out in nine months by Watervliet's Component Developments Branch headed by Walter H. Austin Jr. John J. Busuttil was the project leader.

Other arsenal employes who contributed significantly to the project included Alf Miller, chief of design services, mechanical engineer Ronald Gast and Anthony Rinaldi and Matthew Sroczynski, mechanical engineering technicians.



WATERVLIET ARSENAL TEAM for ring airfoil grenade includes (from left) Walter H. Austin Jr., Ronald Gast, Anthony Rinaldi, Alf Miller and John Busuttil.

BESRL Studies Internal Response Systems to Augment Human Performance

Is it possible to exploit man's covert (internal) responsiveness in order to augment human performance in a military situation?

Essentially, this is the question the U.S. Army Behavior and Systems Research Laboratory (BESRL), a part of the Manpower Resources Research and Development Center, is attempting to answer in long-term experimentation on covert response systems.

Under the direction of Dr. J. E. Uhlaner, Dr. Michael Kaplan, a BESRL principal scientist, is exploring, in the Response Systems Work Unit, a new approach to vigilance and monitoring performance tests. The effort is described as "a relatively unexplored realm of investigation."

Essential to an understanding of this research is the distinction between overt and covert behavior. Overt behavior is action observable without the aid of recording instruments. Covert responses involve internal behavior usually detected and recorded with instrument assistance.

The electroencephalograph, electrocardiograph, and electromyograph are examples of such recording instruments. They utilize electrical signals from the covert response systems, and these signals can be transmitted by radio telemetry. Dr. Kaplan calls them "electro-behavioral signals."

Another helpful distinction is the difference between operant and respondent behavior. Operant responses are voluntary, motor behavior; conversely, respondent behavior is generally involuntary, typified by autonomic nervous system responses.

The overt response systems that Dr. Kaplan is concerned with involve operant behavior, but in the area of covert behavior he is looking at both autonomic responses and imperceptible operants.

Dr. Kaplan's experimental approach depends on the observation of a basic similarity between overt and covert response systems in that both are affected by stimuli from the external environment.

Postulating that man may be "neglecting" his ability to be *internally* receptive to environmental information, Dr. Kaplan is studying the utility of covert responses in monitoring and performance situations.

Past observations from the Army's psychological experimentation in these areas have indicated that soldiers' performance curves exhibit deterioration effects over time. Initially, the men show high performance and accuracy rates, but begin to make discrimination errors after several hours of sustained performance.

Emphasizing that such discrimination errors are external, overt response errors, Dr. Kaplan is searching for internal response-correlates to the same external stimuli as those involved in customary monitoring and vigilance experiments. He is also proceeding on the possibility that internal responses are more rapid and sensitive than external motor or verbal responses to environmental factors.

He hypothesizes that internal response systems might profitably (a) give early warning signals that the subject will soon begin to deteriorate in his monitoring or vigilance behavior; and (b) continue to respond reliably to external stimuli long after overt reactions to signals deteriorate.

His experiment rests on two major speculations: Firstly, that there are some covert responses (e.g., changes in electrical muscle potentials, skin resistance, depth of breathing) which parallel and some which bear special time relationships to overt reactions to external stimuli; secondly, that these internal response changes, characteristic of a particular subject, can be used as cues that predictably precede deterioration of his external responding to monitoring signals.

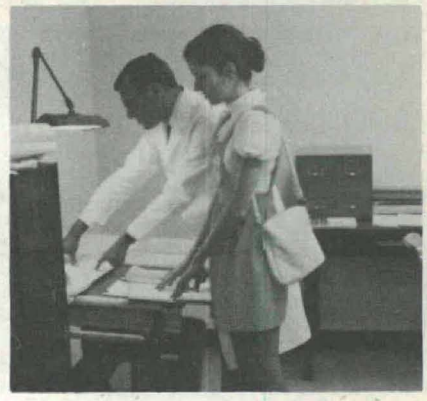
Should these speculations prove true in long-sustained studies, he believes that practical applications abound. For instance, an electrical switch-triggering device might be used to sound an alarm when electro-behavioral signals from a monitoring subject evidence covert cues known characteristically to precede his onset of performance-deterioration.

Deterioration cues also could be transmitted by radio to the commanding officer, who, like the football coach taking players in and out of the game, might suggest the monitor revive himself, rest, or be replaced. Dr. Kaplan also suggests his work may ultimately permit another efficiency in utilization of monitoring personnel.

Should individual differences in the capacity for sustained monitoring performance be established, he explains, soldiers with longer alertness spans could be most suitably assigned to monitoring jobs.

One of the most speculative aspects of BESRL's work in covert response-systems is the possibility (already seen briefly in its laboratory) that internal responses to stimuli continue reliably long after the external responders fail. This could happen when a soldier is drowsy or falls asleep.

If this premise proves true, a subject might "report" stimuli by his internal reactions. In response to these stimuli, the subject is presumably responding via covert as well as overt response systems.



BESRL'S Dr. Michael Kaplan explains electrocardiograph fluctuations concomitant to deterioration of human vigilance performance to Carol Keegan a University of Ohio student employed during the summer as an intern on the *Army R&D Newsmagazine* staff.

Should internal autonomic responses be found more sensitive than overt responses, then classical (Pavlovian) conditioning might be employed so that the critical signal to be detected elicited an autonomic response. A radar operator, for example, might "report" a special blip with his heart rather than his voice.

BESRL leaders see several valuable nonmilitary applications of this research. Medical researchers, for example have explored the activation of prosthetic devices by means of electrical muscle potential. Dr. Kaplan foresees more accurate plotting of a sensitive psycho-physical hearing curve.

Basic research projects such as this covert-overt response experiment require only a fraction of BESRL's research budget and manpower resources. Still, Dr. A. Hyman, deputy director for Human Performance Experimentation Research, believes that the scientific payoff from such investigation may eventually be considerable.

One indirect payoff to Washington's academic community has been the opportunity for American University psychology graduate students to intern with BESRL and merit academic credit for work on the project.

The cooperative relationship with the university serves, in Dr. Uhlaner's view, as a valuable public relations effort. Offering students a "priceless learning opportunity," it also encourages them to seek scientific careers in federal government.

ARMY MATHEMATICIANS CONFERENCE—Dignitaries participating in the 17th conference of Army Mathematicians at Redstone (Ala.) Arsenal, sponsored by the Army Mathematics Steering Committee on behalf of the Office of the Chief of Army Research and Development (OCRD), included (l. to r.) Prof. John D. C. Little, Massachusetts Institute of Technology; Dr. Francis G. Dressel, Army Research Office, Durham (ARO-D), N.C.; Prof. Lawrence C. Young, University of Wisconsin; Dr. Alan S. Galbraith, ARO-D; Dr. Fred Frishman, OCRD; Prof. J. Barkley Rosser, University of Wisconsin; and Prof. Henryk A. Antosiewicz, University of Southern California (L.A.).

Army Mathematicians Discuss R&D Applications

Advanced mathematics technology applications to current and envisioned U.S. Army materiel research and development problems were reported and discussed during the 17th Conference of Army Mathematicians.

HQ U.S. Army Missile Command (MICOM), Redstone (Ala.) Arsenal was host to the meeting sponsored by the Army Mathematics Steering Committee on behalf of Army Chief of Research and Development Lt Gen William C. Gribble Jr.

Featuring the program were four presentations by invited speakers, a panel discussion and 46 technical papers given at 16 sessions. Eleven papers could not be fitted into the agenda. Several of these will be given at the 17th Conference on the Design of Experiments in Research, Development and Testing in October at the Walter Reed Army Institute of Research (WRAIR), Washington, D.C.

Prof. John D. C. Little, Massachusetts Institute of Technology, spoke on "Managers and Models—A Concept of Decision Calculus," and Prof. H. A. Antosiewicz, University of Southern California, Los Angeles, discussed "Stability Theory: An Overview."

Other guest speakers were Robert Miles, University of North Carolina, Chapel Hill, "Historical Background for Mathematical Models," and A. W. Dobieski, TRW, Inc., "A Complete Simulation of Small Independent Action Forces."

Dr. John L. McDaniel, director of Research, Development, Engineering and Missile Systems Laboratory at MICOM, chaired a panel session on "Control Mathematical View of Management in Man-Organized Systems."

Other panelists were Dr. Maurice J. Zucrow, professor emeritus, Mechanical Engineering Department, Purdue University, and Dr. Robert E. Shannon, associate professor, Industrial Systems Engineering, University of Alabama.

SESSION 1. Chairman, Barry Rodin, Ballistics Research Laboratories, Army Aberdeen (Md.) R&D Center. *Geometric Programing Applied to the Design of Thermal Power Supplies*, Gerald M. Schultz, Harry Diamond Laboratories, Washington, D.C. *Compression of Topographical Data Through Polynomial Approximation and Its Application to the Field Artillery Problem*, T. Pavlidis, Princeton University, and M. Langan, Frankford Arsenal, Philadelphia, Pa.

SESSION 2. Chairman, Eric Mendelson, U.S. Army Mobility Equipment R&D Center (MERDC), Fort Belvoir, Va. *Convergence in Measure When the Limit Function is Infinite on a Set of Positive Measure*, 1st Lt Robert D. Tortora, U.S. Army Security Agency, Arlington, Va. *Comparisons of Coordinate Systems and Transformations for Trajectory Simulations*, Bernard F. Engebos, Atmospheric Sciences Laboratory, White Sands (N. Mex.) Missile Range (WSMR). *On Flip Flop Wing Controls and Trackerless Four-Quadrant Seekers for Sampled Line-of-Sight Pursuit Missiles*, Ernst T. Evers-Euterneck, HQ MICOM.

SESSION 3. Chairman, Hal Weidner, U.S. Army Weapons Command (WECOM), Rock Island (Ill.) Arsenal. *Transient Inviscid Compressible Flow Through the Gun Barrel*, Rao V. S. Yalamachili, Science and Technology Laboratory, WECOM. *Using Measured Material Parameters in Solving Forced Motion Problems in Viscoelasticity*, Struan R. Robertson, Watervliet (N.Y.) Arsenal. *Interrelations and Bounds on Moduli in Composite Materials*, E. M. Lenoe, Theoretical and Applied Mechanics Research Laboratory, U.S. Army Materials and Mechanics Research Center (AMMRC), Watertown (Mass.) Arsenal.

SESSION 4. Chairman, Oskar Essenwanger, MICOM. *The Integration of Prandtl's Mixing Length Equation*, Robert P. Lee, Atmospheric Sciences Laboratory (ASL), WSMR. *An Iterative Algorithm for Calculating Potentials Near Small Groups of Finite Charged Plates*, F. S. Acton and J. Barkley Rosser, Mathematics Research Center (MRC), University of Wisconsin, Madison, Wis. *Intermolecular Hard-Core Potentials—Point Transformations with Boundary Conditions*, Norman M. Witriol, MICOM. *On the Numerical Solution of Brovar's Integral Equation for a Generalized Surface Density*, H. Baussus von Luetzow, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Va.

SESSION 5. Chairman, Capt Isaac S. Metts Jr., WRAIR. *Probability Distributions for Multi-Variable Functions*, Charles M. Bowden, MICOM. *Evaluation of a Certain Atomic Integral*, J. F. Perkins, MICOM. *Conserved Quantities in the Equation of a Motion of an Interacting Fermion-Boson Field*, R. A. Shatas, MICOM, and C. A. Coulter, Clark University, Worcester, Mass.

SESSION 6. Chairman, Julian Davis, U.S. Army Munitions Command, Picatinny Arsenal, Dover, N.J. *On Forced Vibrations in the Linear Theory of Micropolar Elasticity*, G. L.

Anderson, Benet Research and Engineering Laboratories, Watervliet Arsenal. *Dynamic Stress Intensity Factor for an Unbounded Plate Having Collinear Cracks*, M. A. Hussain and S. L. Pu, Benet Research and Engineering Laboratories, Watervliet Arsenal. *Plastic Deformation in a Transversely-Isotropic Annular Plate Stressed by Internal Pressure*, Peter C. T. Chen, Benet Research and Engineering Laboratories.

SESSION 7. Chairman, Maj P. V. Perrino, WRAIR. *Fixed Points and Periodic Differential Equations*, Leon Kotin, Institute for Exploratory Research (IER), U.S. Army Electronics Command (ECOM), Fort Monmouth, N.J. *Boundedness of Solutions for a Second Order System of Differential Equations*, Irving J. Epstein, IER. *A Reformulation of Schoenberg's Explicit Solution of the Finite Cubic Spline Interpolation Problem for Equidistant Data*, T. N. E. Greville, MRC.

SESSION 8. Chairman, Capt David L. Bitters, U.S. Army Combat Developments Command, Fort Belvoir, Va. *Response of Rotor Blades to Randam Inputs*, C. Lakshmikantham, AMMRC. *Optimal Design of Elastic Structures II: Continuous Problems*, E. J. Haug Jr., K. C. Pan, and T. D. Streeter, WECOM. *Distributed Parameter Optimal Design*, E. J. Haug Jr., WECOM.

SESSION 9. Chairman, L. C. Young, MRC, U. of Wisconsin. *Computational Solution of Ratio Games by Iterative Linear Programing*, Stephen M. Robinson, MRC, U. of Wisconsin. *The Forced Motion of a Nonconservatively Loaded Elastic System*, Wayne W. Walter, Benet Research and Engineering Laboratories. *Nonclassical Orthogonality and Expansion Principles for Second and Fourth Order Systems*, E. J. Brunelle, Watervliet Arsenal (also associate professor, Rensselaer Polytechnic Institute).

SESSION 10. Chairman, E. M. Lenoe, AMMRC. *The Time Behavior of Plane Cracks Under Impulsive Loads*, Siegfried H. Lehnigk and Bernard Steverding, MICOM. *The Creation of Planetary Surfaces*, Bernard Steverding and Siegfried H. Lehnigk, MICOM. *On Torsion-Extension for Materials That Creep and Its Use in Determination of Mechanical Material Response*, P. A. Lilienthal, U.S. Army Cold Regions Research and Engineering Laboratory (CRREL), Hanover, N.H.

SESSION 11. Chairman, H. M. Hung, WECOM. *A New Approach for Equations of State at Elevated Temperatures and Pressure*, George W. Swan, Department of Pure and Applied Mathematics, Washington State University, Pullman, Wash. *Discrete Variable Method Applied to Transient Heat-Conduction Problems*, Shih-Chi Chu, Science and Technology Laboratory, WECOM. *Simple Thickness Modes for Laminated Composite Materials*, Charles R. Thomas, WECOM Maggs Research Center, Watervliet Arsenal.

SESSION 12. Chairman, William Agee, WSMR. *On the Digital Simulation of Signals and Systems*, Capt Michael J. Piovoso, IER. *Time Series Editing by Generalized Differences*, Louis D. Duncan, ASL. *A Quartic Generalized Spline Digital Filter*, William L. Shepherd, WSMR.

SESSION 13. Chairman, P. A. Lilienthal, CRREL. *Diffraction of a Plane Wave Normally Incident on a Aperture in a Plane Screen*, Walter Pressman, IER. *Analysis of Misalignment Effects on Transmission Properties of Beam Waveguides*, J. Benson, IER.

SESSION 14. Chairman, C. M. Greenland, U.S. Army Chemical R&D Laboratories, Edgewood Arsenal. *An Existence Theorem for Contingent Equations*, Jack T. Markin, U.S. Army Aviation Systems Command, St. Louis, Mo. *Display of Integer Solutions*, W. W. Happ, U.S. Army Corps of Engineers, Champaign, Ill.

SESSION 15. Chairman, Alan Galbraith, U.S. Army Research Office-Durham (ARO-D), N.C. *An Approximate Method for Elastic Indentation Problems with Slip*, Ben Noble, MRC. *Inversion of Almost Identical Matrices*, Goetz Uebe, MRC. *Closed Solution Curves for Nonlinear Differential Equations, A New Method*, G. Di Antonio, The Pennsylvania State University, Middletown.

SESSION 16. Chairman, Walter Sewell, ARO-D. *A Problem in Stochastic Control of Queues*, N. U. Prabhu, MRC. *Approximate Determination of Periodic Solutions of a Class of Nonlinear Differential Equations*, Jagdish Chandra, ARO-D, and B. A. Fleishman, Rensselaer Polytechnic Institute, Troy, N.Y. *Dual Extremum Principles in Applied Mathematics*, M. J. Sewell, MRC.

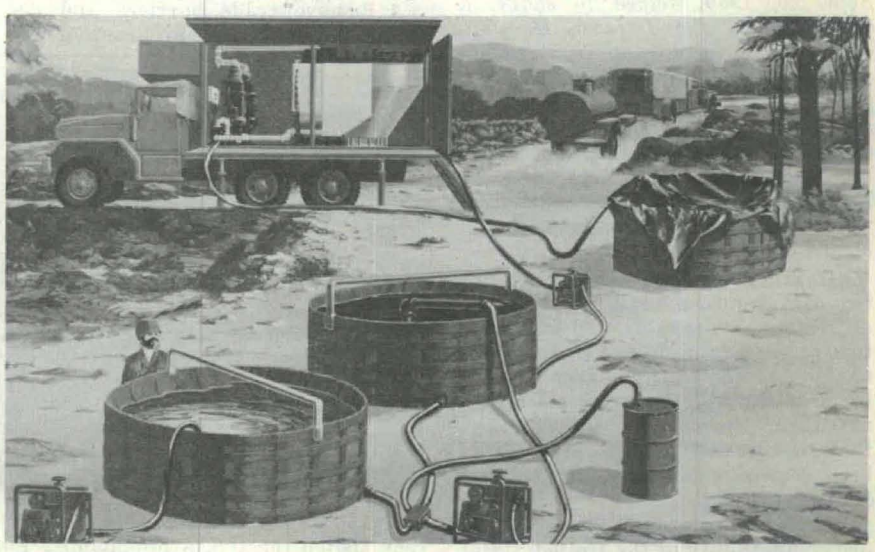
Army Type-Classifies Water Decontamination Set

Equipment designed particularly for the destruction of known chemical and biological contaminants in water has been Type Classified Standard A as a simple and effective method adapted to field army requirements.

Development of the new water decontamination set was announced July 30 by the U.S. Army Mobility Equipment R&D Center, Fort Belvoir, Va.

Chemical and biological contaminants in water are destroyed prior to the normal coagulation and filtration steps inherent in the standard "Erdlator" Army water purification units. Pretreatment consists of superhypochlorination and activated carbon adsorption in series.

The process is the same regardless of chemical or biological materials, eliminating the requirement for differentiating between different materials in the raw water. The system essentially removes the hazard of handling contaminated water in the Erdlator unit.



IN A FIELD METHOD developed to destroy chemical and biological contaminants, water is pretreated by superhypochlorination and activated carbon adsorption before entering truck-mounted Army water purifier. Pretreatment is accomplished in two uncovered collapsible water tanks. Potable water enters the covered tank from purifier developed by the Mobility Equipment R&D Center.

U.S., Canada Review Development-Sharing Program at Meeting

Understanding of current objectives, procedures and some of the outstanding ongoing efforts and results of the United States/Canadian Defense Development-Sharing Program was advanced at a recent briefing for U.S. Army agencies concerned with R&D efforts.

Conducted at the U.S. Army Research Office in the Highland Building, Arlington, Va., the briefing was given by Deputy Chief Richard Blake of the Canadian Defence Research Staff and Earl G. Jones, Canadian Department of Industry, Trade and Commerce.

In attendance were representatives of all directorates and major elements of HQ, Office of the Chief of Research and Development, U.S. Army; also, representatives of the U.S. Army Materiel Command, Combat Developments Command, Office of the Surgeon General, Office of the Chief of Engineers, and division chiefs of the U.S. Army Research Office.

Initiated by an agreement signed Sept. 14, 1960, the Defense Development-Sharing Program had its beginning in the Hyde Park Agreement of 1941 concerning mutual industrial mobilization for World War II. Following that conflict, the concepts were progressively extended, leading to the Joint Industrial Mobilization Planning Committee.

The "Statement of Principles for Economic Cooperation," signed by the Prime Minister of Canada and the President of the United States on Sept. 20, 1950, helped to shape, a decade later, the Defense Development-Sharing Program. It stated in part:

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

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

The historical affinity and continued compatibility of the United States and Canada in pursuance of mutual defense and joint industrial development objectives was stated, rather eloquently, in the January 1967 edition of the *Army R&D Newsmagazine.*

Donn R. Grand Pre, then on the staff of the Deputy Assistant Secretary of Defense for International Logistics Negotiations, and from 1958 to 1966 a key staff member of the International Office, Office of the Army Chief of R&D, stated in an article on the Defense Development-Sharing Program:

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

Grand Pre's article pointed out that Canada has been a major supplier of materials for U.S. industry for more than 100 years and that:

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

Objectives of the Defense Development-Sharing Program outlined in the 1950 statement leading to its establishment in 1963 have not changed greatly despite organizational and procedural modifications consistent with progress. Objectives then were:

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

The need for a briefing to update all U.S. Army R&D primary or related activity leaders with changes in the Canadian R&D organization and procedures was recognized during a recent visit of U.S. leaders to Canada.

Among U.S. representatives were General Henry A. Miley, CG, U.S. Army Materiel Command, Army Chief of R&D Lt Gen William C. Gribble Jr., Army Chief Scientist Dr. Marvin E. Lasser, and members of their staffs.

U.S. Army Chief of Staff General William C. Westmoreland indicated recently a keen interest in foreign developments of potential usefulness in mutual defense activities, and a desire to be kept continuingly informed.

During a recent meeting of heads of directorates in the Office of the Chief of R&D, Director of Army Research Brig Gen George M. Snead Jr. was requested to "look into" the relationship of the Canadian Defence Research Board participation in the U.S./Canadian Cooperative R&D Program—particularly as relates to a need for further cooperative effort.

The Canadian Defence Research Board is concerned primarily with research and preliminary development, corresponding to basic research and exploratory development known in U.S. Army R&D funding parlance as 6.1 and 6.2 categories.

Both of these programs are devoted to the free exchange of research information of mutual interest to the partners in the ABCA (American, British, Canadian, Australian) Ar-

CANADIAN OFFICERS were oriented on magnetic and seismic sensors when they visited the U.S. Army Mobility Equipment R&D Center (MERDC) at Fort Belvoir, Va. Col Bennett L. Lewis (second from right), MERDC commander, welcomed Brig Gen H. B. Brodie (second from left), senior liaison officer (Army) and Canadian Forces attache in Washington, D.C.; Lt Col J. F. Preston (right), senior staff officer, Land Engineering, Canadian Defence Liaison Staff; and Maj. C. K. MacLeod (left), Canadian liaison officer assigned to the MERDC.

mies Technical Cooperation Program.

The Defense Development-Sharing Program is "dedicated to joint development of materiel."

Under provisions of the November 1963 joint agreement, as a follow-on amplification of the earlier Defense Production-Sharing Program, each of the U.S. Armed Forces can enter into cooperative developmental projects with Canada in accordance with the following criteria:

- Designed to meet a specific United States military requirement.
- Jointly funded by the U.S. and Canada (at least 25 percent by the U.S.).
- Performed by a Canadian prime contractor.
- Subject to United States design authority.

U.S. Army Regulation 1–25, dated 29 April 1964, states objectives of the Defense Development Sharing Program (DDSP):

- To assist in maintaining the DDSP at a high level by making it possible for Canadian firms to perform R&D undertaken to meet requirements of the U.S. Armed Forces.
- To better utilize the industrial, scientific and technical resources of the United States and Canada in the interest of mutual defense.
- To make possible the standardization and interchangeability of a larger amount of the equipment necessary for the defense of the United States and Canada.

The Canadian prime contractor is jointly selected; the contract is negotiated between the U.S. developmental agency and the Canadian Commercial Corporation (CCC), a government-owned and operated agency. The CCC signs a separate agreement with the contractor and acts on behalf of the U.S. in all future negotiations.

Responsibility for technical direction and supervision of the project rests with the U.S. developing agency. The Canadian Government assures the contract guarantee.

Six of the 20 projects undertaken since 1963 are now active and at least three additional projects are expected to be negotiated soon.

Active projects include an air-transportable maintenance shop; Band IV head for AN/GRC–103 radio relay set; meteorological research, development, testing and evaluation rocket; meteorological data sounding system rocket; tactical aircraft guidance system and Lance missile lightweight launcher.

Proposed projects include a dual safing and arming mechanism for rockets and guided missiles; recording radiation monitor and automatic radiation alarm system; track for lightweight (10–15 tons gross weight) with increased life and cost effectiveness.

Military, economic and political considerations of mutual benefit to Canada and the U.S. are covered in the U.S. Department of Defense Armed Services Procurement Regulation (ASPR) 6–501. Over 400 Canadian firms have obtained defense prime and subcontracts on this basis.

A brochure on the U.S./Canadian cooperative industrial development effort titled "Canadian Defence Commodities" contains answers to some of the questions asked most frequently by U.S. industry executives. Additional information is presented in "Production Sharing Handbook."

Both of these publications are available free of charge from the nearest Canadian Consulate in the U.S. or from the Canadian headquarters office. The address of the headquarters is: Chief, U.S. Market Development Division, International Defence Programs Branch, Department of Industry Trade & Commerce, 112 Kent Street, Ottawa 4, Ontario, Canada.

OTSG Announces Assignments of Key Personnel

The Army Surgeon General's Office recently announced three asignments of key personnel.

Lt Col John P. Piercy, MSC, will serve as chief of the Environmental Engineering Branch of the Preventive Medicine Division, succeeding Col Bernard L. Goldstein, MSC, new executive officer, Directorate of Health and Environment.

Col Piercy formerly was sanitary engineer with the Eighth U.S. Army in Korea, the U.S. Army Environmental Hygiene Agency at Edgewood (Md.) Arsenal and with the 10th Medical Laboratory in Europe.

He is a member of the Registered Professional Engineers in Texas, the American Society of Civil Engineers, and the National Society of Professional Engineers; a Diplomate of the American Academy of Environmental Engineers; and a Fellow of the American Public Health Association.

Col (Dr.) Robert W. Parvin, MC, is newly assigned to the Army Surgeon General's Office as Chief, Primary Care Branch, Office of the Special Assistant for Medical Corps Affairs, Directorate of Professional Services.

Col Parvin was a consultant and medical member of the Army Council of Review Boards, Office of the Secretary of the Army (1965–71).

Certified by the American Board of Orthopaedic Surgery, he has been based at various hospitals in the Continental U.S., Germany and Hawaii. He was also deputy chief, Physical Standards Division, Office of the Army Surgeon General (1964–65). He has been awarded the Legion of Merit, Army Commendation Medal (with OLC), and fellowship in the American College of Surgeons. He is a member of the American Medical Association, the American Academy of Orthopaedic Surgeons, the Association of Military Surgeons of the United States, the Eastern Orthopaedic Association, and the Washington Orthopaedic Society.

Col Reginald C. Thomas, MCS, is the new special assistant to the Surgeon General for Intelligence and chief of the Medical Intelligence Office. He succeeds Col William B. O'Neill, MSC, who is returning to a NATO assignment in Europe.

Col Thomas has served as a laboratory officer, Microbiology Branch, at the Third U.S. Army Headquarters Lab, Fort McPherson, Ga. Other assignments have been in Europe, Hawaii and Brooke Army Medical Center, Fort Sam Houston, Tex.

Col Bass Assigned as Pine Bluff Arsenal Commander

Command of Pine Bluff (Ark.) Arsenal passed from Col John K. Stoner Jr., who now heads Edgewood (Md.) Arsenal, to Lt Col (Col designate) Sampson H. Bass Jr. late in July. Col Bass had served since July 1969 as director, Weapons Development and Engineering Laboratories, Edgewood Arsenal.

While at Edgewood, he also served as director of Task Force Eagle, the Army's demilitarization program for the destruction of obsolete stocks of bulk chemical agents and munitions stored at Rocky Mountain (Colo.) Arsenal, a subpost of Edgewood Arsenal.

Col Bass has a BS in chemistry from Virginia Military Institute and master's in business administration from Harvard University. He is a graduate from the Command and General Staff College, Fort Leavenworth, Kans., and the Army War College, Carlisle Barracks, Pa.

His decorations include the Legion of Merit with Oak Leaf Cluster, Air Medal with two Oak Leaf Clusters (OLC), and the Army Commendation Medal with four OLC.

Lt Col S. H. Bass Jr.

Army Vehicle Development Contributes to Rover Success on Moon

When the lunar surface rover vehicle was used for the first time in the Apollo 15 moon mission in late July, the U.S. Army Corps of Engineers could take pride in its contribution to that "land mobility."

As far back as 1959, Army scientists projected the requirement for a mobility system during future exploration of the moon. Harry N. Lowe Jr., chief of Corps of the Engineers Extraterrestial Research Agency, recently said the Army then recognized that "any meaningful exploration of the moon must make man mobile."

During the early and mid-sixties, the National Aeronautics and Space Administration likewise cited the urgent need for a lunar rover. Because NASA's primary concern with propulsion systems and spacecraft design was rather divergent from its need to construct a terrestial mobile system, NASA requested the Army's assistance in developing a lunar rover.

Specifically, NASA requested the Army to study the feasibility of converting an existing terrestial vehicle, the Army M–274 "Mule," into an efficient, dependable lunar system.

Consequently, a series of studies led by the U.S. Army Materiel Command and the Office of the Chief of Engineers considered the lunar potential of the lightweight, gas engine-powered Mule—previously designed, developed and employed for the support of combat Infantry operations. The gasoline engine was replaced by battery power for lunar use.

AMC and OCE leaders rallied the assistance of the Army Tank Automotive Command, Warren, Mich., and the Mobility Equipment Research and Development Laboratories, Fort Belvoir, Va., in order to respond to the feasibility questions posed by NASA's Office of Manned Space Flight.

The Army Test and Evaluation Command, Aberdeen (Md.) Proving Ground and the Waterways Experiment Station, Vicksburg, Miss., also contributed pertinent information.

The Army Vehicle Lunarization Study, released in April 1966, was described as, " . . . a study conducted for the purpose of determining if it would be feasible to modify a current military cargo type vehicle to operate in the lunar environment . . . ."

Essentially, the lunarization study subjected three modified versions of the Mule model to levels of analysis.

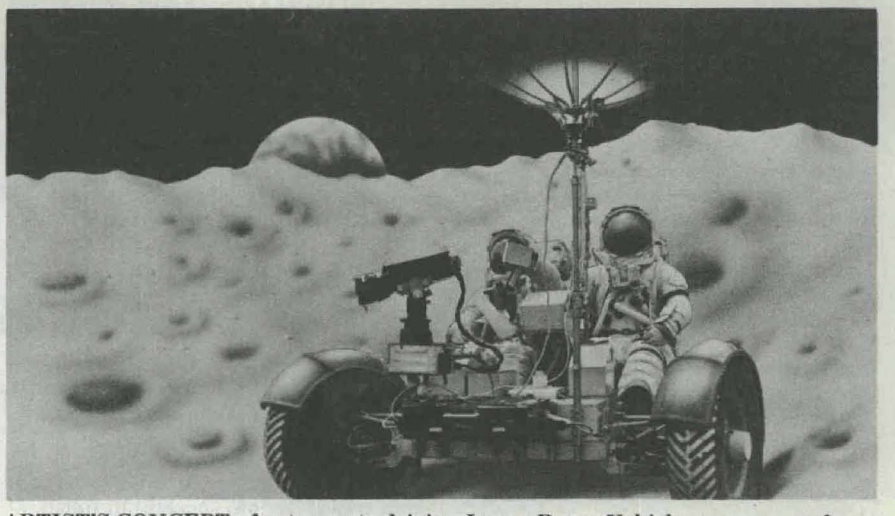
Mod Level One delineated the minimum changes needed to provide the proposed lunar vehicle with a capability consistent with the study criteria at a minimal cost.

Mod Level Two analyzed changes that would provide somewhat better mobility characteristics than the Mod Level One at a modest cost increase.

Mod Level Three described the design with the highest level of performance feasible, with maximum modification logically possible while still retaining any portion of the basic Mule structure.

Upon completion of the study, all three levels of the Mule modification were judged feasible for a vehicle lunarization process. The Mule could, it was agreed, be modified as a lunar rover capable of expanding the surface mobility of U.S. moon explorers.

The study report concluded that while " . . . a development program



ARTIST'S CONCEPT of astronauts driving Lunar Rover Vehicle on moon surface.

WSMR Tested Space Suit for Apollo 15 Astronauts

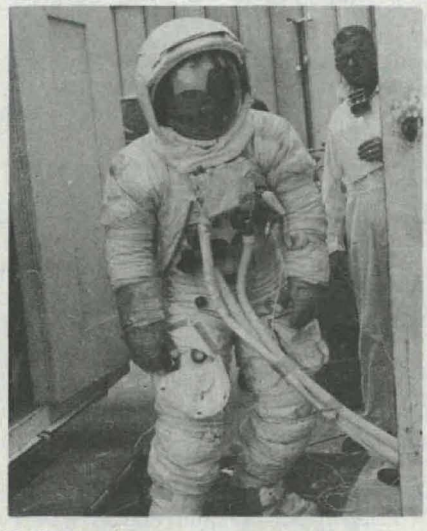
Apollo 15 astronauts wore a new type of space suit tested at White Sands (N. Mex.) Missile Range when they were launched July 26 for the first exploration of the moon's surface using the land rover vehicle.

Mobility and ease of movement are the advantages of the new suit, developed for NASA by ILC Industries. For the first time, the suit permits the astronauts to bend from the knees and at the waist, providing for more natural movement and the flexibility necessary to ride the moon rover.

Tests on the suit were conducted in the WSMR 64-square-foot dust chamber to determine dust interference to mobility. Four 30-minute sessions of mobility exercises were performed in the chamber. After each, the suit was examined thoroughly for framework hinge malfunction, or damage to the outer fabric caused by blowing dust.

Dust used was actually over 200 pounds of pulverized 140 mesh silica "flour," circulated by a P–51 aircraft propeller, driven by a 75-horsepower electric motor.

White Sands was selected for this phase of testing for its low humidity, but the project was delayed in its test phase at WSMR because of unusually high humidity. The suit was also subjected to rigorous testing elsewhere to prove its ability to perform satisfactorily during all the operations and functions required for the lunar excursion.



NASA quality assurance engineer Ben Ingels observes as David Burris, a professional "guinea pig," adjusts space suit pressure before entering dust chamber for tests at White Sands (N. Mex.) Missile Range. Suit pressure was maintained at 3.75 pounds p.s.i. (grade) above normal sea level pressure.

for a lunar surface vehicle by a modification route is practical and feasible . . . the use of any one particular terrestial vehicle as the modification departure vehicle does not appear, however, to be the best answer. Rather, the program would be best attempted by a vehicle concept synthesis of systems and components."

The program feasibility analysis further explained that this synthesis would ideally utilize, to the fullest extent, systems and components already developed or under development for terrestial cross-country vehicles; the modification process would then be applied to lunarize these systems and components.

The suggested synthesis-modification program of lunar vehicle development, it was estimated, would cost close to that of the third-order modified Mule vehicle ($21.1 million).

Acting on the considered advice presented in the Army vehicle lunarization study, NASA subsequently signed with independent contractors for construction of the three lunar rovers now in existence.

While Lowe acknowledges "striking similarities between the lunar rover and the modified Mule," he was quick to emphasize the "continuing solid contribution" of all the U.S. Armed Forces to the national space effort.

Citing past space exploration achievements as an integrated civilian and military effort, Lowe attributes the development of the lunar rover to the "best minds" in astronautical engineering, space environment, power systems and automotive design.

The electric-powered, 460-pound lunar vehicle was designed for a maximum speed of 10 miles per hour. Particularly useful in the astronauts' exploratory missions was the rover's rear storage area, capable of holding the 200 pounds of rock samples collected by Scott and Irwin, during three rover expeditions. The 4-wheel, 2-seater vehicle, with steering power in all four wheels, offered an unusual push-button drive system, as a steering wheel alternative.

CDC Seeks Whirlpool System To Aid Frost-Injured Soldiers

A Cold Injury Rewarming and Treatment System is being considered by the U.S. Army Combat Developments Command (CDC), Fort Belvoir, Va., to provide almost immediate aid to frost-injured soldiers.

The concept is that a hospital-type whirlpool warming bath will be in the Battalion Aid Station to start rewarming and massage of frozen extremities immediately, to avoid further injury or infection. A CDC-directed study, "Medical Operations in Northern Area," showed that water warms human flesh four times faster than does air.

CDC seeks a system capable of circulating water in a tank at a steady 104° F., with pressure temperature controls, "Fair-safe," and alarm systems. The empty tank, heater and all devices should not weigh more than 10 pounds, with most of it fitting into a 3-cubic-foot suitcase.

Aberdeen Proving Ground Participating in PME Program

Aberdeen Proving Ground will participate in a "Personnel Management for Executives" (PME) program beginning this October.

John A. Sternberg, chief of the Training and Development Division at Aberdeen, has been named program coordinator for the District of Columbia-Virginia-Maryland Region PME program.

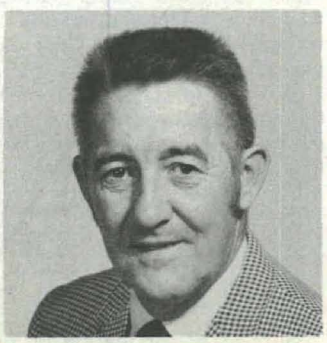
In accordance with the guidelines of the Deputy Chief of Staff for Personnel of the Army, he will conduct the first of the courses Oct. 13–22 in Washington, D.C. Additional classes are planned for Dec. 1–10, 1971; March 1–10, 1972; and May 3–12, 1972.

Since its initiation in 1954, the program has evoked the participation of more than 20,000 military and civilian executives.

Designed to improve the capabilities of Army executives in the management of human resources, the PME classes are not courses of instruction, in the traditional sense.

Rather, PME learning activities include general sessions with speakers from government, industry and educational institutions. Individual study, selected reading in the field of management, case studies, problem-solving exercises and management personnel role-playing are among the educational techniques utilized.

The PME is designed for top levels of management—military and civilian—and is essentially limited to "field grade" (GS–12 and above). First preference is given to nominees who are senior officers, military and civilian, particularly commanding officers, division and branch chiefs, key personnel and staff officers.



John A. Sternberg

Symposium on Air Pollution Scheduled Dec. 7-9 at NMSU

Three internationally known speakers have accepted invitations to address a Symposium on Air Pollution, Turbulence and Diffusion, Dec. 7–9, at New Mexico State University.

They are Dr. Frank Pasquill, British Meteorological Office, Dr. Niels Bush, Danish Atomic Energy Commission, and Dr. Werner Klug, Institute for Meteorology, Darmstadt, Germany. Noted American speakers will include Dr. W. C. Sinbank, National Center for Atmospheric Research, and Dr. Charles Hosler, Dean, School of Mineral Industries, Pennsylvania State University.

Symposium organizers include personnel of the Atmospheric Sciences Laboratory, U.S. Army Electronics Command, at White Sands (N. Mex.) Missile Range, the Sandia Laboratories at Albuquerque, N. Mex., the Physical Sciences Laboratory at New Mexico State University, and the Social Services Department, State of New Mexico.

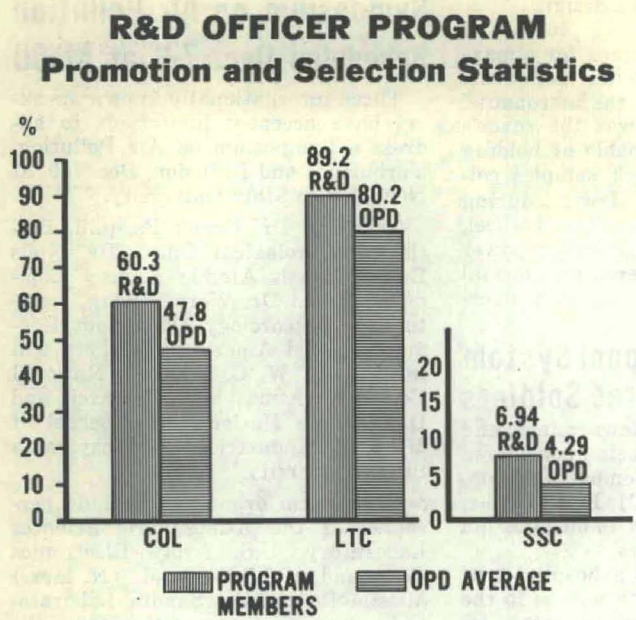
Topics of technical papers will include: the theory of turbulence and the boundary layer with emphasis on short range diffusion prediction methods; intermediate- and long-range prediction methods (mesoscale phenomena); meteorology in air resources management; pollution effects on climate and eco-systems; and instrumentation techniques including remote sensing in the atmosphere.

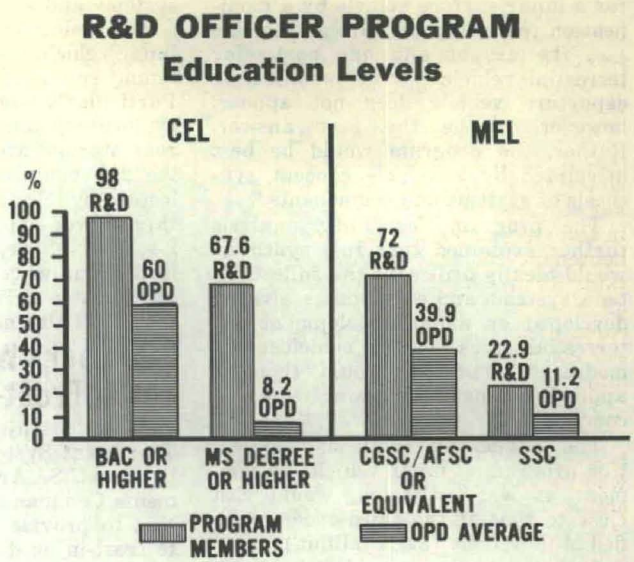
For each of the topics discussed, the symposium planners have invited review papers for the delegates' consideration. Additional papers will treat other facets of the scientific disciplines involved, including legal aspects of pollution, thermal pollution and water pollution.

U.S. Army agencies expected to make substantial contributions to the symposium include the Electronics Command, Munitions Command, Missile Command and the Test and Evaluation Command. The Air Force and Navy also will be actively involved.

Marvin Diamond, technical director of the Atmospheric Sciences Laboratory, sees the prime purpose of the symposium as an international exchange of current research knowledge pertinent to pollution prediction, control and prevention.

The worldwide treatment of pollution problems is expected to be of general public interest, in that pollution control procedures to be explored may well have significant nonmilitary applications in the current ecological improvement activities.





Program Offers Advancement Opportunities to Career Officers

Filled entirely by volunteers since its establishment in 1955, the R&D Officer Program presents an opportunity to a select group of highly motivated Army officers to contribute to building a better future Army.

Through demonstrated performance and educational achievement, participants in this special career field can advance progressively to research and development positions at the highest levels of responsibility.

Officers inclined towards an R&D career are enabled, by explicit design, to develop an additional skill by participating in the R&D Officer Program *without leaving their basic branch.*

Repetitive R&D assignments and educational advances in the program enhance an officer's basic branch qualifications and ultimate value to the Army. Quite logically, the officer best suited to perform the vital tasks in the RDT&E jobs of the Army's developing agencies is an officer who possesses keen knowledge and broad experience in the doctrine and materiel of his basic branch.

Only at the highest level are the functional aspects of R&D afforded equal importance with the technical base of knowledge and experience in an officer's basic branch or commodity orientation.

As an R&D Officer Program member, a participant must compete with his branch contemporaries for promotion and advanced military and civilian schooling. Statistics show that 98 percent of enrollees have a bachelor's degree or higher as compared to an over-all Officer Personnel Directorate (OPD) average of 60 percent. Sixty-eight percent have a master's degree or higher compared to an OPD average of eight percent.

Seventy-two percent of program members, who are or have been eligible for selection, are graduates of the Command and General Staff College, the Armed Forces Staff College or have equivalent schooling versus a 40 percent Army average.

Senior Service College attendance of R&D Officer Program members is more than double the Army average —23 percent versus 11 percent.

Based upon cumulative figures since 1966, the first-consideration promotion rates for R&D program members exceed the Army promotion list average—60 versus 48 percent to colonel and 89 versus 80 percent to lieutenant colonel.

Program membership does not automatically assure advanced military and civilian schooling or promotion ahead of one's contemporaries. Performance effectiveness and personal initiative remain the key factors in career progression.

With respect to assignments and detailed career management of program members, Army Regulation 615–134 clearly assigns the responsibility for such action to the Office of Personnel Operations. OPO's Special Career Branch has until recently had a limited capability to obtain the data necessary to anticipate problems in the utilization of program members.

Successful completion of testing of a management tool called "The Automated Work Force Information System" now provides program monitors and managers with a complete listing of R&D officer program members. Information readily available includes their military and civilian education levels, current assignment (including date of assignment) and each member's previous 10 job assignments.

The system is specifically designed to anticipate impending under-utilization or over-utilization; it also enables OPO to determine training deficiencies of program members.

Career branches are currently being advised of specific cases of improper utilization of program members and are being requested to take corrective action. Program members are encouraged to correspond directly with the Special Career Branch of OPO, ATTN: OPDAA, and with their basic branch concerning individual career management problems.

The R&D Officer Program had 781 officers enrolled as of 31 July 1971. A breakout by grade shows 214 colonels, 296 lieutenant colonels, 241 majors and 30 captains. The Ordnance Corps has the largest number of members with 174 followed closely by Field Artillery with 138.

A further break-out shows 79 in *Air Defense*—25 colonels, 32 lieutenant colonels, 14 majors, 8 captains; 49 in *Armor*—21 colonels, 19 lieutenant colonels, 8 majors, 1 captain; 61 in *Corps of Engineers*—16 colonels, 18 lieutenant colonels, 26 majors, 1 captain; 86 in *Chemical Corps*—12 colonels, 31 lieutenant colonels, 36 majors, 8 captains; 138 in *Field Artillery*—46

colonels, 53 lieutenant colonels, 39 majors; 75 in *Infantry*—38 colonels, 27 lieutenant colonels, 7 majors, 3 captains;

Also, *Military Intelligence*, 1 lieutenant colonel, 1 major; 174 in *Ordnance Corps*—34 colonels, 54 lieutenant colonels, 79 majors, 7 captains; 17 in *Quartermaster Corps*—3 colonels, 8 lieutenant colonels, 5 majors, 1 captain; 62 in *Signal Corps*—12 colonels, 32 lieutenant colonels, 18 majors, 1 captain; 36 in *Transportation Corps*—7 colonels, 21 lieutenant colonels, 8 majors.

The Army's R&D mission, a program supervisor emphasized, will be achieved best by a corps of officers who combine specialized skill with the ability to perform a variety of military duties. Consequently, the program must preserve a broad, branch-immaterial orientation, with relatively easy and repetitive access to R&D assignments available to selected, highly qualified officers. Needed technical skills must be developed to the highest level consistent with a parallel development of each officer's ability to lead and manage.

This is the rationale, the challenge and the opportunity of the R&D Officer Program, a proved avenue of career success for an elitely select group through demonstrated performance in planned assignments.

Army Studies New Materials For Shatterproof Eyeglasses

Materials that may serve satisfactorily as "spectacle substitutes" for soldiers exposed to the threat of eye damage from broken lenses, while working with sophisticated surveillance, target and other devices, are being studied by the Army.

The U.S. Army Combat Developments Command, headquartered at Fort Belvoir, Va., has issued a proposal for "soft" lenses that will not shatter when used by soldiers who must wear eyeglasses under abnormally hazardous conditions.

Existing flexible silicone rubber lenses are being considered to meet the requirements. Preliminary studies indicate they meet many of the required characteristics such as safety, comfort, stability and satisfactory performance for a minimum of five days in a military environment, the CDC reports.

Data collected in CDC studies show that some 35 percent of U.S. soldiers wear eyeglasses (26 percent came into the Army wearing them). The surveys also produced a list of 92 optical sights and devices that a soldier with glasses may be required to operate.

Schrader Succeeds Reed as USACSC Commander

Maj Gen Henry C. Schrader took command of the U.S. Army Computer Systems Command (USACSC), July 30, at Fort Belvoir, Va., succeeding Brig Gen Wilson R. Reed, who retired after 30 years active service.

General Reed was assigned to Fort Belvoir in October 1967 as commander of the Automatic Data Field Systems Command (ADFSC), which became the nucleus of the USACSC when it was established in March 1969.

Under his command, the USACSC established operational ADP systems that provide personnel, logistical and financial support to commanders at all echelons of command throughout the Continental United States, Europe and Southeast Asia.

Additionally, the command has been heavily engaged in the design and development of tactical systems to provide accurate data to the commander on the battlefield.

Maj Gen Henry C. Schrader

General Schrader served as director of Management Information Systems, Office of the Assistant Vice Chief of Staff, for 2½ years, and was responsible for the extensive study that resulted in establishment of the USACSC. He later commanded the 18th Engineer Brigade in Vietnam.

Included in his service record are assignments as chief, Systems Analysis Group in the Office of the Chief of Staff, and in key positions in R&D at HQ CONARC, HQ U.S. Army Materiel Command, and at the U.S. Atomic Energy Commission.

General Schrader received his BS and MS degrees in civil engineering at the University of Illinois. He is a graduate from the Command and General Staff College and the Industrial College of the Armed Forces.

Among his awards and decorations are the Distinguished Service Medal, Legion of Merit with three OLC, Air Medal (fourth award), Army Commendation Medal with OLC, Vietnamese Cross of Gallantry, Award of Guard (Russian), Ordem Do Merito Militar (Brazilian), and ROK Presidential Citation.

General Schrader is a member of the American Society of Civil Engineers (Fellow), National Society of Professional Engineers, and the Society of American Military Engineers.

Edgewood Accepts $2.8 Million Computer System

Inauguration of a $2.8 million scientific and engineering computer system serving six research, development and testing activities at the U.S. Army's Edgewood (Md.) Arsenal was effected July 1.

Arsenal Commander Col George W. Connell Jr. presided at dedication ceremonies during which he formally accepted the Univac 1108 third-generation computer from S. Grady Putnam Jr., vice president of field operations for federal systems, Univac Division of Sperry Rand Corp.

The central processor and main storage units of the computer are in Building 5234. Terminal module controllers and teletype remote terminals are in the Research Laboratories, Weapons Development and Engineering Laboratories, Defense Development and Engineering Laboratories, Army Munitions Command Operations Research Group, Army Environmental Hygiene Agency, and Systems Analysis Office.

The terminal network permits scientific and engineering personnel to feed their inquiries into the system and receive fast solutions to problems without leaving their work areas.

The system is being used in solution of complex problems in chemistry, physics, biophysics, biochemistry, applied mathematics and statistics, toxicological experimentation, operations research, and a wide range of the engineering disciplines.

Five memory drums in the computer have a total capacity of 270 million characters of information, with the main memory bank having a capacity of 98,000 words. Other storage is in four magnetic tape units. Two high-speed printers, a card reader and card punch are included in the system.

Key management information systems personnel from the Army Materiel Command, Munitions Command, directorate and office chiefs from the arsenal, and tenant activities and Univac officials participated in the dedication.

Atomic Energy Officer Program Actions Advance Membership

Membership in the U.S. Army Atomic Energy Officer Program has been stimulated greatly in recent months by actions to enhance this important career field, in which many participants have achieved top leadership positions.

Oldest of the U.S. Army's 11 career officer specialty fields, the AE Officer Program was established in 1953. It was followed two years later by the Research and Development Officer Program, with which it was long merged.

Passage of 18 years has produced many policy changes that have advanced the original goal of developing a professional corps of officers skilled in areas of R&D, operations, doctrine development, training and logistics pertaining to atomic energy.

The program now has the highest membership it has had in six years, with 211 officers enrolled. The Office of Personnel Operations (OPO), HQ DA, has established a goal of 240 officers.

To insure a proper utilization of AE personnel, the appropriate OPO career branch now consults the Specialist Branch each time an assignment is made for an AE officer.

Through the new Automated Work Force Information System, the branch is able to maintain control that assures assignments of progressive responsibility for career training and development consistent with the professional AE corps objectives.

The AE Officer Program Consultant Board also is conducting a program, in conjunction with the major Army commands, to refine the requirements for AE personnel—insuring that AE officers are assigned to jobs that require their special skills.

Maj Gen John G. Appel, director of the Chemical and Nuclear Operations Directorate, Office of the Assistant Chief of Staff for Force Development (OACSFOR), DA, is chairman of the AE Officer Program Consultant Board.

Backed by special qualifications in engineering and the physical sciences, AE program participants are given opportunities to serve in civilian laboratories, military research facilities, military development and test boards, and in technical supervisory jobs throughout the Defense Department.

Based upon proved proficiency as they climb the career ladder in their areas of expertise, program enrollees are selected for key positions involving a high degree of responsibility and authority in nuclear operations and policy matters.

Key positions are designated by HQ Department of the Army in coordination with the commanders of agencies concerned. Listed in AR 614–131, they have recently been reviewed and updated. Most key positions require assignments of colonels; the remainder are lieutenant colonels.

Currently, there are 69 key positions, representing some of the most important assignments in the Department of Defense.

Key positions normally are filled by AE officers who have had experience in varying AE positions to give them balanced qualifications for top leadership responsibility. The AE positions are designated by commanders and agency heads without reference to HQ Department of the Army.

Currently typical of a long line of officers who have held progressively responsible AE positions and responsibility within the Department of Defense are Col William A. Walker, Col John E. DiGrazia Jr., Col Arthur V. Corley, and Lt Col John E. Schweizer.

GENERAL APPEL, as head of the Cnemical and Nuclear Operations Directorate, OACSFOR, is the principal adviser on nuclear matters, chemical, radiological and biological research to the Department of the Army. He is a member of the Military Liaison Committee of the Atomic Energy Commission, and an executive member of the Technical Cooperation Program of the Chemical-Biological Quadripartite Organization.

His career record shows service as director of Plans, Office of the Deputy Chief of Staff for Logistics, DA (1969–70), subsequent to duty as commanding general, Deseret Test Center, Fort Douglas, Utah.

Maj Gen John G. Appel

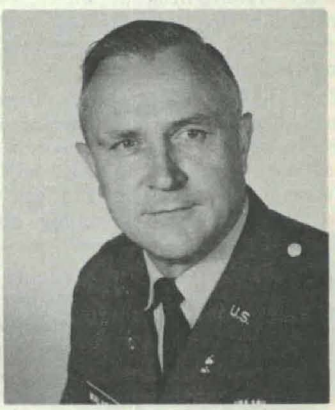
Following an assignment in the G3 Section, Eighth U.S. Army, Korea (1965), he was chief, Plans and Policy Division, CBR-Nuclear Operations Directorate, OACSFOR, and later deputy head of the directorate.

General Appel served (1962–64) as commander of the U.S. Army Pine Bluff (Ark.) Arsenal. He also attended the Management Program for Executives conducted by the University of Pittsburgh Graduate School of Business, and was designated an Army logistician.

Other major assignments have included: CO of the U.S. Army Chemical Procurement District, New York, N.Y. (1957–58); chemical officer, U.S. Army Caribbean, Canal Zone (1954–57); deputy chief, R&D Division, Office of the Chief Chemical Officer, Washington, D.C. (1951–54); staff officer, Plans and Policy Office, Research and Engineering Division, Field Office, Office of the Chief Chemical Officer, Edgewood Arsenal, Md. (1947–51).

General Appel has a BS degree in chemical engineering from Rose Polytechnic Institute, Terre Haute, Ind. (1941). He completed the Army Command and General Staff College (C&GSC) at Fort Leavenworth, Kans. (1946); the Chemical Corps School, Edgewood Arsenal, Md. (1948); the Air Command and Staff School, Maxwell AFB, Ala. (1948); the Armed Forces Staff College, Norfolk, Va. (1958); and the Army War College (AWC), Carlisle Barracks, Pa. (1962).

COL WILLIAM A. WALKER, a charter member of the AE Officer Program, recently was assigned to Vietnam, following assignment since July 1969 as commanding officer of Picatinny Arsenal, Dover, N.J.



Col William A. Walker

As commander of Picatinny Arsenal, Col Walker supervised approximately 7,000 civilian and military personnel, including about 2,000 scientists and engineers. The Arsenal's ammunition responsibilities encom-

pass the research and engineering functions required for design, development, production, maintenance and technical support of Class V items.

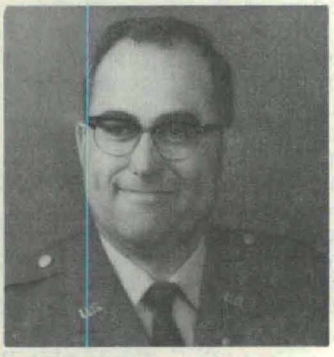
Other ammunition assignments have included adapting nuclear warheads to Army delivery systems; operation of pilot plant facilities for fabrication and assembly of mission items; procurement of all Army nuclear munitions and designated conventional munitions; and operation of the Army Explosive Ordnance Disposal Center. The commander also supervises the operation of the DoD Plastics Technical Evaluation Center.

Col Walker graduated from the U.S. Military Academy (USMA) in 1945 and received an MS degree in physics from the University of Virginia in 1950. He also has completed the Infantry Officers' Advanced Course, the C&GSC and the AWC.

He recently served as Army military representative to the Assistant to the Secretary of Defense for Atomic Energy. Prior to an assignment as a staff officer in the Nuclear, Chemical and Biological Division, Office of the Chief of R&D (1964–65), he commanded the 83d Ordnance Battalion in Korea.

Other assignments have included a tour at Aberdeen (Md.) Proving Ground; with the Office of Special Weapons Developments, Fort Bliss, Tex.; and staff officer, OACSFOR.

COL JOHN E. DiGRAZIA JR. completed a key position as assistant to the Assistant to the Secretary of Defense for Atomic Energy, prior to his recent assignment to Vietnam. He also served recently as secretary, AE Officer Program Consultant Board.



Col John E. DiGrazia Jr.

Since graduating from the USMA in 1950, Col DiGrazia has completed the Army Artic Indoctrination School, Ordnance officer basic and career courses, the Nuclear Supervisor Course, and the C&GSC.

He served 2½ years with the Nuclear Division, Chemical and Nuclear Operations Directorate, OACSFOR, was assigned to the Nuclear Policy subsequent to duty (1966–68) as commander of the 101st Ordnance Battalion in Germany.

His OACSFOR duties included general staff supervision of the Army nuclear weapons surety program.

Col DiGrazzia's interest in the military application of atomic energy was prompted by an assignment as an instructor to Field Command, Defense Atomic Support Agency in 1954.

During his service with DASA, he served on the Weapons Orientation Advanced Team that conducted briefings worldwide for DoD officials at senior service colleges in the U.S. and at major headquarters overseas.

He has served as commander of TUSLOG Detachment 57, Turkey; ammunition officer, HQ First U.S. Army; chief, Ammunition Branch, Ordnance Section, and chief, Munitions Division, G4 Section, HQ Seventh U.S. Army.

COL ARTHUR V. CORLEY was assigned recently to Vietnam upon completion of an assignment as chief, Nuclear Division, Chemical and Nuclear Operations Directorate, Office, Assistant Chief of Staff for Force Development.

In this key position, Col Corley was responsible for qualitative requirements for nuclear weapons, the Army nuclear weapon surety program, and operational capability objectives. He served as alternate Army member of the Military Liaison Committee to the Atomic Energy Commission and was a member of the AE Officer Program Consultant Board.

Prior to his OACSFOR assignment, he commanded the 16th General Support Group at Fort Benning, Ga. He

Col Arthur V. Corley

Branch, War Plans Division, Office of the Deputy Chief of Staff for Military Operations (1964–67).

Col Corley commanded the 5th Missile Battalion (Lacrosse), 39th Artillery at Bamberg, Germany, following an assignment with the Technical Inspections Branch, Inspector General Division, HQ U.S. Army Europe.

Upon completing the Artillery Advanced Course in 1954, he was an instructor at the Artillery School for the Honest John rocket, 280mm gun, 8-inch howitzer, Corporal missile, Lacrosse and associated warheads.

During the Korean War, he was communication officer of the 45th Division Artillery. In 1952, he assumed command of the 140th field Artillery Battalion at Camp Polk, La. He has participated in campaigns in Sicily, Italy and Southern France.

LT COL JOHN E. SCHWEIZER was assigned to the Office of the Joint Chiefs of Staff in an atomic energy position after graduating from the Army War College. Meanwhile, he completed studies for an MS degree from Shippensburg State College, Pa.

A 1951 alumnus of the USMA, he is a graduate of the Engineer officer basic and advanced courses and the C&GSC. He has an MS degree in civil engineering from the Massachusetts Institute of Technology and has done graduate work in nuclear engineering at the University of California, Berkeley, and Argonne National Lab.

Prior to entering the AWC, he was with the Nuclear Division, Chemical and Nuclear Operations Directorate, OACSFOR. There he was responsible for establishment of qualitative requirements for atomic demolition munitions and other nuclear weapons.

He was technical operations officer, Atomic Energy Commission, Chicago (1957–59), responsible for development, design and construction of nuclear reactors.

Other assignments have included S–2 and communications officer, 13th Engineer Battalion, Korea; physics instructor, U.S. Military Academy;

Lt Col John E. Schweizer

assistant division engineer, 3d Infantry Division, Germany; chief, Operations Branch, Engineer Division, CENTAG; and deputy director, U.S. Army Engineer Reactors Group.

Lt Col Schweizer commanded the 168th Engineer Battalion (Combat) and served as deputy engineer, II Field Force in Vietnam (1968–69).

AFIP Serves Nation Through Consultation, Education, Research

Vastly dispersed and varied pathology research interests, a new $7.5 million medical museum, and involvement in creating as well as preserving medical history, are linked to the Armed Forces Institute of Pathology (AFIP) in Washington, D..C

Serving U.S. federal and foreign governments, as well as civilian organizations throughout the nation, AFIP has a 3-fold mission of consultation, education and research. Laser research, to study the effects of prolonged exposure of the retina to low intensity of CW (Continued Wave) laser beams, is one of the currently important AFIP projects.

Due to the increasingly popular use of the laser for military, industrial, scientific and medical purposes, a safety standard to define the threshold level for eye injury in operations is of high-priority concern.

Basic studies at the AFIP assist the Joint Laser Safety Team of the Army Surgeon General and the Army Materiel Command in evaluating laser hazards. Results are used by the Army Environmental Health Agency to establish safe operating standards.

The eye is most immediately vulnerable to laser damage. In the retina, an opthalmoscopically visible lesion has been adopted as the end point for recognition of threshold damage by most researchers.

The AFIP histopathological study of these lesions in the acute stage has shown definite damage to the photoreceptor cells and the retinal pigment epithelium. The previous concept held that the photoreceptor cells, which are neuronal cells, were not capable of recovery following laser injury.

Through detailed studies, Drs. Mark Ts'o, Lorenz E. Zimmerman, James O. Powell and Ingolf Wallow have demonstrated the capacity for regeneration of the photoreceptor elements following photic damage. As is true in the case of eclipse burns, the radiant energy is focused on the retina, producing a clinical loss of visual acuity. In time, regeneration accompanied by a restoration of function is observed.

In follow-up experiments to document initial destruction of the photoreceptor elements and to determine the subsequent fate of these cells, it has been determined that, structurally, these cells may survive and regenerate; the functional state remains to be more definitely defined.

The scientists have differentiated between temporary disability due to reversible damage of photoreceptor elements, and permanent disability due to the death of photoreceptor cells. Further study, however, is required to establish differences in regeneration capacities between rod and cone cells —between photoreceptors of the fovea and those of the remainder of the retina.

Col Robert W. Morrissey

Light and electron microscopy are being used in studies of the effects of laser exposure of varying intensity and duration to photoreceptor cells. Major Ts'o will present a technical report on results of the research in September at the American Academy of Opthamology and Otolaryngology conference. Attendance of about 3,000 is expected at the Las Vegas, Nev., meeting.

Research in another AFIP division, Geographic Pathology, is focusing a large proportion of effort in investigating diseases of tropical Africa. Dr. Daniel H. Connor, chief of the division, termed that area one of the "neglected parts of the world." Consequently, it provides an opportunity to study the processes and treatment of diseases unclouded by other forms of treatment or antimicrobial agents.

Geographic pathology research also continues in other parts of the world. Louse-born relapsing fever is being studied in Ethiopia by Maj Ronald Gillum, MC, at an AFIP permanent unit.

Maj Ernest E. McConnel, VC, is assigned to the Onderstepoort Medical Research Institute in South Africa where he is doing research on zoonoses—those diseases of animals which also afflict man.

Dr. Dan Connor

Baboons, which have become important animals for research in this country because of their human-like characteristics, are the subject of this Republic of South African study.

Lt Col Myron Radke, chief of microbiology in the Geographic Pathology Division, is producing filarial infections in experimental animals and it is hoped that these investigative infections will shed light on the mechanism of human filiariasis. Dr James Connor recently studied patients with onchocerciasis in the Ubangi territory. He found that some patients had obstructive lymphadenitis caused by the microfiliariae of Ovolvulus and that severe elephantiasis resulted.

Lt Col John K. Read, chief of Microbiology in the Geographic Pathology Division has defined a toxic substance in bacterium that inflicts Africans and others in tropical climates by causing large debilitating ulcers. The mechanism by which the ulcers are produced has never been successfully analyzed, but discovery of the toxin is the first step. The organisms are related to those that cause tuberculosis and leprosy.

Future hopes of the division include establishment of a field unit or research station in the Democratic Republic of the Congo. The intent is to study tropical diseases as they exist in the Congo, and to provide professional people with experience in tropical diseases.

Rulers of the Congo, a country of one million square miles with medical care centered in the capitol, Kinshasa, favor the research program in conjunction with medical care for the people.

Studies helpful to American understanding of tropical diseases, or Congolese treatment, are only part of the geographic pathology investigations of vector-born epidemic diseases, or those with an unknown potential for contagion that may jeopardize a military campaign.

Investigations in Geographic Pathology, and in General and Special Pathology Division "C," which includes opthamology, are complemented in similarly far-ranging activities of the other eight divisions within the AFIP Department of Pathology.

The organization includes three other separate divisions of General and Special Pathology; also, divisions for Basic Sciences, Military Environ-

mental Pathology, Dental and Oral Pathology, Veterinary Pathology, and Radiopathology.

The AFIP has a Special Assistant for Veterans Administration Pathology, a Special Assistant for Public Health Service Pathology, a well-staffed and equipped Computer Services Division, Management Services Division and other support elements.

Housed in a beautiful and recently opened new wing of the AFIP building is the Medical Museum, the oldest of the institute's organizational elements and actually the original nucleus of its continuing growth.

Founded in 1862, the museum still emphasizes its original purpose of educating by displaying specimens illustrating all phases of military medicine and surgery. The specimens are representative of all U.S. military history and wars in many parts of the world. The museum loans exhibits or artifacts, and works with other agencies and museums.

Less than 10 percent of the entire collection, according to Miss Helen Purtle, assistant curator, is on exhibit, with the exception of the museum's most famous display, that is, microscopes. Approximately one-third of the world's largest collection of microscopes is open to the public.

That collection began with John Shaw Billings, an early curator, who hired an Englishman to search Europe for antique microscopes. The first shipment of 17 arrived in 1884. Shopping has continued, and 90 instruments of the early eighteenth century were bought from Holland in 1967.

Electron microscopes figure in the collection's progression. A Siemen electron microscope confiscated by the U.S. Army Signal Corps following World War II was operated at Fort Monmouth, N.J., until brought to the museum in 1955.

Displayed also is the first U.S.-made electron microscope, from Columbian Carbon and Carbide Co., which never went into production. It stands beside the first commercially made electron microscope, owned by Loyola University when on exhibit three years ago at a Chicago medical meeting. A few others are in storage but size and weight (up to eight feet and one ton) limit storageability.

The new museum has several halls, including one for current events, and a Brinton Hall of History which was installed in July. A great deal of design and artwork for the museum was done by Colin Thompson, special assistant to the chief of Medical Illustration Service for Museum Design (MISMD).

The MISMD is one of the large AFP departments. Each year, about 250,000 photographic items are produced, 6,400 illustrations prepared, 3,000 motion pictures and 2,500 lantern slide sets loaned. More than 350 scientific exhibits constructed annually and displayed at national and international meetings since 1947 have won more than 185 awards.

Each of the Armed Forces shares in providing the AFIP director. An Army, Navy, or Air Force Surgeon General serves for a normal tenure of four years. Deputy directors are senior pathologists from each of the two military departments not represented by the director.

Col Robert W. Morrissey succeeded Capt Bruce Smith as Director in July. Deputy Director since 1969, Col Morrissey has served at three of the largest Air Force hospitals as chief, Department of Pathology—Wilford Hall USAF Medical Center, Lackland AFB, Texas (1965–69); Wiesbaden, Germany (1963–65); and Maxwell AFB, Alabama (1956–63).

A 1948 Albany Medical College graduate, he also received a master's degree in biochemistry from the University of Iowa. The new director is a Fellow, College of American Pathologists, and the American Society of Clinical Pathologists. He is a member of the American Medical Association, Air Force Association, Aerospace Medical Association and Association of Military Surgeons.

U.S. Army Col James L. Hansen, MC, continues as a deputy director and Capt William A. Schrader is the Navy Deputy Director. The Institute is subject to the authority of the Secretary of Defense.

Located in an atomic-blast-resistant building, with the walls facing downtown Washington made of 26-inch thick, steel-reinforced concrete, the Institute carries out its threefold mission of consultation, education and research.

Pooled information and computerized cases contribute to the advanced consultation service at AFIP. Annually, over 50,000 cases, carefully selected from worldwide histopathology centers, are sent to the institute. The computer can provide 7,000 cases daily for a consultation—drawn from a repository of about 1,400,000 cases, with samples of almost every known pathological condition.

Educational "in-house" training includes residency and fellowship programs, annual postgraduate courses for physicians, technical courses, and individualized training. More than 180 foreign nationals annually join the American students for these programs.

In addition, the AFIP conducts an extensive mail-order training program. Motion picture films, gross tissue sets, lantern slide sets, microscopic slide sets, clinical-pathologic conferences, and film strips are available for short-term loans. AFIP publications may be loaned or purchased.

Research efforts at the institute involve about 230 projects, approximately 65 of which are supported by other agencies or foundations. Activities vary from simple statistical analyses or groups of cases to highly complex projects involving advanced instrumentation.

All AFIP organizational elements are concerned with carrying out the threefold mission through worldwide commitment.

The late President Dwight D. Eisenhower suggested this role at the 1955 dedication of the AFIP building when he said:

"I dedicate this building to the conquest of disease so that mankind, more safe and secure in body, may more surely advance to a widely shared prosperity and an enduring and just peace."

COMPUTER Services Division stores case information for the AFIP.

Aberdeen Proving Ground Absorbs Edgewood Arsenal Functions

Aberdeen (Md.) Proving Ground (APG) has become one of the most diversified military research, development, test and evaluation installations in the nation, if not in the world, as a result of its July 1 acquisition of Edgewood Arsenal.

Merging of the bases means that management, administrative and post support functions that were provided for units at Edgewood by the arsenal's staff are now combined under the jurisdiction of the APG commanding officer.

Consolidation of the two largest Army bases in Maryland required reassignment of almost 950 civilian employes and 150 military personnel stationed at Edgewood to similar offices under the jurisdiction of APG. Some personnel remained physically located at the arsenal while others were relocated to Aberden.

Since the consolidation involves mostly personnel who perform post-wide support or "housekeeping" services, more than 700 civilian and military personnel in the arsenal's Installation Services and Facilities Directorate were affected; over 50 percent are now in the Proving Ground's Facilities Engineering Directorate.

Many of the remaining personnel who transferred have been reassigned to the APG Logistics Directorate. Some of the combined logistics functions are:

Equipment Management. Both motor pools are combined to include maintenance operations. Bus service is provided on an hourly basis during working hours between both locations.

Services. Both commissaries have been merged to utilize more effectively the purchasing, storage and retailing resources. Seven-day service is being provided by scheduling alternate closing days. Property disposal facilities also have been combined and post exchange facilities are being renovated.

Movement Services. All transportation resources have been combined to provide expanded personal services, including all household goods movement transactions and the processing of individual and family transportation requests.

Housing. With the incorporation of government-owned housing facilities at Edgewood under APG control, military personnel of both installations have a greater variety of quarters.

Communications-Electronics. By pooling all maintenance personnel into one unit, this division can operate more efficiently, with greater flexibility for receiving and transmitting teletype messages.

VALUE ENGINEERING Division projects at Picatinny Arsenal, Dover, N.J., accounted for more than $13 million validated savings for FY's 71–73. Harold Kruger and Vincent Baldanze (at left) performed a study with Aaron Vogler that resulted in redesign of the safety clip for M67 and M69 grenades, with first-year savings of $273,400 and a 3-year total of $961,311. John T. Keider, Norman D. Baron and Jack D. Selkin (below, left) demonstrated that the XM224 fuze, with a slight modification, could be used in conjunction with obsolete M218 fuzes in the CBU–49 aircraft bomb dispenser system, thereby cutting FY 71 procurement costs by $698,711. George Buck, Charles Banta, James Spilman and Peter Mahalik (below, right) figured out a way to use fewer parts in the M105A3 fiber container for 105mm cartridges, with savings over $12 million in FY's 71–73.

Supply. Central control permits purchases to be made in larger quantities to effect greater savings. More and varied warehouse space is available. Operation on a self-service basis is planned when the entire supply system becomes computerized.

In the Administrative Office, intra-post mail service, one Daily Bulletin, all records management services, printing and reproduction work, and issuance of all government orders are centrally controlled.

Changes resulting from the merger can be noted elsewhere. Civilian personnel offices, the civilian security guard force, and Military Police platoons were merged.

In the Materiel Testing Directorate, the Proving Ground's "navy" has been expanded to include the fleet of picket boats that patrol the Gunpowder and Bush River areas. Now all range firings are centrally scheduled and controlled by MTD.

Administrative services provided by the post chaplain, staff judge advocate, and certain functions of the comptroller's and management offices are combined to avoid duplication.

Provision of medical services, however, is unaffected by the change since these have been provided at Edgewood on a joint basis for several years by the Proving Ground's Medical Activity.

All of the arsenal's real estate, including 10,450 acres and fixed assets (more than 1,100 buildings, structures, facilities, machinery and equipment valued in excess of $122.8 million) have been placed under the operational jurisdiction of APG.

The Army's Chemical Commodity Management Center is now a tenant activity of the Proving Ground. In making reference to Edgewood Arsenal today, one is actually referring to the Army Chemical Commodity Management Center.

However, the Army Chemical Commodity Management Center's commanding officer still retains command jurisdiction over Rocky Mountain Arsenal, Denver, Colo., and Pine Bluff Arsenal, Ark.

Concomittantly, the eight other specialized military organizations housed at Edgewood are now tenants of the Proving Ground.

Col Warren D. Hodges, APG commanding officer, is charged with serving 21 tenant organizations dispersed throughout a land and water area embracing more than 82,000 acres. The combined military and civilian workforce totals almost 16,000.

Edgewood Arsenal's annual payroll of $51 million and the APG's yearly outlay of $105 million in wages constitute more than 75 percent of the economy in Harford County.

Since both installations have been in existence since World War I, many people find it difficult to understand how Edgewood Arsenal, after 50 years of existence as a separate installation, could be absorbed by Aberdeen Proving Ground.

To others, it's just like when an old established business firm changes ownership—everyone still refers to it by the original name through long-time habit.

IAC Names New Vice Chairman

Edmund B. Fitzgerald is the new vice chairman of the Industry Advisory Council, which provides a forum for discussions between the Deputy Secretary of Defense, his principal management assistants and leaders from the private sector of the U.S. economy.

Chairman and chief executive officer of Cutler-Hammer, Inc., Fitzgerald has served on the 25-member council since October 1969. The council meets three times each year, with the next meeting scheduled Oct. 8–9.

Picatinny Develops High-Intensity Searchlight

A 90-pound pyrotechnic searchlight reportedly producing more light than any other portable system has been developed by engineers at the Feltman Research Laboratory (FRL), Picatinny Arsenal, Dover, N.J.

Devised by Chester Smith, John Wright, Charles Mosner and Richard Frisina, the new light derives its output of 2 to 6 million candlepower from two components—oxygen in gaseous form and aluminum in the form of finely divided particles.

A parabolic reflector, also designed in-house, gathers and directs the illumination to produce a total output (lumens) surpassing that of the standard field unit Army Xenon arc searchlight, powered by a generator that weighs 3,700 pounds.

Portable models of the pyrotechnic searchlight are approximately one-foot wide and three-feet high. Each unit consists of an oxygen tank, a hopper with a supply of aluminum, a mixing chamber and an oxygen-driven motor that supplies a constant and homogeneous mix of the two components to a nozzle. The unit has a high-temperature pilot and a remote method of ignition.

One of the project's critical aspects was development of a self-contained method of providing an accurate and homogeneous mix of the components.

Several models of the torch underwent extensive testing recently under very difficult wind conditions at Aberdeen (Md.) Proving Ground. During night tests conducted at Picatinny, observers were able to read a newspaper nearly one-half mile from the laboratory model source of light.

Because of its small size and tremendous output, the aluminum-oxygen torch has created an interest in its potential for other than military use. It can be used as an emergency light in the event of urban power failure or for emergency illumination at airports and other large areas.,

PYROTECHNIC SEARCHLIGHT, developed by Picatinny Arsenal engineers, has an output surpassing that of standard Army Xenon-arch searchlight.

Army R&D Office Announces Assignments of 23 Officers

Eighteen of 23 officers newly assigned to the Office of the Chief of Research and Development (OCRD) have recently earned advanced degrees from a major college or university or completed courses at one of the three senior service schools.

Col Jerry B. Lauer has been assigned as chairman of the Department of Defense Air Munitions Requirements and Development (AMRAD) Committee, following completion of the Officers Rotary Wing Aircraft School at Fort Wolters, Tex., and Fort Rucker, Ala.

Col Lauer completed the National War College in 1967, subsequent to a tour of duty as a staff officer with the Plans Division, Office of the Chief of Research and Development (OCRD).

He then was assigned as J3 staff officer, STRICOM, and special military assistant to CINCSTRIKE, MacDill Air Force Base (AFB), Fla. During 1969–70, he served as brigade commander and chief of staff with the 7th Infantry Division in Korea.

A 1949 graduate of the U.S. Military Academy (USMA), he has an MS degree in electrical engineering from Georgia Institute of Technology (1960) and has completed the Marine Corps Senior School (1964).

Among awards and citations, Col Lauer holds the Legion of Merit (LOM) with Oak Leaf Cluster (OLC), Bronze Star Medal (BSM) with "V" device, and the Army Commendation Medal (ARCOM) with OLC. He also has earned a Master Parachutist Badge, the Combat Infantryman Badge (CIB), and the Army Aviator Badge.

Lt Col Frank J. Palermo Jr. graduated from the Industrial College of the Armed Forces (ICAF) course shortly before his assignment to the Fire Support Missiles Branch, Air Defense and Missiles Division, OCRD.

He completed the Armed Forces Staff College (AFSC) course in 1966, and the Command and General Staff College (C&GSC) in 1963. He has an AB degree from Xavier University (1952) and an MS degree in aerospace engineering from the University of Arizona (1965).

He served a tour of duty with the Missiles and Space Directorate, OCRD (1967–68), following a year in Vietnam as a task-force adviser with the Vietnamese Airborne Division.

Other recent assignments have included staff officer, HQ U.S. Army Combat Developments Command (USACDC), Fort Belvoir, Va., and battalion commander, 2d Bn., 321st Artillery (Airborne), Ft. Bragg, N.C.

He has been awarded the BSM with "V" device, Meritorious Service Medal (MSM), Air Medal (AM), Joint Service Commendation Medal (JSCM), ARCOM with OLC, CIB, and the Master Parachutist Badge.

Lt Col John G. Burbules, a new staff officer with the Command and Control Branch, Communications-Electronics and Space Division, OCRD, recently earned an MS degree in industrial management from George Washington University. He received a BS degree from the University of Southern Mississippi in 1960 and completed the C&GSC in 1968.

During 1969–70, he served with the Army Concept Team in Vietnam (ACTIV) Liaison Group, Office of the Assistant Chief of Staff for Force Development (OACSFOR). He served two tours with the U.S. Army, Republic of Vietnam (USARV) during 1967–68 and 1965–66, split by an assignment with the Aviation Test Board, Fort Rucker, Ala.

He has been awarded the LOM, BSM, AM with three OLC, and ARCOM with OLC.

Lt Col John J. Top is a new staff officer with the Combat Support Aircraft Branch, Air Mobility Division, following a tour of duty with the USACDC Institute of Systems Analysis, Fort Belvoir, Va. He served with the USACDC Artillery Agency (1966–67) at Fort Sill, Okla.

During 1968–69, he was in Vietnam as commander, 145th Combat Aviation Battalion; S3, 12th Combat Aviation Group; and executive officer, 214th Combat Aviation Battalion. In 1965–66 duty in Vietnam, he was assistant S3, 12th Combat Aviation Group, and duty officer with the Army Aviation Element, Tactical Operations Center, II Field Force.

Col Top has a BBA degree from Texas A&M (1954) and is working toward an MS degree in systems management from the University of Southern California. He completed C&GSC training in 1968.

Among his awards are the LOM, Distinguished Flying Cross (DFC) with OLC, BSM with two OLC, AM with "V" device and 19 OLC, and the ARCOM with OLC. He has received the Social Services Honor Medal, Honor Medal 1st Class, Cross of Gallantry with Silver Star, and the Air Service Medal for service in Vietnam. Other decorations include the Cross of Gallantry with two Palms, Civil Actions Medal 1st Class, and the Presidential Unit Citation.

Lt Col Joseph A. Yore completed the Army War College (AWC) course prior to assignment as chief of the Critical Projects Branch, Surveillance, Target Acquisition, Night Observation (STANO) Division, OCRD.

Col Yore received a BS degree in building construction from Rensselaer Polytechnic Institute (1953) and an MS degree in civil engineering from the University of California at Berkeley (1961). In 1958 he completed the AFSC.

Duty as chief of the Construction Engineer Division Engineer School, Fort Belvoir, Va., followed a tour of

CDC Adviser Attends Fort McNair National War College

U.S. Army Combat Developments Command Scientific Adviser David C. Hardison has been selected to attend the National War College at Fort McNair, Washington, D.C., for 10 months of training designed to prepare graduates for federal executive assignments.

The War College presents a curriculum on national security policies; integration of military and foreign policy; the role of the United Nations and other means to avoid armed conflict between nations; and determination of the influence of the possession or deficiency of economic, scientific, political, psychological and social resources upon national security.

David C. Hardison

Hardison has served since 1964 as CDC scientific adviser, following 12 years as a mathematician and physical scientist in the Ballistic Research Laboratories at the Army's Aberdeen (Md.) Proving Ground. After six years as chief, Armored Systems Evaluations Branch, he was promoted in 1963 to deputy chief, Weapons Systems Lab.

Graduated cum laude with an AB degree from Atlantic Christian College, he earned his master's degree from Duke University in 1951. He has completed a number of Army-sponsored executive training programs, including the Federal Executive Institute in 1969.

duty in Vietnam as CO, 35th Engineer Battalion and chief of operations, 18th Engineer Brigade, USARV.

During 1965–68, he was assignment officer, Engineer Branch, Office of Personnel Operations, Washington, D.C. He has received the LOM, BSM with "V" device, MSM, AM, and the Republic of Vietnam Gallantry Cross.

Lt Col Alvin G. Rowe is newly assigned as a staff officer with the Combat Support Branch, Combat Materiel Division. During two years at Fort Bragg, N.C., he was assistant chief of staff, G4, and CO of the 307th Engineer Battalion, 82d Airborne Division.

In Vietnam he was chief, Support Division, MACV Training Directorate, subsequent to service as operations officer, S3, 307th Engineer Battalion, and CO of the 618th Engineer Company, Fort Bragg.

Educational qualifications of Col Rowe include a BS degree in civil engineering (1956) and an MS degree in structural engineering (1963) from Iowa State University. He completed the U.S. Marine Corps Command and Staff College at Quantico, Va., in 1968.

He has been awarded the LOM, BSM with "V" device, MSM, JSCM, ARCOM, Purple Heart, and Master Parachutist Badge.

Lt Col John L. Johnsen, assigned as a staff officer with the Weapons Branch, Combat Materiel Division, was recently awarded an ME degree from Stevens Institute of Technology. A 1956 graduate of the U.S. Military Academy (USMA), he completed the C&GSC in 1968.

Col Johnsen served in 1968–69 as adviser, Personnel Management Programs, J1, Military Assistance Command, Vietnam (MACV), deputy G2, 82d Airborne Division, Fort Bragg, N.C. (1966–67), company commander and brigade S3 with U.S. Army, Europe (1964–66).

He has received the BSM and the ARCOM.

Lt Col Howard J. Guba completed the C&GSC before he was assigned as staff officer, Studies and Analyses Division, U.S. Army Research Office (USARO).

In 1956 he was graduated from Brooklyn Polytechnic Institute with a BCE degree. He has a BS degree in military studies from the University of Maryland (1962), an MCE from Texas A&M University (1963), and an ME (management) from the University of Alaska (1966).

He was, in 1969–70, chief of the Construction Operations and Management Branch, Lines of Communication Division, Construction Directorate, MACV. In 1967–69 he was a staff officer, Review Branch, Concepts and Doctrine Division, Combat Support Group, USACDC; S3, 577th Engineer Battalion (Construction), Vietnam (1966–67); assistant to the resident engineer, and project engineer for the Alaska Engineer District (1963–66); engineer liaison officer, and instructor, Explosive Ordnance Disposal School, Indianhead, Md. (1958–61).

Among his awards are the BSM with two OLC, MSM, JSCM, and ARCOM.

Lt Col John F. Ingman completed the C&GSC course prior to his new duty as a staff officer, Research Technology Division, USARO, OCRD. He has a BSEE degree from the University of Washington (1956) and an MS degree in nuclear engineering from the University of Michigan (1961).

A tour of duty in Vietnam as executive officer with the 24th Transportation Battalion followed an assignment as nuclear physicist, U.S. Army Nuclear Weapons Surety Group, Fort Belvoir, Va.

During 1965–67, he served as chief of Services, Fort Greely, Alaska, after completing an assignment as liaison officer, U.S. Atomic Energy Commission, Germantown, Md. During 1962–63, he commanded the 60th Transportation Company (Light Truck) in Korea.

His citations and decorations include the BSM and ARCOM with three OLC.

Maj Donald E. Biesenbach is assigned as a staff officer with the Motivation Research Branch, Motivation and Training Research Laboratory, U.S. Army Manpower Resources Research and Development Center (AMRRDC).

Graduated recently with an MBA degree from the University of Texas, he received his BBA degree from Saint Mary's University at San Antonio in 1957, and completed the C&GSC in 1969.

Maj Biesenbach served as S3, 7th Battalion, 11th Artillery in Vietnam during 1967–68, following a tour of duty with HQ Allied Forces, Central Europe, in Fountainbleau, France. He was liaison officer, 8th Infantry Division, USAREUR, from August 1964 to July 1965, and CO of the 377th Artillery, 101st Airborne Division, Fort Campbell, Ky., from April 1963 to June 1964.

His military honors include the LOM, AM with three OLC, ARCOM with OLC, and the Vietnamese Gallantry Cross with Silver Star.

Maj Hugh H. Trumbull Jr., a recent graduate of the C&GSC, is serving as a staff officer with the Fire Support Missiles Branch, Air Defense and Missiles Division, OCRD. A 1958 graduate of the USMA, he earned a 1967 MS degree in aerospace science from Princeton University.

During 1968–70, he was an R&D coordinator with the U.S. Army Advanced Ballistic Missile Defense Agency (ABMDA) at Huntsville, Ala. He served as S3/executive officer, 5th Battalion, 2d Artillery, Vietnam (1967–68).

Other assignments have included assistant S3, 3d Missile Battalion, 21st Artillery, and battery commander 2d Missile Battalion, 82d Artillery, in Germany (1962–64), and Air Defense Artillery director (SAGE), McChord AFB, Wash.

(Continued on page 30)

MERDC Selects Relyea for Executive Director Assignment

Lt Col George R. Relyea is the new executive officer of the U.S. Army Mobility Equipment R&D Center (MERDC), Fort Belvoir, Va., following a year of service with the National Defense College Advisory Detachment in Vietnam.

After serving as an enlisted man (1945–48), he entered the U.S. Military Academy and was commissioned in 1952. He later earned a master's degree in civil engineering from the University of Illinois and has completed courses at the Command and General Staff College, the Armed Forces Staff College and the Army War College.

He has served with the Joint Chiefs of Staff (1968–69); Office of Personnel Operations (1967–68); Thailand (1965–66); Army Engineer Center, Fort Belvoir, Va. (1962–64); U.S. Army Europe (1958–62); the New York Engineer District (1954–55); and in Korea (1953–54).

His awards and decorations include the Bronze Star Medal with Oak Leaf Cluster (OLC), Joint Service Commendation Medal, Army Commendation Medal with OLC, and the Vietnam Honor Medal (first class).

Lt Col George R. Relyea

OCRD Announces Assignments of 23 Officers

(Continued from page 29)

(1959–61). He has received the LOM, BSM, MSM, and AM with OLC.

Maj David A. Nydam served as assistant Joint Plans officer (CBR), CINCLANT, Norfolk, Va., prior to assignment as staff officer, Chemical-Biological Branch, Nuclear, Chemical and Biological Division, OCRD.

Maj Nydam has a BS degree in biology from Norwich University (1958), MS degree in microbiology, University of New Hampshire (1964), and is a graduate of the Naval War College (1968).

He has served as assistant chemical officer, 1st Infantry Division, Republic of Vietnam (1966–67), and deputy chief of the Operations Division, Biological Laboratories, Fort Detrick, Md. (1964–66).

He has received the DFC, Soldier's Medal, BSM with OLC, AM with two OLC, ARCOM, and the Vietnamese Cross of Gallantry.

Maj Robert A. Nulk, staff officer, Test and Evaluation Branch, Management and Evaluation Division, OCRD, recently completed the C&GSC. He has a BSME degree from the University of Santa Clara (1958) and an MSME degree from the University of Alabama (1962).

He served (1968–70) as chief of the Maintenance Evaluation Division, U.S. Army General Equipment Test Activity, Fort Lee, Va., and in 1967–68 was in Vietnam as materiel officer, 27th Maintenance Battalion, 1st Cavalry Division, RVN.

He has served as CO of the 77th Heavy Equipment Maintenance Company, 81st Maintenance Battalion, Germany; staff officer, 4th Battalion, 41st Artillery (Pershing), Fort Sill, Okla., and Germany; and project officer, Pershing Project Office, Redstone Arsenal, Ala.

His honors include the BSM, MSM and the AM.

Maj August M. Cianciolo, a 1971 graduate of the C&GSC, has been assigned as a staff officer with the Air Movement Branch, Air Mobility Division, OCRD. He holds a 1958 BS degree in business administration from Xavier University, and a 1968 MA degree in aerospace operations management from the University of Southern California.

During 1970, Maj Cianciolo was project officer, Internal Literature Branch, Department of Tactics, U.S. Army Aviation School, Fort Rucker, Ala. He was operations officer, Aviation Armament Division, at the School, 1966–68.

The major served two tours in Vietnam with the 2d Battalion, 20th Field Artillery, Aerial Rocket, 1st Cavalry Division—1969, and 1965–66. He holds the BSM with "V" device and two OLC, AM with 16 OLC, ARCOM with two OLC, and the Vietnamese Honor Medal (1st class).

Maj James C. Cercy, staff officer with the Air Defense Branch, Air Defense and Missiles Division, OCRD, has a BSCE degree from the University of Delaware (1958), and an MSME degree from the University of Arizona (1966). He completed the C&GSC course this year.

He was assistant executive officer, 3d Battalion (Hercules), 43d Artillery, Pedricktown, N.J., following 1969–70 duty in Vietnam as S2 and assistant S2, HQ I Force, V Artillery, USARPAC, and battalion executive officer, HQ 6th Battalion, 56th Artillery, Americal Division.

The major completed the Hawk missile system officer course at Fort Bliss, Tex., following 1966–69 duty as an R&D coordinator at the Los Alamos Scientific Laboratory, N. Mex.

Maj Cercy has received the BSM with two OLC, ARCOM, National Defense Service Medal (NDSM), Vietnam Service Medal (VSM), and the Republic of Vietnam Commendation Medal (RVNCM).

Maj Walter J. Wosicki, a new staff officer in the Materiel Needs Branch, Plans Division, OCRD, recently completed the C&GSC course. He is a 1959 graduate of the USMA with a 1969 master's degree in aerospace management from the University of Southern California.

In Vietnam (1969–70) he served as assistant S3, Division Artillery, and battery commander, Aerial Artillery, 1st Cavalry Division, and (1966–67) as brigade aviation commander, 2d Brigade, 1st Infantry Division.

He was company commander, Officer Student Company, Fort Rucker, Ala. (1967–69), and S2, 5th Aviation Battalion, 5th Mechanized Division, Fort Carson, Colo. (1965–66).

His military honors include three DFCs, BSM with three OLC, MSM, AM with 24 OLC and a "V" device, ARCOM with "V" device, Vietnam Campaign Medal, VSM, two awards of the Vietnam Cross of Gallantry, Vietnam Medal of Honor, and the Vietnam Civil Action Medal.

Maj John P. Herrling is a staff officer with the Special Programs and Support Branch, Office of the Chief of Administration, OCRD. He completed the C&GSC course this year, subsequent to duty in Vietnam as brigade senior adviser, Airborne Division, ARVN.

He earned a BS degree in psychology from the University of Scranton (1960) and in 1967–69 was an ROTC instructor at Canisius College, N.Y.

Maj Herrling served in Vietnam as rifle company commander, battalion S2, and assistant brigade S2, 1st Brigade, 101st Airborne Division, RVN. He has been awarded the Silver Star (SS), BSM with two OLC, AM with five OLC, ARCOM with five OLC and the "V" device, Purple Heart, and the Vietnamese Gallantry Cross with Gold, Silver and Bronze Stars.

Dugway CO Moves to APG as Deputy for Support

Assignment of Col Charles M. Shadle to Aberdeen (Md.) Proving Ground as deputy commander for support, early in August, will follow a 3-year tour of duty as commanding officer at Dugway (Utah) Proving Ground.

Col Shadle succeeds Col Richard E. Maloy, who is retiring from military service. During his tour at Dugway, he also served as director for logistics at Deseret Test Center in Utah. His new duty returns him close to his birthplace at Edgewood (Md.) Arsenal.

Service as an enlisted man in the Marine Corps and the Army interrupted his college studies. He received a BS degree from Texas Western College in 1957 and MS from Framingham State College of Massachusetts in 1963, just 20 years after he graduated from Officer Candidate School. His RA commission came in 1947.

Col Charles M. Shadle

Following completion of a tour of duty in Vietnam, Col Shadle took command of the 1st Chemical Battalion at Fort McClellan, Ark., in 1964. He later became personnel director there at the U.S. Army School Training Center. He also has served as chief of industrial operations at Rocky Mountain Arsenal and as assistant professor of military science at Massachusetts Institute of Technology.

He has received the Bronze Star Medal (with OLC), Army Commendation Medal, Purple Heart, Air Medal, and Korean Presidential Unit Citation.

Maj Charlton G. Johnson Jr., a new staff officer, Budget Branch, Programs and Budget Division, OCRD, recently was awarded an MBA degree from Indiana University and has a 1962 bachelor's degree in business administration from Auburn University.

Maj Johnson, in 1968–69, was a management analyst, HQ 1st Logistical Command, Vietnam, following graduation from the U.S. Army Finance School (USAFS), Fort Benjamin Harrison, Ind., where he remained as an instructor (1965–67).

He was adjutant and platoon leader with the 3d Armored Division at Kirch Gons (1962–64) and later served as deputy finance officer with the 106th Finance Section at Stuttgard. He has been awarded the BSM and ARCOM.

Maj Gilbert J. Stieglitz was awarded an MS degree from the University of Texas at El Paso in June and is a staff officer with the Management and Analysis Branch, Management and Evaluation Division, OCRD.

He earned his BS degree in mechanical engineering from the University of Delaware in 1962 and in 1969–70 completed advanced officer courses at Fort Bliss, Tex.

Maj Stieglitz served in Vietnam (1967–68) as assistant S2, 173d Airborne Brigade, and assistant S3, 3d Battalion, 319th Artillery, 173d Airborne Brigade. He holds the BSM, AM, ARCOM and RVNCM.

Maj Robert A. Burns completed a tour of duty in Vietnam as G2 plans officer, HQ II Field Force, prior to assignment as staff officer with the Physics, Electronics and Mechanics Branch, Physical and Engineering Sciences Division, USARO, OCRD.

A 1961 graduate of the USMA, he has a 1969 MS degree in mechanical engineering from the University of Michigan. In 1970 he was graduated from the Armed Forces Staff College.

During 1966–67, the major was troop commander and S2, 1st Squadron 9th Cavalry, 1st Cavalry Division. He holds the BSM with OLC, AM, Purple Heart, Presidential Unit Citation, and the Vietnamese Cross of Gallantry.

Capt Kurt F. Buckley, military assistant in the Optical Systems Division, ABMDA, recently received an MS degree in mechanical engineering from the University of Texas at El Paso and has a 1964 BA degree from the University of California, Berkeley.

In Vietnam (1968–69) he was assistant S2, II Field Force, Artillery, and with HQ USAREUR (1964–69) was a battery commander, fire control, and missile assignment officer.

Awards and decorations include the BSM with OLC, and the AM.

Capt Donald E. Nowland has been assigned to OCRD as a research associate stationed at the Lawrence Radiation Laboratory, Livermore, Calif. He recently received an MS degree in physics from the University of Texas.

Capt Nowland was plans officer, ARADCOM, Ent AFB, Colo. (1969–70), after completing the guided missile systems engineering course at Fort Bliss, Tex.

He served as battery officer, 7th Battalion, 13th Artillery, Vietnam (1967–68), following an assignment as battery officer, 3d Battalion, 517th Artillery, Selfridge AFB, Mich.

He has been awarded the BSM and the ARCOM with OLC.

Capt Ralph W. James is the new adjutant of the U.S. Army Manpower Resources Research and Development Center, OCRD.

He served (1970–71) as assistant S4 with the 16th Combat Aviation Group, Americal Division, after serving in Vietnam as S4, CO and platoon leader with the 2d Battalion, 35th Infantry, 4th Division.

He was assigned in 1969–70 as assistant division and command information officer, 82d Airborne Division, Fort Bragg, N.C. Among his awards are the BSM, AM, VCM, VSM, NDSM CIB, and Parachutist Badge.

Army Uses Navy Jet Fighters To Test SAM-D at White Sands

Obsolete U.S. Navy F3–D Skynight jet fighters are being used to test the Army's newest surface-to-air missile at White Sands Missile Range.

One of the 22-year-old jets will serve as a "target" while the other chases it in the initial testing phase, designed to detect flaws in the electronic gear before the instruments are packaged in the SAM–D.

F3–D fighter planes were selected because each has a large nose cone for the installation of instruments, and two front seats to accommodate the pilot and a senior electronic technician, who will check highly intricate instruments. The F3–D jet was used during the Korean War.

AAMRDL Announces Coleman as Directorate Head

One of the key executive positions in the U.S. Army Air Mobility Research and Development Laboratory was filled in July with appointment of Thomas L. Coleman to head the Langley (Va.) R&D Directorate.

Selection of Coleman was announced by Paul F. Yaggy, director, Army Air Mobility R&D Laboratory, Moffet Field, Calif. Coleman had been serving as technical assistant to Lawrence K. Loftin Jr., director for Aeronautics, Langley Research Center.

The directorate Coleman heads is one of four subordinate elements of the Army Air Mobility R&D Laboratory, which is a part of the NASA-Ames Research Center. Establishment of the AAMRDL was announced in January 1971 by the U.S. Army Materiel Command, as an outgrowth of a November 1969 agreement with the National Aeronautics and Space Administration.

Key officials of these agencies have estimated that the agreement for joint use of NASA facilities is saving the U.S. Government more than $100 million that would have been necessary to erect separate Army facilities.

Coleman's qualifications for his new role with the Langley Directorate include about 24 years employment with the Langley staff, following his honorable discharge from the U.S. Navy in 1947. He will be concerned with generation of plans and the conduct of research in low-speed aeronautics. He has a BS degree in aeronautical engineering from Georgia Institute of Technology.

Regarded internationally as an authority in the field of operational flight loads (especially gust loads and effects of repeated loads on aircraft and structural design criteria), he has served as a consultant representing NASA in the U.S. and abroad.

Coleman's Langley Research Center assignments have included assistant head, Airworthiness Branch, and technical assistant to the director for Aeronautics.

He was a member of the International Civil Aviation Organization (1958–61); also, a member of a working group assessing runway construction, ground environment, and preparing recommendations for the AGARD Structures and Materials Panel. He did some of the initial work on the use of randomly spaced satellites for communications, was chairman of a NASA Subcommittee on Environmental Design Criteria for Space Vehicles, and served as a member of the NASA Committee on Fatigue Research and Technology.

Thomas L. Coleman

Major Army RDT&E, Procurement Contracts Exceed $589 Million

Army research, development, test, evaluation and procurement contracts, each exceeding $1 million, totaled $589,251,084 since the previous edition of the *Army R&D Newsmagazine* through Aug. 1.

Eastman Kodak Co. is receiving $33,149,454 for operation and maintenance of the Holston Army Ammunition Plant at Kingsport, Tenn. Boeing Co. was awarded $33,069,187 for CH–47C helicopters, for overhaul of crash-damaged helicopters, and for research to advance technology relating to heavy-lift helicopter development.

Textron, Inc., was issued $32,718,641 in contracts for OH–58A helicopters, for rotor blades and for repair of crash-damaged helicopters. Remington Arms Co., Inc., will receive $31,332,790 for operation and maintenance of the Lake City Ammunition Plant, Independence, Mo.

Page Aircraft Maintenance, Inc., gained $25,146,781 for aircraft maintenance services. NHA, Inc., Arlington, Tex., is receiving $22,966,896 for work in support of U.S. Army aircraft in the Republic of Vietnam. Mason and Hanger-Silas Mason Co., Inc., successfully bid $20,398,060 for operation of Army ammunition plants at Grand Island, Neb., and at Burlington, Iowa.

Contracts under $20 million. Raytheon Co., $19,962,124 (five contracts) for radar antenna cartridges, for metal parts for bomb fuzes, for preparation of contract definition studies for the Hardsite Defense Program, and for engineering services for the improved Hawk missile system.

General Motors Corp., $19,867,731 (four contracts) for development and engineering for the XM803 combat tank, for M113A1 armored personnel carrier diesel engines and transmissions, and for diesel engines for M107 and M110 tanks.

Chrysler Corp., $19,239,015 for M60A1 combat tanks and AVLB chassis; Olin Corp., $19,234,512 (six contracts) for 45 caliber and 81mm illuminating cartridges, and for operation and maintenance of Army ammunition plants at Barbaroo, Wis., and at Charlestown, Ind.

Western Electric Co., $18,371,692 (six contracts) for changes at the Varian and Spences Test Stations, for Safeguard ABM System training efforts, for command and control equipment and maintenance support services for the Safeguard Perimiter Acquisition and tactical softwear control site, for site housing for Safeguard, and for research and development for the data processing subsystem of the Safeguard Ballistic Missile Defense System.

Southern Airways of Texas, Inc., $14,752,413 for providing helicopter pilot training, maintenance of aircraft and support services; A. M. General Corp., $14,365,762 for ¼-ton and 2½-ton trucks; Harvey Aluminum Sales, Inc., $13,638,367 for operation and maintenance of the Army Ammunition Plant at Milan, Tenn.

Day and Zimmermann, Inc., $12,814,350 for operation and maintenance activities at Texarkana, Tex., and at Parsons, Kans.; Uniroyal, Inc., $12,733,379 for operation and maintenance of the Army Ammunition Plant at Joliet, Ill.;

LTV Aerospace Corp., $12,344,650 for test sets and containers for the Lance missile system and for Phase II of the Homing Interceptor Technology Program; Hughes Aircraft Co., $11,987,239 (three contracts) for laser rangefinders and spares, and for preparation of a contract definition study for the Hardsite Defense Program.

AVCO Corp., $11,186,617 (five contracts) for radio sets, for a product improvement program for the T–55–L–11 gas turbine engine, for rotor modification kits for turbine engines, for advanced development models of a lightweight VHF–FM radio system, and for continued development, fabrication, and test of the AGT–1500 turbine engine.

Contracts under $10 million. Atlas Chemical Industries, Inc., $9,736,373 for operation and maintenance of facilities at the Volunteer Army Ammunition Plant, Chattanooga, Tenn.; HARSCO, York, Pa., $8,677,838 (four contracts) for M110 8-inch howitzers and M578 recovery vehicles, and for armor fragmentation kits for tactical vehicles.

Ford Motor Co., $7,856,458 for engineering services for M151, M718 and M825 trucks, and for research in ceramic materials design for use in high-temperature gas-turbine engines; General Electric Co., $6,000,000 for 20mm guns; International Harvester Co., $5,779,100 for trucks and vans; Caterpillar Tractor Corp., $5,152,912 for GOER cargo vehicles; Union Carbide Corp. $5,110,238 for dry batteries.

Contracts under $5 million. Global Associates, $4,806,750 for logistic support at the Kwajalein Missile Range; Aerojet Solid Propulsion Co., $4,471,416 for loading Hawk rocket motors; Thiokol Chemical Corp., $4,437,376 for operation and maintenance of the Army ammunition plant at Marshall, Tex.;

Federal Cartridge Co., $4,383,849 for operation and maintenance of the Army ammunition plant at New Brighton, Minn.; CONDEC Corp., $4,366,285 for mobile floating assault bridges; Dynalectron Corp., $4,280,925 for maintenance services in Vietnam.

Control Data Corp., $4,000,000 for electronic equipment; Radiation, Inc., $4,000,000 for electronic equipment; Ravenna Arsenal, Inc., $3,846,826 for

UNIVERSAL LIQUID DISTRIBUTOR. This cross-country vehicle is being developed by the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va., to provide combat support units with highly mobile means of spreading dust-control materials. It is capable of distributing dust palliatives and bituminous materials at rates up to 300 gallons per minute. Designed to be especially helpful at helipads and airstrips, the distributor can apply, simultaneously, water to pre-condition soil, fiberglass scrim for reinforcing, and liquid dust-control material. The vehicle can travel 10 mph cross country.

operation of the Ravenna Army Ammunition Plant; Beech Aircraft Corp., $3,800,000 for U–21F aircraft.

Maremont Corp., $3,771,950 for 7.62mm machineguns; Martin Marietta Corp., $3,568,684 for multiplexers; Honeywell, Inc., $3,469,009 for R&D efforts on artillery munitions and for value engineering change proposals and royalty payment for the M219E1 fuze.

Teledyne Industries, Inc., $3,389,046 for engineering support for production of engines and for engine assemblies; IBM Corp., $3,323,057 for combat services support system; Cutler-Hammer, Inc., $3,314,388 for advanced development models and engineering design for tactical landing system.

Sperry Rand Corp., $3,184,894 for operation and maintenance activities at the Army Ammunition Plant, Shreveport, La.; FMC Corp., $3,122,858 for production engineering and maintenance of evaluation functions in support of the M113 family of armored personnel carriers; Gulf and Western Industries, Inc., $3,121,272 for parts for 105mm projectiles.

Norris Industries, Inc., $2,873,640 for parts for 105mm cartridge cases; Westinghouse Electric Corp. $2,720,012 for work on the first prototype unit of a new federal radio warning network Decision Information Distribution System.

Electromagnetic Technology Corp., $2,645,600 for radar sets, installation equipment and test sets; ITT Gilfillan, Inc., $2,642,000 for testing of radar systems; Hawthorne Aviation, $2,605,172 for aircraft maintenance and related test support services.

McDonnell Douglas Corp., $2,500,000 for contract definition study for the Hardsite Defense Program; R. G. LeTourneau, Inc., $2,362,500 for parts for 750-pound bombs; Lockheed Aircraft Corp., $2,406,921 for a cost-reduction study for AH–56 aircraft, and for equipment and services in connection with underground nuclear testing at the Nevada Test Site.

Federal Electric Corp., $2,165,691 for technical support services and engineering maintenance services in Thailand; Harvey Aluminum Sales, Inc., $2,142,686 for operation and maintenance activities of the Army Ammunition Plant at Milan, Tenn.; Hamilton Watch Co., $2,000,000 for the acquisition of ammunition production facilities.

Contracts under $2 million. RCA Corp., $1,996,375 for lightweight radio systems; New Mexico State University, $1,961,145 for data reduction analysis and processing, and computer operations; LTV Electrosystems, Inc., $1,940,888 for receiver transmitters.

Resdel Engineering Corp., $1,912,500 for radio frequency monitors; Computer Sciences Corp., $1,858,600 for scientific and operations research effort in support of combat development and related studies; ITT Corp., $1,820,000 for test sets for radios.

Magnavox Research Laboratories, $1,798,000 for refurbishing and modifying radio communications subsystems for satellite communications; Harvard Industries, $1,770,733 for 2.75-inch rocket launchers; Hewlett-Packard Co., $1,701,200 for automatic calibration systems and instrument calibration programs for an automatic network analyzer.

Airport Machining Corp., $1,631,961 for 60mm projectile parts; General Dynamics Corp., $1,592,593 for electromagnetic intrusion sensing devices; REMCOR, Inc., $1,560,127 for 81mm projectile parts; Gearhart-Owen Industries, $1,549,380 for parts for demolition kits.

AMBAC Industries, Inc., $1,404,546 for flares; White Engines, Inc., $1,366,979 for multifuel engines for trucks; System Development Corp., $1,326,317 for a training program for the AN/TSQ–51 Missile Mentor and the AN/GSG–5 BIRDIE Air Defense System.

Textron, Inc., $1,282,812 for repair of crash-damaged helicopters; Navigate, Inc., $1,272,138 for automated storage retrieval system at the Letterkenny Army Depot; Teledyne Ryan Aeronautical Division of Teledyne Industries, $1,244,160 for a missile flight and repair program.

Allied Products, $1,205,468 for 12-ton semitrailers; REDM Corp., $1,204,685 for parts for bomb fuzes; United Aircraft Corp., $1,196,378 for Phase II advanced development of an open-cycle fuel cell power plant.

Polan Industries, $1,101,992 for infrared searchlights and repair parts; Boehme, Inc., $1,082,950 for gyromagnetic compass sets; GFR Industries, Inc., $1,081,880 for bomb parts; Eureka-Williams Co., $1,038,000 for bomb fuze assemblies.

Massachusetts Institute of Technology, $1,030,000 for basic and applied research in general physics, plasma dynamics, communications sciences and engineering; Leece Neville of Michigan, $1,003,891 for alternator assemblies; and TRW, Inc., $1,000,000 for electronic equipment.

Ceramics for Turbines Studied Under Contract

Development of ceramic materials designed for use in high-temperature gas turbine engines, including feasibility demonstration, is ordered in a contract awarded recently by the Army Materials and Mechanics Research Center (AMMRC), Watertown, Mass.

AMMRC issued the contract in behalf of the Advanced Research Projects Agency (ARPA) of the Department of Defense. Westinghouse Electric Corp. was designated as a subcontractor to Ford Motor Co. for this program. Together they represent both ends of the gas turbine range—Ford with automotive-type engines, Westinghouse with large electrical power generators.

The 5-year, $10,500,000 incrementally funded government contract is expected to yield knowledge having many applications in vehicles, ships, aircraft and field power generators for the U.S. Army, Navy and Air Force.

The ARPA contract calls for development of ceramic test assemblies, operable at ceramic temperatures of 2,500°F. or higher, on two turbine systems. One system is an automobile engine, under development at Ford. Westinghouse is developing a 30,000,000-watt electrical power generator engine.

ARPA expects that this contract for development of design technology for the practical use of high-strength, high-temperature ceramic materials will constitute an extremely important breakthrough applicable to many civilian and military requirements.

AMMRC Director Dr. Alvin E. Gorum (center), Dr. Maurice J. Sinnot (left), ARPA director for Materials Science, and Harold G. MacDonald, vice president of Ford Motor Co. Product Development Group, examine experimental ceramic parts for turbine engines, following signing of $10.5 million contract.

Army Program at Edgewood Seeks to Improve Effectiveness of Detector Dogs

Improved detector dogs—rather than the "Super Dog" term applied by some news media—are the long-range objective of Edgewood (Md.) Arsenal's research and development selective canine breeding program.

That goal, advanced encouragingly by the first two generations, still has eight generations to go, the Army estimates. This calculation is the consensus of a select group of Army veterinarians and technicians.

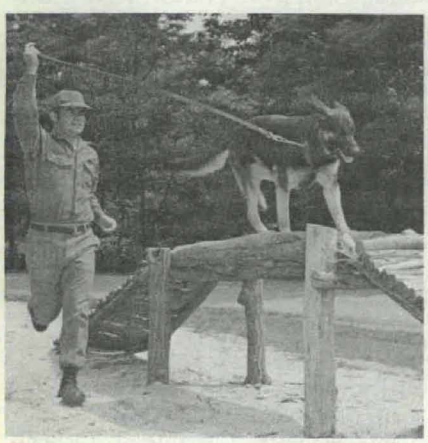
The search to find the best breed in the effort to develop "super snoofer" dogs originated in response, several years ago, to the U.S. Army's urgent need for more effective ambush detection and mine-sensor devices for Southeast Asia operations.

Col M. W. Castleberry, chief of the program at Edgewood, beams with pride as he comments "that by 1980 we will have a remarkably superior dog."

The program originated in 1967 and the January 1968 edition of the *Army Research and Development Newsmagazine*, pages 8–9, carried a feature article headlined "Army Evaluating Skills of Dogs for Special Duty."

The initial effort, involving Walter Reed Army Institute of Research (WRAIR) and the University of Maryland (under contract), required assembling of 125 dogs. Twenty-five in each of five categories were evaluated.

Castleberry explains that it is the Army's goal "to develop a more intelligent and sensually acute dog which is physically and temperamentally better suited for military purposes than is now generally available."



VETERINARIAN TECHNICIAN Pfc Milton Coley exercises Neil, a 16-month-old German Shepherd sire used in selective breeding program designed to develop a better military dog. Army veterinarians estimate 10 generations will develop the dogs they are seeking.

A function of the Army's Medical Research and Development Command, the selective breeding program is conducted through the WRAIR Department of Bio-Sensor Research.

"Bio" means life and "sensor" describes the capacity to recognize and evaluate details of the environment.

Castleberry says that the dog is without a doubt the most mobile and versatile detector the Army has today. "There is no electronic sensing device at this time that can equal the dog," he says. "Members of the K-9 Corps have proved their worth time and time again in Vietnam."

The German Shepherd was selected for the Army breeding program on the basis of its suitability and learning ability. Used for years by armies throughout the world, this breed was recommended by the University of Maryland following the evaluation process.

Selective breeding was launched at Edgewood Arsenal in September 1968 with four males and 21 females, selected from more than 200 dogs examined in the eastern and midwestern sections of the U.S.

The unit now keeps about 250 puppies and 50 adult dogs on hand. To date more than 500 dogs have been transferred to military units throughout the nation and overseas.

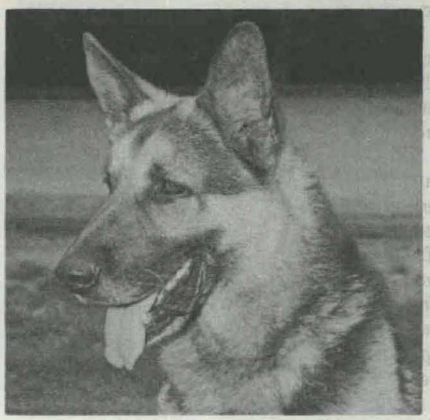
Trainers at Fort Benning, Ga., reportedly are enthused with the Edgewood dogs. Handlers and trainers are confident that these second-generation dogs are superior to those procured elsewhere.

All dogs whelped at Edgewood undergo extensive conditioning and evaluation from birth until 11 months of age, when they are shipped to other military units or retained for breeding stock.

Evaluation begins when the puppies are eight weeks old. They undergo tests once a week for the next five weeks and each puppy is "socialized" daily from the 4th through the 14th week.

Evaluations include the standard fetch, sit and come tests used in selecting guide dogs for the blind. Other tests developed by the bio-sensor unit include reaction to rag play, loud noises, bright lights and mirrors, alertness to hidden decoys, and ability to escape from a complicated, 10-foot maze.

When the pups are seven months old they are tested to see how they react to strict basic obedience training, rag agitation, to strange animals, decoys hidden in wooded areas and a menace that threatens themselves and their handlers.



KONRAD, a 6-year-old German Shepherd, has sired more than 200 Dysplasia-free puppies. Dysplasia has long been a crippling hip and elbow abnormality common to dogs and humans.

Col Castleberry pointed out that it is not the mission of his 36-man team to train dogs for specific military roles, only to determine intelligence, explaining: "The only way you can judge a dog's intelligence is by evaluating his ability to learn."

Usually about 50 percent of all German Shepherd dogs develop some degree of hip dysplasia, a deformity of the hip joint. Selective breeding over the past three years at Edgewood has reduced this problem considerably. Konrad, one of the Army's choice studs, has sired more than 200 dysplasia-free puppies.

X-rays are taken of all dogs at 5, 8 and 11 months of age to check for hip and elbow dysplasia. Radiographs of those dogs selected for breeding stock

Col. M. W. Castleberry, chief Department of Biological Sensor Research at Edgewood (Md.) Arsenal, looks over two German Shepherd pups, the second generation of dogs being raised in Army selective breeding program.

are sent to the Orthopedic Foundation of America for certification that they are dysplasia-free.

All litters whelped at Edgewood are registered with the American Kennel Club. Those puppies selected for retention as breeders are also registered individually.

The bio-sensor team is proud of the fact that it has successfully weaned more than 600 puppies during the past 2½ years without a single case of distemper. *They credit this remarkable feat in part to innoculating the puppies with gamma globulin and human measles vaccine at 14 days of age.* When old enough, they receive permanent distemper shots.

Col Castleberry is confident that their work in developing a better strain of military dog will also contribute to a better all-around civilian dog.

"Dogs developed through selective breeding will be smarter, healthier, happier and more useful to both the military and civilian dog lover," he said, adding:

"With the development of a dysplasia-free dog, and by making the blood lines available to the general public, the Army will help relieve the suffering of many dogs and at the same time provide less heartaches and expense to their owners."

Castleberry credits dedication of the team of four veterinarian officers and the 30 enlisted veterinarian technicians for success of the program to date. His deputy is 30-year-old Capt Jeffery Lin. Capt Willard L. Wilke is responsible for the health and comfort of the unit's 300-plus charges, who are fed only normal dog food and examined periodically for physical fitness.

First Lt Stephen E. Scalara, 24, has a master's degree in genetics from the University of Arizona. Dubbed by associates as a "chromosomal engineer," he is in charge of the puppy evaluations. All later work is based on Scalara's recommendations.

Results of the evaluation program are being computerized and eventually may be helpful in determining what dogs should be used for selective breeding.

Many of the enlisted technicians have college degrees. Others were veterinary or animal husbandry students. One was a professional animal trainer in Hollywood until drafted.

Scientific and selective breeding has produced cows that give more milk, chickens more eggs, sheep more wool and horses that run faster, Col Castleberry said, adding: "By using these same principles, we'll produce a better military dog . . . . We will come up with a dog that will be trained easier and faster, be more stable and physically capable to perform a wider range of duties.

"If you think these second-generation pups are something, then come back in a few years and we'll show you a truly super dog."

GERMAN Shepherd and pointer puppies at Edgewood (Md.) Arsenal. During the past 12 months, 369 puppies were weaned from 65 litters. The present Biological Sensor Research Group kennel population is about 300, which includes the German Shepherd breeding stock of 4 sires and 44 bitches.

Model Helps Determine Flare Illumination Needs

Flare illumination requirements in Southeast Asia combat operations are being calculated by using Picatinny Arsenal's scale model of the terrain.

The model is used in an effort to estimate reliably the amount of illumination required to see and recognize military targets from theoretical considerations.

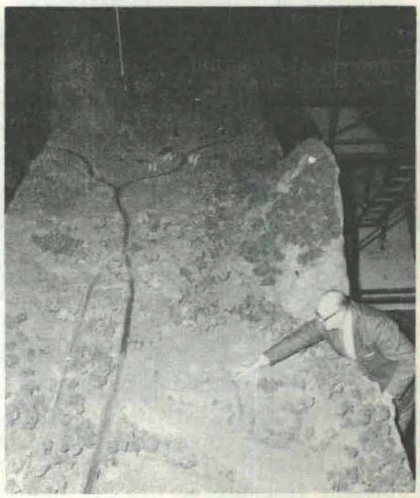
Unique characteristics of flare illumination include spectral distribution, flicker, oscillation and drift. These make it almost impossible to estimate reliably the amount of illumination required for military purposes. Until recently, requirements were determined by field tests.

The model, 10′ by 40′, built to a 160:1 scale, with native villages, bamboo huts, palm trees and dense undergrowth, simulates an area of Southeast Asia about .3 by 1.2 miles.

Electrical sources exactly reproduce actual flares in regard to illumination level, flicker, parachute descent rate, and wind velocity. Miniature tanks, guns, trucks and personnel are part of the model.

With this model, a test can be repeated without variation as often as necessary. Each parameter can be varied independently to determine illumination requirements, just as the effect of each parameter on the recognition of the target can be determined.

The pyrotechnic illumination scale model is operated by the Physical Radiation Research Branch, Pyrotechnics Laboratory, Feltman Research Laboratories. The information provided is important in designing flare systems, and in the evaluation of numerous potential improvements.



TERRAIN MODEL of Vietnam village is used at Picatinny Arsenal to determine flare illumination requirements for Southeast Asia combat operations.

HumRRO Reviews 20 Years of Training, Education R&D Progress

Ways of utilizing more effectively the nation's manpower resources through technological advances in training and education have come more urgently into the public focus in recent years, in line with social changes of profound significance.

In an exceptionally favorable position to respond creatively to this nationwide requirement is the Human Resources Research Organization. Originated July 31, 1951, HumRRO was established as the U.S. Army's principal training and education research and development contract agency, and has held that status.

Known until late 1969 as the Human Resources Research Office of the George Washington University, HumRRO terminated that affiliation to reorganize as an independent nonprofit organization. The purpose was to provide greater flexibility in undertaking contract R&D in its highly specialized field with private industry and other federal and local agencies.

Progressing steadily in furtherance of that objective, HumRRO still concentrates about 75 percent of its total activities on U.S. Army requirements for R&D studies.

Other contract efforts are with the U.S. Navy, Air Force, Federal Aviation Administration, U.S. Department of Transportation, Department of Labor, National Science Foundation, and National Institute of Mental Health.

In marking the 20th anniversary, July 31, HumRRO investigators could take well-earned pride in achievements that have contributed importantly to solution of many U.S. Army training and educational problems.

HumRRO scientists have provided the Army with R&D information, training programs, training devices and other products that have coped successfully with problems of motivation, leadership and personnel management.

Complete "packages" of instruction for riflemen, medical corpsmen, radio operators, field wiremen, armor crewmen and junior noncommissioned officers (among many others), were based on development of psychotechnology of instruction.

Uses to which the U.S. Army has directed HumRRO-developed information are spelled out in a series of pamphlets published by the U.S. Continental Army Command. More than 1,200 reports and papers HumRRO has produced for the Army in 20 years are listed and annotated in the *HumRRO Bibliography of Publications.*

Copies of the CONARC pamphlets and bibliography are available upon request from HumRRO, 300 N. Washington Street, Alexandria, Va. 22314.

CONARC Regulation 350–100–1, *Systems Engineering of Training,* embodies major concepts and techniques that HumRRO behavioral scientists have produced for the Army since 1951. It requires that all courses taught in CONARC's 26 schools be "systems-engineered," in effect, redesigned in accordance with modern technology.

HumRRO's contributions to the effectiveness of the U.S. Army's vast training program, involving man-machine compatibility whenever a new weapon or weapon system comes into being, takes on real meaning in consideration of the fact that 70 to 80 percent of the life cycle costs of a weapon system are personnel costs.

The Department of Defense has termed CONARC Regulation 350–100–1 a model for all the U.S. Armed Forces in systems engineering designed to achieve a 10 to 15 percent reduction in training costs—meanwhile improving the proficiency of course graduates.

HumRRO R&D studies are identified by a code name or acronym. Listing of the more significant of the studies over the past two decades is complicated by the fact that the Army tends to stress those that have produced specific products; HumRRO scientists tend to favor those more generalizable—that is, have produced *principles* applicable to a number of Army or even civilian needs.

HumRRO's most ambitious effort in 20 years is easy to identify, without even a close second. Project IMPACT (Instructional Model Prototypes Attainable in Computerized Training) was initiated in 1967 as a 5-year estimated $4.3 million R&D program headed by Dr. Robert Seidel of Division No. 1.

The project will actually take longer to complete than originally planned because of a reduction in the level of per-year Army funding. It is now scheduled for completion in 1974.

Because of its vast interest to academic institutions throughout the United States — although directed primarily from the outset to military training applications — Project IMPACT has attracted support, too, from the National Science Foundation and the James McKeen Cattell Fund. (A detailed discussion of Project IMPACT will conclude this article.)

Some other Army HumRRO results are:

FORECAST—produced a new approach to Army electronics maintenance training . . . cut classroom instruction hours by more than half

PACE-SETTING TECHNICAL DIRECTOR Billy M. Horton, U.S. Army Harry Diamond Laboratories, honored recently as Inventor-of-the-Year by the Patent, Trademark and Copyright Institute of George Washington University, is surrounded by HDL employees who also are recent patent winners. Honored for their inventions at a ceremony July 28, with HDL Commander Col David W. Einsel Jr. presiding, were (l. to r.) John F. Burke, flueric vortex proportional amplifier (with John L. Dunn and K. R. Scudder); Fernando Villarroel, plural reed reciprocating generator (with Carl J. Campagnuolo); Jonothan E. Fine, fluidic demodulator (with Campagnuolo); Col Einsel; Billy Horton; Allan B. Holmes, supersonic jet engine flueric bypass control (with R. W. Warren); George Mon, fluid amplifier with improved interaction region; C. J. Campagnuolo; Warren P. Morrow, mine fuze safing system; and John L. Dunn.

while maintaining proficiency of the graduates.

LOCK-ON—produced a method (and materials) for on-the-job training of guided missile operators. The Army adopted this method and materials, and also based its "conventional" instructional program on the LOCK-ON approach.

ARMORNITE—examined the human factors aspects of armor operations under conditions of limited visibility, and made recommendations which the Army adopted for tank night fighting.

SHOCKACTION—developed a new program of advanced individual training for armor crewmen; current armor AIT is based on it.

FIGHTER—developed an approach which increases the trainee's confidence in his ability to "do the job."

NCO—developed Leader Preparatory Program, enabling the Army to identify and train junior NCOs early in their careers.

OFFTRAIN—produced methods and materials for teaching leadership to ROTC cadets and junior officers, primarily in garrison use.

LEAD—identified the critical combat skills and knowledges required of the small-unit infantry leader.

TRANSITION—studied problems involved in transitioning civilians into soldiers, and made recommendations for improving the process. Findings were incorporated in Drill Sergeant Program (for which HumRRO developed the instruction program).

SUPPORT—developed a new method for combining BCT and AIT for the medical corpsman; utilized instructional television to improve the training program.

CONTACT—produced tape-recorded, self-instructional programs to give front-line soldiers a limited language capability in Russian and Mandarin Chinese.

MALT—produced a tape-recorded, self-instructional program in Vietnamese language, tailored for military advisers.

AUTOSPAN—produced a tape-recorded, beginner's level self-instructional program in Spanish.

PATROL—produced a "package" of instruction for infantry soldiers to increase accuracy, extent, and reliability of information obtained from reconnaissance patrols.

INGO—produced a new method for deriving instructional objectives from job and task analyses, adopted and promulgated by CONARC in CON Regulation 350–100–1.

SAMOFF—produced systematic analyses of updating training requirements and procedures for surface-to-air missile officers.

UPSTREAM—developed a set of procedures the Army can use in predicting training requirements, and developing new training programs, for future air-defense guided missile systems.

ECHO—training program for helicopter pilot candidates that reduced attrition and increased proficiency of graduates.

SYNTRAIN—studied use of aviation training devices and developed plans for synthetic flight training system which promises to save Army millions of dollars each year.

UPGRADE—developed an approach to improving aviation maintenance training through task and instructional analyses.

AREA—developed concepts and techniques for training U.S. military personnel to work productively in foreign countries with host-country personnel.

JOBTRAIN—developed a new method for building training programs for Signal Corps electronics repairmen.

OBSERVE—developed training for aerial observers; program can be taught in classroom or can be self-instructional; produced the Army's first "programed" technical manuals.

STOCK—developed a set of procedures (now being used by the Quartermaster School) for managing the training of widely heterogeneous ability groups.

RECON—developed training methods and techniques for improving the combat readiness of Armored Cavalry Platoons.

REALISTIC—determined the read-

(Continued on page 38)

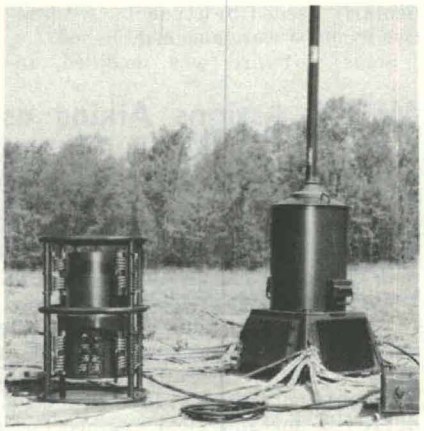
ECOM Announces Thermoelectric Mini Generator

Development of a 500-watt, 28-volt direct current thermoelectric generator, without moving parts and weighing only 57 pounds, was announced recently by the Army Electronics Command, Fort Monmouth, N.J.

Fully "militarized," the 26-inch high generator is only 18 inches in diameter. Consuming only about half a gallon of fuel (diesel oil, gasoline or aircraft fuels) an hour, it can operate unattended in field areas as long as the fuel supply lasts.

Built for and demonstrated with the Army's new low-frequency aircraft beacon, the AN/TRN–30, the generator may be used with field radio transmitters and receivers, radars, data terminals and navigational aid equipment. It also can be employed as a vehicular-mounted battery charger.

Generation of electricity by application of heat to two dissimilar metals in a thermocouple, which is the principle of the thermoelectric generator, has been used for years on a limited basis—primarily in the laboratory for temperature measurement or commercially for controls.



THERMOELECTRIC GENERATOR, designed to operate 1,000 hours without maintenance, is demonstrated with low-frequency AN/TRN-30 aircraft beacon.

Instead of being made of two different metals, each thermocouple in the Army's generator is a single lead-telluride semiconductor whose two sides are "doped," or treated, separately. One side is positive and the other negative.

The 500-watt unit has 256 such thermocouples, hermetically sealed between "hot" and "cold" walls—the hot side with a maintained heat of 1,100°F. and the cold side at 250°F. by forced air cooling.

Maintenance of heat on the hot wall is achieved by ultrasonically atomizing and burning any of the various fuels with an atomizer driven at 77 kilohertz (77,000 cycles per second) by a transistorized oscillator whose transducer is a piezoelectric disc. The power is taken from the cold wall.

The thermoelectric generator can be used for continuous operation and is designed for a minimum of 1,000 hours without maintenance. It is inaudible beyond 100 feet.

Participating with the Army Electronics Command in work on the generator was the Minnesota Mining and Manufacturing Co., which is now building three engineering development qualification units.

The thermoelectric generator is one of many military power sources under development at the Power Sources Division of ECOM's Electronic Components Laboratory. Project engineer is Joseph P. Angello of Eatontown, N.J., chief of the Thermal Conversion Section of the Power Sources Division.

HumRRO Reviews 20 Years of Progress in R&D

(Continued from page 37)

ing, listening, and arithmetic skills required for major military occupational specialties.

SWINGSHIFT—developed training methods for improving individual and squad infantry performance in operations during periods of limited visibility.

NIGHTSIGHTS—produced information on ability of individuals to use the new electronic night-vision devices; developed instructional methods and materials for teaching their use.

SKYFIRE—developed method for training infantrymen to locate, identify and fire upon incoming hostile aircraft with small arms.

TRAINMAN—developed a program to teach Army officers how to manage training in accordance with latest developments in instructional technology.

President (Dr.) Meredith P. Crawford has headed HumRRO since its inception and Dr. William A. McClelland, executive vice president, has served since Sept. 26, 1955. Charles W. Smith is treasurer. In charge of the four HQ directorates at 300 N. Washington St., Alexandria, Va., are:

Arnold A. Heyl, Operations; Dr. Eugene A. Cogan, Research Design and Reporting; Dr. Robert G. Smith Jr., Program Development; Charles W. Smith, Business Affairs.

Directors of divisions are: Dr. J. Daniel Lyons, No. 1, Systems Operations, Alexandria; Dr. Donald F. Haggard, No. 2, Fort Knox, Ky.; Dr. Howard H. McFann, No. 3, Presidio of Monterey, Calif.; Dr. T. O. Jacobs, No. 4, Fort Benning, Ga.; Dr. Albert L. Kubala, No. 5, Fort Bliss, Tex.; Dr. Wallace W. Prophet, No. 6, Fort Rucker, Ala.; Dr. Arthur J. Hoehn, No. 7, Social Science, Alexandria.

Former Secretary of the Army Stephen Ailes is chairman of the 12-member Board of Trustees, and president, Association of American Railroads. Vice Chairman Dr. Louis T. Rader is chairman, Department of Electrical Engineering and professor, Business Administration, University of Virginia. Other members hold key industrial or academic posts.

PROJECT IMPACT reportedly is progressing satisfactorily toward its goal of achieving effective methods of computer-assisted instruction (CAI). The operating prototype system is capable of matching specific subject matter with individual trainee capabilities, with a wide diversity of applications in numerous diverse locations.

System hardware includes a computer, display devices to present information to the students and take answers, and teaching devices that return answers to the system for analysis and storage.

Software—the computer language and processes which drive the courses of the computer—carries signals from the computer to students, and vice versa. Software is of the basic telecommunications access mode (BTAM).

The system requires development of an instructional logic and instructional material is another part of the research effort.

Heart of the CAI system is the instructional decision model. This model stores information about the student, his capabilities, and the course; it also provides a means for interaction of information.

The decision to determine what to do with a student at a given time is based upon student answers to particular questions, his history of responses to similar types of questions, and his aptitudes and abilities as ascertained by a battery of tests.

Previously, tests were conducted to determine what aptitudes and abilities are predictive of performance. Through cluster analysis, and subsequent correlation of test scores with performance as predictors, a small, select group of tests was chosen.

The purpose of the first program of instruction was to teach common business oriented language, COBOL, to military and civilian programers. Subjects were chosen from Project TRANSITION, designed to assist those leaving the Army to develop skills of marketable economy.

Results suggested breaking down the course to small units (modules) to provide more easily instruction particularly needed by students. Alternative modules were also established.

Some software was modified, including the CAI language, and a new language was developed linked with the IBM Coursewriter language—to overcome limitations of that language and increase the potential of the system.

Software changes and other developments are directed towards making the system foolproof, limiting the number of monitors necessary, and simultaneously providing for a large number of students.

Despite budget cuts, HumRRO has developed, to varying degrees, the software, hardware, and instructional material for the CAI course.

Current efforts include developing a second version of the course incorporating all the improvements. The feasibility of voice input and output techniques is being investigated.

Dr. Felix Kopstein, principal associate of Dr. Robert J. Seidel, head of the research team, distinguished between development progress and use of that which gets developed operationally.

In his opinion, experiments have yielded a fair idea of how the Army can or could make operational use of what has been developed, and it is now the Army's role to implement CAI experimentally in its schools, particularly those of the Continental Army Command. He feels the project has reached a stage at which "limited operational implementation seems feasible."

Much work remains to be done, however. Increasingly complex systems with increasingly sophisticated subject matter must be taught. Removing some restrictions of the system, increasing its efficiency, and making the program more cost beneficial are all part of future goals.

Ralph Dabbs, research manager for the project, adds that COBOL I must be perfected now; also, based on experience, that technical documentation be refined to assist further development of this and other CAI efforts.

MERDC Assigns Atkins as Representative in Vietnam

Roger M. Atkins is the U.S. Army Mobility Equipment R&D Center's (MERDC) fourth representative in Vietnam under the Vietnam Laboratory Assistance Program, Army (VLAPA).

Atkins replaces Jimmy Lee, who recently returned to his regular assignment as an electronics engineer in the MERDC Intrusion Detection and Sensor Laboratory. The others were Vernon Urie and Jack Stevenson.

Atkins will visit various bases to ascertain in what manner the center can assist in improving equipment under test or evaluation in Vietnam.

Graduated from Purdue University with a BS degree in metallurgical engineering in 1947, he was employed in private industry prior to joining MERDC in 1969. Currently he is employed in the Systems Management Division, Systems Engineering and Computation Support Office.

Roger M. Atkins

BESRL Officials Consider Extension of SIMTOS to Field Units

Rewarding results of SIMTOS (Simulated Tactical Operations Systems), tested three years by the Army Behavior and Systems Research Laboratory as an aid to key decision-makers, have reached a point where they have direct implications for Army systems in the field.

BESRL scientists are exploring the feasibility of establishing remote computer terminals in the field to provide proficiency maintenance support for planning and operations decision-makers.

Directed by James D. Baker, senior task leader of BESRL Command Information Systems, the study is being continued as an investigation of the determinable critical factors in making successful tactical decisions.

Since January 1970, BESRL has been one of three laboratories of the U.S. Army Manpower Resources Research and Development Center, which was then established in Arlington, Va. BESRL, however, traces its origin to 1917 and has passed through numerous redesignations and reorganizations.

Currently deeply involved in behavioral research aspects related to some of the major areas in the Modern Volunteer Army Program, BESRL is described by its director, Dr. J. E. Uhlaner, as one of the nation's first organizations to apply computer science and technology to personnel selection and motivational problems, beginning 15 years ago.

SIMTOS deals essentially with the communication processes, the subtleties of message encoding and screening irrelevant from relevant information for decision-makers; also, the optimal means of message display (e.g., alpha-numeric vs. graphic) for rapid assimilation.

In its efforts to explore the numerous complex aspects of command information processing and decision-making, BESRL has devised a combat decision booth. An experimenter-controlled teletypewriter bombards the officer-subject with hypothetical information from the field, extensive mapping of the hypothetical combat area, and enemy troop location.

Within the booth is a computer console, giving the officer an index of available information categories pertaining to the hypothetical tactical decisions he must make and justify.

During the particular time limit set on his 3-to-1 clock, the officer is requested to query the computer for data deemed most pertinent to the simulated combat problem; also, to justify his conclusions in explanatory briefing papers. Officers may be requested to 'role-play' the enemy's expected tactical maneuvers.

From a separate experimenter-control booth, the project coordinator is able to monitor the decision-making behavior of officers working in four individual isolation booths. The booths are "ideal for facilitating reliable experimental conditions essential to a controlled exercise environment."

About 130 officer subjects have participated in these simulations runs over a 3-year period. From the data bank still being developed by these experiments, BESRL psychologists will investigate an extensive variety of research applications.

"Decision-process pattern scores" of all subjects will supply experimenters with:

- Indications of the type of information most consistently requested by officers, systematically presented with identical problem-situations.
- The specific order in which officers query the computer for data.
- The frequency distribution of information requests over the time period allotted to the decision.

The Army plans to utilize the information gathered from the SIMTOS study to improve officer training programs. Eventually, officers in the field will use remote computer consoles to "plug into" a central data bank to supplement their decision-oriented seeking of information as a normal part of daily activities.

Baker foresees far-reaching implications of SIMTOS as an experiment in computer-assisted decision-making. SIMTOS is termed a study in "intellectronics," a novel field of cybernetics designed to extend man's intellectual abilities through computer technology.

OFFICER SUBJECT charts hypothetical location of enemy troops in simulation study of command information-processing and decision-making.

SIMTOS and researchers in the entire intellectronics field use computers to explore the contingencies inherent in various decision alternatives. This "decision look-ahead technique" is intended to prevent contingent errors in decision-making by revealing information essential to sound judgment. The computerized concept aims to project all effects possible within a programed scenario.

BESRL plans to offer these same computer-assistance techniques to Army field officers through direct application of SIMTOS findings.

Col Ives Directs Test Operations at USATECOM

Col Robert N. Ives is the new director of Test Operations at HQ U.S. Army Test and Evaluation Command (USATECOM), Aberdeen Proving Ground, Md.

Graduated from the U.S. Military Academy at West Point in 1945, he is also a graduate from the Army Command and General Staff College, and the Industrial College of the Armed Forces. He was a student at the University of California at Los Angeles when selected to attend the academy.

Col Robert N. Ives

Col Ives served two years (1967–68) as chief of the Command, Control and Communications Branch, Joint Continental Defense Systems Integration Planning Staff, U.S. Army Element, Office of the Joint Chiefs of Staff. Until assigned to TECOM he was chief of the Republic of Vietnam Armed Forces Plans and Force Structure Division, U.S. Army Military Assistance Command. In 1966–67 he commanded the 1st Battalion, 32d Infantry, 7th Infantry Division in Korea.

His military decorations include the Legion of Merit, Bronze Star Medal, Joint Services Commendation Medal with Oak Leaf Cluster, Meritorious Service Medal, Army Commendation Medal and the Combat Infantryman Badge.

Army Agencies Discuss Future Role in Pollution Abatement Areas

Pollution abatement areas pertinent to military operations and current capabilities for corrective action in an integrated, coordinated program were discussed at a recent conference of U.S. Army Materiel Command representatives and other agencies.

In his opening remarks, Brig Gen Mahlon E. Gates, AMC Director of Research, Development and Engineering, stressed that communication directed toward a more comprehensive understanding of the magnitude of the over-all problem, as related to Army program development, was the basic purpose.

Discussion development of a data bank and center in the Office of the Chief of Research and Development to coordinate over-all Army long-range environmental quality goals.

AMC Deputy CG for Materiel Acquisition Maj Gen John R. Guthrie contributed a strong sense of purpose and motivation to the conference by explaining, in a letter, that the AMC and Army-wide programs will entail a systematic evolution of procedures and capabilities to:

- Define the over-all Army pollution problem related to operations.
- Compare the Army problem of emission of environmental pollutants as related to existing federal standards, and develop standards as necessary.
- Undertake appropriate actions to ensure continued compliance with future environmental quality requirements.

Army Vice Chief of Staff General Bruce Palmer Jr. provided guidance relative to the envisioned scope of Army pollution control and environmental quality objectives in a letter that stated, in part:

". . . Avoid directing . . . efforts to resolving even those problems that apply both to the military and the general public, if the problems are being addressed by nonmilitary government agencies, or would more properly fall within their responsibilities . . . ."

General Palmer's letter recognized also that "Each Agency has specialized capabilities that can and should be utilized by other Army agencies. In this regard, persons operating in positions with liaison potential should maintain contact and coordinate capabilities and requirements with their counterparts in other agencies . . ."

Further clarification limiting the scope of the Army activities came in a letter from the Office of the General Counsel, Environmental Protection Agency, U.S. Government. It states that tracked vehicles do not have to conform to the emission control standards of the Clean Air Act.

Army Materiel Command activities represented at the meeting included those responsive to pollution abatement problems as part of their mission responsibilities, e.g., research, development, engineering, procurement, construction and maintenance.

Reports were presented by the Natick (Mass.) Laboratories (NLABS), Tank-Automotive Command (TACOM), Mobility Equipment Command (MECOM), Munitions Command (MUCOM), Aviation Systems Command (AVSCOM), and the Coating and Chemical Laboratory (C&CL) at the Aberdeen (Md.) R&D Center.

Army agencies represented that did not present reports included the Office of the Chief of Research and Development, Office of the Chief of Engineers, Office of the Surgeon General, Electronics Command, Test and Evaluation Command, and Missile Command.

NLABS reported on studies in four areas: the conversion of waste paper products to glucose sugar or clean-burning fuel, studies in biodegradation, the particle analysis of air pollutants, and disposal problems. Dr. Fred Oesterling introduced the NLABS presentation and described the process of converting cellulose (waste paper) to glucose. (For descriptive details, see *Army R&D Newsmagazine*, April-May-June, p. 1.)

Dr. Arthur M. Kaplan, head, Ap-

ATTC Aids University of Panama During D7E Tests

Serendipitous civilian benefits were combined with military testing objectives when the U.S. Army Tropic Test Center, Panama Canal Zone, conducted recent product improvement test of the D7E medium tractor.

Routine evaluation of the Marden brush-cutter developed into a full-fledged civic action when the University of Panama asked the U.S. Army to help in clearing pasture land at its research farm. The Third Civil Affairs Group of the U.S. Army Southern Command responded favorably.

Designed to clear land covered by secondary growth containing little or no heavy timber, the test equipment consists of two drum rollers fitted with longitudinal cutting blades. Weight can be increased by adding water or oil to the drums. A full-tracked tractor is required as a prime mover.

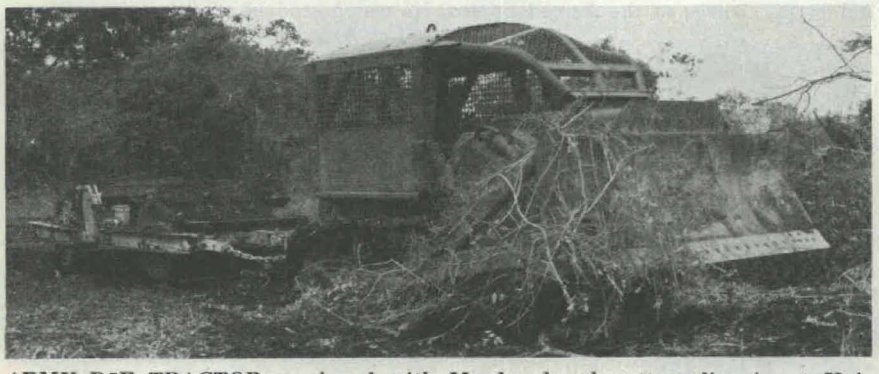
Test plans for the brush-cutter, one of five pieces of land clearing equipment being evaluated by the Tropic Test Center, called for completion of a 50-hour test mission in a humid tropic environment, which Panama possesses in abundance.

Inspection of the areas to be cleared at the university research farm disclosed that they consisted primarily of overgrown farm land, making them well-suited to the Army's purpose.

With an ideal test site at hand and an appreciative host, the Army's tractors moved "on campus" in early May to begin clearing operations.

In the over-all test, the objectives were to compare the performance of a tractor equipped with a Bush Hog Treedozer Blade, the Rome Plow, the Spade Plow, and the Fleco V-Blade.

Other functions included a comparison of the performance of a tractor with an armored radiator to one equipped with a standard radiator; also, evaluating relative merits of the Spade Plow and the Marden Brush-Cutter.



ARMY D7E TRACTOR, equipped with Marden brush-cutter, digs in at University of Panama Research Farm during product improvement tests conducted by HQ U.S. Army Tropic Test Center, Fort Clayton, Panama Canal Zone.

plied Microbiology Group, Pioneering Research Laboratory, reported on that group's research in pollution abatement. Three decades of experiments in biodegradation, suggested Dr. Kaplan, render Natick highly capable in the study areas of biodegradability of machine-working fluids, biocides, detergents and surfactants, polymers and plastics, packaging materials, and degradation through cometabolism.

Pollution abatement activities in packaging, food service equipment and organizational field equipment were explained by Dr. Leslie A. McClaine, chief, Engineering Sciences Division, General Equipment and Packaging Laboratory.

Natick Laboratories' problems include dealing with the solid wastes of packaging, food and packaging wastes of the food service systems, and contaminated water from preparative and cleaning operations. These include control, handling, and disposal problems in both garrison and field situations.

Some approaches being investigated include plastic laminates to replace cans, vacuum packing to reduce bulk, and expandable field shelters adaptable as a field kitchen or latrine unit.

Another study area involves minimizing waste disposal through reclaiming, recycling, or reusing package materials, as well as exploring the use of new materials and designs. Reduction, elimination and conversion of wastes are the major concerns emphasized by the General Equipment and Packaging Laboratory.

Particle analysis of air pollutants at NLABS was presented by Dr. John A. Sousa, Quantum Physics Group, Physical Science Division.

Particles greater than 0.1 microns in size contribute to the visible air pollution in the form of smog and industrial plumes. These particles constitute the greater fraction by weight, but little is known of the particles smaller than 0.1 microns, which are greater in number and concentration.

The dominant mechanism in the formation of submicroscopic particles is combustion. Techniques to study the smaller particles include laser spectroscopy, electron spin resonance, flash photolysis, and pulse radiolysis.

TACOM's presentation focused on reduction of exhaust gas pollutants from ground operating vehicles. Internal combustion power plants affected include diesel engines, and spark ignition engines.

The Propulsion Systems Division has the in-house capability to test compression ignition engine emission in nine fully equipped temperature controlled test cells. Capacity ranging from larger type vehicles as a total system, to engine/drive train components, permits the application and evaluation of alternate corrective actions under the entire spectrum of ambient conditions.

Delivery of an exhaust gas analyzer system in November will provide TACOM with complete baseline and certification testing capabilities for both spark ignition and compressed ignition systems.

An aldehyde test apparatus and a large Clayton Dynamometer will soon be operable. This will permit testing of all wheeled vehicles in present or planned use. A mobile emissions laboratory is planned to evaluate emission levels anywhere in the Continental United States.

MECOM provides some 50,000 different items of equipment, spare parts, and tools used by the Army. Responsibility includes sanitizing waters in hostile environments, as well as waste waters from Army operations.

Engine-driven items managed by MECOM, including Army watercraft ranging from small tankers to outboard driven crafts are part of MECOM's pollution abatement concern.

MECOM would like to initiate a program to evaluate oil-in-water monitoring equipment and oily water separators, because the hazard of potential oil pollution is ever present at Army installations activities.

Should present equipment prove inadequate to deal with Army-generated oily water discharges, MECOM would prefer to develop adequate oil/water separators to process such waste.

AMC recommended that MECOM indicate that this effort is not a duplication of any other agency's effort or of maritime interest to the U.S. Navy, U.S. Coast Guard, etc. It was further advised that this program be coordinated with an earlier approved program, dealing with water craft usage, to provide a "package" approach for marine craft, with the exception of engine exhaust.

MUCOM claimed that, with 32 in-

(Continued on page 42)

British Team Tests Chieftain Tank at Yuma PG

Britain's Mark Four version of its Chieftain main battle tank is at the Yuma (Ariz.) Proving Ground where a 26-man British Army trials team is subjecting it to three months of progressive environmental testing.

The Chieftain was billed by the British Ministry of Defence as "the battle tank of the 1970s" when it was introduced in the early 1960s.

In the current trials, endurance and durability in hot, dry desert conditions will be two of the categories under examination, stated Lt Col Leslie Douglass, British Embassy representative.

". . . Embodying new requirements arising from lessons learned in the past," the Chieftain was described by the Ministry of Defence when it was introduced as providing greater firepower and a larger radius of action. Major improvements at that time included:

- A 120-millimeter gun, stabilized in azimuth and elevation, using ammunition with separate bagged charges.
- A short period to target engagement.
- Immunity against conventional attack achieved by low silhouette and heavy, well-disposed armor. Filtered air, maintained at slightly above atmospheric pressure, gave the crew compartment protection against nuclear, biological and chemical effects.
- A multifuel opposed piston engine.
- A unique gear change system that eliminated driver fatigue and speeded the changing of gears.

MARK FOUR Version of British Army Chieftain Main Battle Tank

Army Agencies Discuss Roles in Pollution Abatement

(Continued from page 41)

stallations and activities in 20 states, it has the "largest pollution abatement problem within the Department of Defense." It was the fourth largest U.S. manufacturing industry in Fiscal Year 1969, exceeded only by General Motors, General Electric, and Chrysler Corp.

Installation of "red water incinerators" at Joliet Army Munition Plant in 1955 and current updating of waste treatment facilities at MUCOM installations are designed to meet federal, state and local standards. Separate short-range and long-range modernization programs are planned for abatement procedures.

Meeting anticipated standards, it was stressed, requires an extension of capabilities through research, development, and engineering in support of the manufacturing operations. End item developments are carried on in three MUCOM installations.

Edgewood Arsenal is the center for chemical warfare items, Frankford Arsenal for metal parts, and Picatinny Arsenal for explosives, propellants and pyrotechnics. Each commodity center is responsible for the load, assembly and pack operations for its mission-oriented items.

The U.S. Army Air Mobility Research and Development Laboratory (AMRDL), an activity of AVSCOM, explained its pollution abatement capabilities and needs in noise pollution, emphasizing its facilities available to other Army agencies desiring to reduce noise-pollution problems.

AVSCOM aircraft noise research is almost exclusively related to rotary-wing aircraft noise, with the majority of that work addressed to aerodynamically generated noise. The Army's primary objective is to minimize aircraft detection time and distance.

Additional goals include reduction of aircraft cabin noise, and noise to the surrounding community. Basic acoustic theory and vortex shedding noise are being investigated, as is helicopter and V/STOL noise reduction.

The Coating and Chemical Laboratory is concerned with fuels and lubricants for Army vehicles, and organic and semi-organic coatings used for surface preservation. Current pollution abatement procedures include the investigation of specifications and test procedures for low-leaded or unleaded gasolines, improved combustion properties of diesel fuels, improved engine oils and other lubricants.

In addition to these studies on abatement of pollution from mobile sources, work is being done to reduce pollution in two other areas, under the Organic Materials Program.

The first of these is the elimination of photochemically reactive solvents from organic coatings. Second is the elimination of fluorides and chromates from phosphatizing baths used in the production of ammunition and other types of equipment.

In the summary, Dr. J. V. Richard Kaufman, AMC Deputy Director of Research, Development and Engineering (Plans), reemphasized the need for joint projects in areas related to pollution abatement rather than single command projects which may tend to duplicate.

Dr. Kaufman reported the current funding status of FY 72 R&D pollution abatement projects. He stressed that neither OCRD nor AMC has a "kitty" of withheld funds, and recommended that unfunded requirements be absorbed within program resources.

Throughout the meeting, the ability of AMC, in terms of both staff and equipment, to investigate pollution abatement procedures was emphasized. Stress was also placed on the need for coordination and communication to utilize effectively this potential.

Army Group Redesignated at Training Device Center

Redesignation of the U.S. Army Participation Group at the Naval Training Device Center, Orlando, Fla., gives the unit a new name as the U.S. Army Training Device Agency.

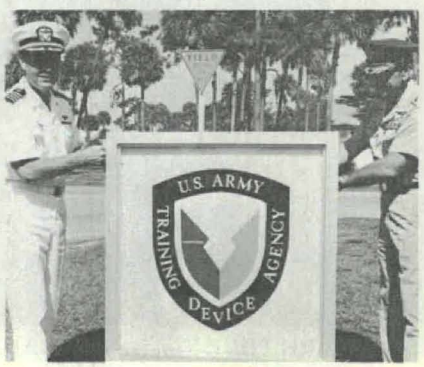
Participating in an unveiling ceremony showing the sign with the new name were Col Robert E. Phelps, commander of the unit (since succeeded by Lt Col Myles H. Mierswa), and Capt Frank H. Featherston, commander of the Naval Training Device Center.

When established in 1950 by Army-Navy agreement, the U.S. Army Participation Group was part of the Continental Army Command. During the 1962 Army-wide reorganization, it was shifted to the Army Materiel Command.

Col Phelps emphasized that the redesignation "will not affect the close working relationship the Army Group has had with the Naval Training Device Center for more than 21 years."

The new name, he added, will provide greater visibility throughout the Army. The cutback in defense funding accents the need for expanded use of training devices as a means to the achievement of the goal of finding "more efficient and less costly ways of accomplishing the Army's training mission."

Col Phelps said the Army Chief of Staff is in strong support of better utilization of training devices in the Army, and that numerous general officers and many senior Army officers have visited or are turning to the Army Training Device Agency for assistance in solving training problems.



Surplus Equipment in SEA To Be Used in AUTODIN

Equipment made surplus by troop reductions in Southeast Asia will be used in test programs for the integration of intelligence communications into the automatic digital network (AUTODIN).

Maj Gen W. B. Latta, head of the worldwide Army Strategic Communications Command (STRATCOM), said the integration will save "several million dollars" in manpower and essential equipment.

Surplus equipment will be used to develop, test and proof communications hardware and software systems for the intelligence community.

AUTODIN, which became operational in the early 1960s, is a modern automated computer-controlled data system that provides communications at speeds up to 6,000 words a minute in support of the defense communications system.

In contrast, the present manual torn-tape intelligence communications network (Defense Special Security Communications System, DSSCS), utilizing a semi-automatic teletypewriter system developed in World War II, operates at 60 to 100 words-per-minute and requires many human interactions.

Placing the DSSCS on AUTODIN is expected to reduce significantly the human errors; also, to provide greater writer-to-reader speed and full system backup for message transmission reliability, as well as an error-detection capability.

To facilitate the integration, the AUTODIN switching center at NHA Trang, Vietnam, is being relocated to the East Coast Telecommunications Center, Fort Detrick, Md.

SPL Rates Weapons Systems Concepts at Aberdeen R&D Center

Weapons systems concepts are being advanced and evaluated in the Signature and Propagation Laboratory of the U.S. Army Ballistics Research Laboratories, newest of the complex of facilities in the Aberdeen (Md.) Research and Development Center.

Full-scale operations in the SPL are driving ahead rapidly following a move into a new $1,242,776 building that was spread over several weeks. The 2-story structure has a full basement and two rooftop penthouses designed for testing. Construction of the building began in August 1968.

Staffed currently with about 100 civilian and military personnel, the SPL also employs nationally eminent scientists and engineers during the summer months and uses them as consultants throughout the year.

The staff includes 15 scientific personnel with doctoral degrees. Physicists, mathematicians, ballisticians, statisticians, engineers and technicians offer a vast amount of practical experience in solving the Army's field problems with weapons systems.

Under direction of Harry L. Reed Jr. as chief, SPL personnel conduct theoretical and experimental studies in several disciplines. Areas of effort include optical and radar signal propagation; also, target signatures and acquisition, including detection, recognition and identification, with emphasis on environmental effects.

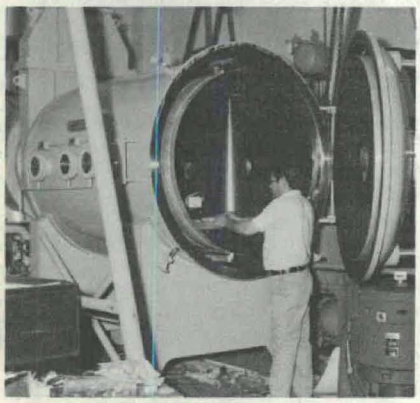
SPL investigators are concerned with methods of missile guidance, with emphasis on correlation and pattern recognition concepts; effects of the external environment upon weapons system technical feasibility; analysis of concepts, including analog simulations; and the theory of measurements in these areas.

OPTICAL SYSTEM is used to determine effects of the atmosphere on electromagnetic radiation in the Signature and Propagation Laboratory at APG. The system includes a helium-neon laser source and a beam-splitting device.

Some of the projects in progress are a radar-like experiment working at a frequency of 70 GHz (that's 650 times higher in frequency than FM radio); a highly complex experiment for duplicating in the laboratory certain reactions occuring in the upper air; and the development of a weapons concept for shooting at tanks "over the hill" with deadly accuracy.

Other efforts include the measurement of laser-beam bending caused by atmospheric shimmer; also, the measurement of the attributes of military targets (tanks) by which they can be detected and identified by shape, sound, temperature, reflectivity, etc. These characteristics are called the target's signature.

Results of these studies and related projects currently in the planning stage are expected to yield information and data of considerable scientific value in determining componentry of many of the weapons systems required to provide more effective and efficient firepower for the future Army.



TESTING of many parameters encountered in rocket flight is carried on in the Aeronomy Branch of the new Signature and Propagation Laboratory (SPL) at Aberdeen Proving Ground (APG), Md. Donovan M. Thurn, a mechanical engineering technician, is shown making measurements on an antenna system installed in the nose cone of an instrument rocket prior to testing in the controlled temperature vacuum chamber at the laboratory.

Ponder Heads TECOM Infantry Materiel Test Directorate

Col Lewington S. Ponder is the new director of the Infantry Materiel Testing Directorate, U.S. Army Test and Evaluation Command (TECOM), Aberdeen Proving Ground, Md. He was serving with the Infantry Training Center, Fort Lewis, Wash., until selected for the TECOM assignment.

He commanded the center's 3d Training Brigade from August 1968 until January 1970 and then was named G3 (later director of Plans and Training).

Col Ponder served in Vietnam (1967–68) following graduation from the Army War College. He completed the Command and General Staff College course in 1959 and was graduated in 1943 from Syracuse University with a BS degree in business administration.

Col Ponder served during World War II in the Rhineland and Central Europe campaigns; Hawaii, 1949–51; Korea, 1955–56; and Germany, 1960–62. He has served at Camp Croft, S.C.; Fort Benning, Ga.; Fort Holabird, Md.; and in Washington, D.C.

Among his military honors are the Legion of Merit with two Oak Leaf Clusters (OLC), Bronze Star Medal, Army Commendation Medal with two OLC, Combat Infantryman Badge, European-African-Middle East Campaign Medal, Republic of Vietnam Campaign Medal, and Republic of Vietnam Armed Forces Hero Medal First Class.

Col Lewington S. Ponder

Picatinny Refines Infrared Spectroscopy Technology

Identification of the chemical composition of an enemy fuze that until recently might have required about three weeks was accomplished recently in two days by improved infrared spectroscopy at the Army's Picatinny Arsenal, Dover, N.J.

Use of this technology in nondestructive testing has long been employed at the arsenal. The recent improvement permits analysis of very small samples (.3 milligrams in weight) by precise preparation of the specimen.

Either transmission or attenuated total reflectance (ATR) methods may be used. Thermoplastic materials may be analyzed as received or may be processed into a cast or pressed film. The potassium bromide IR crystal may be dipped in a solution of a material to deposit a very thin film amenable to IR scanning.

If one component is obscured by another, they may be separated by extraction or preferential pyrolysis so that the nature of each may be determined. For opaque material, the IR spectrum may be obtained directly by ATR or by pyrolyzing the material and examining the pyrolyzate spectroscopically. The method may be used to identify purity, the components within a compound and the degree of degradation of a material.

Examples of how the techniques have been used include such tasks as proving that ethyl cellulose items were compounded with different plasticizers, and that two batches of a polyester prepegged glass were identical as claimed.

In another case, a 60-40 polymethylmethacrylate-butyl acrylate was distinguished from 70–30 polymethylmethacrylate-ethyl acrylate.

Applicability of the technique to very small amounts of material was established when an identification was made of a piece of chemical compound about the size of the period at the end of this sentence.

Robert Lee and Jay Pasman, mechanical engineers in the Nuclear Reliability Division, Quality Assurance Directorate at the arsenal developed the improvement in the technique while working on nondestructive testing.

Infrared scanning has long been used for nondestructive testing to detect poorly seated rotating bands on artillery projectiles. By interacting with rifling grooves in the gun tube, the rotating band—a strip of metal about one-eighth-inch thick near the base of the projectile—provides a gas seal and the all-important spin to the projectile.

Lee and Pasman had the task of determining, by infrared spectroscopy, if the rotating band was seating properly. Optimum range and accuracy of an artillery shell require that the rotation band be seated with metal-to-metal contact to the shell body. This required detecting any thermal differentials created by clearance under the band.

Refinements in infrared spectroscopy technology achieved in their work give Picatinny Arsenal an identification method for analysis of extremely small specimens of material that is accurate, fast, low in cost, and is applicable to nondestructive tests for larger projects.

WRAIR Computerizing Medical Slide Collection

The Division of Medical Audio-Visual Services at the Walter Reed Army Institute of Research (WRAIR) is initiating a new program to automate retrieval of its medical slide collection and from its stock of motion picture footage.

Under this computerized-access system, physicians, medical students and researchers will have rapid access to valuable medical photographs gathered on a worldwide basis by WRAIR's audio-visual division.

Since 1966, WRAIR has collected and categorically stored more than 200,000 color slides dealing with innovative surgical techniques, patient case histories and a variety of medical research. The collection is known for its medical detail and accuracy—qualities assured by a close working relationship between the physician and the photographer in the filming process and caption composition.

The planned electronic file for slide collection is expected to be invaluable to the WRAIR research staff, medical students and their professors. Harold E. Dixon, director, Division of Medical Audio-Visual Services, cited WRAIR's slide studies of complete surgical cases as one of many unique subject areas on file.

Ultimately, the division will be able to offer medical researchers instantaneous access to a visual record of the complete medical history of Vietnam.

The division recently purchased the electronic photo documentation facilities necessary for the planned storage system and is developing and implementing an effective coding system.

In the process of developing the initial coding system, Dixon explained, it is essential that the system be compatible with coding procedures already in operation at Tobyhanna (Pa.) Army Depot, enabling exchange of motion picture footage.

Under the prospective retrieval system, WRAIR's Division of Medical Audio-Visual Services will be equipped to supply medical professors, students and researchers with identification of requested slides within seconds. The current manual filing system may require up to 1½ days for slide retrieval.

CSC Selects Two From Picatinny for Management Program

Picatinny Arsenal's Dr. T. H. Chen, research chemist, Feltman Research Laboratories, and Ronald Moore, employed in the Quality Assurance Directorate, have been selected by the U.S. Civil Service Commission for the 1971–72 Education for Public Management Program.

They will receive a year's free scholarship at Cornell University with their salaries paid, plus all living and travel expenses and most incidental fees. They also have freedom to develop the academic program best suited to individual needs.

The purpose is to encourage agencies to identify men and women who have the potential to hold high management positions. The Education for Public Management Program thus can be an important part of an agency's executive development effort.

Dr. Chen in 1968 won the R&D Achievement Award and in 1969 took one of the top honors at the first Munitions Command science conference at the Dover, N.J., installation. His doctorate in chemistry is from the University of Louisville.

Moore is chief of the anti-armor section in the Ammunition Systems Reliability and Safety Division. He has a BS degree in mechanical engineering from Rutgers University.

Dr. T. H. Chen

Ronald Moore

Reserve Officers Symposium Focuses on Executive Role in R&D

U.S. Government, industrial and academic leaders are programed as speakers at the 2-week 13th annual Reserve Officers Symposium Aug. 15–27, Fredericksburg, Va.

The U.S. Army Mobility Equipment Research and Development Center (MERDC) and the 1664th Mobilization Designation Detachment Unit, both at Fort Belvoir, Va., are cosponsors. Focused on "The Role of the Technical Executive in Research and Development," the symposium objectives are to examine their career executive objectives and their influence in program innovations; also, to seek more effective means of managing, utilizing and motivating creative scientists and engineers.

Edward M. Glass, Assistant Director (Laboratory Management), Office, Deputy Director of Research and Engineering, Department of Defense, is a guest lecturer on "The Role of the Tech Executive in Government."

Other invited speakers include J. P. D'Arezzo, vice president, American Machine and Foundry Co., "The Role of the Executive in Industry"; and Dr. R. W. Roberts, R&D manager, Materials and Engineering, General Electric Co., "Meeting Career Scientific and Engineering Goals as an Executive."

Dr. A. Longacre, Dean of Engineering, Syracuse University will speak on "In What Capacity Can I Contribute Most?" Dr. D. D. Roman, chairman, Committee on Doctoral Studies, George Washington University, will present "Technical Management and Management of Technical Activities" and "Management/Scientist Conflict."

Also, Dr. D. P. Boyd, George Washington University, "Supervision of Creative Scientists and Engineers and Executive Responsibilities to Subordinates"; Col H. F. Sykes Jr. (Ret.), former MERDC commander, "Allocation of Resources for Mission and Future"; R. H. Hastings, director, Labor Relations Training Center, U.S. Civil Service Commission, "Growing Union Influence (Management Viewpoint)."

John F. Griner, president, American Federation of Government Employes, is programed for "Growing Union Influence (Organized Labors Point of View)." H. Tecklenburg, vice president, R&D, Proctor and Gamble Co. will discuss "U.S. Government Policy on Pollution and Affect on Department of Defense R&D Community."

Lt Gen A. W. Betts, Army Chief of R&D until he retired Dec. 31, 1970, and now vice president, Southwest Research Institute, is programed for "Developing and Maintaining Internal and External Support of Programs." Dr. E. Appenfeld, School of Education, New York University, has selected as his subjects "The Contemporary Image of the Scientist and Engineer" and "Cultural Influence on R&D."

Maj Gen J. M. Roberts, Chief, Army Reserve, Department of the Army, is on the agenda for "The R&D Mobilization Designee," and Maj Gen G. Sammet Jr., Army Deputy Chief of R&D, is listed for "Future Importance of Effective Executives in Department of the Army R&D."

Director of Army Research Brig Gen George M. Snead Jr. will speak on "The Need for Creative Executives in Department of the Army R&D Activities."

"Supervision of Scientists and Engineers" will include as panelists Dr. Boyd, George Washington University; Brig Gen H. L. Willard, mobilization designee to the Office of the Chief of Research and Development; Dr. Gilford G. Quarles, chief scientific adviser, Office of the Chief of Engineers; W. B. Taylor, MERDC technical director; Dr. D. C. O'Connor, chief, Research Institute, U.S. Army Engineer Topographic Laboratories; and Billy M. Horton, technical director, Army Harry Diamond Laboratories.

Col A. H. Humphreys, an MERDC civilian employe, and commander of the 1664th Mobilization Designation Detachment, will serve as director of the symposium. Other members of the faculty are Col Herbert L. Ley Jr., Col Raymond L. Dennis, Col Trelyon W. O'Connor Jr., Maj Richard S. Medding, Maj James C. Stillman, and Capt Francis M. Cevasco Jr.

WES Automates Testing of Pavement Surfacings

Fully automated testing of membrane materials and pavement surfaces, subjected to continuous traffic under various wheel and load conditions, is one of the answers to "What's new?" at the U.S. Army Waterways Experiment Station at Vicksburg, Miss.

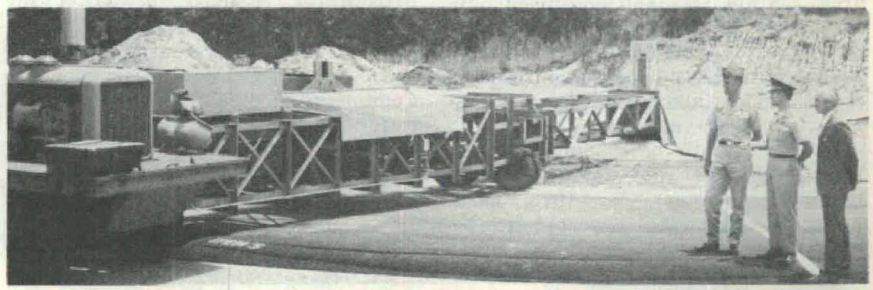
In support of the WES mission of developing design criteria and construction techniques for military roads and airports, the system speeds up evaluation of "candidate" materials and surfaces for specific operational requirements.

Traveling at a speed of 30 miles an hour, the rig spins around the circular track every 10 seconds applying rolling wheel traffic on pavement surfacings. In one hour it has applied loads equivalent to 360 aircraft landings, or the same highway traffic as six heavy trucks passing over any spot each minute.

The inside radius of the track is 28 feet and the outside 49 feet. Test sections are constructed 22 feet wide. Traffic with maximum gross weights up to 50,000 pounds can be applied in uniform coverages or in fixed-wheel paths at any speed up to 30 mph.

Present tests are applying an 18,000-pound, single-wheel highway axle loading on the inside lane of eight different items of pavement. Before the tests are completed, the wheels will have rolled over the 240-foot test section 300,000 times. Data collected will be evaluated to determine which of the designs and material qualities are the most serviceable and economical for roads carrying heavy truck traffic during military operations.

These and other carefully controlled WES engineering tests give valuable guidance on paving mixes, total thickness, compaction requirements, membrane strength, and other aspects of design for military roads, heliports and airfields constructed by the Corps of Engineers.



AUTOMATED FACILITY for testing membrane materials and pavement surfaces is inspected by Brig Gen Curtis Chapman, director of Military Engineering, OCE, during Waterways Experiment Station tour with Col E. D. Peixotto, WES director, and J. P. Sale, chief of the Soils Division at Vicksburg, Miss., facility.

Kudos

EXCEPTIONAL Civilian Service Award is presented to recently retired Mrs. Frances L. Whedon by Chief of Research and Development Lt Gen William C. Gribble Jr. for achievements as meteorologist, Environmental Sciences Division, OCRD, August 1959 to January 1971. The citation states, in part: "Mrs. Whedon's extraordinary dedication of purpose, her mature wisdom and astute judgment, and her leadership have enhanced the U.S. Army's atmospheric sciences research and development program. . . ."

OUTSTANDING Civilian Service Award. Army Chief of Staff General William C. Westmoreland presented the OCSA to *Russell DeYoung*, chairman of the board and chief executive officer of the Goodyear Tire and Rubber Co., for services as an adviser to the Army from January 1968 to December 1970.

Under DeYoung's supervision, the citation states, the company researched and developed a crash-resistant fuel system for Army helicopters which substantially reduced postcrash fires, saving lives and equipment. In conjunction with the Army, Goodyear devised a tougher, more crash-worthy fuel tank that would withstand severe crash impacts and would be self-sealing when hit by small-arms fire.

The tanks are now being used in UH–1 "Huey" and AH–1 "Huey Cobra" helicopters. By 1975, most Army aircraft are expected to be equipped with the new tanks.

MERITORIOUS Civilian Service. *James E. Gillis Jr.* was awarded the MCSA for "professional guidance and technical direction of major U.S. Army R&D programs," as technical director of the Advanced Systems Directorate, U.S. Army Topographic Command, since January 1969.

The citation credits Gillis for his efforts in support of the Army's Topographic RDT&E Program, saying, in part, "His mature and objective counsel has been a substantial factor in the success of the Army's Topographic R&D Program and in the continuing effort to adapt advancing technology to military requirements."

DISTINGUISHED Service. *Brig Gen Wilson R. Reed* received the DSM from Army Assistant Vice Chief of Staff Lt Gen William E. DePuy, in Pentagon ceremonies, prior to his retirement after 30 years of military service.

The award was made for "exceptionally meritorious service in positions of great responsibility . . . culminating his long and distinguished military career as commanding general of the Automatic Data Field Systems Command and the U.S. Army Computer Systems Command during October 1967 through July 1971."

LEGION OF MERIT. *Lt Col Lucien T. Winegar*, deputy commanding officer of Fort Detrick since June 1969, received the LOM at a recent ceremony honoring him upon retirement following 20 years of active military service. He was recognized in particular for "establishing an exceptionally high state of administrative, financial, and logistical efficiency at Fort Detrick."

Col Margaret E. Bailey, an Army nurse for the past 27 years, received the LOM from Lt Gen Hal B. Jennings Jr., the Surgeon General, at retirement ceremonies in the Office of the Surgeon General (OTSG), Washington, D.C.

Col (Dr.) Harold G. Stacy, acting director of Plans, Supply and Operations (PS&O), OTSG, was presiding officer at an award ceremony held recently to recognize the services of six Medical Service Corps officers.

MERITORIOUS Service Medals. *Col Ralph W. Parkinson Jr.*, who recently became chief of the Operations Branch, Plans, Supply and Operations Directorate, received the MSM for accomplishments in a prior assignment as chief, Evaluation Division, U.S. Army Combat Developments Command Medical Service Agency, Fort Sam Houston, Tex. *Lt Col Leander K. Beckley III*, chief, Stock Fund Office, Division of Logistics and Facilities, PS&O, received the MSM for service with 2d Logistical Command, U.S. Army Ryukyu Islands.

Lt Col Joseph E. Herndon Jr. received the MSM for services covering the period July 1968-June 1971 when he was assigned as chief of the Sanitary Engineering Branch, Utilities Division, Facilities Engineering Directorate, U.S. Army Engineer Command, Europe.

He is now serving as an environmental pollution consultant, Preventive Medicine Division, Directorate of Health and Environment, OTSG.

The U.S. Army Computer Systems Command at Fort Belvoir, Va., recently awarded MSMs to *Lt Col John D. Chastain*, chief of the Organization Systems Division, Project Control and Integration Directorate; *Lt Col William H. Mitchell*, project officer for Division/Corps Combat Service Support System and the Quick Reaction Inventory Control Course; and to *Maj James Giddens*, an electrical engineer with the Engineering Directorate.

BRONZE STAR. *Maj Jimmy Walker*, project officer in Plans, Support and Operations Directorate, OTSG, received this award for recent duty in Vietnam.

ARMY COMMENDATION Medals went to *Maj Paul M. Pugh* for service as operations staff officer, Operations Division of PS&O; *Maj Lloyd M. Mallory* for service as chief of the Hospital and Evaluation Section, PS&O; and to *Capt Jonothan P. West* for service as a management analyst in Health Care Organization and Management Analyst Branch, PS&O.

COMMENDATIONS. Chief of R&D Lt Gen William C. Gribble Jr. recently presented commendation certificates to *Virginia Richards, Glea Lassen, Mildred Kern & Bea Hester.*

Brig Gen Wilbur H. Vinson Jr., director of Missiles and Space, OCRD, presented outstanding performance rating to *Edna T. Jernigan, Edith V. Johnson* and *Mildred B. Pence. Betty F. Kleindienst* received awards for outstanding performance and sustained superior performance.

VIETNAMESE Civilian Service Medal is pinned on Vernon W. Urie by Col Bennett L. Lewis, CO of the U.S. Army Mobility Equipment R&D Center, Fort Belvoir, Va., giving recognition to a year in Vietnam as the center's representative under the Vietnam Laboratory Assistance Program, Army (VLAPA), it was complemented by a $750 "Special Act or Service Award."

Coastal Problems Research Review Slated at MRC-CERC Seminar

Research on coastal problems will be reviewed at an Advanced Seminar on Waves on Beaches, Oct. 11–13, cosponsored by the Mathematics Research Center of the University of Wisconsin and the Coastal Engineering Research Center, Army Corps of Engineers.

Sessions on the University of Wisconsin campus will be devoted to a survey and discussion of recent advances in knowledge on the motion of waves and currents on beaches, with resultant sediment transport.

Reports will concentrate on developments still undisclosed in books or university courses, according to Prof. J. Barkley Rosser, director of the Mathematics Research Center.

Lectures will aim at a balanced review of the subject from the points of view of theory, experiment and observation. Specifically, the characteristics of wave records in the coastal zone will be examined to discuss agreement with, and departure from, commonly used theories.

Diverse systems of equations for water waves in use, and the approximations behind them from the view of mathematical physics, will be discussed. The phenomenon of off-shore wave resonance due to refraction will be described to show the dominant effect of shore lines on wave trapping.

In this connection, the radical advances of the geometrical optics approximation for the determination of resonant frequencies will be explained. A variational method and studies of Coriolis force effects will be delineated.

The role of Caustics in refraction will be examined from theoretical and experimental points of view. Use of such developments in calculation of refraction upon the forecasting of the wave environment in shallow water also will be discussed.

One lecture will report recent results on the shoaling of waves, with emphasis on effects of frequency dispersion upon development of wave shapes and wave breaking; also, interaction between primary and secondary wave trains.

Another lecture will describe recent theories and observations which have led to rapid advances in understanding mechanisms of alongshore currents.

Sediment transport on beaches, including varying forms of accumulation, and results of wave-induced sediment suspension obtained by experiments with a new electro-optical system, also will be reported.

A review of the past decade's research on 2-dimensional wave motion on beaches of small slope with emphasis on the water wave mechanism at the very shore is on the agenda. This will treat standing wave theory and its connection with classical hydrodynamics as well as bore theory with its shore singularity and its distinctive swash and backwash mechanism. A survey of wave breaking in shallow water will conclude the lectures.

Programed lecturers include Prof. R. G. Dean, University of Florida; Dr. D. Lee Harris and Dr. C. J. Galvin, Coastal Engineering Research Center; Prof. H. A. Einstein, University of California at Berkeley; Prof. J. J. Stoker and Prof. Willard Pierson, New York University; Prof. M. C. Shen, Prof. D. H. Peregrine and Prof. R. E. Meyer, University of Wisconsin; Prof. T. Y. Wu, California Institute of Technology; Prof. C. C. Mei, Massachusetts Institute of Technology; Prof. D. L. Inman and Prof. W. G. Van Dorn, Scripps Institution of Oceanography; Prof. M. S. Longuet-Higgins, Cambridge University; Prof. J. F. Kennedy, University of Iowa; and Prof. M. O. Hayes, University of Massachusetts.

The program will allow ample time for informal discussion. (Further information may be obtained from the Seminar Secretary, Mrs. G. Moran, Mathematics Research Center, University of Wisconsin, Madison, Wisc. 53706, Tel. 608–263-2652.)

'The Well-Rounded Tomato' Rewarded

ISEF Winner Caps Success With Summer at WES

Basic research resulting in "The Well-Rounded Tomato," a technical report and exhibit, has paid off to Debra Rhodes in cash honorariums, a summer job, a college scholarship, a trip to Japan and national recognition.

The title describes her project, which won the top U.S. Army award at the recent 1971 International Science and Engineering Fair in Kansas City, Mo. However, her parents, Mr. and Mrs. W. O. Rhodes of 348 Kimberly Lane in Los Alamos, N. Mex., reared a well-rounded girl with interests ranging from scientific research to gymnastics to music.

During summer employment with the U.S. Army Engineer Waterways Experiment Station (WES) at Vicksburg, Miss., as part of her Army award, Debra is assisting technical personnel with ecology and waste-water management studies. Debra was surprised to find that one of the judges at the International Science Fair is her boss.

Debra has learned about major missions of WES relative to hydraulics, soils, concrete, mobility and environment, and nuclear weapons effects at the vast laboratory complex of the Army Corps of Engineers.

Debra captured top honors at the first high school science fair she entered. Selecting the tomato as a plant suitable for growing in pea-gravel, by using a hydroponic technique, she analyzed the chemical needs of the plant through all stages of its life cycle. She devised the needed equipment out of an alarm clock, a used juice can, an old thermometer holder, and other odds and ends.

After winning local, regional, and state honors, Debra went on to compete at the national and international science fair levels. In January, she will represent the U.S. Army in Operation Cherry Blossom along with Air Force and Navy award winners, in the Japanese Student Science Awards in Tokyo.

Honors and prizes she has garnered include an Air Force award as the most outstanding high school student in chemistry and a National Aeronautics and Space Administration cash award for creative scientific endeavor in aerospace research.

Turning down a music scholarship in favor of science, Debra will enter New Mexico Institute of Mining and Technology on a university scholarship this fall. Although definitely aiming toward a career in science, Debra is allowing herself a little more time to decide if her major will be biology, or chemistry, or environmental engineering.

Debra's favorite sport is softball, her instrument specialty is the bassoon, and she holds an amateur radio license for International Morse Code.

Debra Rhodes

Maj Gen Sammet Outlines Executive Role in R&D

(Continued from page 2)

Secretary Packard's testimony before the Mahon Committee last spring.

It should be noted, judged from remarks of the various members of Mr. Mahon's House Appropriations Committee, that Mr. Packard enjoys an unusually high degree of respect. It is quite logical to assume that what Mr. Packard said on management to his committee shall be DOD policy as long as he is in office.

Mr. Packard noted the political climate and its budget implications, which he says means we must now focus our attention far more on *capability* and less on *numbers* of people and items of equipment.

This means there must be continued attention to a productive R&D effort, and that all monies received for this R&D work be much more carefully managed than in the past.

Secretary Packard listed eight major areas where he said management improvements had been or were being made. These included:

- Decentralization to the Services of much of the day-to-day managing.
- Better cost control by better and more frequent trade-off analysis.
- Making early and correct decisions regarding the real need for a proposed system and the ability to develop it.
- Reduce failure by more component testing—the "fly-before-buy" concept.
- More emphasis on hardware and less on paper studies.
- Elimination of total package procurement.
- Use of suitable type of contract.
- Put good men in charge, along with the necessary authority, responsibility and staffs.

Then there is today's climate within the Army itself. The Army R&D manager is now going to have to struggle to maintain or augment his level of effort in the face of competing pressures—what I call the operating accounts versus the investment accounts.

By this I mean that assuming a given level of dollars, one must then measure immediate requirements in terms of force structure and modernization of equipment against the requirements for materiel for the next decade and beyond.

We are constantly preaching that R&D should not be related to force structure. As one looks ahead to 1980, I'm tempted to say that it should make no difference on the size of the R&D effort whether the Active Army of 1975 has 10 divisions or 20.

But do we really mean this? We also say we counter quantity with quality . . . in times of a small Army, don't we need to do more R&D in order to keep the quality up? A side benefit is that at the same time we are helping maintain a military oriented individual base.

What all of this says is that the future climate does not appear to make us odds-on favorites to receive everything, or nearly everything, we in R&D believe we need. And what we do get better be carefully managed.

Having set the climate in which tomorrow's executive will have to operate, let's look at the executive himself. Some people believe that the military R&D executive should come up via a specialized program—like an R&D career field—entering it very early in a career and having his attention undiverted by other work. I tend to look at things that pure as being sterile.

I would rather quote Peter Drucker of New York University—that there is no correlation between effectiveness and any other characteristic. His view is that there are brilliant people who are totally ineffectual; others rather modestly endowed who were quite effective—there is no correlation with knowledge and no correlation with personality.

Peter Drucker sums up by saying there are no natural executives, that executives are largely made, not born. *They learn their craft.*

The first characteristic of an effective executive is that he knows where his time goes. He can triple his effective time *by not doing things that don't have to be done.*

The second characteristic of an effective executive is that he is upward focused, not downward focused. Ask an executive what he gets paid for and he says he supervises 5,000 people. That's not a job, it's an application. The job of the executive is to make sure that top management is prepared to make the decisions it will have to make in the future.

Another important characteristic of a top executive is that he sets priorities and sticks by them. It's not really difficult to determine the real priorities; it's numbers 5 to infinity which are hard.

Unbelievably, the larger the organization, the fewer things it can do at once.

This is due to the difficulty of communication. When there are *X*,000 people who must be informed of a

MERDC Airmobile Laboratory To Test Military Aviation Fuels

An improved airmobile laboratory to test military aviation fuels in the field has been developed by the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.

Designed to replace a previous expedient, the laboratory is a military standard electrical equipment shelter, approximately 12 by 7 by 7 feet, modified to accommodate equipment and supplies necessary to conduct quality surveillance of aviation fuels.

Weighing 3,340 pounds, it is designed for rapid movement by ground or air transportation, for quick on-site set-up and operation in temperatures from —40° to +125°F.

Tests can be made of vapor pressure of petroleum products, distillation, copper-strip corrosion, gravity determination, moisture determination, millipore-for-solid contamination, and water tolerance of aviation fuels.

The lab has an ultra-violet detector kit for undissolved water, and a tank-and-drum sampling and gauging kit. It is self-contained except for an external power source, water supply and waste water disposal facility. A purging and alarm system provides a unique safety feature to prevent possible explosions due to build-up of vapor.

One unit has been built by the Hoppmann Corp., Springfield, Va., under contract with MERDC, at a cost of $22,096.

ASSISTANT SECRETARY of the Army for R&D, the Honorable Robert L. Johnson (right), reviewed the mission and objectives of the U.S. Army R&D Group (Europe) during a recent visit to its offices in London, England. Accompanying the ASA (R&D) were Chief of R&D Lt Gen William C. Gribble Jr., and OCRD Executive Officer Col Donald R. Keith. General Gribble presented the Meritorious Service Medal to Col Benedict L. Freund (left) commanding officer of the group.

change in direction, the people far down the line don't get the word until long after it is too late for them to change course.

To put it in other words, the ability to put aside the interesting and popular tasks and do the one most important task *now* is one of the secrets of effective management.

Lastly, the effective executive builds on strength—the strength of his subordinates and his boss. You can't fire all your subordinates and you surely can't fire your boss. Therefore, learn what your people can do and make full use of them.

Dr. Ralph Siu, who used to work with me in the Army Materiel Command, always used to say to me when I was getting hot under the collar over someone, "Tis better to aid the ailing ass than carry the whole load yourself."

Maybe you've heard it put another way—in the definition of a sane man. A sane man is not the man who believes that the universe is rational; only a paranoid believes that. A sane man is a man who knows how to behave rationally in an irrational universe.

I am very much concerned over one weakness in our system. We just do not seem to have what industry calls a "bright young men" plan. I attended recently a Brookings Institution conference on business operations, and I was very much impressed by the formal methods and the attention given at the very top corporate level to the early identification of bright young men in their corporate structure.

The bright young men are usually identified early in their careers, like their 20s, and the list is updated yearly to eliminate those who show signs of wear and to add in the late bloomers.

For example, I feel we in the Office of the Chief of Research and Development have become too inbred. We need a bright-young-men plan, and I am planning to explore this concept in the coming year.

Having defined the executive and where he is to come from, how do we identify such a man? In an over-simplification, it's perhaps a man with a record of winning, or showing a profit, or running an organization in a manner as to do both.

But how do you identify a man who will be able to do this, or how do you assure you will become such an individual, particularly as it applies to moving up an echelon in the magnitude of the endeavor?

One thing we do know, for sure, is that skill at one level does not imply equal skill at the next level up—whether one is concerned with baseball, football, the military leadership business, or the R&D business.

The corollary to this is that even assuming one has equally good executive talent, he must make a conscientious effort not to continue to be the technician in his new task. In the Army it is like being promoted from captain to major, and having to learn to stay out of your old company supply room.

I once told a group of newly assigned OCRD officers and new civilians that too often the R&D executive tends to act like a product engineer. Face it, acting like a product engineer is fun. You feel like you are making something, contributing directly to the effectiveness of the Army by introducing a new piece of hardware.

But if that were the product engineer's interpretation of their job, then they would miss the boat. That is the job of the engineer. Being an executive means managing, which means setting policy and managing through controlling R&D funds. Whoever controls the money controls the project!

Another aspect at Department of the Army level is to support the hardware-cutting people by stating their case effectively before Congress, before ODDR&E, and before the rest of the Army staff. But it really isn't their case. It's your case. The engineers are only doing what you at the corporate level authorized or directed them to do.

While part of an executive's job may be to support and defend a given program or group of programs to the next higher authority, he must first be a bit of a skeptic—review every-

(Continued on page 50)

ALMC Tests Computer-Driven Microfiche Tutorial System

Effectiveness of a computer-driven microfiche tutorial system as compared to programed instruction texts is being tested and evaluated by U.S. Army Logistics Management Center, by direction of the Department of the Army.

Testing of the tutorial system for large-scale implementation begins Aug. 23 at the center and three Army depot field locations. It will end Jan. 15, 1972.

Related research has been conducted by Florida State University in the learning and retention effectiveness of computer instruction. Most of these experiments were conducted with children and not adults, as is being done in the Army program.

Most Computer Assisted Instruction Systems currently use cathode ray tubes or printers to display the course text. This is costly in terms of the huge amounts of computer storage required and data to be transmitted between the computer and the terminal.

The system that the Army has announced will use a microfiche terminal capable of holding up to 75,000 pages of course materials. The computer will position the proper page of instruction dependent upon the student response to the course material and questions.

The amount of data transferred between the computer and the terminal will be extremely small in volume as will the data base stored on-line. This will greatly reduce the cost of a computer-assisted instruction system.

Taurus Associates, Alexandria, Va., under contract with the Army, will provide the systems design, hardware design and software package for the computer-driven microfilm system.

Students at the ALMC and Sharpe Army Depot, Calif.; Sacramento Army Depot, Calif.; and Lexington (Ky.) Blue Grass Army Depot, will be divided into two groups. One group will use programed learning texts, the other the computer-driven instruction system. Identical frames of instruction will be used to teach the two groups.

The two groups will be equated on the basis of intelligence scores received by students on the California Test of Mental Maturity, experience in subject matter, educational background, and any other factors which might be used as a basis for matching pairs of students.

Student response will be graded by the computer, which under program control, will respond to the answers. Structured interview and open-end type questions will be used, with the latter giving the student freedom of response.

This system provides an interactive method of instruction that allows the student to proceed at his own pace, and also allows a group instructor to monitor the student's educational attainment.

Instructors also will provide their evaluation of student reactions to each mode by completing a rating scale. This scale will cover such factors as student interests, enthusiasm, perseverance, and seriousness of purpose.

Testing of the computer-driven microfiche tutorial system for large-scale implementation is a first in the educational field. The Army Logistics Management Center cites this as an example of innovation being used to reduce costs of training personnel. The ALMC is an educational activity of the U.S. Army Materiel Command.

Maj Gen Sammet Outlines Executive Role in R&D

(Continued from page 49)

thing; question it. Is it needed, really needed? Who says so, and why?

If the answer is yes, are all things being done that should be done, and with due haste and adequate support? Is there a hole in the program? Are we overlooking something? Can we accept just a little less with a considerable saving in time and money?

And always demand proof—convince me! Be a critical enthusiast who is looking for a better way.

R&D by nature is the antithesis of the status quo. The R&D executive should be no less so. There is a word that we hear used to describe this quality—innovative.

There's an old saying that nothing is constant but change, but change frequently comes in for criticism. Changes are often criticized because they are changes for change sake; other changes are criticized because they fail. Still others are regarded as disruptful of a then smooth flowing operation or organization.

I believe not in change for change sake, but that the good executive should be ever ready to alter ways of doing things, if there is a good promise of improvement.

The industry feeling here is that they are continuously reorganizing, because one cannot solve today's problem with yesterday's methods and organization.

Industry doubts that they will be able to solve tomorrow's problems with today's methods and organizations. And, as an extension of this, the innovative quality in their executives is a key to corporate success.

Industry has an advantage over government here in that they recognize that while innovative people bring success, they also make mistakes. They are prepared to accept this.

Unfortunately, we in the Services are not given much leeway in permissible or acceptable mistakes, possibly because the size of our high risk programs dictates that failure is extremely costly.

Rather than rambling on further, let me paraphrase what I've been saying by reciting a set of six commandments which I have picked up somewhere along the way.

THE FIRST COMMANDMENT, and probably the most important one, is—"*hang loose.*" Experience shows there is no greater impediment to progress than the wish to determine its outcome by means of obscure symbols printed on paper.

Formalized organization charts tell you more about what you can't do than about what you can do. Too often, those neat little boxes establish functional islands, with no way to get from one to another except up narrow lines to the top, along the wings and back to the bottom.

An organization chart is a comfort, but once you have it, stick it in the bottom drawer of your desk and —"hang loose." Probably the worst thing you could do is create a completely efficient organization. That kind of perfection leads to rigidity—it leaves no room for mistakes or innovation.

THE SECOND COMMANDMENT is to *delegate responsibility.* It is a human trait to want to keep a finger in every pie, but there are two things wrong with that attitude: First, you don't have enough fingers for all the pies and, second, you crowd everyone else out.

People often tell the story of Harry Truman's desk sign which said, "The buck stops here." That is a good slogan, but I counter that every executive should have another sign which says, "The buck starts here—keep it moving."

The surprising thing is that once people get used to that idea, they enjoy the freedom that responsibility gives them.

THE THIRD COMMANDMENT is *keep your intuition well lubricated.* If you have a well-developed intuition, use it. Don't get me wrong; some of my best friends are computers, and I welcome their help—so long as they know their place.

But any executive who turns the final decision over to a computer has to ask himself what his role is in the process. I have found that some of my biggest mistakes were made after I ignored my intuition under the pressure of what looked at the time like unshakeable evidence.

THE FOURTH COMMANDMENT is to *know where the information is*

EPA Appoints Breidenbach As Director of NERC in Ohio

Appointment of Dr. Andrew W. Breidenbach as director of the Environmental Protection Agency's National Environmental Research Center in Cincinnati, Ohio, was announced Aug. 6 by William D. Ruckelshaus, EPA administrator.

Dr. Breidenbach directs the efforts of nearly 1,200 EPA employes in 10 locations in the city, and is responsible for the $28 million multi-disciplinary environmental research laboratory to be built at the University of Cincinnati by 1975.

The Cincinnati complex is one of three National Environmental Research Centers being established under EPA. The others are in Research Triangle Park, N.C., and Corvallis, Ore.

Dr. Breidenbach, 47, who will receive program direction from Dr. Stanley Greenfield, EPA's Assistant Administrator for Research and Monitoring, earned his BS degree from the University of Cincinnati and his doctorate from the University of Florida.

SCIENTIFIC CALENDAR

3d Biennial Cornell Electrical Engineering Conference, Ithaca, N.Y., Aug. 17-19.

Astrodynamics Conference, sponsored by AAS and AIAA, Fort Lauderdale, Fla., Aug. 17-19.

International Geoscience Electronics Symposium, sponsored by IEEE, Washington, D.C., Aug. 25-27.

1st World Congress of Nuclear Medicine and Biology, Montreal, Canada, Aug. 30-Sept. 4.

5th National Symposium on Fracture Mechanics, Urbana, Ill., Aug. 31-Sept. 2.

International Symposium on Antennas and Propagation, Sendai, Japan, Sept. 1-3.

2d National Symposium, Society of Flight Test Engineers, St. Mary's City, Md., Sept. 1-3.

1971 International Electrical and Electronic Engineers/City University International Symposium on Network Theory, London, England, Sept. 6-10.

6th Aerospace Mechanisms Symposium, sponsored by Ames Research Center, Sunnyvale, Calif., Sept. 9-10.

3d International Colloquium on Gasdynamics of Explosions and Reactive Systems, Marseilles, France, Sept. 12-17.

Petroleum and Chemical Industry Technical Conference, sponsored by IEEE, Atlanta, Ga., Sept. 13-15.

5th International Materials Symposium: The Structure and Properties of Materials—Techniques and Applications of High-Resolution Microscopy, Berkeley, Calif., Sept. 13-17.

International Symposium of the Institute of Electrical and Electronics Engineers, Los Angeles, Calif., Sept. 20-23.

22d International Astronautical Congress, Brussels, Belgium, Sept. 20-25.

Joint Conference on Infrared Techniques, sponsored by IERE, Reading, England, Sept. 21-23.

Aeronautic and Space Engineering and Manufacturing Meeting, sponsored by SAE, Los Angeles, Calif., Sept. 27-Oct. 1.

3d International Congress on Spectrometry of Absorption and Atomic Fluorescence, Paris, France, Sept. 27-Oct. 1.

19th Annual Joint Engineering Management Conference, sponsored by IEEE, Los Angeles, Calif., Oct. 4-5.

IEEE Electronic and Aerospace Systems Convention, Washington, D.C., Oct. 6-8.

International Electron Devices Meeting, sponsored by IEEE, Washington, D.C., Oct. 11-13.

Advanced Seminar on Waves on Beaches, sponsored by MRC, University of Wisconsin and CERC, Madison, Wis., Oct 11-13.

Joint Meeting of the American Nuclear Society, Miami Beach, Fla., Oct. 17-21.

1st EUROCON Convention, sponsored by IEEE, Lausanne, Switzerland, Oct. 18-22.

1971 Fall Symposium of Research and Development Associates for Military Food and Packaging Systems, Inc., Natick, Mass., Oct. 19-20.

Convention on Aerospace and Electronic Systems, sponsored by IEEE, Washington, D.C., Oct. 25-27.

8th Annual Meeting and Technical Display, sponsored by AIAA, Washington, D.C., Oct. 25-28.

17th Conference on the Design of Experiments in Army Research, Development and Testing, sponsored by ARO-D and WRAIR, Washington, D.C., Oct. 27-29.

buried. When it comes to the point of decision, you have to reach, sometimes with lightening speed, all the information you have locked in your memory cells.

That is what intuition really is. The human being is a marvelous instrument. It can give you 40 or more years of service; it can store billions of bits of information, and it answers you in clear, understandable English. It can even program and reprogram itself.

Don't be too proud to leave your office to seek information from others. Any day of the week there is a million dollars worth of intelligence a few minutes down the hall. Right outside your office there is a moving conference room. It's amazing how much you can learn, day after day, from a 5-minute nose-to-nose conversation in the hallway.

THE FIFTH COMMANDMENT says *set your priorities in terms of the probable rather than the merely possible.* I can restate that in three words—work from strength.

MY SIXTH COMMANDMENT says *make sure you generate a reasonable number of mistakes.* Take a look at your record, and if you can come to the end of a year and haven't made any mistakes, then I say, you haven't tried everything you should have tried.

It's a cliche to say we learn by our mistakes. I'll state the case more strongly. I'll say you can't learn without mistakes.

I'm beginning to feel like Polonius, full of advice and great formulas for successful living. But I remember that eventually Polonius got stabbed for his troubles. And I remember what Hamlet said as he stood over Polonius' body. He said, "Thou wretched, rash, intruding fool, farewell!"

Before I reach that point, I should say farewell to you. However, I would like to leave one more bit of executive mystique with you. It comes from a talk by Leo Burnett, founder and chairman of the Leo Burnett Advertising Company. He titled his talk, "When to Take My Name off the Door." Let me paraphrase a few of his words of counsel to his executives:

- Don't lose the sheer fun of your job—enjoy what you're doing, and let it please and stimulate you further.
- Don't ever lose the restless feeling that nothing you do is ever quite good enough.
- When you disapprove of a piece of work, don't start tearing the hell out of *the man who did it* rather than the work itself.
- Finally, never lose respect for the lonely individual—the man at his drawing board, or scribbling ideas on a yellow tablet, or working overtime on a test plan because he wants to.

"When you forget those things," said Mr. Burnett, "then it is time to take your name off the door."

MERDC Breaks Ground for CCID Facilities at Fort Belvoir

Improved facilities for the Countermine/Counter Intrusion Department (CCID) and for the Barrier and Countersurveillance Division (B&CD) of the Military Technology Department, U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va., will be provided in two new buildings.

Col Bennett L. Lewis, CO of the center, broke ground in August for the CCID building which will be a 3-story structure that will provide 30,000 square feet of space, and house approximately 135 scientists, engineers, technicians and administrative personnel.

The facility will include a seismic simulator room, a magnetic room, optics and infrared room, radiation lab, mechanical lab, five electronic labs, an anechoic chamber, a chemistry lab and a soils lab.

The Barrier Field Experimental Facility will be a 2-story brick building with more than 18,000 square feet of space. Special facilities will include a controlled humidity and dust-free area, a shock-in-materials lab, a barriers lab, electronics lab, simulator lab, electro-mechanical area, and a minor shop area.

The Countermine/Counter Intrusion Department, headed by Terence G. Kirkland, is responsible for research, development and engineering in the fields of intrusion and antiinfiltration sensors and detection systems, buried land mines detection, concealed munitions and explosives detection, covert personnel and vehicular movement, tunnel detection, etc.

The Barrier and Countersurveillance Division has responsibility for research and development in the fields of mine laying and clearing, barriers and counterbarriers, combat fortifications and obstacles, and countersurveillance and deception. Virgil M. Davis is chief of the Division.

GROUND-BREAKING ceremonies are shown for new facilities for Countermine/Counter Intrusion Department (CCID) and for the Barrier and Countersurveillance Division of the Military Technology Department at Fort Belvoir, Va. Left to right are William Fineglass, owner, American Construction Co., which will erect the buildings; Lawrence Krause, project inspector; Ira Reed, area engineer; Col Bennett L. Lewis, CO of the U.S. Army Mobility Equipment R&D Center; Francis Paca, program manager for countermines; Terence G. Kirkland, CCID chief; architect Dr. Leslie Kara of Daniel, Mann, Johnson and Mendenhall.

Army-Developed Vaccine Used to Combat VEE

The vaccine currently proving successful in Mexico and the southwest United States in treating the deadly Venezuelan Equine Encephalitis (VEE) was developed during 18 years of U.S. Army research effort at Fort Detrick, Md., laboratories.

VEE, the horse "sleeping sickness" that has been sweeping Texas and parts of Mexico in recent months, is a mosquito-borne disease that kills about 50 percent of the unvaccinated horses it infects.

The Army-developed vaccine, announced in 1961 and effective experimentally in 1962 in immunizing a donkey, proved successful on a large scale in 1967–68–69 in preventing the spread of the sleeping sickness in outbreaks in Columbia, Guatemala and Costa Rica. More than two million doses of the vaccine have been administered to animals in these nations, as well as in Mexico, Panama, ElSalvador, Nicaragua and Honduras.

In these nations, the vaccine has also been given to more than 6,000 persons, protecting 95 percent of them. Even vaccinated researchers working closely with virulent strains of VEE remained protected.

Science, the journal of the American Association for the Advancement of Science, devotes nearly three pages in the 30 July 1971 edition to an account of the U.S. Army's 18-year research effort in producing the VEE vaccine. In accordance with Army Policy, this research was oriented to military objectives.

Titled "VEE Vaccine: Fortuitous Spin-off from BW Research," the article points out that, "ironically," the vaccine now proving extremely valuable in efforts to cope with threatened catastrophic outbreaks in Mexico and the U.S. Southwest, was a serendipitous result of biological warfare research. Except for medically oriented defensive research, this effort has recently been phased out at Fort Detrick in line with national policy.

The Army's interest in the virus was first aroused by an epidemic which began on Trinidad in October, 1943. The Trinidad outbreak was alarmingly lethal among horses, donkeys, mules and burros. Two human fatalities also occurred.

By 1960, Fort Detrick virologists successfully applied the experimental data gathered from nearly two decades of VEE research. At this time, a live attenuated vaccine was prepared.

The vaccine was subsequently tested with animal and human subjects. Experimenters concluded that the vaccine conferred a solid and long-lasting immunity. In 1966, the National Drug Company, a subsidiary of Richardson-Merrell, Inc., began producing the vaccine under an Army contract.

VEE is native to Central America, Northern South America, and the Caribbean Islands. Outbreaks occur practically every year in one or more places in these areas. The specific cause of the epizootic in a particular area at a given time is still unknown.

Speculations emphasize the environmental conditions suitable for transmission of the virus by mosquito and the availability of susceptible target populations, infra-human and human.

The human VEE epidemic that swept through Venezuela between 1962 and 1964 reportedly caused 32,000 human illnesses and 190 deaths, mostly among children.

Besides equines, dogs, swine, bovines and birds have proven susceptible to VEE infection. With the virus in their blood, these animals serve as reservoirs for infection of mosquitoes, which in turn can transmit the disease to man.

Army CofS Announces New Training Policy

Army Chief of Staff General William C. Westmoreland announced July 15 a new Army policy that places training into three basic categories: mission training, individual training and training that deals with the soldier's personal knowledge of his rights and responsibilities.

In a message to commanders, he stated, "We must reaffirm our confidence in the dedication, judgment and professionalism of the officer corps by decentralizing the management and conduct of training. Only by doing so can we enhance the realism and effectiveness of our training to produce the best possible level of mission performance."

The existing DA policy of specifying certain training subjects as mandatory will be discontinued. Unit commanders at battalion level and below will now receive training guidance in the form of mission-type instructions rather than by detailed directives.

Mission training is that training a unit must conduct to accomplish military tasks it may be assigned. Individual training includes such areas as the soldier's individual job, physical fitness and proficiency with his assigned weapon.

The third category, the soldier's personal knowledge of his rights and responsibilities, includes training in the Code of Conduct, the Geneva and Hague Conventions, service benefits, race relations and drug problems.

This new training policy does not affect current programs of instruction for basic and advanced individual training, preparation for overseas movement, or service school courses.

Colonel Fair Takes Command of USACCS at Fort McClellan

Col Stanley D. Fair, 1959–62 action officer with the Office of the Chief of Research and Development, will become commandant of the U.S. Army Chemical Center and School at Fort McClellan, Ala., July 28.

In his previous assignment, Col Fair was a member of the Directorate of Strategic Studies, U.S. Army Combat Developments Command (USACDC) Strategic Studies Institute, Carlisle Barracks, Pa.

Graduated from the U.S. Military Academy in 1946, he has attended the Chemical Officer Advanced Course at Edgewood (Md.) Arsenal, studied physical science at the Navy Postgraduate School in Monterey, Calif., and received a master's degree in radiobiology from the University of California at Berkeley in 1954.

Col Stanley D. Fair

Following a tour of duty as a nuclear staff Officer with the Chemical Field Requirements Agency at Fort McClellan (1954–58), he attended the Command and General Staff College, Fort Leavenworth, Kans.

In 1962 he was assigned to Vietnam as a chemical staff officer with the Advanced Research Projects Agency, Office of the Secretary of Defense. He served as CBR representative of the U.S. Army Standardization Group in Ottawa, Canada (1966–68), following graduation from the Army War College at Carlisle Barracks. His military honors include the Legion of Merit with Oak Leaf Cluster, the Bronze Star Medal and Commendation Medal.

AMMRC Applies Split Hopkinson Apparatus to Material Testing

By Dr. S. C. Chou

Most Army materiel must operate in a dynamic environment, thereby imposing analyses requirements for predicting the dynamic response of structures. Since mechanical properties of materials are generally time and temperature dependent, it is essential that these effects be included in the predictive analyses.

A constitutive equation of the material, which incorporates temperature and strain rate effect, is needed to obtain good predictions. The U.S. Army Materials and Mechanics Research Center, Watertown, Mass., is using a split Hopkinson bar apparatus to determine the strain-rate effect on mechanical properties of both metallic and nonmetallic materials.

Figure 1 shows a schematic of three arrangements of a modified split Hopkinson bar for conducting compression, tension and shear tests on any arbitrary material at high strain rates.

The range of strain rates achievable with such a device is from 50 to 1,000 inches/seconds, governed by the length and strength of the elastic bars and those of the test specimen.

The principle is that a striker is accelerated down a barrel (by releasing compressed gas in a reservoir) to impact an elastic weighbar. The resulting stress wave travels down the weighbar.

When the wave reaches the interface between the weighbar and the specimen—sandwiched between the weighbar and the anvil-bar—part of the wave is reflected at the interface and part is transmitted into the anvil-bar through the specimen.

Under this condition, the specimen is plastically deformed. Three sets of strain gauges are mounted to the elastic weighbar and anvil-bar. Semiconductor gauges are used to eliminate the magneto-strictive effect that occurs if wire or foil gauges are used in an impact test.

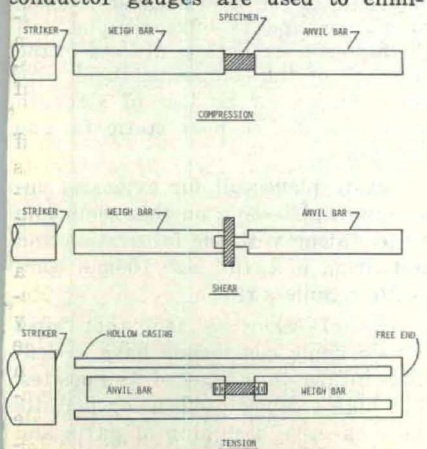


Fig. 1 Compression, Shear and Tension Test Arrangements

Two sets of gauges are located as close to the two interfaces as possible; the other set is located near the impact end of the weighbar. The output of each set of gauges is fed to an oscilloscope. The oscilloscopes are triggered by a crystal pinducer and a delay system.

These gauges record: the incident wave at the impact end of the weighbar; the resultant of the incident and reflected waves at the interface of the weighbar and the specimen; and the transmitted wave at the interface of the specimen and anvil-bar.

Once these stress-time curves are obtained, they are analyzed by using the one-dimensional theory of wave propagation to obtain a stress-strain-strain rate relationship for the test material.

A computer program has been written to provide a rapid method for computing the dynamic stress-strain curve. The analytical form of the stress-strain curve is then formulated. Temperature effect may also be incorporated into the system.

Dr. Shun-chin Chou graduated from National Taiwan University in 1956 with a BS degree in civil engineering. He obtained an MS from the University of Washington and a PhD in applied mechanics from Stanford University in 1964.

Since joining the Theoretical and Applied Mechanics Research Laboratory of the U.S. Army Materials and Mechanics Research Center (AMMRC), Watertown, Mass., in 1968, he has been engaged in studying the propagation characteristics of stress waves in solids and determining constitutive relations of materials. Prior to his employment at AMMRC, he worked as senior staff scientist at AVCO–Missile Systems Division, Wilmington, Mass., where he also was engaged in material characterization.

He is the author of several papers on wave propagations in solids and large deformation theory of shells of revolution, and is a member of the American Society of Mechanical Engineers, the Society for Experimental Stress Analysis and Sigma Xi.

ASAE Cites Edgewood Employe

Dr. Arthur T. Johnson, a civilian engineer in Edgewood (Md.) Arsenal's Defense Development and Engineering Laboratories (DDEL), was honored late in July by the "American Society of Agricultural Engineers."

Dr. Johnson was cited for a technical paper of "exceptional merit," titled "Measurement of Hypothalamic Temperature and Heart Rate of Poultry." It reports on research completed during graduate study at Cornell University, Ithaca, N.Y.

Dr Johnson's bachelor's and master's degrees in agricultural engineering and his doctorate in biological engineering were earned at Cornell in 1964, 1967 and 1969.

Watervliet Develops Automatic Mortar System

Automation has corrected mortar system firing displacement caused by movement of the weapon's baseplate.

Watervliet Arsenal has developed an automatic mortar system which requires less than two seconds to return the barrel to its original aiming position. This reduction from the minute needed for manual operation provides for an increased rate of fire and decreases the possibility for error in manual re-aiming.

Currently undergoing further laboratory and field tests, the device utilizes an elevation angle sensor that transmits a differential air pressure signal to a fluidic amplifier. This activates a piston-cylinder combination attached to the barrel that returns the barrel to the original firing position.

The system is applicable to all mortars now being used by U.S. military forces, and those of the future.

WATERVLIET ARSENAL automatic controls group members credited with developing a mortar system that automatically repositions weapon barrel within seconds are (from left) tool and die-maker Herbert Lewis, technician W. H. Ziegler and physicist Gary Woods.

Watervliet Uses Composite Materials To Reduce Weight of 106mm Rifle Tube

Fabrication and successful test firing of a 106mm recoilless rifle with a section of tube made of composite materials weighing 40 percent less than its conventional steel counterpart was reported recently by a team of Watervliet (N.Y.) Arsenal scientists and engineers.

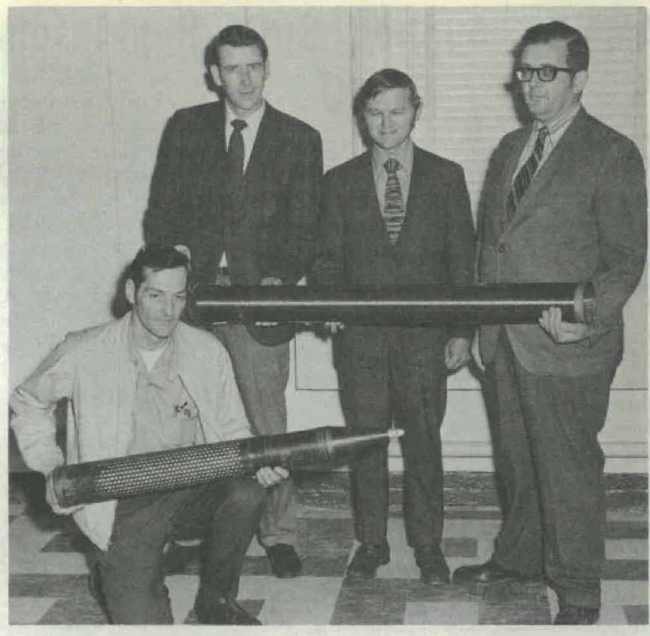
Initial successful test results on the 54-inch-long lightweight tubing are regarded as a major step toward development of a complete 106mm tube made entirely of composite materials. Improving the strength-to-weight ratio is expected to increase significantly the weapon's efficiency in terms of increased mobility.

Created in the arsenal's Organic Composite Laboratory, the tube was fabricated of steel wire and epoxy binder to form a composite jacket, which was then filament-wound on a thin-walled steel-rifled liner. The length limitation of 54 inches was imposed by the wire winder; normal 106mm tubes are 108 inches.

Dr. Giuliano D'Andrea, who heads the development project, says the steel-epoxy composite gives the component lower density, higher tensile strength and higher modulus of elasticity—or stiffness—than can be obtained with conventional structural materials.

Developed following long-sustained and intensive work in elastic-plastic analysis by Watervliet Arsenal researchers, the tube was successfully test-fired at Picatinny (N.J.) Arsenal. Plans call for manufacture of economical and highly effective gun tubes made of similar composite materials readily available from commercial suppliers.

Dr. D'Andrea is being assisted in the project by chemists Robert Cullinan and Martin S. Ferguson, physicist Lt Frank A. Costa and engineering technician Paul Croteau.



COMPOSITE MATERIAL TUBING for the 106mm recoilless rifle was developed by Watervliet (N.Y.) Arsenal team comprised of (standing, from left) Robert Cullinan, Dr. Giuliano D'Andrea and Martin S. Ferguson. Paul Croteau (kneeling) holds 106mm projectile of the type successfully test-fired through the experimental 54-inch tube section.

Investigators, the world over, in their search for the ideal composite for gun tubes and other ordnance items, have long been screening the potential candidate fibers which have strengths exceeding 200,000 psi and modulus values over 25 million psi.

Boron and graphite fibers, both very expensive to date, have begun to approach the applications stage in the aerospace field because of their extremely high strength and modulus/density ratios.

Watervliet Arsenal scientists more recently have made extensive investigations into the characterization and filament winding fabrication of steel wire (0.002"–0.008" dia.) with tensile strengths of 500,000 psi and tensile modulus of 30 million psi. Commercially available, these wires have been found to be easily handled on filament-winding equipment.

Steel wire has been generally overlooked as a legitimate candidate for advanced composites because of its high density. Watervliet investigators have found that steel wire has definite advantages over other reinforcing fibers besides availability and price. The tensile and compressive modulus and tensile strength are higher; wetting is quicker and the bond is generally stronger between resin and filament.

Significant also is that there is no loss of strength due to mechanical damage of the filaments during fabrication. This is a very important characteristic of the wire because it leads to high composite efficiency, i.e., all the filament strength is utilized in the strength of the composite. Steel wire composites show no loss of strength with time due to poor static fatigue resistance.

Future plans call for extensive environmental testing on this composite system along with the fabrication and test firing of a full size 106mm composite recoilless rifle.

Arsenal scientists feel that steel wire organic composites have a definite future in advanced composites. The high composite efficiency permits more effective designing of parts and results in good correlation between theory and experimental data.

Canadian Forces Officer Assigned to AMC Liaison

Assignment of a Canadian Forces Liaison Officer at HQ, U.S. Army Materiel Command, Washington, D.C., was announced recently.

During a 3-year tour of duty, Lt Col Glassco Henderson will be responsible for providing the AMC staff with research and development information on Canada and the Canadian Forces. His duties include reporting on AMC projects in which Canada is interested by virtue of mutual defense goals.

Lt Col Glassco Henderson

On the completion of officer candidate training at the Royal Canadian School of Artillery (Antiaircraft), Lt Col Henderson was commissioned as a Reserve officer and retained as an instructor. During 1959 he was a student at the British Army Staff College, Camberley, England.

In 1963, he was appointed commanding officer of the 2d Surface-to-Surface Missile Battery, Royal Canadian Artillery, an independent unit equipped with the Honest John rocket. He was moved in 1966 to Cyprus, where he served as Operations Officer for the United Nations Force.

After completing a course in 1969 at the Armed Forces Staff College at Norfolk, Va., he was appointed senior staff officer, Equipment Requirements, HQ Mobile Command in Montreal.

NLABS-WPI Innovate Technological Education Program

Described as a "completely new approach to technological education" is a program agreement between Worcester Polytechnic Institute and the U.S. Army Natick (Mass.) Laboratories that sets up internship centers.

Announced July 22 and scheduled for initiation with the resumption of classes at WPI in September, the plan will begin on a limited basis. Up to 20 WPI undergraduates will spend about 25 percent of their normal study time working with NLABS staff engineers and scientists.

Students selected for the innovative program, intended to stimulate creative-thinking graduates with proven skill, will be assigned to projects that will train them in solving technological and societal problems.

Working closely with faculty advisers, students will develop their individualized programs of study, instead of following a prescribed set of required courses. Under the plan, projects will pertain to real problems needing solution by industry, business, government or the public.

WPI is arranging with cooperating companies and agencies to have work on some of the projects done away from campus. For example, NLABS will provide special laboratory equipment and ready consultation with some of the world's leading authorities in the project areas.

Student progress will be evaluated by a WPI faculty adviser assigned to work with the student teams and to cooperate with sponsoring organizations. The agreement with NLABS was described as the first formal arrangement between WPI and a sponsor.

U.S. Army Materiel Command Deputy for Laboratories Dr. Robert B. Dillaway participated in the ceremonies on the WPI campus marking agreement on the plan. Dignitaries included Brig Gen Dean Van Lydergraf, CG of NLABS, and Dr. Dale H. Sieling, scientific director and his NLABS deputy.

WPI was represented by Dr. George Hazzard, president, Milton P. Higgins, trustee chairman, and William R. Grogan, dean, Undergraduate Program. Dr. Hazzard termed signing of the agreement "a great day for WPI students."

Citing NLABS as a world-renowned research center in food processing, protective clothing and other human needs, he said it is "an ideal site for our first internship center. This type of work is particularly appealing to today's socially conscious students who want to work on projects to improve the quality of life. . . ."

Project activity in which WPI students will become involved at NLABS will include food preservation, packaging for dropping from aircraft in isolated or emergency areas, development of mobile and portable field kitchens, design of insulated food containers, microwave cooking, taste research, and recycling of waste paper to form fuels and edible sugar.

Students will all work in nonclassified areas on projects having broad potential for civilian applications. In groups of two or three, they will be under direction of NLABS technical personnel. Dr. Yi H. Ma, associate professor of chemical engineering at WPI, will be faculty adviser to the students working at NLABS. He has worked with the labs as a consultant.

The WPI plan was developed after 18 months study by faculty members, students, administrators, alumni and trustees. After planning with his adviser a program to meet career objectives, a student works at his own pace. By attending optional summer terms, he/she may graduate in as little as three years or go slower for the normal four years.

Each student will work on two projects or independent studies during his undergraduate program—one in his technical field and the other in effort emphasizing the humanities.

The conventional letter grading system has been changed so that students will earn course grades of "acceptable with distinction" or "acceptable." His adviser provides a written evaluation of his work to become part of the academic record. A sufficiency examination in his studies, in the science project and in the humanities must be passed to qualify for a BS degree.

Adaptation of the plan on a small scale has demonstrated that most students learn better with this approach, in that a real problem challenge gives purpose to textbooks and lectures.

Interest in the plan from prospective students is credited by the WPI admissions office with increasing the WPI entering class in September by 12 percent over the originally planned enrollment of 550 men and women.

SAM-D System CTV Flights Meet Test Objectives at WSMR

Controlled test vehicle (CTV) flights with the SAM–D missile have been completed successfully at White Sands (N. Mex.) Missile Range.

The SAM–D (Surface-to-Air Missile Development) has passed numerous launch-eject, propulsion and control system flight tests. Test objectives included a series of high-angle attack maneuvers that subjected the missile to severe stress to verify structural integrity, and ability to be controlled and maneuvered.

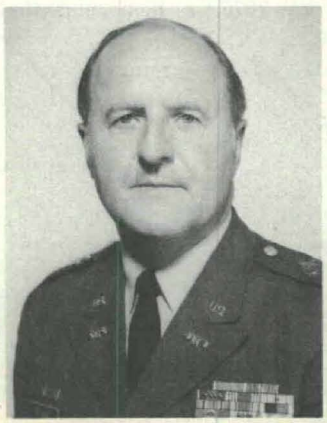
The highly mobile system, being developed for use against high-performance aircraft in the late 1970s, will be able to engage and simultaneously destroy several targets.

Brig Gen J. C. Fimiani of MICOM is project manager.

Stahl Takes Command of Fort McClellan C-B-R- Agency

Command of the U.S. Army Combat Developments Command's (CDC) Chemical-Biological-Radiological Agency at Fort McClellan, Ala., was assumed recently by Col Kenneth L. Stahl.

In 1968 he served at Fort McClellan as chief, Technical Department, U.S. Army Chemical Center and School and subsequently as CO of the 100th Chemical Group (Provisional). He completed the Chemical Officer Advanced Course at the installation in 1959 and was assigned as operations officer (S3) with HQ Army Chemical Corps Training Command.



Col Kenneth L. Stahl

He was inspector general, 1st Logistical Command, Vietnam, prior to completing the Industrial College of the Armed Forces, Washington, D.C. He also has completed the Command and General Staff College at Fort Leavenworth, Kans.

Commissioned in 1950 after completing the ROTC program as a distinguished military graduate at the University of Wisconsin, Col Stahl holds a BS degree in chemistry and an MS degree in microbiology (1956) from the same university.

He has served in the Far East with the 1st Cavalry Division, as general staff officer in the Office of the Chief Chemical Officer in Washington, D.C., and U.S. liaison officer in London.

His decorations include the Legion of Merit, the Bronze Star Medal and the Army Commendation Medal with four Oak Leaf Clusters.

High-Strength Aluminum Alloys

By Harold Markus and Dr. Thomas E. Sullivan

High-strength aluminum alloys are used extensively in Army materiel because of their light weight, ease of fabrication and good mechanical properties. Utilization would be increased, particularly for critical structural components, if alloys with higher strengths, improved ductility and good secondary properties could be produced.

Two new processing techniques were demonstrated recently which significantly improve the mechanical properties of high-strength aluminum alloys. Developed cooperatively by Frankford Arsenal and the Massachusetts Institute of Technology is a technique that involves elimination of undissolved phases in the material through control of purity, ingot solidification rates and homogenization treatments.

New also is a thermal mechanical treatment (TMT). Patent applications for the treatment, involving the application of plastic deformation between aging cycles, have been filed in Italy and the United States. Providing excellent combinations of strength and ductility in high-strength alloys, TMT was developed under a Memorandum of Understanding between the U.S. Army and the Italian Ministry of Defense.

In the "U.S.—Italy Cooperative Research and Development Program on Aluminum Alloys," work was conducted at the Instituto Sperimentalle dei Metalli Leggeri (ISML), Milan, Italy, under contract with the Italian Ministry of Defense.

The program was monitored for the U.S. Army by Frankford Arsenal, and its establishment resulted from efforts of the Physical and Engineering Sciences Division, Office of the Chief of Research and Development.

HOMOGENIZATION. Strength and ductility of commercial high-strength wrought aluminum alloys are impaired by the presence of undissolved phases in the microstructure, arising from two sources—insoluble impurity phases and soluble phases that were not dissolved due to inadequate treatments.

Experimental work on homogenization was carried out on 7000 series alloys, primarily 7075 (Al–5.6%Zn–2.5%Mg–1.6%Cu), but the results are applicable also to the 2000 and 6000 series alloys. Homogenization was facilitated by: (1) low impurity content, (2) small dendrite arm spacing (DAS) in the ingot, (3) proper homogenization temperature and time, and (4) mechanical working of the ingot.

Previous studies showed that the insoluble impurity phases are mainly iron-rich. Consequently, the amount of iron was limited to less than 0.01 percent. Silicon was also limited to less than 0.01 percent as a precautionary measure since it also has low solubility in aluminum. Specifications for commercial 7075 alloy permit 0.5% max. iron and 0.4% max. silicon.

The DAS is an important parameter affecting homogenization because it is a measure of the diffusion distance involved in the homogenization process. The finer (i.e., smaller) the DAS, the more rapid the material can be homogenized. If the DAS is greater than 100 microns, it was found, homogenization will be incomplete in reasonable times at temperature. By using a direct chill-casting technique and by proper control of casting procedures, one is able to achieve a very small DAS even in large ingots.

To achieve a structure that is completely free of undissolved soluble phases, the homogenization temperature must be chosen so that the composition of the alloy is in the Al-rich, solid-solution phase field. In the experiments on 7075, a homogenization temperature of 900°F. produced a completely homogeneous material.

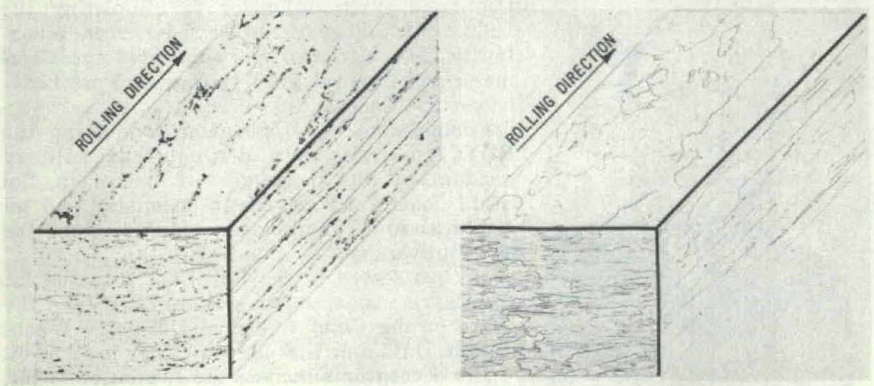


Fig. 1. Longitudinal, transverse, and short-transverse microstructures of: (a) commercial 7075–T6 and (b) specially processed 7075–T6 rolled plate.

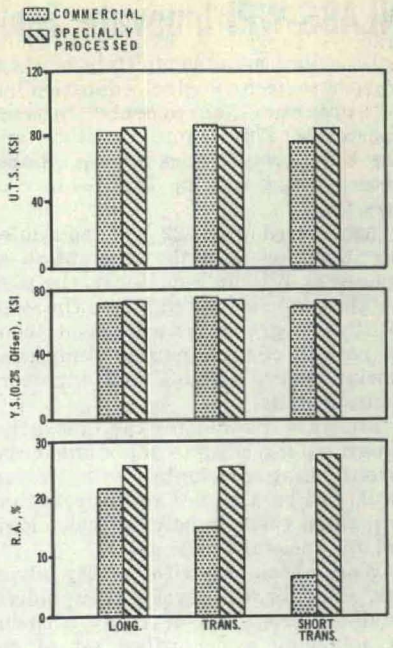


Fig. 2. Longitudinal, transverse and short transverse properties of commercial and specially processed 7075–T6.

Mechanical working of the ingot at elevated temperature prior to or as part of the treatment decreases the time required for complete homogenization. In fact, the greater the mechanical work, the less the time required for homogenization; the working decreases the diffusion distance between the second phase particles, breaking them down to a small size so they are more readily dissolved.

Figure 1 shows the longitudinal, transverse and short transverse microstructures of commercial 7075–T6 and specially processed (homogenized) 7075–T6 rolled plate. It should be noted that the second phases have been eliminated in the specially processed material.

Tensile properties of these materials are plotted in Figure 2. Strengths of the materials are about the same. Ductility of the homogeneous material, as measured by reduction of area, is much greater, however, than that of the commercial counterpart. This difference is especially noticeable in the short transverse direction.

Figure 2 also shows that the mechanical properties of the homogeneous material are essentially isotropic whereas there is considerable directionality present in the properties of the commercial material.

Secondary properties, such as fracture toughness and fatigue behavior, are improved by homogenization, especially in the short transverse direc-

tion. Specifically, the plane strain fracture toughness, K_{Ic}, in the short transverse direction in 2-inch thick plates is 22,000 psi for commercial 7075–T6 compared to 50,000 psi for homogeneous 7075–T6.

Preliminary tests show that the fatigue strength in the short transverse direction in commercial 7075–T6 is 22,000 psi compared to 27,000 psi in the homogeneous 7075–T6. Fatigue strengths of the two materials are equal in the longitudinal direction (their value is 27,000 psi), indicating that the fatigue strength of homogeneous 7075–T6 is isotropic.

Other preliminary results show that the stress corrosion resistances of commercial and homogeneous 7075–T6 are essentially equivalent.

THERMAL MECHANICAL TREATMENTS. TMT in aluminum alloys combines thermal treatments and mechanical processing techniques to improve the properties of the materials over those of the standard T6 condition (solution heat-treated, quenched and artificially aged).

A common thermal mechanical treatment is the T8 temper, which involves solution treating, quenching, cold working and then artificial aging. Since the cold work is applied prior to aging, the aging kinetics are affected.

In the 2000 and 6000 series alloys, the cold work accelerates the aging kinetics and the strength is greater than in the T6 temper. The T8 temper is used commercially in these alloys.

Cold work prior to aging does not have a favorable influence on the aging kinetics of 7000 series alloys and the strength in the T8 temper is no better than that in the T6 temper. Therefore, T8 is not a commercially used temper in 7000 series alloys.

One means of raising the strength of the 7000 series alloys is the so-called T9 temper. This is only a mechanical treatment involving cold working the material in the T6 condition, which does not influence the aging kinetics because the cold work is applied after aging is completed. Hence the effects of aging and cold work are merely additive.

Cold working T6 material naturally increases the strength, but the ductility is greatly reduced. In addition, the T9 temper is not commercially feasible for use in the 7000 series alloys.

With this as a background, ISML developed TMT for 7000 series alloys. Better combinations of strength and ductility result than can be obtained by the use of conventional thermal mechanical treatments. Although TMT was developed primarily for the 7000 series, it has given similar results for the 2000 and 6000 series.

TMT involves solution heat treatment, cold-water quench, natural aging for three to seven days, low temperature artificial aging, cold work, and final artificial aging at either a higher temperature than the first artificial aging step or for a longer time at the same temperature as the first artificial aging step.

In the TMT of 7075 alloy, the first artificial aging step has been carried out at about 220°F., the working has been 10 to 30 percent at room temperature (although working temperatures up to 375°F. are acceptable), and the final artificial aging step has been carried out at 200° and 250°F. Work is being conducted in optimizing the steps involved in TMT.

The yield strength and corresponding elongation of several 7000 series alloys in the TMT and T9 conditions are plotted in Figure 3. These data are for commercial purity material 5/64 of an inch thick. It can be seen that for a given treatment, T9 or TMT, the strength increases and the elongation decreases. However, TMT gives a better combination of strength and elongation than does T9 temper. For a given strength, the elongation is greater in the TMT than in the T9 temper; for a given elongation, the strength is greater in the TMT than in the T9 temper.

The 7001 data in Figure 3 also show that, compared to the T6 temper (open symbol at far right), TMT (closed symbol at far right) significantly increases the yield strength while decreasing the elongation only a very small amount. Note in the upper curve, illustrating the TMT properties of 7001 alloy, that a yield strength of 100,000 psi with an elongation of 10 percent was achieved.

SUMMARY. The processes of homogenization and the new thermal mechanical treatment have been shown to improve significantly the properties of high-strength aluminum alloys. The combined effect of homogenization and TMT is potentially capable of additional improvement in the properties of aluminum alloys.

Current work is directed towards optimizing the parameters involved in TMT and evaluating the combined effect of homogenization and TMT on the mechanical properties, fracture toughness and stress-corrosion cracking resistance. Furthermore, these new techniques are being applied to several development programs involving such critical applications as cartridge, armor and rocket motor cases.

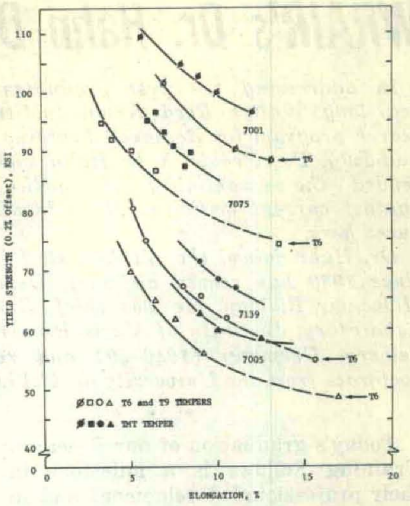


Fig. 3. Yield strength vs. elongation of 7001, 7005, 7075 and 7139 alloys in the T6, T9 and TMT tempers categories.

Syracuse AUTODIN Center Transferred to Army Control

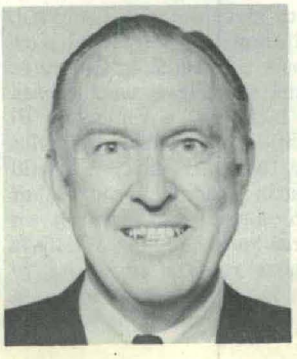
Transfer of a computerized communications center at Hancock Air Force Base, Syracuse, N.Y., from the Navy to the Army, July 1, was announced by Maj Gen W. B. Latta, CG of the Army's worldwide Strategic Communications Command, Fort Huachuca, Ariz.

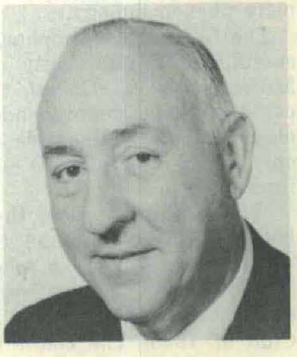
One of 19 located around the world as part of the defense communications system (DCS), the Syracuse AUTODIN (automatic digital network) Switching Center is a computer-controlled data system. Operational since April 1966, it provides high-speed communications of over 100,000 messages a day at rates of up to 6,000 words a minute.

Renamed the STRATCOM Northeast Telecommunications Switching Center, the facility is part of STRATCOM's National Communications Command (Provisional), headquartered at Fort Ritchie, Md.

Similar to the STRATCOM East Coast Telecommunications Center at Fort Detrick, Md., the Syracuse AUTODIN will be the second controlled in the United States by STRATCOM, which has overseas facilities in the Republic of Vietnam, Okinawa, Italy and West Germany.

The Syracuse AUTODIN links Department of Defense organizations with STRATCOM's Pentagon Telecommunications Center and northeast Federal agencies.





Dr. Thomas E. Sullivan (left), chief, Materials Sciences & Technology Branch, Physical & Engineering Sciences Division, U.S. Army Research Office, Office, Chief of Research and Development.

Harold Markus (right), director, Metallurgy Research Laboratory, Pitman-Dunn Research Laboratories, Frankford (Pa.) Arsenal.

WRAIR's Dr. Hahn Defends Army Medical Research Essentiality

In addressing the first graduates from the year-long Walter Reed Army Institute of Research program for Research Training Fellows in mid-July, Dr. Freidrich E. Hahn vigorously defended the essentiality of medical research against current criticism. His address is reproduced here.

Dr. Hahn joined the WRAIR staff in 1949 and since 1959 has served as chief, Department of Molecular Biology. He was chief, Biomechanical Laboratory, Institute of Virus Research in Heidelberg, Germany (1946–49) and received his doctorate from the University of Kiel in 1948.

* * *

Today's graduation of our Research Training Fellows is a milestone in their professional development and in the 78-year history of our Institute. . . . This is the first time that we graduate research training fellows. In so doing we give formal expression to the fact that our curriculum emphasizes the training of medical officers in the planning, actual conduct and reporting of original biomedical research. Gentlemen, we have been trying to give you a scientific education in miniature.

I hold it appropriate, therefore, to comment on the current condition and problems concerning biomedical research at large. We all know that this research is the target of various lines of adverse criticism and of attempted interference.

Firstly, there has arisen a neo-romantic and highly irrational movement among younger intellectuals which is often called the counterculture. (This counterculture attacks science as we know it and considers it not relevant to the contemplation of nature and of man.) Instead, it advocates reliance on intuitive and speculative insights based upon naive openness to nature and to people.

This is neither new nor surprising. In the early 1800s arose the original romantic movement in Europe which was an emotional reaction to the rationalism inherent in the philosophy of Enlightenment. Natural Philosophy, as it was called, relegated science to mere phenomenology.

The German philosopher, Schelling, speculated, interestingly enough in *Medical Science Annual*, that nature could never be comprehended through observation and scientific theory but only through speculative and intuitive interpretation.

Within thirty years, the romantic Natural Philosophy had crossed the Atlantic and found an echo in Ralph Waldo Emerson's treatise, "Nature," and in the ideas of the Transcendental Club of 1836. The counterculture of the 19th Century finally came to grief in the revolutionary year 1848 and did not impede the advancement of science, medicine and technology.

Today's irrational and antiscientific counterculture, it seems, does have an impact on critical thought concerning science and technology in general, and medical research in particular, even among individuals and institutions who or which are not camp-followers of the new cult.

From such an impact arises the second argument, which holds that funds which are spent for medical research should be more appropriately used for improvements in practical health care, based upon knowledge which is already established.

To the extent to which the argument romanticizes the underpriviledged, it is incapable of objective discussion. Taken at its face value, it is patently fallacious. Care for mental patients, for cancer patients or for patients suffering from cardiovascular diseases is expensive for the evident reason that research has not yet provided the fundamental knowledge necessary to develop effective means for the cure or prevention of these diseases.

Let me remind you that less than 30 years ago, the institutional care of patients suffering from tuberculosis was lengthy, costly and of uncertain prognosis. The medical aspects of Thomas Mann's *Magic Mountain* have a positively medieval flavor.

Today with streptomycin, isoniazid, PAS and rifampicin, the radical cure of tuberculosis is a routine procedure and TB sanatoria have been closed down for lack of chronically ill patients. While it is desirable to allot more money to health care, it would be self-defeating for the progress of medicine to dismantle research in order to free such funds. What is needed is more research in order to generate fundamental knowledge as a basis for the development of successful therapy.

The element of skepticism concerning science and technology the countercuture is injecting into our culture leads, thirdly, to an unfocused line of criticism that grows out of frustration and impatience with the measured rate of progress in medical research.

People have called antibiotics miracle drugs and they are demanding continued miracles for their money. We read much about political and administrative infighting over the establishment of a $100-million-a-year crash program to cure cancer.

Laymen, whether in office or not, argue that a technology which has developed atomic bombs and landed men on the moon should also be able to come up with cures of the major diseases of man. The argument is superficial and uninformed. The Manhattan Project and the Apollo Program were based upon established scientific knowledge: Atomic fission and the laws of gravity were known.

The famous letter of Albert Einstein to President Roosevelt in the fall of 1939, which suggested the technological feasibility of developing atomic explosives, was written precisely *because* uranium fission had been discovered earlier that year by Hahn and Strassmann and the way was now open for an application of this discovery.

To develop the bomb or to build the moonship required prodigious feats of expensive engineering, but did no longer require the acquisition of the fundamental scientific knowledge on which these projects were based.

In the disease categories which constitute major causes of morbidity and mortality, we do not yet have the fundamental knowledge to organize medical Manhattan Projects and to develop the medicinal items or procedures that will be needed to eliminate these health problems through the practice of medicine on a broad basis.

We cannot even judge with confidence if the elimination of diseases must be brought about by the study of diseases themselves or if the means for such elimination will come from non-disease-oriented areas of scientific investigation.

Don't forget that the bacterial etiology of many infectious diseases was known for 70 years before the first curative drug, prontosil, was found as a sideline of the industrial development of synthetic dyes. We come perhaps closest to an engineering approach in the development of

vaccines or of chemotherapeutic drugs. Even in these areas there remains too much trial and error and a large element of scientific uncertainty, as born out vividly by the history of the drug-resistance problem in malaria during the past 12 years.

Fourthly and lastly, unrealistic appraisals of what current medical research *can* or *cannot* accomplish ultimately, in the form of improvements in the practice of medicine, have shown a tendency of spilling over into legislative bodies and into upper administrative echelons.

This has led to the adoption of a management concept known as *mission orientation*. It is in this form and with the associated managerial and fiscal controls that the biomedical research scentist encounters the new criticism directly on his own operational ground.

Let me say at this point with unmistakable clarity: If, when, and as soon as, basic scientific knowledge becomes available which can be directly applied to the solution of medical problems, such application and the ensuing developments must, indeed, be oriented according to the mission of any given organization that is dedicated to the solution of such problems.

In research areas in which biomedical scientists are still groping for the fundamental knowledge on which to base future applications, the sense of direction is an intrinsic feature of the research process. Interference by superimposing premature mission orientation can only be counterproductive.

Basic biomedical research is the indispensible procedure by which you *come to know*, and mission orientation of applied research and development is the mandatory procedure to follow *after you know*.

Professionally speaking, this is self-evident. The current crisis in medical research can, in the last analysis, be traced to a condition in which lay unrest, fostered among other factors by the counterculture with its incessant agitation and prodding, diffuses into the planning and management of medical research and causes disunity among those who can only jointly succeed.

You gentlemen who graduate today after a period of toil but, I hope, also of satisfaction with your research experience, should remember beyond the technical details of your experiments that medical research—more research, the best possible research—holds the one promise of eliminating the miseries of disease of man, military and civilian alike.

EPA Establishes Standing Advisory Unit

The Environmental Protection Agency announced July 31 the establishment of a Standing Advisory Committee of state and interstate officials to provide consultation on a continuing basis to EPA's Office of Water Programs.

The EPA said the Advisory Committee will offer the views and advice of the states and interstate agencies on the programs and proposed policies, legislation, and other matters of mutual concern in the nationwide effort to prevent water pollution and enhance the quality of water resources.

First of its kind to be set up within the EPA, the committee will consist of executive officers of three national organizations—the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA), the Conference of State Sanitary Engineers (CSSE), and the Interstate Conference on Water Problems (ICWP).

Until the committee selects officers, the president of the ASIWPCA, Robert A. Lafleur of Louisiana, and the chairmen of the CSSE, Wesley G. Gilbertson of Pennsylvania, and the ICWP, Norman Billings of Michigan, will serve jointly as committee vice-chairmen.

Nicholas M. Golubin, EPA Office of Water Programs, will be the executive secretary of the committee.

Under proposals now before the Congress, the Water Programs Office of the Environmental Protection Agency would receive $2 billion in FY 1972 for construction grants to municipalities for installation, expansion, and updating of municipal waste treatment facilities. An additional $15 million in grants would support operation of state and interstate water pollution control programs.

Hospital at Fort Devens Named To Honor Famed Army Surgeon

Dedication of a new $6,822,000 U.S. Army hospital at Fort Devens, Mass., July 27, provided the occasion for Army Surgeon General (Lt Gen) Hal B. Jennings Jr. to pay tribute to the famous surgeon, Dr. Elliott Carr Cutler, for whom it is named.

Dr. Cutler, commissioned in the Reserve as a brigadier general, served as surgical consultant to the Chief Surgeon, European Theater of Operations during World War II.

Upon his return to the U.S. in 1945, he resumed a position as Moseley Professor of Surgery at Harvard University and chief surgeon, Peter Bent Brigham Hospital in Boston. Until his death two years later he also was a consultant to the Secretary of War.

Dr. Cutler was credited with helping to lay the foundation for rebuilding the Army Medical Department capabilities, following the ravages of demobilization, and also assisting the Veterans Administration to improve care of wounded veterans.

DoD R&D Agencies Evaluate BRL Program at APG Meet

Nearly 200 scientific and engineering personnel from U.S. Army, Navy, Air Force and other Department of Defense R&D agencies participated in a mid-July conference at Aberdeen (Md.) Proving Ground.

The 2-day semiannual Technical Review of the Ballistic Research Laboratories (BRL) agenda included presentations by BRL representatives, the Army Materiel Command's various commodity commands and other Army agencies.

In his introductory remarks, Dr. R. J. Eichelberger, BRL director, said the purpose of the review is to evaluate the over-all BRL program, to insure that the organization is making effective use of its resources in meeting current and envisioned future Army requirements.

Discussions emphasized ongoing and planned programs in exterior, interior and terminal ballistics. Vulnerability, reduction of vulnerability, target signatures, propagation and recognition and nuclear weapons effects research and simulation were among topics considered.

Dr. Eichelberger described the BRL as an integral organization within the complex of the U.S. Army Aberdeen Research and Development Center. He delineated the following objectives of the BRL program:

- To establish a technological base and provide Army agencies with basic tools for the design and evaluation of weapon systems.
- To innovate by synthesizing the results of BRL research into feasible concepts for advanced weapon systems or components.
- To provide consultation services to weapon developers and to solve problems occurring in specific systems undergoing development or arising during field use of completed systems.

The review discussions concentrated on the BRL's rate of progress, milestones reached and the importance of certain research results.

TACOM Initiates R&D on Vehicle Ignition System Improvement

By Joseph Steyaert

Joseph W. Steyaert is an electrical engineer in charge of vehicle instruments and ignition systems in the Vehicular Components and Materials Division, U.S. Army Tank-Automotive Command Warren, Mich.

A U.S. Government employe for 12 years, he has a BS degree in electrical engineering from the University of Detroit and is a registered professional engineer in the State of Michigan.

Recognizing a requirement for substantial ground vehicle ignition system improvement, the U.S. Army Tank-Automotive Command's Vehicular Components and Materials Laboratory is engaged in an R&D program directed toward a system maintenance-free for the life of the vehicle on which it is installed. (Vehicle life is defined here as 50,000 miles or 3,500 hours of engine operation.)

The current military vehicular ignition system is basically the same as the one used on the family car. One difference is that the military system has the coil located in the distributor housing for waterproofness and radio suppression; also, it does not use a vacuum advance mechanism now standard with the automotive industry.

Cam-actuated breaker points in military engines are used in conjunction with a capacitor to interrupt the primary current of the coil. Secondary voltage is distributed to each spark plug by a rotor and distributor cap.

The system requires regular maintenance and parts replacement. Spark plug performance and longevity are relatively poor. Furthermore, military vehicles of all types spend characteristically long periods at low-speed operation or at idle. This causes serious spark plug fouling problems which, coupled with normal maintenance, result in very long "down" times for Army vehicles.

To achieve long maintenance-free life, a breakerless ignition system must be used. Such a system should eliminate maintenance associated with engine timing, and adjustment and replacement of breaker points.

An electronic sensor, either optical or magnetic, is used to replace the points in this type of system, thus eliminating timing variations due to the wear of the rubbing block and the contacts. This sensor is permanently adjusted when the distributor is manufactured so that the engine timing, once set, remains fixed for the life of the distributor.

A capacitor discharge (CD) system was chosen for this program because its associated fast spark plug voltage rise-time, high available voltage over the entire speed range, and large energy reserve are very desirable.

These characteristics allow a capacitive discharge system to fire severely fouled or widely gapped spark plugs, a feature necessary to assure long spark plug life.

Conventional spark plugs obviously would not meet the 50,000-mile or 3,500-hour requirement, so annular gap spark plugs were chosen. Due to their massive electrodes, annular gap spark plugs are not affected by increasing gap size as rapidly as conventional plugs.

An additional advantage of using annular gap spark plugs is the possibility of establishing a universal heat range for plugs used on all military spark ignition engines. Tests also show they can be used with further advanced spark settings than conventional spark plugs.

The CD system under development is a basic 2-piece assembly consisting of an electronic power pack and a distributor assembly. The electronics are reverse-polarity protected so that an accidentally reversed battery connection will not cause damage.

The distributor is currently equipped with a vacuum as well as a centrifugal advance mechanism, but this will not necessarily be a requirement for the production unit. The possibility of incorporating the electronic power pack within the distributor is being investigated. To date this has not proved practical.

To keep costs down and still have a large number of test vehicles available, the system is being tested on the 4-cylinder engine used in the M151 jeep. It is designed for use on all existing 4-, 6- and 8-cylinder military spark ignition engines by altering the distributor.

To assure optimal system design, the characteristics of the electrical spark had to be determined; also, parameters of the standard ignition system had to be identified to assure that the CD system under development is superior.

To accomplish this, an M151 engine was mounted on an electric dynamometer, thoroughly instrumented and carefully calibrated. Intake air, coolant and lubricant temperatures were held constant throughout the tests to assure valid repeatable data.

Exhaust hydrocarbons, CO and CO_2 were measured during engine operation to detect poor combustion or borderline misfire. (Borderline misfire is defined here as poor burning of the fuel mixture rather than the mixture's failure to ignite. A worsening condition would eventually lead to complete misfire.) Bonuses from this instrumentation were an accurate exhaust emission graph and pollutant generation data.

Effects of spark voltage rise-time, spark duration and spark energy on performance were studied on the calibrated engine by constructing a CD system with variable spark characteristics. This was a "breadboard" system with potentiometer controls for varying rise-time, duration or energy through a predetermined range.

Initial testing revealed that even the lowest energy system (3.6 millijoules) performed as well as or better than the standard system. The test program was enlarged and from it an optimum system was selected. The spark energy was 8 millijoules, spark duration 120 microseconds, and voltage rise-time 8 microseconds. Nominal output voltage was 18 kilovolts, with an available 22 kilovolts for low-temperature starting.

Although the ignition system performance was satisfactory with spark energies in the 3.5-millijoule range, the 8-millijoule value was selected because it is well above any marginal performance area.

A higher energy was not chosen because electrode erosion must be kept to a minimum to assure the long plug life necessary for a maintenance-free system. The 120-microsecond spark duration keeps peak power at a maximum and electrode heat losses at a minimum. The 8-microsecond rise-time (2¼ KV/μS) assures a good firing capability for a fouled plug.

Once these characteristics were determined, 12 prototype CD ignition systems were fabricated. Currently they are undergoing rigorous tests in the laboratory and in the field.

Results to date show improvements

in engine performance and durability with a marginal improvement in fuel economy. The vacuum advance raises the level of exhaust emissions and apparently does not offer any significant performance advantages.

The prototype units can be operated with centrifugal advance only, as in conventional military systems, by blocking the vacuum line. Because of this factor and the added cost and complexity of the vacuum advance, production units will use only the conventional advance mechanism.

A detailed cost analysis was run on the system as applied to current vehicle densities. It shows that a maintenance-free ignition system of this type would yield a yearly saving in excess of 1.8 million dollars. If the results of tests currently being conducted are favorable, the breakerless CD ignition system could become a production item for military vehicles.

WRAIR Investigates Effects of Microwave Energy

Behavioral and physiological effects of microwave energy on human and infra-human organisms are being investigated by the Department of Microwave Research, Division of Neuropsychiatry, Walter Reed Army Institute of Research (WRAIR) in a newly initiated research effort.

In this context, "microwave" is taken to include the frequency range from 100 megahertz to 100 gigahertz (wavelength from 3 meters to 3 millimeters, respectively).

WRAIR's Chief of the Department of Microwave Research, H. Mark Grove, explained that the interest in this study originated within the Department of Defense in 1965. Concern developed at that time because of the large number of high-powered radar and communication systems being used by Armed Forces personnel.

WRAIR's Division of Neuropsychiatry was subsequently requested to design and execute a microwave study that, hopefully, will delineate behavioral and physiological effects upon personnel exposed to microwave energy in their work routines. In this action, the Department of Defense gave recognition to WRAIR's established expertise in radiation biology and experimental psychology.

In preparation for the requested study, a specialized microwave laboratory was designed and installed at WRAIR annex at Forest Glen, Md. The research project was started early in August and is scheduled to continue at least five years.

WRAIR's unique microwave facility will be utilized throughout the experiment. It will serve also as a national facility for cooperative research with the academic community, the Department of Health, Education and Welfare, and other U.S. Government agencies.

In studying microwave energy effects upon human and infra-human organisms, WRAIR uses this facility to generate microwave energy at low levels and to amplify it to the desired intensity.

The microwaves are then channeled into any or all of four animal-exposure chambers. Rats, rhesus monkeys, hamsters, cats and rabbits will be methodically exposed to varying microwave intensity levels throughout the experimental schedule.

The Division of Neuropsychiatry's interdisciplinary research team of 20 Army scientists includes neurophysiologists, mathematicians, psychiatrists, neurochemists, electronics engineers, computer specialists and experimental psychologists.

Four distinct areas of postulated microwave effects will be explored:

- Behavioral effects, such as the learning, vigilance and performance patterns of exposed animals.
- Electrophysiological effects (e.g., EEG, EOG, ECOG, and EKG).
- Neurochemical effects (e.g., interactions with important enzyme systems and central transmitters).
- Electronic and physical measurements of the interactions of microwave energy with organisms and other biological preparations and refinement of the techniques of measurement and dosimetry.

WRAIR's experimental paradigm will allow Army researchers to explore conflicting theories of microwave effects proposed by Eastern and Western countries. Mr. Grove said a flurry of microwave studies, conducted during the late 1950s and early 1960s established profound differences of opinion between Eastern and Western scientists treating microwave effects.

Specifically, Western nation researchers generally postulated such effects to be thermal. Conversely, investigators in Eastern countries have tended to concentrate on transient, nonthermal effects such as neurasthenia, fatigue and irritability.

A noteworthy divergence exists also in the respective safety levels established by these nations. The Eastern level is only 1/1,000th of the current Western standard of 10 milliwatts per square centimeter.

Upon completion of this program, WRAIR will be prepared to propose appropriate protective measures for personnel handling microwave instruments, including revisions to current operating procedures and recommended safe-exposure levels.

WECOM Appoints Brinkman as Deputy for RD&E

Appointment of John A. Brinkman as deputy director, Research, Development and Engineering Directorate, HQ U.S. Army Weapons Command, Rock Island (Ill.) Arsenal, was announced Aug. 4.

Graduated with BS and MS degrees in physics and mathematics from Michigan State University, he has pursued advanced studies in physics at California Institute of Technology.

Prior to joining the USAWECOM, he was the director of the North American Rockwell Science Center, Thousand Oaks, Calif. There he directed the planning and conduct of all research, support and administrative activities of the corporation's central research laboratory.

In addition to winning various scholarships and receiving his BS degree with honors, he has been elected to several honor societies and is a Fellow of the American Physical Society. In 1958 he organized an International Conference on "Lattice Defects in the Noble Metals" and in 1960 was a faculty member of the Fourth International School of Solid State Physics, a 3-week course at Ispra, Italy.

He has been chairman of the Radiation Damage Symposium held in connection with the Fifth International Congress for Electron Microscopy, Philadelphia, Pa., a member of the editorial board of *Radiation Effects Journal*, has authored more than 30 technical publications and has been awarded two patents.

John A. Brinkman

AMMRC Studies Impact of Erosion on Materials, Materiel

By Dr. Joseph Prifti

Environmental degradation of materials has been studied in depth—to the degree that erosion has become increasingly a major design consideration for advanced weapon systems—in a recent state-of-the-art survey by the U.S. Army Materials and Mechanics Research Center (AMMRC), Watertown, Mass.

Results of the study have provided direction to and led to expansion of AMMRC research and development activities to produce materials with improved erosion resistance. The AMMRC is a part of the Army Materiel Command. Among problem areas facing engineers and designers are:

- Sand, dust or rain erosion of aircraft, principally helicopter gas turbine engine components and rotor blades.
- Hypervelocity particle phenomenon associated with the antiballistic missile system development.
- Erosion phenomenon relative to gun-tube degradation.

U.S. Army helicopters operating in the Southeast Asia theater are experiencing particularly severe sand/dust erosion effects due to the frequency with which they must land on, take off from and hover above unprepared surfaces.

Dust particles subsequently cause erosion of helicopter rotor blades. Upon ingestion into gas turbine engines, the dust causes damage, particularly to compressor blade airfoils.

Cost of premature replacement of gas turbine engines in Southeast Asia operations attributable to this damage has been estimated as high as $150 million annually. Engine life has been cut from a normal range of 1,000 to 1,600 hours to only 300 hours (sometimes appreciably less when operating in severe sand/dust environments).

In addition to the sand/dust erosion problem, degradation of helicopter rotor blades and the high-speed aircraft radomes is caused by rain.

Another area of prime concern is the erosion of materials occurring in hypervelocity flight through dust and rain environments. This is recognized as a major barrier to the efficient operation of ultra-high-speed ballistic vehicles (interceptors, reentry, and boosters).

A dust/rain environment on the existing severe aerodynamic heating and shear conditions can substantially reduce the efficiency of a hypersonic vehicle's thermal protection system. The mechanisms of erosion and penetration generate temperature levels high enough to destroy the vehicle traveling at hypervelocities.

An understanding of particle erosion characteristics in the hypervelocity regime is fundamental to design and development of these systems.

Erosion of gun tubes has been investigated in the past, but better understanding of the erosion heat transfer mechanisms is needed to guide the development of improved materials.

The erosion problem is increasingly acute because of the need for higher rates of fire, higher projectile velocities, higher operating temperatures and greater accuracy, along with longer life of gun barrels and liners.

In attacking the Army problem areas described above, and many industrial processes requiring erosion control, considerable effort has been devoted to investigating the particle erosion phenomena and the development of materials having improved sand/dust/rain erosion resistance.

In studies of particle impingement, cavitation and abrasion, progress has been slow in developing useable mathematical models for the development of erosion-resistant materials. This has been mainly due to the insufficient basic understanding of the mechanisms that control the complex erosion process.

A limited number of models have been developed; those which have provided some insight involve ductile, deformation or cutting wear, brittle fracture or fatigue mechanisms. These relationships are functions of the impacting particles' kinetic energy, and the basic mechanical properties of the eroding material.

Recent advances, taking into account the thermal effects occurring at the impact sight, have shed additional light on the erosion process. This includes the importance of the material's thermal properties (specific heat, conductivity, and melting temperature) on erosion resistance.

The common point of agreement among these studies is that the erosion process involves a net interchange or transfer of energy and momentum from the impacting particles to eroding surface. A fraction of the particle's kinetic energy is converted into other energy forms at the impact surface.

The probable energy translations (not mutually exclusive) are: (1) localized heating of impinging particles and/or impact surface, (2) plastic deformation or cracking of impact surfaces, (3) shattering or spinning of the impinging particles, and (4) net transfer of momentum to surface.

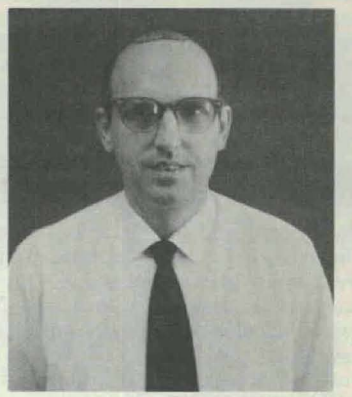
In view of the state-of-the-art concerning erosion of materials, a direct design engineering approach involves acquiring the appropriate experimental data to: (1) rank materials, (2) determine quantitative erosivity coefficients and (3) develop relationships based on environmental parameters (impact velocity, particle size, temperature, time, etc.).

Test facilities employed to determine the dust/rain erosion characteristics of materials include high velocity gas-particle jet systems, particle accelerators, whirling arms, wind tunnels, vibratory methods, ballistic ranges and rocket sleds.

To investigate the erosion effects associated with aircraft materials, gas-particle jet and whirling-arm test rigs operating in the subsonic and low supersonic flow regimes are used.

For hypervelocity erosion characteristics relevant to missile performance, particle accelerators, wind tunnels, ballistic ranges and rocket sleds are employed to develop the appropriate data to accomplish a reliable engineering design.

Unfortunately, high costs are associated with the operation of these facilities, ranging from $200–$500/specimen for low-velocity erosion (air-



DR. JOSEPH J. PRIFTI has been employed since 1967 at the U.S. Army Materials and Mechanics Research Center, Watertown, Mass., in heat transfer-fluid investigations, particle erosion phenomena of materials, and in development of personnel armor materials systems.

Dr. Prifti, 36, received a BS degree in chemical engineering from Northeastern University in 1959. Following four years of federal government service, he resumed his academic training and obtained MS and PhD degrees in chemical engineering from Northeastern in 1964 and 1967.

craft) to $2,000–$7,000/specimen for the hypervelocity erosion effects. The amount of testing is modest because of budgetary considerations.

A consensus among erosion investigators is that considerable advances can be achieved in both understanding the erosion mechanism and in the subsequent development of erosion-resistant materials by better coordination of experimental and theoretical investigations.

AMMRC's intent is to employ a materials science approach to investigate concurrently the erosion phenomena and guide the development of materials having improved erosion resistance.

AMMRC's extensive background dealing with metal, ceramic, polymeric and composite materials, and technical capability in the areas of metallurgy, metallography, electron microscopy, etc. will permit investigation of a wide variety of base/coating systems to fulfill the various Army needs for erosion-resistant materials.

AGS, Major Commands Review New OPMS Proposals

Proposed changes under a new Officer Personnel Management System (OPMS) have been submitted to the Army General Staff and major commands for review, the Department of the Army announced Aug. 3. Objectives are:

- Improve the professional and personal standards and goals of the officer corps.
- Develop an officer career management system that meets present and future Army requirements.
- Provide for the professional development of each officer in an atmosphere of constructive competitive advancement.
- Create confidence in the career management system by allowing each officer more control over his career.

Ideas proposed are the result of a study begun in Fiscal Year 1970 and are aimed at improving professionalism and job satisfaction within the Army by allowing each officer more control over his career.

The concept allows more specialization to meet the needs of the Army, by providing increased utilization of individual skills, aptitudes, interests and desires, and by maintaining equitable promotion opportunities.

If the proposals are accepted the present system of designating some military occupational specialties (MOSs) as "branch immaterial" would be abolished. Responsibility for individual MOSs would be assigned to individual career branches or branch groupings and related MOSs would be grouped to establish career fields.

Upon promotion to major, officers would be tentatively identified for further development as commanders or staff officers. Formal command or staff identification would be accomplished in conjunction with selection for promotion to lieutenant colonel and colonel.

A new "specialist" career branch would be established to manage officers pursuing careers in the areas of computer science, information, comptroller, research and development and operations research and systems analysis.

The Army promotion list would be divided into competitive groupings of related branches, with equitable promotion opportunities afforded to each.

Ongoing efforts to improve the officer evaluation system are being incorporated into OPMS. A new performance report is due for field testing in August and September.

The OPMS concept now being circulated envisions a long-range, gradual implementation to insure a smooth transition from the present to the proposed concept. Additionally since the concept is now in its initial staffing and since many of the proposed changes are highly controversial, substantial changes may be made before a final concept is ready for approval.

Brig Gen Fimiani Assigned as SAM-D Project Manager

SAM–D (Surface-to-Air Missile—Development) System advanced development activities are now the responsibility of Brig Gen Joseph C. Fimiani. He has succeeded Col James C. Miller Jr. as project manager at HQ Army Missile Command, Redstone (Ala.) Arsenal.

MICOM Commanding General (Maj Gen) Edwin I. Donley announced that Col Miller is reassigned as chief of staff to succeed recently retired Col Eugene J. McGinnis. Col Miller was SAM–D P.O. for 42 months.

The SAM–D project office staff of approximately 100 government civilian employes and military personnel is based at Redstone Arsenal. Brig Gen Fimiani reports directly to General Henry A. Miley, CG of the U.S. Army Materiel Command.

Formerly an enlisted man, General Fimiani, 50, has specialized in air defense artillery since he started missile work with the Nike Ajax in 1952. He commanded a Hawk battalion in Korea in 1961–62 and an Artillery Group (Air Defense) in Vietnam in 1967–68. His new assignment follows two years as director, Air Defense Directorate, Office of the Assistant Chief of Staff for Force Development, HQ DA.

Graduated from Officer Candidate School in 1942, he served during World War II in air defense units in North Africa, Sicily, France, Belgium and Holland.

Graduated from Rensselaer Polytechnic Institute with a bachelor's degree, he has a master's degree in government administration from George Washington University and has worked for a doctorate in public administration at American University. His military education includes the Officers Guided Missile Course, the Command and General Staff College and the Army War College.

Brig Gen Joseph C. Fimiani

HISA Established at Picatinny

HQ U.S. Army Munitions Command (MUCOM) at Picatinny Arsenal, Dover, N.J., and tenant activities are being served by a recently established Headquarters and Installation Support Activity (HISA).

Major elements of the new activity are facilities engineering, internal security, administrative services, morale and welfare, communications electronics, equipment management, post transportation and station supply and stock control.

The organization is made up of Picatinny's Installation Support Office, Security Office, and Staff Services Office elements.

The reorganization is part of the Army Materiel Command's standard Commodity Command and Commodity Center concept. Similar HISA operations have been or are being established at each of AMC's major subordinate commands.

The Picatinny Arsenal commander also heads the HISA.

DRRI to Begin First Class At Patrick AFB in October

The Defense Race Relations Institute (DRRI), recently established at Patrick Air Force Base, Fla., will begin instructing the first class of about 100 students in October.

Primary purpose of the program is to train Armed Forces personnel as instructors to help achieve a more harmonious relationship among all military personnel so that organizational efficiency and combat readiness will not be impaired by racial unrest, tension or conflict.

Army Col Edward F. Kries, who holds a doctorate in social welfare from the University of Chicago, is director of the Institute. Air Force Col Claude Dixon is deputy director.

TACOM Seeks Improvements in Army Transportation System

By Roger Gay

Today's Army is dependent on a complex transportation system for initial deployment of the men and material necessary to military operations, and for supply of the vast quantities of goods consumed.

The U.S. Army Tank-Automotive Command (TACOM), Warren, Mich., is playing a major role in efforts to improve Army line-haul capability.

In most military operations conducted to date, preparation and deployment time for Army forces has involved several months; however, recent planning has indicated the necessity for speeding up this process.

To provide military commanders with the flexibility necessary for large-scale maneuver tactics, the transportation system must now be capable of moving large quantities of goods to any point on the globe within hours. These movements must be made without prior knowledge of the exact time or destination.

In addition to this requirement for increased speed and flexibility, the resources with which to accomplish the job are increasingly restricted. Military costs are being reviewed at every level with the basic objective of providing required increases in capability through greater effectiveness rather than additional cost. Besides the dollar costs, the public clamor for an end to the draft is placing great emphasis on the reduction in manpower requirements. The combination of these factors reflects in the classic motto—"Do more with less."

The basic line-haul mission involves all bulk movement of goods not accomplished by the using units with their own vehicles—such as artillery units which return to supply points to obtain their own ammunition resupply, as opposed to having it delivered by a transport truck.

The primary difference between the Army line-haul mission and a public common carrier is the lack of predictability in either the destination or the quantity and type of goods.

The TACOM Mass Transport Vehicle Program is based on two predictions. First, the Army's present line-haul vehicles will not use the full potential of future unitized loads. Second, a more cost-effective line-haul transport system is feasible and practical.

The Army's basic line-haul capability for resupply is in the form of medium truck companies. Each company has, as its mission vehicles, 60 tractor/semitrailer combinations. The basic type company has 5-ton M52 tractors and 12-ton M127 stake and platform semitrailers. In addition, there are separate companies equipped with 5,000-gallon fuel tank semitrailers and 7½-ton refrigerated van semitrailers.

The current TACOM program for investigating the potential increase in capability and effectiveness consists of five separate study areas.

Load Rating. The first obvious area is the load rating of the individual truck. The present rating came into being rather arbitrarily during World War II as the maximum capacity which could be readily produced in large quantities.

The vehicle drivers represent approximately two-thirds of the total cost; thus any increase in capacity will result in a significant cost savings for those operations where the full capacity can be utilized.

Since the transport vehicle operates primarily on available road networks, a study was initiated to determine the capacities of roads throughout the world. This study involves identification of both legal and physical limitations for the roads.

The necessity for the Army to recognize the legal limits is sometimes questioned. However, as long as we class ourselves as "the guys with the white hats," we must recognize the rights of the local governments, especially during peace-keeping or limited-war type operations.

Further, the legal limitations are frequently the only indication available and they generally correlate with

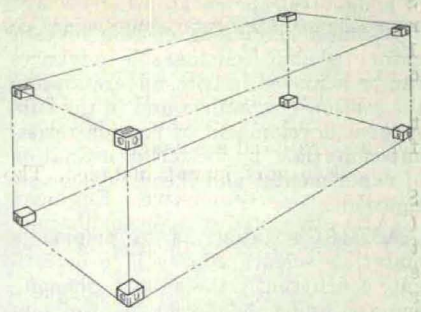


Fig. 2. System of 8 Points in Space

the design criteria used in road and bridge construction.

The study is not yet complete but indications are that a 70,000–75,000 pound gross weight will be practical for a 5-axle unit. This would permit payloads to be increased about 20 percent. It should be noted that this does not indicate an error in the previous load rating; it is a result of the general upgrading of the world's road networks.

Unitized Loads. The next area being addressed is the impact of unitized loads on the total transportation system. Technically, a unitized load is any packaging of smaller packages into a larger unit to facilitate handling. Thus, a 6-pack of beer is probably the most common unitized load. However, in considering the impact on military trucks, only the larger units are of significant interest.

Several different type containers and pallets are presently in the military system and many more have been proposed (Fig. 1). The basic limitation of most systems is that they are designed for only one or two modes of transport.

For example, 40- by 48-inch pallets are essentially too small to be considered unit loads for either air or sea transport because present goals for turn-around time cannot be met with these small packages.

The CONEX box was designed for the World War II Liberty ships but is usable on trucks. The Air Force 463L pallet system is optimized for aircraft and must be loaded, unloaded and transported at an airhead. Semitrailer vans are suitable only for roll-on/roll-off ships, piggy-back rail movement in the United States, and general road movement.

The new container standards are offering a solution to these problems. The American Standard Association issued the MH5.1 initial standard in 1965. The American Standard Association is now known as the American National Standards Institute (ANSI).

Concurrent with the U.S. national

	In Use	
Pallets:	NATO (40 in. x 48 in. and 32 in. x 40 in.)	
	Air Force 463L (88 in. x 108 in.)	
Containers:	CONEX (Two Types)	
	ISO Standard 8 ft. x 8 ft. x 20 ft.	
	Various Specially Configured Air Cargo Containers	
	Proposed	
	TRICON Container (ISO Standard 8 ft. x 8 ft. x 6-2/3 ft)	
	ISO Standard 8 ft. x 8 ft. x 10 ft.	

Fig. 1. Military Unitized Load Configurations

standardization, efforts to establish worldwide standards were conducted by the International Organization for Standardization (ISO). The basic ISO recommendation was published in 1968 with the approval of 20 member countries.

These two standards provide essentially identical standard containers for land, rail and sea usage.

Air transport is not included. The Society of Automotive Engineers (SAE) attempted in 1968 to eliminate this deficiency by publication of Aerospace Standard 832. This provides for air-transport containers dimensionally interchangeable with those of the other two standards. The degree to which they are suitable for land, rail and sea transport is dependent on options exercised within standard.

In all three standards, the height and width are both 8 feet, and the length is varied. Lengths of 10, 20, 30 and 40 feet are specified in each standard. Other size options (5- and 6⅔ foot) are available only in the ISO and ANSI standards. Of all the sizes, the 20-, 30- and 40-foot lengths have proved most popular.

While the standards refer only to van-type containers, the basic principle permits an enlargement of the concept from the basic cargo-carrying role. Commercial industry has developed containers for all types of cargo. Open gondolas, refrigerated vans, tankers, livestock and auto transport containers have already seen service.

Refrigerated and liquid container configurations are of special military interest. However, the real potential is realized when the standards are visualized as a system of eight points in space (Fig. 2) which provide for a universal interface with all forms of transport and materials-handling equipment.

Each of the eight corner fittings provides for engagement on any of the three exposed faces for handling, supporting or restraining the container module. All types of military equipment could be manufactured to the interface standards. This would permit maximum speed and flexibility in deployment, using both civilian and military modes of transportation.

In this area, proposals have been made to mount field kitchens, radar units, maintenance shops, missile-firing units, field hospitals and even a complete shower and latrine in standard container-size units.

Fig. 4. End-loading Test Unit

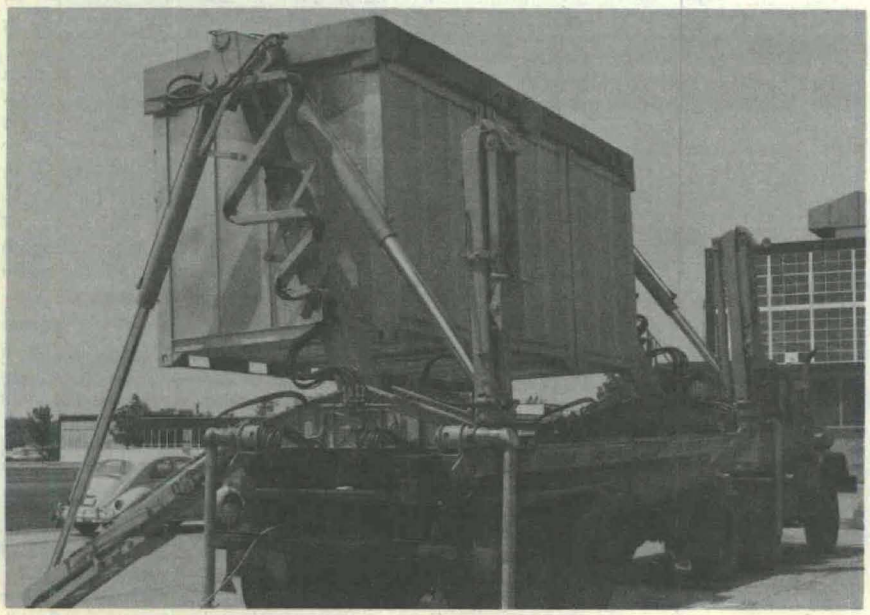


Fig. 3. Side-loading Semitrailer

Self-Loading. The Army is operating a fleet of containers and special trailer chassis in a pilot operation between the West Coast and Southeast Asia. The container remains on a semitrailer chassis except when on board a ship.

This approach requires a relatively larger number of specialized semitrailer chassis. For this reason, TACOM is involved in a third important area of study: that of evaluating potential approaches to provide self-loading and unloading capabilities for the trucks.

This concept would eliminate the necessity of having a large fleet of semitrailer chassis and could provide self-unloading capabilities for other types of cargo as well.

Two basic approaches to self-loading are being evaluated. Side-loading is represented in a commercial semitrailer built by a German manufacturer (Fig. 3). The second is an end-loading approach and a test unit has been fabricated under TACOM's direction (Fig. 4).

One of the prime considerations in design of this unit was that it should be capable of all missions currently performed by the existing semitrailer. This includes all interfaces with existing or proposed material-handling equipment (MHE).

Each concept design is capable of loading not only the ISO container, but also all other types of loads within the size and weight limits of the truck.

The self-loading and unloading concept should not be confused with the material-handling equipment function. What TACOM is proposing

(Continued on page 66)

TACOM Seeks Improvements in Army Transportation System

(Continued from page 65)

is to free the truck from dependency on the MHE for turn-around time. The form of unloading envisioned will still require MHE to sort, stack and store the container and its contents.

The savings will be based on truck turn-around time. Any reduction in MHE requirements would be a secondary benefit. The dependency on MHE is becoming increasingly critical as the size of the unit loads is increased. The number of MHE units is decreased when a large unit replaces several smaller ones, and the potential field expedients are reduced as the load increases.

The success of studies in the areas of unit loads and self-loading would permit the fielding of a vehicle in which turn-around time is no longer dependent on MHE or prepositioned semitrailers.

Pilot cost studies have indicated this one basic change could make possible a savings in operating costs for the Army of about $5 million annually through increased utilization of fewer trucks.

Power Level. While the first three areas are being investigated primarily to take advantage of new technology, another area is becoming critical from a legal standpoint. The power level of the Army's current line-haul trucks is below some of the presently recommended minimums.

In 1972, a new German law takes effect, requiring eighty horsepower per ton for all on-road vehicles. Compliance with this law will necessitate a significant power level increase of U.S. Army trucks.

While the German law is presently an isolated case, similar requirements are being imposed by other governments, domestic and foreign, to reduce congestion caused by slow-moving vehicles.

Mobility. The last TACOM transportation system study area is the potential improvement in mobility. Past studies of high-mobility vehicles have considered trailers as a hinderance to mobility. However, when the trailer wheels are powered, a tractor/semitrailer combination becomes an articulated, all-wheel-drive vehicle.

Early studies in this area considered relatively complex systems for providing this power. TACOM is now evaluating a simple hydrostatic drive system that delivers trailer axle power from the tractor engine. This system operates only in the lowest gear range, since this is where the highest mobility is required.

Data obtained from this testing will establish the performance capabilities of such a system. The next step will be to determine the desirability of such an improvement as compared with cost.

The five study areas—payload increase, unit loads, self-loading, power requirements, and mobility—are to a large extent independent. They may result in independent or coordinated changes in the line-haul vehicle fleet.

Probably the most significant study area is the combined impact of large unit loads and self-loading trucks. Caution must be exercised in this area. Many revolutionary systems can be visualized, but the line-haul vehicle for the near future will have to interface with all of the present transportation and material-handling equipment.

Any transition to a new system will require more than a decade. During this transition, the truck will have to interface with all new and old transportation materials-handling systems.

Roger R. Gay graduated from the Illinois Institute of Technology with a bachelor's degree in mechanical engineering and is studying business administration at Michigan State University. He is a registered professional engineer in the State of Michigan.

With the Ford Motor Co. Scientific Laboratory he worked on development of free-piston engines. While in the Army he was assigned to test missile control systems. With the U.S. Army Tank-Automotive Command since 1958, he has served as technical director of system formulation studies, and has played a major role in advanced development engineering efforts in transport vehicles.

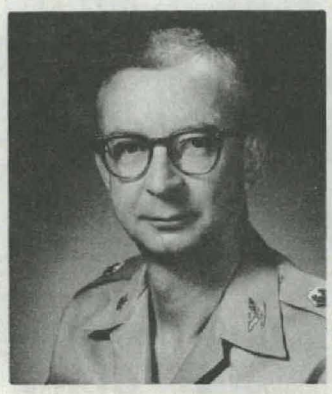
Currently acting as chief of a task force developing a tracked carrier for the SAM–D missile system, he holds one patent in the area of vehicle floalation techniques. Several of his technical papers on heavy-equipment transporters and statistical techniques for measuring cross-country vehicle speed have been published.

Templeman Directs Procurement, Production

Col (Brig Gen designate) James M. Templeman is the new director of Procurement and Production, HQ Army Electronics Command, Fort Monmouth, N.J.

Col Templeman, who recently commanded the 7th Signal Brigade in Mannheim Germany, was at HQ ECOM as project manager of the Army Area Communications Systems (AACOMS) project from 1965 to 1967. This is his sixth tour at Fort Monmouth, where he was commissioned from OCS in 1943.

He has served assignments at Pirmassens, Germany, at the STARCOM relay station, and with the G–1, United States Army in Europe at Heidelberg. As commander of the 560th Signal Battalion at Vicenza, Italy, in 1961–62, he worked with Italian Army officials in the laying of a radio relay system through the Dolemite Alps.



Col James M. Templeman

In 1963 he was assigned to the J–6 Directorate, Office of the Joint Chiefs of Staff in Washington, D.C., later went to HQ ECOM as AACOMS project manager, and in 1967–68 was adviser to the Vietnamese J–6, Joint General Staff, and the Vietnamese Chief Signal Officer.

Col Templeman has a BS in electrical engineering, a BA degree in mathematics and master's in physics, all from the University of Washington. He has graduated from Command and General Staff College, Armed Forces Staff College, and National War College.

DoD Establishes Security Assistance Agency, Council

Responsibility for increased emphasis on management and control of the Department of Defense portion of President Nixon's new International Security Assistance Program is vested in two new agencies.

Secretary of Defense Melvin R. Laird announced that the function of the Defense Security Assistance Agency (DSAA) is to administer all approved DoD Security Assistance Programs. The new Defense Security Assistance Council is charged with advising him and coordinating such activities within the DoD.

The DSAA director has responsibilities as a deputy under the Assistant Secretary of Defense (International Security Affairs). This will permit him to participate in policy formulation and recommendations, to control administration of approved programs, and serve as secretary to the Defense Security Assistance Council.

Chaired by the Assistant Secretary of Defense (ISA), the council includes representatives of the Joint Chiefs of Staff, the Director of Defense Research and Engineering, the Assistant Secretary of Defense (Installations and Logistics), the Assistant Secretary of Defense (Systems Analysis), and the Director of the Advanced Research Projects Agency.

Present roles of the Joint Chiefs of Staff, the ASD (ISA) and the commanders of unified commands will remain essentially unchanged.

In accordance with statutory responsibility, the Joint Chiefs will continue to provide directly to the Secretary of Defense military advice on security assistance matters; also, to correlate security assistance planning with U.S. military force planning and security objectives.

The Joint Chiefs will participate in formulation of Security Assistance Programs and will conduct evaluations of the effectiveness of such programs in relation to the security interests of the United States. The ASD (ISA) will formulate comprehensive DoD security assistance programs and provide the DSAA director policy direction and staff supervision.

Commanders of unified commands will retain military command over the Military Assistance Advisory Groups, which are authorized to deal directly with the DSAA on approved program administration and implementation.

Woman Heads New Programs Of EPA for Noise Control

Army R&D installations concerned with problems of noise control and abatement, as part of the over-all military antipollution program, can now work with a nationally known leader who has joined the staff of the Environmental Protection Agency.

EPA Administrator William D. Ruckelshaus announced July 24 the appointment of Elizabeth Cuadra as one of two deputies to Alvin F. Meyer Jr., who heads the newly established EPA Office of Noise Abatement and Control (ONAC). She will be responsible for the development of new programs.

EPA's noise control activities were established by the 1970 amendments to the Clean Air Act and the office was organized in April 1971. The ONAC is authorized to conduct a broad research program in all aspects of noise pollution, evaluate noise aspects of the Environmental Impact Statements, and hold public hearings and demonstrations.

Mrs. Cuadra has been a senior research and consulting specialist in acoustics at Wyle Laboratories, El Segundo, Calif. Her areas of specialty involved aircraft, transportation and community noise problems and architectural and legal control of noise.

In the American Institute of Aeronautics and Astronautics and the Acoustical Society of America she has served as chairman of the Los Angeles Regional Chapter 1970–71. Mrs. Cuadra is also a member of a number of conservation groups.

DoD Announces Two Appointments as DASD (ISA)

Deputy Assistant Secretary of Defense duties were assumed Aug. 3 by Lt Gen George M. Seignious II, U.S. Army, and Lawrence S. Eagleburger.

General Seignious heads Military Assistance and Sales, Office of International Security Affairs, filling a vacancy left by the July 1 retirement of Lt Gen Robert H. Warren, U.S. Air Force. Eagleburger became head of ISA Policy, Plans and National Security Council Affairs, succeeding Robert J. Pranger, now enrolled in the American Enterprise Institute for Public Policy Research.

Assigned until recently as U.S. Commander and Deputy Chief, U.S. Mission, Berlin, Germany, General Seignious earlier commanded the 3d Infantry Division, U.S. Army Europe, and the Seventh Army.

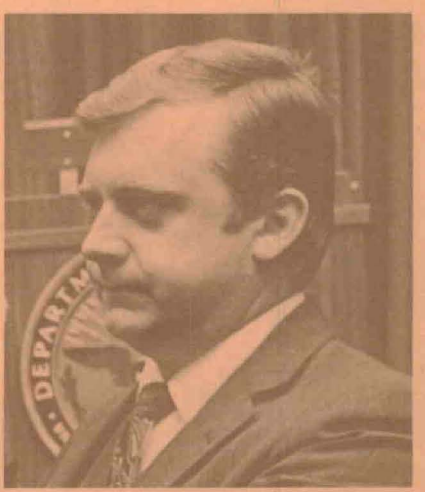
High points in his distinguished career include assignments as deputy director, Plans and Policy Directorate (J–5), The Joint Staff, Office of the Joint Chiefs of Staff, Washington, D.C., and director, Policy Planning Staff, Office of the Assistant Secretary of Defense (ISA).

General Seignious graduated from The Citadel, Charleston, S.C., and the National War College. His military honors include the Distinguished Service Medal, Silver Star, and Legion of Merit with three Oak Leaf Clusters.

Credentials of Eagleburger for his new duties include assignments as special assistant, National Security Council Staff, the State Department's Foreign Service Institute, and (1969 to present) counselor for political affairs, U.S. Mission to the North Atlantic Treaty Organization in Belgium.

His career has included service as an economic officer at Belgrade, Yugoslavia, and with the State Department's Bureau of Intelligence and Research, Washington, D.C. He joined the Foreign Service in 1957 after teaching political science in 1956–57 at the University of Wisconsin, from which he has BS and MS degrees.

Lt Gen George M. Seignious II



Lawrence S. Eagleburger

Tri-Services Honor MIT Achievements in Military Electronics R&D

Testifying proudly to Massachusetts Institute of Technology's quarter-century of "outstanding achievements" in military electronics research and development is a handsome wall plaque signed recently by the Army, Navy and Air Force Assistant Secretaries (R&D).

Signatures of Robert L. Johnson (Army), Robert A. Frosch (Navy) and Grant L. Hansen (Air Force) credit the significant research achievements through the Joint Services Electronics Program (JSEP) to the MIT Research Laboratory of Electronics.

"MIT's scientific advances during this period have greatly enhanced our national security, our civilian economy, and our scientific knowledge, in a spirit that truly reflects the best traditions of a great university," the plaque proclaims in part.

MIT's Silver Anniversary was duly observed at a banquet at which the plaque was presented to Prof. Henry J. Zimmerman, director of the Research Laboratory of Electronics (RLE). Dr. Hans K. Ziegler, chairman, JSEP Technical Advisory Committee and Army Electronics Command chief scientist, made the award.

Developed in 1946 out of the mutual interests of physics and electrical engineering, the RLE soon encompassed the fields of chemistry, mathematics, computer sciences, and bioelectronics.

Spurred by a number of imaginative military and civilian scientists who felt that ending of World War II in 1945 might bring about a termination of U.S. Government support for academic research in electronics, various agencies of the Armed Forces stepped into the breach and undertook the sponsorship of basic research.

RLE, in particular, owed its first major and continuing support to this foresight and initiative. In March 1946, a contract was drawn up providing for joint support of RLE by the Army, Navy and Air Force.

The U.S. Army Signal Corps was chosen as the administering agency, and to this date the U.S. Army Electronics Command administers the RLE contract.

The task statement amounted to a very broad interpretation of the term "electronics." Designed to insure that the studies carried out would be relevant to the interests of the supporting services, the statement declared:

"MIT, through its RLE, shall undertake a program of research with a view extending the useful range of the electromagnetic spectrum."

The area of responsibility was from the region at that time exploited by ultrahigh-frequency techniques, through that employed by microwave radar and communications systems, to a region of shorter wavelengths, approaching ultimately that of infrared radiations.

"It is contemplated," the charter statement declared, "that this program shall include the following, but may be extended to related studies as may appear desirable:

1. A search for useful generators of power at frequencies falling within this designated range, including their modulation and control and a study of the theory of their operation;

2. Research on basic components and techniques necessary for the practical utilization of this region of the spectrum, including circuits and instrumentation;

3. A study of the spectroscopy of the region, including propagation and absorption, and in general the interaction of electromagnetic fields at such frequencies with solids, liquids, and gases;

4. The conversion of electromagnetic energy to sonic vibrations at these frequencies and the employment of such vibrations as a tool for further studies of structure of matter."

RLE has grown from a personnel complement of 150 in 1946 to about 700 at the present time. RLE research has resulted in more than 600 technical reports and 1,100 journal articles. Results have proved valuable to both the military and the industrial sectors.

Enumeration of the many RLE research contributions that have had military applications necessarily must be limited to a few examples.

A classic paper with a "negative" result saved the military countless dollars by pointing out the limitations of "super-gain" antennas.

Contributions to the theory of beam-shaping antennas and helical antennas have had important applications. Work on microwave filters examined the possibility of broadband impedance matching.

Pioneering work was done on such diverse topics as ionospheric communication, missile guidance, phased-array antennas, and atomic clocks.

Contributions to signal detection in the presence of noise have been acclaimed as exceedingly important in military and commercial applications.

PARTICIPANTS during plaque presentation, testifying to Massachusetts Institute of Technology's outstanding achievements in military electronics R&D, include (from left) Dr. J. B. Wiesner, president of MIT; Prof. H. J. Zimmerman, director of the MIT Research Laboratory of Electronics; Dr. H. K. Ziegler, chairman of the JSEP Technical Advisory Committee and ECOM chief scientist; and Prof. A. G. Hill, vice president of MIT.

Early work in communications included trans-Atlantic frequency-modulation tests. Results led to substantial improvements in FM receiver design, special-purpose analog and digital computers, work in tropospheric and ionospheric scatter techniques, and theory of sequential switching circuits.

Major contributions were reported in development of the statistical approach to communication theory, and in information and coding theory.

In environment of active research on communication theory and advanced electronic instrumentation techniques, the stimulus provided by the late Norbert Wiener encouraged the initiation and growth of research related to living systems.

Work was done also on simple automata, possibilities of human sensor augmentation or replacement and measurement techniques were developed to study neuroelectric signals.

In each of these areas, RLE has made continuing contributions and has had a part in stimulating similar work in other laboratories.