ARMY RESEARCH AND DEVELOPMENT

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167 In-House Scientists Listed as Authors Of 96 Army Science Conference Papers

Ninety-six narrative summary proposals for technical papers, involving 167 authors and coauthors, have been selected from 428 submissions by aspirants to the distinction of presenting their Army-in-house laboratories research results at the Fifth Biennial Army Science Conference.

The "tradition" of holding the conference at one of the Nation's proudest centers for traditions of excellence—the United States Military Academy at West Point, N.Y.—will be continued. The conference dates are June 14-17, 1966.

As in previous years, some 500 of the Army's leading in-house scientists, engineers and technical directors, scientific management personnel from other Federal R&D agencies, and representatives of the ABCA Standardization Program allies — Great Britain, Canada, Australia and the United States—are expected to participate.

(Continued on page 2)

DoD Assigns Task Force For Integrated Thesaurus Of Scientific Terminology

Department of Defense action to compile a technical thesaurus of terminology to be used in all scientific information activities is newly assigned to a 14-man DoD task force. The Scientific and Technical Information Division, Office of the Chief of Research and Development, has been designated as the Department of the Army contact point.

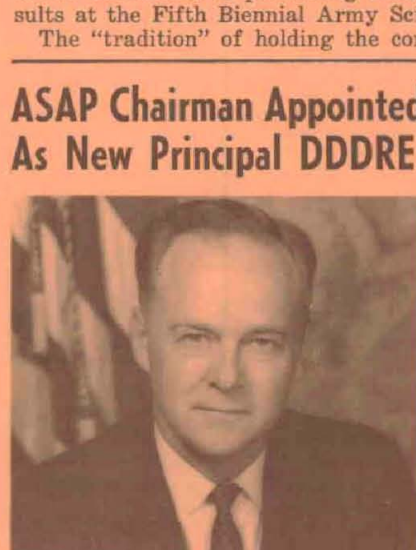
Overall coordination and contact point responsibility for the project is assigned to the Office of Naval Research, which will establish a full-time work force to accomplish the task in accordance with a schedule extending to April 1967. The completed thesaurus will become a part of the Data Elements Standarization Program.

The action setting up the task force was initiated by an Oct. 12 memorandum issued by the Director of Defense Research and Engineering. Addressees included the Secretaries of the Army, Navy and Air Force; also, the Assistant Secretaries of Defense for Comptroller, Installations and Logistics, and Systems Analysis.

The memorandum also was directed to the Advanced Research Projects Agency (an element of the Office of

(Continued on page 3)

ASAP Chairman Appointed As New Principal DDDRE



Dr. Finn J. Larsen

President Johnson has announced appointment of Dr. Finn J. Larsen as Principal Deputy Director of Defense Research and Engineering. See story on page 52.

3 Top Officials Evaluate Army Combat Readiness

Secretary of the Army Stanley R. Resor, Chief of Staff General Harold K. Johnson and Vice Chief of Staff General Creighton W. Abrams gave featured addresses at the recent 11th annual meeting of the Association of the U.S. Army (AUSA) in Washington, D.C.

Keynote speaker, Secretary Resor, reviewed the United States mission in Viet Nam and performance of U.S. Army troops there, current combat readiness of other Army forces, the

(Continued on page 5)

High Army, DoD Officials Review Nike-X Progress

Nike-X antimissile missile development, which at nearly $400 million is the Nation's highest-funded Army R&D program this fiscal year, recently was reviewed by top Department of the Army officials.

Assistant Secretary of the Army (R&D) Willis M. Hawkins headed the representatives from the Department of Defense, Department of the Army and Nike-X contractors who assembled at Winston-Salem, N.C., for the annual review conference.

Being developed by the Army to provide a defense against ICBMs and submarine-launched ballistic missiles, Nike-X system is in engineering development. Tests are being conducted currently on various components. Col I. O. Drewry is project manager.

Keynoting the conference was Lt Gen Charles B. Duff, CG of the Army

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Featured in This Issue . . .

Fifth Anniversary Edition

This consolidated December-January edition marks the fifth anniversary of the establishment of the Army Research and Development Newsmagazine.

Reader demand for the publication, as certified by submission of Department of the Army Form 12-4 to the Office of the Adjutant General, supplemented by public sales through the Superintendent of Documents, U.S. Government Printing Office, recently reached a peak of more than 38,000 copies monthly.

The editorial staff has received many letters of commendation from high-ranking R&D officials and from readers, but the most gratifying indication of broad approval continues to be the increase in distribution.

To the many persons who have contributed to the success of the Newsmagazine by submitting interesting material, the staff gives HEARTY THANKS and to all readers conveys wishes for A MERRY CHRISTMAS AND HAPPY NEW YEAR! PEACE BE WITH YOU!

Army R&D Newsmagazine

Vol. 7, No. 1 Dec. '65-Jan. '66

Editor .... **Clarence T. Smith**
Associate Editor ..... **George J. Makuta**
Assistant Editor ..... **Joseph R. Weikel**
Assistant Editor .... **Read Wynn**

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

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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 Specialist Programs and to members of the U.S. Army Reserve R&D Unit Program. Otherwise, distribution is made only to the Army installation, office or organizational element to which the requester is assigned.

CHANGES OF ADDRESS for AE and R&D Officer Specialist Program enrollees should be addressed to: Specialist Branch, ECP, OPD, Office of Personnel Operations, Department of the Army, Washington, D.C. 20315. Reserve R&D Unit members should contact: Special Assistant for Reserve Affairs, OCRD, Department of the Army, Washington, D.C. 20310.

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

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

167 In-House Scientists Listed as Authors

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For the first time, the practice of inviting four eminent scientists to present papers as guests (not eligible for consideration for the numerous prizes that will be awarded for the best technical papers) will be abandoned in favor of a panel discussion on a controversial subject of broad interest to the public as well as the Army.

This new approach to the objective of generating maximum interest in a general assembly session will call for the selection of a panel of recognized experts in their respective fields.

Accommodations for the general assembly sessions and the banquet at the Military Academy, as well as the number of rooms available at the Hotel Thayer, naturally limit participation in the conference to about 500 persons. To facilitate planning arrangements this year, reservations will be open to all in-house Army scientists and engineers on a first-come, first-served basis, rather than on the basis of quotas for major commands.

One of the innovations this year is the selection of 14 supplemental technical papers in addition to those now scheduled for presentation. This change is intended to provide a reserve should any of the selected papers be withdrawn, and also to broaden the recognition of papers that judges considered meritorious.

The 428 narrative summary proposals submitted to judges who made the final selection is not truly indicative of the high degree of interest among in-house research personnel in being chosen to report on their work at the Army Science Conference. Preliminary screening of summaries within the Army Materiel Command, Office of The Surgeon General, and Office of the Chief of Engineers eliminated about 60 percent of the prospective authors.

The purpose of the conference, sponsored by the Chief of Research and Development through the U.S. Army Research Office, is to disseminate information on significant progress in Army research; also, to stimulate integrated, coordinated effort toward the goal of minimizing duplication or overlapping of activities, through such communication, in the interest of economy.

Discussions on the papers presented serve also to promote closer rapport among scientists, engineers and management personnel, as well as to stimulate pride in Federal Civil Service scientific careers by recognition of achievement that focuses attention on the importance of maintaining a strong in-house research capability.

Dr. Harold C. Weber, Chief Scientific Advisor to the Chief of Research and Development, will be the presiding chairman, a role he has filled without a break since the Army Science Conference was initiated. Dr. Richard A. Weiss, Deputy and Scientific Director of Army Research, is general chairman and the United States Military Academy project officer is Lt Col C. A. Mitchell.

The panel of judges which selected the technical papers consisted of Dr. Weiss, Army Materiel Command Chief Scientist Dr. Craig M. Crenshaw, Dr. G. G. Quarles, Chief Scientific Advisor of the Office of the Chief of Engineers, and Col Ervin C. Plough, Office of The Surgeon General.

Information on the number of awards and the total of cash honorariums involved was not available as this publication went to press. For every Army Science Conference held to date, the Association of the United States Army has contributed the prizes for military authors and the civilian authors have been recognized through the Department of the Army Incentive Awards Program.

In 1964 the awards totaled $3,800, including two of $750 each, three of $500 each, and lesser awards distributed among a total of 20 authors and coauthors. Certificates of Achievement signed by Assistant Secretary of the Army (R&D) Willis M. Hawkins and the Chief of Research and Development Lt Gen William W. Dick, Jr., also recognized authors of the winning papers.

The trend toward multiple authorship, showing the growth of team effort as opposed to individual effort in Army in-house laboratories, is reflected in selection of this year's papers. The teams include 21 pairs, 11 trios, eight quartets and one quintet.

The Army Materiel Command submitted 334 narrative summaries, from which 76 were selected for presentation and nine were placed in the supplemental list. Seven of the 26 narrative summaries offered by the Office of The Surgeon General were selected for presentation and two made the supplemental list. The Office of the Chief of Engineers turned in 43 summaries, nine of which were chosen for presentation

(Continued on page 56)

Nike-X Manager Wins AIAA 1965 Toftoy Award

Col Ivey O. Drewry, Nike-X project manager, is the first military official to receive the Holger N. Toftoy Award presented annually by the American Institute of Aeronautics and Astronautics (AIAA).

Named for retired Maj Gen Toftoy, a former commanding officer of Redstone Arsenal, Ala., the honor and accompanying trophy for outstanding missile project management went to civilians in 1963 and 1964.

Carl Pinyerd, 1964 winner as deputy project manager of the Pershing system, presented the 1965 award to Col Drewry at Headquarters, Army Missile Command (MICOM), Redstone, Ala.

The Nike-X project is the Army's highest-funded R&D program, totaling nearly $400 million this fiscal year. The missile system is being developed as a defense against intercontinental and submarine-launched ballistic missiles.

Col Drewry, an Army officer for 25 years, went to Redstone Arsenal in 1962 from duty in Korea to head the Nike-Zeus antimissile-missile project, forerunner of Nike-X.

Under Col Drewry's direction, the Nike-X project has developed a huge, multiple function phased-array radar, the first of its kind in the Free World, and a high acceleration guided missile for defense purposes.

The Nike-X project office has 300 employees at Redstone and nearly 100 more at other locations, including Kwajalein Test Site in the Marshall Islands.

The AIAA also honored three civilians at the 1965 Alabama meeting:

Lloyd Johnson, former MICOM employee, received the 1964 Martin Schilling Award for his contributions to the Alabama Section of AIAA as editor of the newspaper, *The Explorer*, for four years.

NIKE-X PROJECT MANAGER Col Ivey O. Drewry receives the Holger N. Toftoy Award from 1964 winner Carl Pinyerd at Redstone Arsenal, Ala.

Dr. William Lucas of the Marshall Space Flight Center received the Herman Oberth Award for his contributions in aeronautics and astronautics.

A special award was given to Dr. Walter Dornberger in recognition of his participation in the German rocket research programs.

Watervliet Scientists Report On Materials Properties Study

Results of basic research studies on properties of materials—the effect of loading times as short as one-thousandth of a second—were reported recently in a paper prepared by two Watervliet (N.Y.) Arsenal employees.

"Effect of Strain Rate on Yielding in High Strength Steels" was presented at the annual national meeting of the American Society of Mechanical Engineers (ASME), Nov. 8-11. The paper was prepared by Thomas E. Davidson, chief of the Physical and Mechanical Metallurgy Laboratory, and David P. Kendall, project engineer in the Laboratory.

DoD Assigns Task Force for Integrated Thesaurus

(Continued from page 1)

the Director of Defense Research and Engineering), the Defense Atomic Support Agency, Defense Communications Agency, Defense Intelligence Agency, Defense Supply Agency, and National Security Agency.

Scheduled for issuance in April 1967, the Department of Defense scientific thesaurus will constitute a consolidation of all scientific and technical information terminology, currently in use, plus many added terms. It will be used by all DoD elements, and their contractors, engaged in research, development, engineering, design, procurement, supply and maintenance.

The thesaurus will focus on terms and concepts essential to the storage and retrieval of information or data. It will be designed to provide:

- Definition or scope notes showing the uniqueness of each term, its generic relationship with others, and appropriate cross reference.
- Orderly arrangements in natural language that will afford rapid and straightforward approaches for different kinds of usage.
- Relationship of the whole to the Committee of Scientific and Technical Information (COSATI) Subject Category List. (The COSATI list was issued by the Committee of the Federal Council for Science and Technology in December 1964, as the official Government-wide technical vocabulary for document announcement, security control, and management reporting.)
- Codes for machine manipulation.
- Indexes necessary for usage guidance.

A work plan and approximate time schedule is being followed by the task force group in accomplishing the thesaurus task, with target dates of some of the important events as follows:

Jan. 28—Completion of conventions and guidelines for publication.

Feb. 4—Collection of pertinent vocabularies and tapes or punch cards.

Aug. 15—Completion of preliminary compatible list showing inclusions, exclusions, and cross references to accommodate concepts and make preliminary assignments to COSATI Subject Category List.

Jan. 7, 1967—Preparation of final draft.

Feb. 10—Codes for computer input.

Feb. 24—Computer tape preparation.

April—Issuance of thesaurus.

Army, DoD Officials Review Nike-X Project

(Continued from page 1)

Air Defense Command, Colorado Springs, Colo.

In addition to the annual progress report, discussions included highlights of the Nike-X R&D program, equipment design, power requirements and preliminary production planning.

Leading participants included: Gen Frank Besson, Jr., CG of the U.S. Army Materiel Command; Deputy Assistant Secretary of the Army (I&L) for Logistics, A. Tyler Port; W. E. Burke and A. P. Clow, vice presidents of Western Electric Co., and W. C. Tinus, vice president of Bell Telephone Laboratories. As the R&D arm of Western Electric Co., the Bell Telephone Laboratories are responsible for Nike-X design and development.

Other attendees included Brig Gen Raymond B. Marlin, Director of Plans and Programs, Office, Chief of Research and Development, Department of the Army; Maj Gen John G. Zierdt, CG, U.S. Army Missile Command; and Brig Gen A. P. Rollins, Deputy Director of Military Construction, Army Corps of Engineers.

Assistant Director of Defense Research and Engineering (Defensive Systems) Charles S. Lerch, Jr., and his deputy, Robert S. Sargent; and Col Robert M. Brewer, chief, War Plans Division, Office, Army Deputy Chief of Staff for Military Operations.

Army Exhibits Progress in Special Aircraft at International Technology Congress

Progress of the U.S. Army in developing special aircraft for modern mobility requirements was exhibited, along with a precision jump by the Army Golden Knights parachutists, No. 1 team in the world, at the International Congress on Air Technology, Nov. 15-18, at Hot Springs and Little Rock, Ark.

Some 1,000 of the world's foremost technical experts—"almost everybody who is anybody in modern aviation," as one observer somewhat grossly overstated it—convened to discuss the part winged air technology will play in shaping tomorrow's course of world progress.

Sponsored by the U.S. Department of Commerce and the Arkansas Valley Education and Research Foundation, the Congress stemmed in substantial measure from the initiative of Senator John L. McClellan of Arkansas, who introduced Secretary of Commerce John T. Connor as the opening speaker.

Governor Orval Faubus of Arkansas welcomed guests and Senator A. S. (Mike) Monroney of Oklahoma and Senator Frank Carlson of Kansas also participated in the program.

Top-level officials among the speakers included Federal Aviation Administrator General W. F. McKee; Under Secretary of Commerce for Transportation Allan Boyd; Dr. Robert White, head of the Environmental Sciences Services of the Department of Commerce; Dr. F. L. Thompson, director of the National Aeronautics and Space Administration Langley Laboratories; and Air Force Chief of Staff General John P. McConnell.

Other prominent speakers included Dr. Charles Stark Draper, head of the Department of Aeronautics and Astronautics, and director, Instrumentation Laboratory, Massachusetts Institute of Technology; Thomas C. Mann, Under Secretary of State for Economic Affairs, Department of State; and Dr. Floyd Thompson, director, National Aeronautics and Space Administration, Langley (Va.) Research Center.

Presidents and top executives of numerous aircraft companies and affiliated industrial firms also made presentations.

Army speakers included: George Singley, Jr., of Army Aviation Materiel Laboratories, Fort Eustis, Va.; Col Cyril Stapleton, CO of the Army Aeronautical Activity, NASA-Ames Research Center, Calif.; and Harold H. Cosgray, Army Materiel Command.

Several Army and contractor exhibits featured models or full-scale cutaways and complete aircraft, including VTOL, STOL and VSTOL (vertical and short takeoff and landing types), the CH-37 Mohave, OV-1 Mohawk, UH-1B Iroquois, UH-1C "Huey" Cobra, an LOH (low-observation helicopter) model. Shown also was the Army's Flex-wing program, the crew-seat armor protection system, and several gas turbine aircraft power plants.

Represented in the Army exhibits were the U.S. Continental Army Command, Army Materiel Command, Army Engineer Research and Development Laboratories, General Electric Co., Bell Helicopter Co., Boeing Co., Hughes Tool Co., Lycoming Division of AVCO Corp., Continental Motors and Allison Div., General Motors.

HDL Physicists Develop 'Tube' for Plasma Tests

Laboratory experiments with Army hardware in controlled plasma conditions, where the environment of nuclear bursts can be closely simulated, are possible in a new facility at the Harry Diamond Laboratories (HDL), Washington, D.C.

Scientists and engineers at the U.S. Army Materiel Command laboratories have produced a plasma "tube," slightly more than four cubic feet in volume, which permits in-house testing heretofore impossible.

Research supervisor John Tompkins and physicists John Rosado and William Vault, working as a team, designed and developed the tube. The plasma facility is regarded as a major addition to modern laboratory equipment. Development was supported by the Defense Atomic Support Agency.

Antenna impedance and mutual coupling between antennas have been successfully measured with the tube in experiments to date. Many other operating characteristics of materiel are expected to be confirmed with the HDL facility.

Measurements of such plasma activity as electron density, collision frequency and electron temperature normally are obtained by costly firing of a microwave antenna into space. The simulated conditions within the HDL plasma tube now permit close readings to determine characteristics the physicists are seeking.

HDL scientists foresee a wide range of possible laboratory tests with Army systems and subsystems with the new "open door" to controlled plasma.

John Tompkins, supervisor, John Rosado and William Vault, research physicists at the Army Materiel Command's Harry Diamond Laboratories, Washington, D.C., are shown with the new large volume plasma facility they designed and constructed for testing.

Lt Col Stockdale Becomes New Deputy of ERDL

Lt Col George R. Stockdale recently assumed duties as deputy commander of the U.S. Army Engineer R&D Laboratories (USAERDL) at Fort Belvoir, Va. He relieved Lt Col John W. Consolvo, now serving as executive officer.

Col Stockdale's new assignment follows 33 months service as chief of the Construction Section, Headquarters, U.S. Army Communications Zone, Europe. In 1960 he served several months as military assistant in the Electrical Department at the Engineer R&D Laboratories until he became assistant director for Military Construction for Missiles, Office of the Chief of Engineers.

Entered the Army in 1941, he served in North Africa, Italy, Southern France and Germany during World War II. A native of Morgantown, W. Va., he received a BS degree in electrical engineering in 1947 from West Virginia University.

Lt Col G. E. Stockdale

3 Officials Review Army Combat Readiness

(Continued from page 1)
25 percent expansion of the active Army, and increasing readiness of the selected Reserve force.

General Johnson, the annual luncheon speaker, discussed Viet Nam as "Challenge and Response." He spoke of the outstanding response to the Communist challenge through the efforts of the individual American soldier despite personal hardship.

Other challenges which the Chief of Staff said were being met with spirited response included supply support, the demands of expansion, and training requirements. "Responding to challenges," he said, "is the U.S. Army way."

General Abrams discussed "Thinking Readiness." The ability of the Army to respond rapidly to many different threats, he said, has been steadily increasing in recent years, adding:

"We can all be glad that our Government had been thinking in terms of national readiness when the threat came in Viet Nam—for we were ready for it; ready to respond in a coordinated governmental effort in which the U.S. Army is playing its part."

Deputy Assistant Secretary of the Army for Logistics A. Tyler Port spoke on "Building a Better Army," a discussion of how the Army helps industry compete for contracts, and Lt Gen Bruce Palmer, Jr., CG, XVIII Airborne Corps, Fort Bragg, N.C., discussed "Army Operations in the Dominican Republic."

Lt Gen Ben Harrell, CG, U.S. Army Combat Developments Command (USACDC) talked about future Army planning with "Vision Unlimited." Brig Gen George B. Pickett, Chief of Staff, USACDC, and Brig Gen Leland G. Cagwin, CG, USACDC Experimentation Command, also made presentations supporting this theme.

Other speakers included: Maj Gen Michael S. Davison, Deputy Assistant Chief of Staff for Force Development, "The Changing Army and Air Mobility";

Brig Gen George P. Seneff, Jr., Director of Army Aviation, Office of the Assistant Chief of Staff for Force Development, "Review of Air Mobile Concept"; Brig Gen Robert C. Taber, deputy director, Strategic Plans and Policy, Office of the Deputy Chief of Staff for Military Operations, "The Army's Role in Stability Operations."

Maj Gen William R. Peers, Assistant Deputy Chief of Staff for Military Operations (Special Operations), moderated a panel discussion on military operations.

The climax of the AUSA meeting was the General Marshall Memorial Dinner, during which General Jacob L. Devers (USA, Ret.) received the George Catlett Marshall Medal for "selfless and outstanding service to the United States of America." AUSA President Elvis J. Stahr, a former Secretary of the Army, made the presentation.

General Devers commanded the sixth U.S. Army group in Europe during World War II. As a Marshall Medal recipient, he joins the distinguished company of former President Dwight D. Eisenhower, retired General of the Army Omar N. Bradley, John J. McCloy, who served as Assistant Secretary of War and U.S. High Commissioner for Germany, and Robert A. Lovett, former Secretary of Defense.

Attending the VIP dinner were more than 2,300 guests, including Deputy Secretary of Defense Cyrus R. Vance, Secretary Resor, General Johnson, and General Maxwell D. Taylor, former Chairman of the Joint Chiefs of Staff, who made the featured address.

Additional highlights of the AUSA meeting included the President's reception for Secretary Resor and General Johnson, and the Sergeants Major Personnel Conference, featuring an address by Lt Gen J. K. Woolnough, Deputy Chief of Staff for Personnel.

More than 60,000 square feet of industrial exhibits and 30,000 square feet of U.S. Army exhibits were displayed. Among exhibits of special interest to the Army R&D community was a fully-equipped prototype of the U.S. Army Medical Service (AMEDS) field hospital concept MUST (Medical Unit Self-Contained, Transportable). It included an expandable surgical unit, another expandable unit equipped for central material supply, an inflatable ward unit, and a utility element.

Another AMEDS exhibit from Brooke Army Medical Center, Fort Sam Houston, Tex., showed the progress of that world-renowned institution for burns research in treatment of electrical injuries. A U.S. Army Aviation Materiel Laboratories exhibit gave an explanation of the Aircrew Seat Program, designed to provide more effective ballistic and crash protection for helicopter pilots. The Armed Forces Institute of Pathology, Washington, D.C., offered an exhibit on its Missile Wound Investigation Program.

Other Army exhibits included a pictorial display of members of the Army Scientific Advisory Panel, depicting their home areas on a map of the United States; a showing of materiel developments by the Limited War Laboratory; a U.S. Army Materiel Command portrayal of combat arms; and displays on the mission of the U.S. Army Combat Developments Command and the U.S. Army Test and Evaluation Command.

$19.8 Million Contract Begins Expansion of USMA Facilities

Construction of the first major facilities in the U.S. Military Academy expansion and modernization program is ordered in a $19.8 million contract awarded recently by the Army Corps of Engineers.

The program is necessary to accommodate the gradual increase in enrollment over the next eight years authorized by the President in March 1964. The Corps of Cadets will be expanded from 2,519 to 4,417.

The contract with Lasker-Goldman Corp., New York City, calls for a 6-story addition to Washington Hall, the kitchen and the dining facility which also contains some classroom space. The addition will include barracks, dining hall, kitchen and classroom facilities.

The gothic tradition of West Point will be preserved in the architectural treatment of the new facilities, featuring granite and limestone construction.

CONSTRUCTION started recently on the $3.5 million Army "fast pulse" nuclear reactor facility at Aberdeen Proving Ground, Md., and is expected to be completed in about 15 months. Shown here as an artist's concept, the reactor will be similar to one successfully operated for more than three years at the Oak Ridge National Laboratory for health physics research. It will be one of seven such reactors in the U.S. used for research.

100 Electronic, Optical Stations Tracking Giant Geodetic Satellite 1,414 Miles High

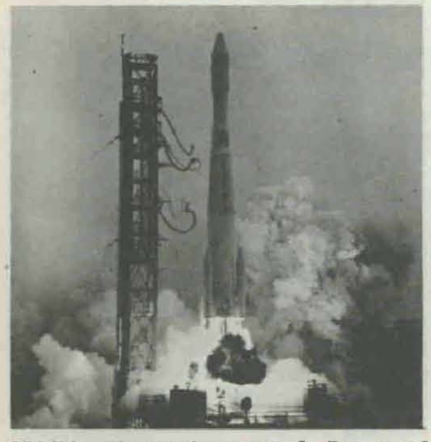
Five geodetic instrumentation systems are contained in satellite GEOS A, now orbiting the earth at an unprecedented—and unplanned—1,414 statute miles in apogee with a perigee of 690.

Inclement weather at Cape Kennedy launch time last Nov. 6 caused ground control to lose contact with the new NASA Delta second-stage rocket 30 seconds before the scheduled time of cutoff. Consequently, the rocket carried the space vehicle beyond the planned 920-mile height, but its inclination of 59° is according to plan.

Four sequential collation of range (SECOR) stations of the U.S. Army Corps of Engineers Geodesy, Intelligence and Mapping Research and Development Agency (GIMRADA) are tracking the satellite. The stations were moved from the west coast to the eastern part of the U.S. thereby ending the "angulateration" experiments with ERGS-5 reported in the October issue of the *Army R&D Newsmagazine*, page 28.

In addition to Corps of Engineers, major agencies taking part in this most extensive of all U.S. geodetic experiments are primarily the National Aeronautics and Space Administration (NASA), the U.S. Air Force Cambridge (Mass.) Research Laboratory (AFCRL), and the U.S. Navy Bureau of Weapons.

Other scientific investigators of this largest—385 pounds—geodetic explorer satellite are Ohio State University, Columbus; University of California, Los Angeles; Smithsonian Astrophysical Observatory (SAO), Cambridge, Mass.; and NASA's Goddard Space Flight Center, Greenbelt, Md.



NASA Thrust-Augmented Improved Delta (TAID) lifts off Pad A, Complex 17, at Cape Kennedy to launch Explorer XXIX, the first NASA satellite designed exclusively for geodesy —the study of the Earth's size, shape, mass and variations in the gravitational field. (NASA photographs)

The geodetic measurement systems being used in GEOS A recordings are: a flashing light beacon being photographed against a background of stars to define the arc of orbit and angular data; corner cube quartz reflectors to pinpoint the satellite's position by reflecting Laser beams; three radio transmitters for Dopplershift determination of the precise orbit; radio-range transponder fixing the satellite's position and that of interrogating ground stations; and range and range-rate transponder to determine the changing range and radial velocity of the satellite.

Simultaneous operation of the five independent and diverse geodetic-tracking systems permits cross-checking evaluation of the functioning and accuracies of the different techniques.

The unexpected distance of the satellite from the earth required considerable readjustment by the more than 100 participating tracking stations in the U.S. and overseas. The GEOS A is orbiting the earth every 120 minutes instead of the planned 112 minutes.

Goddard Space Flight Center is responsible for the project's integrated tracking and control effort.

In-flight optical and radio ranging includes the already operational NASA Range and Range Rate stations; Minitrack Optical Tracking Station (MOTS) cameras; the Satellite Tracking and Data Acquisition Network (STADAN); and Laser tracking units.

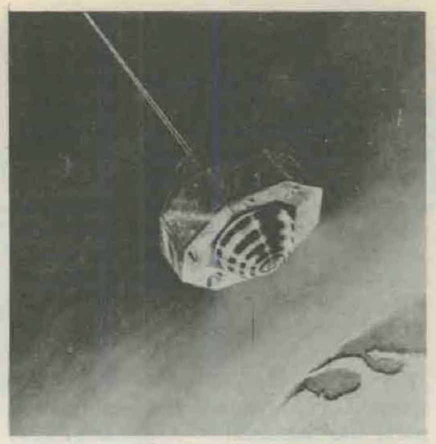
The Smithsonian Astrophysical Observatory is supporting the optical tracking with the worldwide network of Baker-Nunn camera stations.

Radio ranging or tracking systems being operated for the Explorer include the Navy Doppler Tracking Network (TRANET) facilities.

The program has broad international cooperation in ground-based observations and data acquisition and analysis. Integrated networks of ground stations, some mobile, extend around the globe and from Greenland to Antarctica.

The first all-geodetic satellite, ANNA, sponsored by the Army, Navy, Air Force and NASA, was launched in 1962. It provided much detailed information on the highs and lows of the geoid and gravitational field.

The GEOS A satellite, an octahedron topped by a truncated pyramid, is 48-inches wide and 32-inches high. It was designed and built for a one-year minimum life by Johns Hopkins University's Applied Physics Laboratory in Howard County, Md.



GEOS-A, 385-pound Geodetic Explorer spacecraft, contains five geodetic instrumentation systems to provide simultaneous measurements scientists require to establish a more precise model of the Earth's gravitational field and to map a world coordinate system that will relate points on or near the surface to the center of mass.

Army Engineers Buy 4 Satellites To Enhance Geodetic Program

Four additional SECOR (sequential collation of range) satellites are being purchased for $557,000 by the U.S. Army Engineer Geodesy, Intelligence and Mapping R&D Agency (GIMRADA), Fort Belvoir, Va.

Similar to the geodetic satellites presently in orbit, the new ones will have transponders capable of operating at a higher altitude.

These artificial satellites enable teams from the Army Corps of Engineers to obtain data on the exact location of land bodies with an all-weather electronic system that measures distance up to 1,000 miles with an accuracy of less than 100 feet.

The contract was awarded to the Cubic Corp., San Diego, Calif. Delivery of the first of the satellites is scheduled for February.

Army Awards Contract

A $3,107,000 contract was recently awarded by the Army to Douglas Aircraft Co. to support research in Project PRESTAGE, involving ballistic missile systems. The contract supports the Project Defender program, a series of investigations in ballistic missile defense conducted by the Advanced Research Projects Agency.

Army Awards $353 Million RDTE, Materiel Contracts

U.S. Army contracts for research, development, test, engineering and procurement of materiel in recent weeks totaled $353 million.

Kaiser-Jeep Corp., issued a $53,323,287 second increment of a 3-year agrement for 5-ton trucks, received the largest single contract. General Dynamics Corp. was issued $42,956,304 for FY 66 procurement of Redeye shoulder-fired missiles and for further research and development effort on Redeye.

Remington Arms Co. was awarded two contracts totaling $30,203,328 for ordnance items and .22 caliber cartridges. FMC Corp. received $29,300,178 in modifications for cargo, mortar, personnel and armored personnel carriers.

Harvey Aluminum Sales, Inc. was issued a $24,802,693 modification for ammunition. Holston Defense Corp. (a subsidiary of Eastman Kodak Co.) received a $17,960,195 contract modification for production of various types of propellants and explosives.

Hercules Powder Co. won a $16,212,624 contract modification for the balance of reactivation of the Sunflower Army Ammunition Plant, Lawrence, Kans., and for production of propellant powder for 2.75-inch rockets.

Continental Motors Corp. will get $12,665,676 as the second increment of a 3-year procurement of multi-fuel engines for 5-ton trucks. AVCO Corp. was awarded an $11,559,290 contract for design, development, fabrication and test of gas turbine engines.

Chamberlain Corp. received three contracts, totaling $10,951,784, for 2.75-inch rocket components and 175mm projectiles. Hupp Corp.'s pair of contracts, totaling $10,331,347, call for industrial-type engines and 2- and 4-cylinder, gasoline-driven engines.

TRW, Inc. was awarded $6,500,000 to design, develop and fabricate test vehicles and to conduct a flight test program over an instrumented range. Amron Corp. received $6,161,992 for 20mm brass cartridge cases.

Hughes Aircraft Co. was issued two contracts, a total of $5,427,942, for research and development on the SAM-D (Surface to Air Missile Development) project and for six months of research on the use of TOW (Tube-launched, Optically-tracked, Wire-guided missile) with helicopters.

Chrysler Corp. was issued a $5,251,829 contract for combat engineer vehicles and repair parts. Bell Helicopter Co. received $4,946,224 for basic instrument helicopter trainers. General Motors Corp. was awarded a $3,753,540 agreement for transmissions for the Main Battle Tank. Kennedy Van Saum Corp., Danville, Pa., will produce 105mm tracer projectiles and metal parts for 105mm projectiles under a pair of contracts totaling $3,395,280.

Zeller Corp., Defiance, Ohio, received a $3,224,312 contract for 20mm projectiles. Bulova Watch Co. was issued $3,199,100 for ordnance items. Skagit Corp., Sedro-Woolley, Wash., received $3,144,820 for cartridge cases. Norris Thermador Corp. was awarded two contracts valued at $3,127,215 for 105mm tracer projectiles and other ordnance items. REDM Corp., Wayne, N.J., also will produce ordnance items under a $3,079,616 agreement. Honeywell, Inc. received the second increment of a 4-year contract to produce classified electronic equipment for $3,000,000.

Lesser contracts were as follows: Magnavox Co., $2,971,889, vehicular radio sets; Rohm and Haas Co., $2,900,000, research and development of solid and hybrid rocket propellants and propulsion; Decitron Electronics Corp., $2,494,800, radio sets; Martin Marietta Corp., $2,261,340, assembly of mine field launching skids with demolition charges; Baifield Industries, EMTEX Division, $2,072,564, bomb dispensers;

Lehigh, Inc., $1,833,991, ordnance items; Radio Corp. of America, $1,805,337, continued research and development on a component verification program for the SAM-D (Surface-to-Air Missile Development); Lockheed Electronics Co., $1,658,970, continued research and development on range instrumentation equipment; Airport Machining Corp., $1,508,650, ordnance items; Maremont Corp., $1,482,148, M60 machineguns with bipod assemblies;

Raytheon Co., $1,432,228, ordnance items; Finchbaugh Products, Inc., $1,380,488, 90mm target practice tracer shells; Albion Malleable Iron Co., $1,333,309, components for 2.75-inch rockets; Thiokol Chemical Corp., $1,315,410, ammunition; Air Logistics Corp., $1,291,154, air transportable fueling systems;

Sperry Rand Corp., $1,254,914, electronic assemblies for the Sergeant missile; International Mapping Corp., $1,248,000, work on a horizontal control system used to compile topographic maps; Collins Radio Co., $1,200,000, air-to-ground communication sets; Williams Co., $1,192,129, modifications to aircraft engine shipping containers; American Cytoscope Makers, Inc., $1,161,040, preproduction evaluation of technical data and production of telescopes and telescope mounts;

Astrodata, Inc., $1,119,740, advanced range testing, report and control; National Cash Register Co., $1,141,645, classified electronics equipment; Philco Corp., $1,051,900, electronic equipment; Firestone Tire and Rubber Co., $1,022,190, tires for 2½-ton vehicles; Federal Laboratories, Inc., $1,021,746, chemicals.

JUNGLE CANOPY PLATFORM, undergoing Army tests, consists of two steel nets 200 feet long and 20 feet wide. The nets are laid by helicopter criss-cross over the trees. Another helicopter brings in an 18-foot hexagonal platform (shown in artist's concept above) and lays it on the intersection of the nets. The platform contains an integral power hoist that can be used to lower materiel to the jungle floor and raise casualties to the platform for quick evacuation. It also can be used for an observation post or radio relay station.

Princeton Statistician Gets 1965 Wilks Medal

Long recognized as one of the world's foremost mathematicians and statisticians, Prof. John W. Tukey of Princeton University has added the "first" Samuel S. Wilks Memorial Medal to his long list of honors.

Presented at the U.S. Army Eleventh Conference on Design of Experiments in Research, Development and Testing, held recently at Stevens Institute of Technology, the award honors the memory of a man associated with Prof. Tukey on the Princeton University faculty for many years.

Dr. Frank E. Grubbs of the Army Ballistics Research Laboratory, Aberdeen Proving Ground, Md., the "initial" winner of the Samuel S. Wilks Award in 1964, made the presentation to Prof. Tukey on behalf of the American Statistical Association.

Finely delineated semantics enters into the distinction between the use of initial and first, as applied to the award. Webster's International and Roget's Thesaurus are in general harmony in using these words as synonyms, for most purposes, as meaning the beginning.

Prof. Tukey, however, is indisputably the first recipient of the award under the criteria established by a committee appointed by the American Statistical Association. Dr. Grubbs was selected for his outstanding contributions to the Army as the initial recipient in the desire to commence the award as a highlight of the Tenth Conference on the Design of Experiments held in November 1964 in Washington, D.C.

Prof. Wilks died on Mar. 7, 1964, and Philip G. Rust, one of his former associates now retired in Thomasville, Ga., donated about $5,000 to establish a fund for presentation of the Samuel S. Wilks Memorial Award. The time remaining before the conference did not permit the American Statistical Association to select a committee to establish the criteria for selection of the initial award winner.

The citation to Prof. Tukey recognized "his contributions to the theory of statistical inference, his development of procedures for analyzing data, and his influence on applications of statistics in many fields," for which he has received many honors during an illustrious career.

In accepting the Wilks Medal, accompanied by a cash honorarium, Prof. Tukey paid tribute to his former associate by quoting from the memorial minutes of the Princeton University faculty in eulogizing Prof. Wilks:

"His death terminates a quiet, penetrating and influential leadership in the work of many organizations—especially in mathematics, statistics, and social science — to which he brought wisdom, commitment, persistence, and a remarkable sense of the importance of new developments."

Prof. Tukey also quoted from a memorial notice of the American Philosophical Society which eulogized the deceased as "Samuel S. Wilks: Statesman of Statistics."

DR. FRANK E. GRUBBS (left) presents Samuel S. Wilks Memorial Medal to Professor John W. Tukey, Princeton University world-renowned statistician.

Present at the award ceremony were Prof. Wilks' widow and Mrs. Tukey.

The idea for the Wilks award is attributed to Maj Gen Leslie E. Simon (USA, Ret.) who presented a paper at the 10th conference: "The Stimulus of S. S. Wilks to Army Statistics."

Under criteria established by the American Statistical Association, the award is given to a statistician "based primarily on his contributions, either recent or past, to the advancement of scientific or technical knowledge in Army statistics, ingenious application of such knowledge, or successful activity in the fostering of cooperative scientific matters which coincidentally benefit the Army, the DoD, and the Government, as did Samuel S. Wilks himself."

The Wilks Award Committee for 1965 consisted of: Dr. Grubbs, chairman; Dr. Francis G. Dressel of Duke University and the Army Research Office, Durham, N.C.; Dr. Churchill Eisenhart, National Bureau of Standards; Prof. Oscar Kempthorne, Iowa State University; Dr. Alexander M. Mood, U.S. Office of Education; and Maj Gen Simon, Winter Park, Fla.

The 3-day conference at Stevens Institute was sponsored by the Army Mathematics Steering Committee and conducted on behalf of the Army Chief of Research and Development. The Army Munitions Command, Dover, N.J., was host.

The broad, continuing purpose of the annual conference is to foster the use of statistical methodology in the Army. More than 100 scientists, representing the Army and university scientific communities engaged in Army R&D programs, attended the technical sessions and clinical meetings on specific problems and experiments.

Dr. Rall Succeeds Percy at Army Math Center

The U.S. Army Mathematics Research Center at the University of Wisconsin has appointed Dr. Louis B. Rall as assistant director to succeed Donald E. Percy, new dean of the College of Letters and Science.

Dr. Rall has served since 1962 as a member of the Center's research staff, comprised of some 40 leading mathematicians from all parts of the United States and numerous foreign countries. This MRC staff is concerned with developing advanced mathematical techniques to meet military requirements.

After receiving an MS degree in 1954 and a PhD in 1956 from Oregon State University, where he served also as a research assistant for three years, Dr. Rall worked a year with the Shell Development Co. He then joined the faculty of Lamar State College, Tex., and remained until 1960.

Dr. Louis B. Rall

Dr. Rall is known for his work in functional analysis, numerical analysis and computing. A member of the subcommittee on numerical analysis and computers of the Army Mathematics Steering Committee since 1963, he was program chairman for the MRC 1964 advanced seminar and 1965 symposium on digital computing errors.

Volumes I and II of "Error in Digital Computation," edited by Dr. Rall and published by John Wiley and Sons, 1965, were an outgrowth of the 1964 MRC-sponsored symposium at Madison, Wis.

AMS Publishes New Sets of Lunar Maps

Contours of the visible surface of the moon are defined more sharply by color gradations of elevation on a new series of maps published by the Army Map Service, Corps of Engineers.

Termed a "unique treatment introduced for the first time," the portrayal is based on the 1:5,000,000 scale Lunar Topographic Map published in 1964 by the Army Map Service. Cartographers consider the 1964 series the first relatively accurate topographic map of the visible surface.

The new series of maps consists of three sets of six sheets each, at a scale of 1:2,000,000, forming a mosaic about 10 feet square. An individual sheet measures 41 x 57 inches.

On set number 1, "work sheet," topographic form is portrayed by contours printed in brown and grey inks. Set 2 is identified as the "gradient tint" edition. Each elevation tint band is in a different color tone to facilitate reading. Four different colors are used to portray 11 different relief bands, covering elevations ranging from 3,200 feet to 14,000 feet high—based on an elevation datum value of 7,000 feet for a crater near the center of the Lunar surface named Mosting "A."

Set 3 is the pictorial relief edition, on which the contoured relief form is supplemented by the portrayal of mountains and valleys of the moon, its maria (seas), craters, rills and other distinctive features—rendered in color for third dimensional effect.

On each set, place and feature names are shown on the face of the map. An alphabetical listing of approximately 5,000 names, showing Selenodetic coordinates for each name or feature listed, is printed on the back.

AMS scientists in cooperation with NASA are also studying the reduction of orbital data, including methods, procedures and instrumentation for maximum use in future maps.

When the back side of the moon becomes better known, experts will be in a position to produce accurate maps of the entire moon surface. Preliminary steps are being taken toward accomplishing this task.

In other spatial areas, Army Map Service is compiling a topographic map of Mars. Technicians are using Mariner IV photography and terrestrial based photography in their work. Heretofore, the best likeness of Mars has consisted of a photographic projection designed according to the latest scientific data.

New Automatic Equipment Aids Map Compilation Operations

New automatic compilation equipment that eliminates a 20-hour manual operation and "tells all" about aerial photographs used for mapping purposes is reported by the U.S. Army Corps of Engineers.

The universal automatic map compilation equipment produces orthophotos and shows relative heights and position of features on the earth's surface. It was developed by the U.S. Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va.

The automatic equipment is centered around a computer complex which controls all system operations. The production model under test for baseplant use was built by Bunker-Ramo Corp., Canoga Park, Calif. A van-mounted rugged version of this equipment is now being developed for use by topographic units in the field.

ECOM Scientist Wins 1966 Harry Diamond Award

The 1966 Harry Diamond Award winner is John J. Egli, chief of the U.S. Army Electronics Command (ECOM) Electromagnetic Environment Division, who recently became the fifth Fort Monmouth, N.J., scientist or engineer selected for this honor.

Established 16 years ago in honor of the late Harry Diamond, the award is presented annually by the Institute of Electrical and Electronics Engineers (IEEE) to a Federal Government career employee for outstanding communications-electronics research.

Harry Diamond was a career employee noted for his work on the proximity fuze during World War II and many other inventions. The Diamond Ordnance Fuze Laboratories (DOFL) in Washington, D.C., were named in his honor when they were founded in 1953. Ten years later they were renamed the Harry Diamond Laboratories.

The 1966 award, accompanied by a $500 honorarium, will be presented at the International IEEE convention in March. Egli's citation states in part . . . "For outstanding contribution in Government service in the fields of wave propagation, electromagnetic compatibility and advanced radio communications."

Since he joined the present ECOM laboratories staff in 1941 (then the Signal Corps laboratories) he has worked on radio relay, wave propagation and systems, and as chief of Project Monmouth. Earlier, he was employed by Mackay Radio and Telegraph Co., and the Commercial Products Department of Bell Telephone Laboratories.

John J. Egli

Egli holds electrical engineering degrees from Cooper Union and New York University and has done graduate work at Rutgers. He is vice chairman of the IEEE Group on Electromagnetic Compatibility.

Previous Fort Monmouth winners of the Harry Diamond Award were Dr. Marcel J. E. Golay (1951), who has since left Government employment; Dr. Harold A. Zahl (1954), director of Research at the Electronics R&D Laboratories; Dr. Georg J. Goubau (1957); and Dr. Helmut L. Brueckmann (1961).

2 Research Engineers Accept Key CDCEC Staff Posts

Under the specialized support program provided for the Army Combat Developments Command's Experimentation Command by contract with Stanford Research Institute, two research engineers recently assumed key staff positions.

Announcement of the appointment of Dr. G. W. Rollosson and R. J. Allen was made by Dr. William C. Pettijohn, director of the SRI research office at CDCEC Headquarters, Fort Ord, Calif.

Dr. Rollosson was named head of the Instrumentation Group. He has directed a number of major development programs, including full-scale nuclear effects tests in Nevada and at Eniwetok, and for 16 years was with Sandia Corp. in the sensor development field.

Mr. Allen, promoted to senior research engineer, Instrumentation Group, formerly was with North American Aviation Autonetics Division in Anaheim, Calif. He developed and flight-tested one of the first terrain clearance alarms and has since specialized in the application of digital data and the engineering of command and control systems.

New Techniques 'Pump' Lasers With High Explosives

Using pyrotechnics and explosives safely to "pump" Lasers, thereby eliminating the need of conventional electric power sources for specialized applications, Picatinny Arsenal scientists are developing new techniques of potentially broad interest.

Under certain conditions, this method may lead to a smaller, lighter-weight pump to produce the concentrated light beam energy of Lasers. Optically pumped Lasers normally require energy from powerful light sources, such as flash lamps.

Pyrotechnics Laboratory personnel at Picatinny Arsenal, Headquarters of the U.S. Army Munitions Command at Dover, N.J., have succeeded in developing and containing a reaction between cyanogen and oxygen that produces brightness temperatures in the range from 6,000 to 8,000 degrees K.

One of the major objectives of this research program has been accomplished, that is, the direct and non-destructive pumping of conventional neodymium-doped glass rods, viewed as an important advance in Laser technology. It takes about 5,500°K to pump a ruby Laser; neodymium-doped glass rods can be pumped at brightness levels below 5,000°K.

Lasers are finding application in a number of Army requirements, such as rangefinders, fire control in weaponry, target identification, communications and flight instrumentation. Scientists at Picatinny point out that despite this increasing use of Lasers, the optical pumping source has remained virtually unchanged.

Pumping is normally accomplished by discharging the stored energy of a capacitor bank through a high-pressure xenon arc lamp. This produces a controlled bright light source, but the technique has a disadvantage.

C. Smith (left) and P. Kisatsky examine fixture for studying pyrotechnic reactions at Picatinny Arsenal.

The trouble is that the weight and volume of the power supply and capacitors required to fire the optical pump make it difficult to adapt the Laser to certain Army applications requiring light weight, mobility, long shelf-life and dependable ruggedness.

Picatinny Arsenal researchers are using the energy derived from pyrotechnic reactions because the energy available from a chemical system amounts to millions of joules (watt-seconds) per pound. Capacitor supply systems may be of considerably less magnitude.

The cyanogen-oxygen reaction produces one of the hottest known flames. When this gaseous mixture is detonated, that is, when the flame front moves at supersonic rates, brightness of the detonating zone is still higher.

Brightness temperatures in excess of 6,000°K. can be observed in the detonation region and, if the detonation wave is allowed to impact a surface, the brightness temporarily soars to nearly 8,000°K.

The Picatinny research program also involves the design of fixtures to tailor the light-pulse shape to the pumping of solid-state crystals. This means the design of vehicles to increase the brightness and to lengthen the duration of the bright zone in the vicinity of the doped glass rod.

Experimenters believe that lasing can be sustained by rushing in new fuel and flushing out the gaseous products. Conceivably, if this approach is fruitful, it can lead to useful Army application where light weight and economy are of prime importance.

Army Expediting Development of AAFSS Helicopters

Development of Army helicopters designed exclusively as weapons ships and termed the Advanced Aerial Fire Support System (AAFSS) is being initiated on an expedited basis under recent Department of Defense approval.

Ten prototypes of the radically new compound helicopter, designed to fire a variety of weapons, are being produced by Lockheed California Co.

Reportedly 50 percent faster than any other operational Army helicopter and twice as fast as armed helicopters now in service in Viet Nam, the new helicopter will cruise at speeds in excess of 200 knots.

The AAFSS was designed as an integral system, combining the aerial vehicle, avionics, weapons and ground support equipment. It will be powered by the new 3,400 horsepower T-64-S4A gas-turbine engine being developed by General Electric Co. under a Navy contract with Army support.

Conceived to replace the Army's present armed helicopters, which were adapted from troop carriers, the AAFSS will escort troop-carrying helicopters in air mobile operations and will provide suppressive fire in the landing zones.

A feature of the AAFSS is the use of an advanced rigid rotor system which offers a highly maneuverable, as well as an extremely stable platform, at both high and low speeds and while hovering. Incorporated in the design are a thrusting pusher prop, short stubby wings and an anti-torque rotor in addition to the main rotor blades.

In battle, the AAFSS, with its 2-man crew, will employ a variety of weapons, including machineguns, grenade launchers, rockets and antitank missiles. Systems analysis and cost effectiveness studies indicate that the new system will be significantly superior to existing helicopter weapons systems.

The AAFSS is the first major Army weapons system to undergo the Department of Defense development cycle specified by new regulations, which includes Definition (Phase I), Engineering Development (Phase II) and Production (Phase III).

USACDC Establishes Special Studies Unit

The U.S. Army Combat Developments Command (USADC), Fort Belvoir, Va., has announced establishment of a Special Studies Directorate.

Under the command of Col Norman Farrell, the new staff element is the sixth of the USACDC Headquarters directorates. The others are Plans, Doctrine, Materiel, Organization, and Evaluation.

Lt Gen Ben Harrell, commanding general, said the Special Studies Directorate provides the USACDC with a responsive organization to produce studies of a wider scope than those normally assigned to a single USACDC directorate, or to one or more of its 28 subordinate headquarters and field agencies.

The directorate is responsible for planning and supervising war games conducted by other agencies as well as its own. It is intended to provide an expansion base for conducting unscheduled studies and tasks which help USACDC keep increases in combat effectiveness orderly and realistic.

IDEP to Convert Files to Roll Microfilm Jan. 1

Under the Interservice Data Exchange Program (IDEP), a new system of microfilm storage and retrieval will be implemented Jan. 1.

Conversion of all IDEP files from strip to roll microfilm is expected to be completed by Jan. 1, and a new rapid-access technique will permit rapid retrieval of new film reports.

Chartered originally in July 1959 by the Army, Air Force and the Navy to provide interchange of test performance data on electronic components of missile and space systems, the IDEP has been attracting attention of other Federal Government agencies as an example of data exchange cooperation.

The charter was assigned by (rank at that time) Brig Gen J. A. Barclay, U.S. Army Ballistic Missile Agency, Rear Adm W. F. Raborn, Jr., Naval Special Projects Division, and Major Generals O. J. Ritland and B. I. Funk, Air Force Ballistic Missile Division.

The agreement provided for establishment of a Component Parts Data Distribution Center to transmit automatically all parts test data generated by any ballistic missile center, contractor or service agency to all other ballistic missile contractors of the three services.

Army staff supervision and coordination for the IDEP is provided by the Scientific and Technical Information Division, U.S. Army Research Office, Office of the Chief of Research and Development (OCRD).

A new charter signed recently by Assistant Secretary of the Army (R&D) Willis M. Hawkins is being staffed for signature by the Air Force and Navy Assistant Secretaries for R&D. It provides for expansion of the program to include "such other equipment and systems as are of interest to IDEP participating agencies."

The program will include results of controlled tests by contractors, subcontractors and agencies engaged in the design, development and production of equipment for the Government. Primary emphasis will be on results of user tests rather than vendor tests.

Exchange of Government specifications, contractor proprietary information and classified information is not within the scope of the program.

IDEP has now grown to over 170 major aerospace contractors and government agencies in the U.S. and Canada, the latter participating through the Canadian Military Electronic Standards Agency (CAMESA).

Contractors have exchanged more than 20,000 test reports and a microfilm copy is available at each contractor facility having a certified interest in that subject area.

An average participating contractor receives about 100 times as much data as he contributes. This permits each one to examine deficiencies or find additional information in his own interest area. He also is kept informed of peripheral areas that could have application to his work.

The volume of data generated by this exchange has pointed to techniques of retrieval. As a result, the Contractor Advisory Board (CAB) requested participating industrial members to study and recommend a system that would meet expanding program requirements.

Working with the three service field offices of IDEP, the CAB determined that cartridge-mounted roll microfilm would best serve such requirements.

When combined with a technique for random access retrieval of environmental parameters on a specific component, roll microfilm storage reportedly will permit the user to query more efficiently the expanding system.

Areas of responsibility assigned to IDEP offices of the three services to meet the Jan. 1 operational date are:

- Redstone Scientific Information Center, U.S. Army Missile Command, Redstone Arsenal, Ala.—convert back files to roll microfilm.
- U.S. Naval Fleet Missile Systems, Analysis and Evaluation Group, Corona, Calif.—maintain a directory of participating firms, with periodic printing and distribution of the directory; and serve as the contact point for all Contractor Data Control promotional material, with responsibility for reviewing, revising and distribution.
- Space Systems Division, U.S. Air Force Systems Command, Los Angeles, Calif.—serve as cognizant IDEP field office of contract negotiation of the new microfilm-retrieval system and for microfilming future reports coming into the system.

STRATCOM-Europe Adds 20 Signal Units

Responsibilities and manpower of STRATCOM-Europe increased substantially in November when control of all U.S. Army Europe signal units and facilities above field army level was assumed.

Effected in line with the single manager concept adopted when STRATCOM was elevated to major command status in 1964, the consolidation streamlines the U.S. Army's European communication system.

The realignment of functional responsibility, it was explained, is part of a general change in the USAREUR command structure. Negotiations leading to the transfer of about 20 units began in mid-summer 1965 between General Andrew P. O'Meara, USAREUR Commander-in-Chief, and Maj Gen Richard J. Meyer, STRATCOM commander.

Brig Gen W. B. Bess

Brig Gen Walter B. Bess, former USAREUR signal officer, is now CG (position upgraded from CO) of STRATCOM-Europe and serves also as deputy chief of staff, Communications, USAREUR. Assigned to the Signal Corps following graduation from the U.S. Military Academy in 1936, he has broad experience at staff and command level.

Included in the transfer of units to STRATCOM-Europe are the 102nd and 17th Signal Battalions, the 516th Signal Group and the USAREUR Signal Center. STRATCOM also gained control over a military microwave net that spans the European continent.

The largest of STRATCOM's five subcommands, STRATCOM-Europe encompasses the 106th and 22nd Signal Groups, the 21st Signal Company, and major relay centers at Saran, France; Pirmasens, Germany; and Leghorn, Italy.

STRATCOM's global activities span 30 countries. Other subcommands are in the Mid-East, South (America) Pacific, and the continental United States. Field installations include the Radio Propagation Agency, Fort Monmouth, N.J.; the Interagency Communications Agency, Washington, D.C.; Joint Support Command, Fort Ritchie, Md.; and 11th Signal Group, Fort Lewis, Wash.

OCRD Announces Changes In Staff Officer Positions

Col Wilson R. Reed, assigned as Assistant Director of Developments, Office of the Chief of Research and Development (OCRD), reported recently for his third OCRD tour.

In 1962, he headed the office which developed the plan for reorganization of Army research and development as part of the Army-wide reorganization recommended in the Hoelscher Committee Report. During his 1960-62 tour he served in a number of major assignments. From 1950-54, he was in the OCRD Tripartite Standardization Branch.

Other recent asisgnments have included: commander of the 1st Cavalry Division, Artillery, Korea, 1964-65; chief, Policy and Strategy Division, Office of the Chief of Staff, Washington, D.C., 1962-64; and G-3, 9th Infantry Division, Fort Carson, Colo., 1958-59.

A 1941 graduate of the U.S. Military Academy, Col Reed also completed the Artillery Advanced Course, Command and General Staff College and the Army War College. He earned an MA degree in international relations from Georgetown U. in 1952.

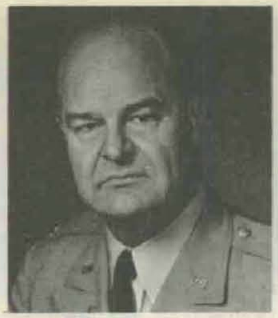
Decorations he has earned include the Bronze Star, Army Commendation Medal with Oak Leaf Cluster, Croix de Guerre with Silver Star and the George Washington Gold Medal of the Freedom Foundation (1958, 1965).

LT COL LOREN R. LESTER succeeds Lt Col William B. Murray (assigned to Korea) as OCRD assistant for Reserve Affairs. Until recently he was commander of the 1st Battalion, 2nd Basic Combat Training Brigade, U.S. Army Training Center, Fort Leonard Wood, Mo. In 1963-64 he served in Korea as CO of the 1st Battalion, 31st Infantry and G-3, 7th Infantry Division.

His education includes a BA degree in history from the University of Mississippi and completion of the Infantry Officer's Advanced Course, and Command and General Staff College.

LT COL GORDON C. CONKLIN, assigned to the Human Factors and Operations Research Division, U.S. Army Research Office, is the new military adviser to the Human Resources Research Office, an Army contract agency of George Washington University.

Recent assignments have included: Intelligence and security officer, Combat Developments Command Infantry



Col W. R. Reed

Lt Col L. R. Lester

Lt Col C. E. Ramsburg

Lt Col G. C. Conklin

Lt Col J. B. Lauer

Lt Col J. G. Cleveland

Lt Col O. F Spencer

Lt Col L. K. Solt

Lt Col L. G. Hergert

Agency, Fort Benning, Ga., 1963-65; Post S-4, U.S. Army, Giessen, Germany, 1962-63; Civil Affairs officer at Giessen, 1960-62; assistant professor of military science and tactics, Jacksonville (Ala.) State College, 1957-60.

His educational qualifications include a BS degree from State Teachers' College, Genesco, N.Y., and a master's degree in education from Alfred (N.Y.) University. He has completed the Troop Information and Education School, Carlisle Barracks, Pa., and the Infantry Officers Associate Advanced Course, Fort Benning, Ga. He wears the Bronze Star, Purple Heart with Oak Leaf Cluster and the Combat Infantry Badge.

LT COL LOWELL K. SOLT, assigned to the Combat Support Aircraft Branch, Air Mobility Division, has a BS degree in business administration from Ohio State. He has completed the Artillery basic and career courses, Command and General Staff College and aviation courses.

For the past three years he served in London, England with the Tri-National Planning Office, preceded by two years with the Test Division, U.S. Army Aviation Board, Fort Rucker, Ala., and two years in Korea with the 7th Infantry Division.

LT COL CHARLES E. RAMSBURG, after two years with the Joint Staff, Joint U.S. Military Mission for Aid to Turkey, returned to the U.S. Army Research Office with the Social Science Research Division. Before a 2-year assignment to Turkey, he served as a staff officer in the Research Support Division, 1959-63.

He attended the University of Georgia, completed the Infantry School, Advanced Infantry, Special Warfare Staff Officer and Military Assistance Orientation Courses, and is a 1955 graduate of the Command and General Staff College. Among his decorations are the Bronze Star Medal, Army Commendation Medal and Combat Infantry Badge.

Maj P. W. Wilson

Maj R. E. Lester, Jr.

Maj P. L. Bolte

LT COL JOHN G. CLEVELAND, assigned to the Combat Support Aircraft Branch, Air Mobility Division, is a 1944 graduate from the U.S. Military Academy, a 1954 graduate from the Massachusetts Institute of Technology with an MS degree in civil engineering and a 1956 graduate from the U.S. Air Force Command and General Staff College.

His tour as CO, 2nd Aviation Battalion, 2nd Infantry Division, Fort Benning, Ga., 1964-65, was preceded by three years in Germany as CO, 504th Aviation Co., 4th Armored Division, post engineer at Stuttgart, and CO of the 16th Aviation Battalion. He earned the Purple Heart during World War II.

LT COL LOUIS G. HERGERT, JR., assigned to the Mid-Range Plans Branch, Plans Division, graduated from the U.S. Military Academy in 1950 and the Command and General Staff College in 1960. He has an MBA in business statistics from the University of Alabama (1964).

He served previously in OCRD as assistant executive secretary to the Army Scientific Advisory Panel (1960-63), followed by a tour in Korea with Headquarters, 38th Air Defense Brigade. He also has served in Korea with the 7th Infantry Division, at the Artillery School and with the 25th Infantry Division in Hawaii. He wears the Bronze Star and Air Medal.

LT COL JERRY B. LAUER, a staff officer in the OCRD Plans Division, returned from Korea as a battalion commander with the 1st Cavalry Division. A 1949 graduate from the U.S. Military Academy, he served from 1960-63 at Fort Bragg, N.C. as chief of the Analysis and Control Division, Airborne Electronics and Special Warfare Board.

He has an MS degree in electrical engineering from the Georgia Institute of Technology and has earned the Bronze Star and the Army Commendation Medal.

LT COL ORTON F. SPENCER, assigned to the Nuclear-Chemical-Biological Division, earned an MS degree from Purdue Academy in nuclear physics in 1961, graduated from the U.S. Military Academy in 1949, and completed the Command and General Staff College Course in 1964.

Recently he concluded a tour with the Eighth U.S. Army in Korea, serving in the office of the Inspector General and as aide de camp to the deputy CG, Eighth Army. Earlier he was assistant S-3, 56th Artillery Brigade, Boston, Mass., and a senior instructor with the Air Defense School, Fort Bliss, Tex.

LT COL HENRY J. HUGHES, assistant for management and ADP Operations, Scientific and Technical Information Division, U.S. Army Research Office, since July 1965, recently retired from the Army after 20 years of service. A 1945 graduate of the U.S. Military Academy, he began his USARO service in June 1964 as chief of the Support Branch, S&TI Division. He has accepted a position with the Combat Army's Research Office, Booz Allen Co., Fort Leavenworth, Kans.

MAJ PATRICK W. WILSON, assigned to the Nuclear-Chemical-Biological Division, was commander of the 51st Ordnance Co., Thule, Greenland in 1964-65 after two years with the Defense Atomic Support Agency in weapons effect testing. He served as an instructor at the U.S. Army Chemical School (1959-61) and earlier was with the 11th Airborne Division and the 1st Infantry Division. He is a 1950 graduate of the U.S. Military Academy and in 1959 received an MS degree in physics from the U.S. Navy Postgraduate School.

MAJ PHILIP L. BOLTE, assigned to the Communications and Electronics Division, graduated from the U.S. Military Academy in 1950 and from the Canadian Army Staff College in 1965.

His most recent assignments have been with the Armor Board, Fort Knox, Ky., where he served as a project officer, branch chief and division executive. He also has served in Germany, Japan and Korea. His decorations include the Silver Star, Purple Heart, Army Commendation Medal and Combat Infantry Badge.

MAJ RUFUS E. LESTER, JR., is a new addition to the Medical and Biological Sciences Branch, Life Sciences Division, USARO. He received an AB degree from Mercer University in biology and economics, an MS degree in food technology from Massachusetts Institute of Technology, and has completed the Command and General Staff College course.

He spent the past year in Viet Nam as a senior Quartermaster adviser and in 1961-63 was an instructor in the Subsistence Department at the Quartermaster School, Fort Lee, Va. From 1956-58, he was R&D coordinator in the Radiation Preservation of Foods Division at the Armed Forces Food and Container Institute, Chicago, Ill., followed by a tour at the Quartermaster Supply Center, Giessen, Germany.

Army Lets Defense Contract

An $847,854 U.S. Army contract to Douglas Aircraft Co. calls for studies on HARD POINT Defense Systems, a program of the Advanced Research Projects Agency (ARPA).

Part of ARPA's Project Defender, a study of ballistic missile defense systems, HARD POINT is being managed by the U.S. Army Missile Command, Redstone Arsenal, Ala. Work on the contract will be done at the Douglas plant in Santa Monica, Calif.

ECOM Scientist Describes New Microwave Modulation

Solid State Electronics, a British scientific journal printed in English, French and German, recently published an article on a new type of microwave modulation coauthored by Dr. Harold Jacobs of the U.S. Army Electronics Command, Fort Monmouth, N.J.

"Semiconductor Reflection Type Microwave Modulator" describes a device employing a semiconductor, short-circuited by a plate to which it is attached, in a cavity, to obtain relatively large modulation depths.

Dr. Jacobs wrote the paper with R. W. Benjamin of the Monmouth College electronic engineering faculty and Dr. Dale A. Holmes of Carnegie Institute of Technology, Pittsburgh.

Dr. Jacobs is a senior research scientist in the Electronics Command Solid State and Frequency Control Division. He is also chairman and professor of electronic engineering at Monmouth College.

Army R&D Officials Brief Swedish Defense Chiefs

Two high-ranking Swedish Defense officials were briefed on U.S. Army research and development activities during a recent visit to learn more about U.S. defense R&D planning and management.

Dr. Erik M. Fehrm and Folke Mattson visited the Office of the Chief of Research and Development, the U.S. Army Research Office (USARO), and the Research Analysis Corp., an Army contract agency in McLean, Va.

Dr. Fehrm is Director General of the Research Institute of National Defense, Stockholm, and Mr. Mattson serves as chief of the Research Planning Division at the Institute.

Subject areas covered during the USARO briefing included policy, plans and programs for research and exploratory development; defining and translating operational requirements into R&D activities; techniques and procedures used to control R&D efforts; and tri-service coordination within research councils.

The Swedish defense officials also received briefings from the Navy and Air Force, elements of the Department of Defense, the National Science Foundation, Institute of Defense Analysis, the Department of State, the Rand Corp. and Massachusetts Institute of Technology before departing the United States.

Two Swedish defense officials were briefed by top U.S. Army Research Office (USARO) personnel during a visit to the U.S. From left to right are Dr. Erik M. Fehrm, Director General, Swedish Research Institute of National Defense; Col Wallace L. Clement, Assistant Director of Army Research; Folke Mattson, chief, Research Planning Division at the Swedish Institute; and (in rear) Dr. I. R. Hershner, chief, Army Research Office Physical Sciences Division.

ARGENTINE MINISTRY OF DEFENSE Joint R&D Board members are shown in front of U.S. Army Research Office (USARO), Arlington, Va., following a briefing on the Army research program. Left to right are Col Wallace L. Clement, Assistant Director of Army Research; Commodore Pedro Garrido (AF); Dr. Richard A. Weiss, Deputy and Scientific Director, USARO; Capt Charles E. Saucier, U.S. Air Force escort officer; Capt Jorge N. Vilaclara (Navy); Rear Adm Julio Ques (Navy), president of the Argentine Defense R&D Board; and Col Robert P. Tiscornia (Army). The Argentine officers also were briefed by the Office of the Director of Defense Research and Engineering, Office of Naval Research and the U.S. Air Force Office of Aerospace Research and Air Force elements. While in the U.S., they toured Fort Belvoir, Va., Cape Kennedy, Fla., National Aeronautics and Space Agency and the Industrial College of the Armed Forces, Washington, D.C., and the United States Air Force Academy at Colorado Springs, Colorado.

AMSC Meets at Redstone For Briefing by MICOM

Army Mathematics Steering Committee members, meeting for the 20th time since the AMSC was established in 1956, were guests of the Army Missile Command at Redstone (Ala.) Arsenal for a briefing on MICOM's mission and current R&D activities.

Dinner speaker Dr. John P. Minton of Ohio State University, a researcher for the National Cancer Institute, discussed "Laser Medical Experiments." He has been working with MICOM physicists using Army Laser devices as a surgical tool in successful cancer research on animals.

Chaired by Dr. Ivan R. Hershner, Jr., chief of the Physical Sciences Division, Army Research Office, the AMSC was welcomed to MICOM by Brig Gen Charles W. Eifler, deputy CG for Land Combat Systems. Dr. S. H. Lehnigk of MICOM's R&D directorate was coordinator for the steering committee meeting.

The AMSC functions as an advisory group and is responsible for program guidance to the Mathematics Research Center, U.S. Army, established in 1956 at the University of Wisconsin. The Committee assists top level R&D leaders, Army staff elements and mathematics groups in planning, coordinating and supervising mathematics research.

Speakers at the AMSC meeting included John L. McDaniel, technical director of MICOM's R&D Directorate, Norman M. Shapiro, acting director of the MICOM Physical Sciences Laboratory, and two laboratory representatives, Dr. Oskar M. Essenwanger and Dr. John D. Stettler.

Thomas G. Wetheral of the Inertial Guidance and Control Laboratory spoke on fluerics and Carl Bezner explained inertial fuzing.

Frank W. James and Albert R. Mayket represented the Propulsion Laboratory with an outline of the lab's mission and a film, "Automated Design of Solid Propellant Rockets."

The Electromagnetics Laboratory's mission was discussed by the deputy director, Waite H. Todd. An outline of high-energy Laser array research was presented by William Otto.

Dr. William C. McCorkle, director of the Advanced-Systems Laboratory explained recent development in the missile guidance field.

The meeting was attended by 30 representatives and guests from various branches of the Army.

6163rd Army Reserve R&D Unit Devises System For Precise Mobilization Designation by ADP

A computerized system to match USAR R&D personnel to a precise mobilization designation is the product of a year of work by the 6163rd U.S. Army Reserve Research and Development Unit, Phoenix, Ariz.

Designed to increase the number of USAR R&D personnel with "Mob Des" assignments, the program will be administered for the Chief of Research and Development by the U.S. Army Administration Center (USAAC), St. Louis, Mo. The USAAC is responsible for maintenance of all U.S. Army Reserve permanent 201 files, and will assume the data bank for the new program.

Chief of Research and Development Lt Gen William W. Dick, Jr., and Chief of Army Reserve Maj Gen William J. Sutton have been following the project with interest and have expressed satisfaction with its successful completion.

Upon congratulating the 6163rd USAR R&D Unit personnel, General Sutton directed them to brief the Reserve Components Personnel Center, Fort Benjamin Harrison, Ind., on the computerized system because of possible application to areas other than USAR R&D units.

Present Military Occupational Specialty (MOS) designations have been recognized as not definitive enough to delineate all research and development activities. Personnel of the 6163rd identified 71 descriptors, or job codes, pertinent to research and development activities.

A questionnaire was sent to each of the R&D Reservists, asking his name, rank, primary, secondary and tertiary civilian occupational speciality, geographical location, Reserve unit number, highest degree, year received, major subject, and whether he has a mobilization designation. This resulted in a manpower resource allocation file.

When transferred from punch cards to magnetic tape, the information comprised the data bank of the computerized system.

When a Mob Des vacancy occurs in a certain occupational field, the system makes it possible to retrieve from the computer the names of the best qualified individuals. Primary aim of the program is to increase the number of Mob Des assignees to about 80 percent of the USAR R&D Unit personnel. The Reservists are responsible for updating information in the data bank.

The project concept was developed originally by Lt Thomas F. Duggan of the 1332nd USAR R&D Unit, New York City, while he was serving a 2-week active duty assignment in the summer of 1964 in the Office of the Chief of Research and Development.

Under direction of the commanding officer, Col James W. Elmore, scientific personnel of the 6163rd Unit prepared for the feasibility study and list of job descriptors for the project.

The Unit's Automatic Data processing Section (the only such detachment in the Reserves) developed the computer program and machine processing. Lt Col L. P. Elbinger heads the ADP section, which includes Maj Richard Shimmons, Capt Clyde McGuffie, Sp/4 Kurt Renz and Sp/4 John A. Wertz.

Because of their specialized capability, they volunteered to undertake the project. They all are employed in data processing in Phoenix for the General Electric Computer Department, which offered use of its facilities for portions of the project.

Capt McGuffie traveled to Washington, D.C., to turn over the computer program to Army Headquarters. While there he discussed with officials of the Army Information and Data Systems (AIDS) element of the Office of the Chief of Staff possibility of the Unit undertaking another automatic data processing project.

6163rd USAR R&D Unit members who developed a computerized system of mobilization designation for R&D Reservists are shown with ADP equipment similar to that used on the project. They are (l. to r.) Capt C. W. McGuffie, project leader for programing integration; Sp/4 J. A. Wertz and Sp/4 Karl Renz, programing analysts; and Lt Col L. T. Elbinger, patent attorney. All work for the Computer Department of General Electric Co.

WSMR Building Noise Room for Missile Testing

In line with a 5-year program of instrumentation modernization linked to progress in missile development, White Sands (N. Mex.) Missile Range is building a $150,000 test chamber to simulate aerodynamic environments of missile flights.

The high-intensity noise chamber will be capable of simultaneously producing vibrations of various aerodynamic environments. Production of 20,000 watts acoustic power—planned for later increase to 50,000 watts—will enable scientists to create conditions similar to those of missiles throughout performance sequence.

Expected to be operational in June 1966, the new facility will permit effects of high intensity noise on missiles, missile structures, mechanical and electronic components to be measured and evaluated.

Many aspects of actual flight tests can be conducted in the chamber, which will be the only one in the United States capable of producing a programmed noise level simultaneously with vibration effects of missile flights.

The acoustic power of 20,000 watts can be likened to the noise produced by 200,000 hi-fi sets going full blast (the average hi-fi loud speaker operates at .1 watt of acoustic power).

The extreme noise levels will be produced by a 1,700-horsepower compressor forcing 3,000 cubic feet of air per minute at 50 lbs. per square inch through 10 acoustic transducers, or horns.

The test facility itself is an expanding horn designed so that sound waves will reverberate within the chamber at sound pressure levels up to 165 decibels at frequencies up to 7,500 cycles per second in a uniform sound field.

While the test item is being subjected to the high-intensity sound, a large electrodynamic "shaker" beneath the chamber will produce up to 28,000 pounds of force with a frequency range of 5 to 2,000 cycles per second. The test item is thus subjected to mechanical vibration and high-intensity noise at the same time. The shaker can also be attached at floor level or the chamber for operation in the horizontal plane.

The noise chamber is designed for three configurations: closed, 500 cubic feet; partically closed, 1,000 cubic feet; and with doors open for items too large for closed chamber testing.

C. H. Clark

John Hessel

H. W. Parmer

ABCA Program Results in ECOM Personnel Shifts

MALLARD, code name for a 4-nation effort to coordinate design of future tactical communications systems, has involved the U.S. Army Electronics Command, Fort Monmouth, N.J., in several personnel reassignments.

Brig Gen Wesley C. Franklin, ECOM deputy CG, now has the additional duty of serving as chief of the MALLARD Project Management Office for ECOM. The nations participating in this project, known as the ABCA group, are the United States, Great Britain, Canada and Australia.

MALLARD is another phase of the highly successful ABCA Army Standardization Program. Now in its 18th year of operation, the ABCA cooperates in development knowledge and scientific talents to strengthen joint combat capability.

Brig Gen W. C. Franklin

Simultaneously with the announcement of General Franklin's assignment to head the ECOM participation in MALLARD, it was revealed that John Hessel, a radio communications engineer first assigned to Fort Monmouth in 1931, is the technical director of the Project Management Office.

When reassigned, Hessel was technical director of the Communications/Automatic Data Processing Commodity Management Office of ECOM. He has a degree in electrical engineering from the University of Michigan and served in Europe during World War II, achieving the rank of lieutenant colonel.

Installed as Hessel's successor is Harry W. Parmer, formerly director of Technical Plans in ECOM Laboratories until they were involved in a major reorganization during 1965.

Parmer has been employed at Fort Monmouth since 1929, following graduation from Auburn University as an electrical engineer. He holds eight patents and was the U.S. delegate for communications to the NATO Long-Range Study Group that convened in Naples, Italy, in 1961.

Charles H. Clark was appointed chief of the Operations Control Office of the ECOM Procurement and Production Directorate, a promotion from prior duty as civilian personnel officer for the Directorate of Personnel and Training.

Formerly he was deputy director of engineering in the ECOM laboratories. A Certificate of Achievement and a Quality Step Increase in salary accompanied elevation to his new duties. He is a graduate from Newark College of Engineering and has served as chairman of the Battery Working Group of the Interservice Group for Flight Vehicle Power and of the Battery Division, Electrochemical Society.

MICOM Begins Using New DARE System

DARE is the challenging acronym that denotes Documentation Automated Retrieval Equipment, developed through findings of a 4-year study and being put into operation at Redstone (Ala.) Arsenal by the U.S. Army Missile Command.

Believed unique in the Free World, DARE permits storage of more than 1,500,000 engineering drawings and associated documents. Retrieval time for reproduction averages 60 seconds.

Each month, 30,000 new or revised drawings are added to the working file maintained in the Engineering Documentation Division of the Procurement and Production Directorate at Redstone. Approximately 5,000 requests for copies of drawings are received every day from bidders, depots and other agencies.

In the pre-DARE era, each drawing was photographed on 35-millimeter microfilm and the developed film inserted in the "window" of an electric accounting machine aperture card.

When a request for a drawing was received, a clerk went to the numerical file of these 3x7-inch cards and manually removed the one needed—if it was there. At peak periods, as many as 50,000 cards were out.

Under the DARE operation, all microfilm aperture cards have been converted to 35-millimeter microfilm chips, with coded identifying data on each chip. These 3-inch chips are kept in a master file, and when a drawing number is fed into a computer—the brain of DARE—that chip automatically is brought forward.

From the chip, either a microfilm aperture card which can be screened in a viewer or a copy of the drawing is made. The chip then is returned to the master file.

The entire file of film chips normally is processed once a day, taking about seven hours. Routine requests are filled, new chips are inserted and outdated ones deleted during the daily searching operation.

Before the advent of DARE, preparation of engineering documents for a procurement request required up to 15 days. Individual requests consumed as many as five days. Engineers and scientists frequently had to wait while clerks searched the microfilm card file for urgently needed drawings.

Now, a "blue streak" priority request for engineering drawings must be filled within 24 hours. Normal orders are fed into the computer in the form of punch cards. But for a "blue streak" a switch can be pulled, stopping the normal DARE operation, and the drawing numbers typed straight into the storage and retrieval system.

DARE was designed and built by Magnavox Co. of California.

Research Firm Publishes Army Food Radiation Study Report

A report on a comprehensive study of the Army Radiation Preservation of Food Program was published recently by the Federation of American Societies for Experimental Biology (FASEB), Washington, D.C.

Dr. Wendell H. Griffith, director of FASEB's Life Sciences Research Office, is the author. The study was made under contract with the U.S. Army Research Office.

In its basic form the report was used in the preparation of the Army's revised 5-year food irradiation program as presented to and approved last June by the Sub-Committee on Research, Development and Radiation of the Joint Committee on Atomic Energy, Congress of the United States.

A report on Federal approval for unlimited public use of certain food items preserved by ionizing radiation, and the presentation to the Congressional committee, was published in the September 1965 issue of the *Army Research and Development Newsmagazine* (pages 22, 23)

Dr. Wendell's report does not "necessarily reflect official Department of Army policy or doctrine." It presents the majority view of an ad hoc committee representing Federal agencies, private industries and university scientists concerned with the Army food radiation preservation environment.

The FASEB study reviews the 13-year-old Army food preservation program and discusses progress. It tabulates, in addition to the radiation requirements of approved food items, the planning schedule up to 1970 for some 30 types of food for which petitions for approval will be submitted to the U.S. Food annd Drug Administration.'

Dr. Wendell summarizes the FDA acceptance of sterilized canned bacon, deinfested wheat and wheat products, and sprout-inhibited white potatoes. He cites possible problems associated with the use of the electron accelerator in food irradiation and recommends that the Army continue to support research on irradiation preservation as well as other types of food preservation.

The FASEB scientist sees as "highly desirable" a definitive and realistic estimate of the future role of the Army in support of scientific research on the irradiation preservation of ration components and in the support of technological developments required for their production. He suggests that the estimate consider accomplishments and deficiencies of the program, the lack of progress in commercial application, and the relative importance of irradiation preservation as compared with other types of food preservation.

Dr. Wendell suggests that the Army's support of irradiation sterilization may need to be extended to industrial subsidies for procurement by the Armed Forces because of the apparent lack of consumer appeal in radiation-processed food.

He reports little progress in the development of commercial capabilities for irradiation sterilization of foods—despite the cooperation and interest in the extensive programs of the Army and other U.S. governmental agencies.

Chaired by Dr. Wendell, the FASEB Ad Hoc committee which evaluated the food preservation program consisted of the following members:

Dr. John C. Ayres, professor of food technology, Iowa State U.; Maj Roger W. Baker, VC; Col Irvin C. Plough, MC; and Lt Col Eugene A. Rosenberger, MC, of U.S. Army Medical Service R&D Command; Dr. John Bogusky, Army Materiel Command; Lt Col J. E. Canham, MC, and Dr. Nicholas Raica, Jr., of Fitzsimmons General Hospital's Army Medical Research and Nutrition Laboratory, Denver, Colo.;

Also, Dr. Laverne E. Clifcorn of Crown Cork and Seal Co., Philadelphia, Pa.; Raymond Cooper and Dr. Edward S. Josephson of Army Natick (Mass.) Laboratories; Dr. Hans L. Falk, National Cancer Institute, Bethesda, Md.; Dr. David B. Hand, Cornell U.; Dr. Glen C. King, College of Physicians and Surgeons of Columbia U., N.Y.; Dr. Lee O. Kline, Dr. Edwin P. Laug, Dr. Arnold J. Lehman, and Dr. Glenn G. Slocum of U.S. Food and Drug Administration;

Also, Dr. William H. Koch, National Bureau of Standards; Dr. Herman F. Kraybill, U.S. Public Health Service; Dr. Herbert Pollack, Institute for Defense Analysis, Arlington, Va.;

Also, Dr. Bernard S. Schweigert, Michigan State U.; Dr. Walter M. Urbain, Swift and Co., Chicago, Ill.; Maj Leo A. Whitehair, VC, Atomic Energy Commission; Harry W. Ketchum and Jack Osburn, Jr., U.S. Department of Commerce; Dr. C. Jelleff Carr, Dr. Allan L. Forbes and Dr. Carl Lamanna of the U.S. Army Research Office, Office of the Chief of Research and Development.

Evaluation meeting attendees included Dr. Frank R. Fisher, National Academy of Sciences—National Research Council Advisory Board on Military Personnel Supplies, Washington, D.C.; Col Tyron E. Huber and Dr. Eugene M. Sporn, U.S. Army Research Office; Jacob M. Schaffer, consultant to U.S. Army Natick Laboratories, Beltsville, Md.

Veteran Signal Officers Fill 2 STRATCOM Posts

Two key field positions of the Army Strategic Communications Command have been filled by veteran Signal Corps officers, Maj Gen R. J. Meyer, STRATCOM CG, announced.

Col George W. Rhyne, former commandant of the Southeastern Signal School at Fort Gordon, Ga., is the new commander of STRATCOM's Joint Support Command (JSC) at Fort Ritchie, Md. He succeeds Brig Gen John E. Kelsey, new deputy CG of STRATCOM.

Lt Col Charles J. Dominique, previously in the Office of the Deputy Chief of Staff, Personnel, The Pentagon, is now commander of the 11th Signal Group at Fort Lewis, Wash.

Col Rhyne served as senior signal adviser, Republic of Korea Army, later was signal officer of the Third U.S. Army, and is a former chief of the Personnel and Training Division of the Office of the Signal Officer, Washington, D.C.

Col G. W. Rhyne

Lt Col C. J. Dominique

NATIONAL SCIENCE FAIR-INTERNATIONAL winners are greeted in Tokyo where they participated as American delegates to the Ninth Annual Japan Science Student awards ceremonies and exhibits. L. to r. are William A. Voelkle, U.S. Air Force sponsored; J. Richard Gott, III, U.S. Navy sponsored; Barbara Ann Bennett, the Army's representative; and Col Charles W. Cook, Commander, U.S. Army Research and Development Group, Far East.

Army Choice Charms Japanese Science Fair

Charm and beauty suspected of influencing U.S. Army judges almost as much as her outstanding scientific talents won Barbara Ann Bennett a warm place in the affections of many thousands during her participation in the tenth annual Japan Student Science Awards in Tokyo.

Selected at the 16th National Science Fair-International to represent the U.S. Army, along with representatives of the Air Force and the Navy, the blue-eyed blonde "did herself proud" as a 10-day goodwill envoy early in November. Now a biology-chemistry major at Indiana State College, and a model in her spare time, Miss Bennett "enchanted" the Japanese, reports indicate.

In displaying her prize-winning NSF-I exhibit, "Mushroom Production by Tissue Culture and Fermentation—Related Nutritional Studies," Miss Bennett found herself the center of attraction for many thousands of visitors to the Japan Student Science Awards. The students' exhibits of their scientific ability were displayed at Japan's National Science Museum.

ORIENTAL WINNER at Japan Student Science Awards, Takako Okuda, is greeted by Barbara Ann Bennett, winning student sponsored by the U.S. Army, during a lull at Yomiuri Hall.

FOR FOLKS AT HOME, Barbara Ann Bennett, Army-sponsored representative at 9th annual Japan Student Science Awards, is interviewed for radio broadcasts by Sfc Revis L. Taylor, Office of Information, USARJ.

The consensus appeared to be that Miss Bennett's radiant smile, ready laughter, friendliness and sparkling vitality impressed the Japanese just as much as the proof of her capabilities as a young scientist. She made it winsomely obvious that she was mighty happy to be there, meeting with them on a people-to-people basis, and they swarmed eagerly around her.

Miss Bennett shared the limelight with the other U.S. representatives, William A. Voelkle of Houston, Tex., the Air Force choice, and J. Richard Gott, III, sponsored by the U.S. Navy, whose science exhibits equally impressed the Japanese.

Popular appeal of the American trio of student scientists was manifested in a variety of their appearances in public, in addition to displaying their exhibits in the National Museum. It was the third successive year that the U.S. Army, Navy and Air Force have joined in sending representatives to the Japan Student Science Awards.

The ambitious program of activities mapped out for them might have had its origin in goodwill left by the earlier American participants.

Miss Bennett and her companions were guests at the Japanese Imperial Palace, Japanese high schools, industrial facilities and various receptions. They also were guests of the U.S. Ambassador to Japan, the U.S. Navy, and the U.S. Army R&D Group (Far East). In addition, they toured many of the cultural landmarks in the Tokyo-Yokohama region.

"Just overwhelming" was the way Miss Bennett summarized her visit. In that enthusiastic reaction she joined in a viewpoint expressed by her two predecessors as U.S. Army "beauty with brains" representatives in the Japanese competition, Rhea Keller in 1963 and Nancy Lee Williamson in 1964.

U.S., Britain Approve Plan To Develop VSTOL Engine

British-American joint development of an advanced lift-jet engine has been approved through a memorandum of understanding signed by Secretary of Defense Robert S. McNamara and United Kingdom Minister of Aviation Roy Jenkins.

Intended for vertical and short take-off and landing (VSTOL) aircraft, the engine to be developed could have wide application to transport as well as tactical military aircraft in the event of a significant advance in lightweight engine technology.

By collaborating in this project, the United States and United Kingdom hope to achieve substantial cost reduction in developing an engine incorporating the best of each contractor's technology.

As a further gain, it is hoped that the experience accumulated by the two governments, in negotiating this agreement and supervising the project, can simplify and encourage further collaboration in Defense research and development.

Scheduled to begin early in 1966, the joint project development work will be performed by Rolls Royce, Ltd. and a U.S. contractor yet to be selected on a competitive basis.

AGED Prepares DoD Research Program

The Department of Defense Advisory Group on Electron Devices (AGED) recently concluded a series of eight meetings during 1965 to dovetail state-of-the-art studies by its working groups and prepare the AGED annual report.

Sessions were held at the New York City secretariat of AGED.

The advisory group, under the Director, Office of Electronics of Defense Research and Engineering (DDR&E), also has prepared an overall, updated summary of the AGED 5-year research program for DoD. The program began in 1955 and is updated every other year.

The end-of-the-year review of reports from AGED's five permanent working groups accomplished one of the primary goals of the organization—coordination of research by the tri-service working groups to eliminate needless duplication of effort in the electron devices field.

The AGED was established in 1961 by DDR&E to provide technical advice and to assist DDR&E and the military departments in planning and directing adequate and economical R&D programs in electron devices.

The AGED replaced the Advisory Group on Electron Tubes, a joint Army-Navy effort organized early in World War II, and the Advisory Group on Electronic Parts established in 1954.

Today's AGED consists of working groups in five specific areas: Microwave Devices, Low Power Devices, High Power Devices, Special Devices and Passive Devices. Currently in existence is one special ad hoc Working Group on Optical Masers, headed by R. H. Kingston of Stanford Electronic Laboratories.

Special ad hoc groups are set up from time to time by DDR&E as needs arise. They remain in a working status until studies and reports are completed.

Under continuing study by the AGED and its subgroups are all phases of research and development of electron devices—active and passive microwave, high- and low-power nonmicrowave, special electron and conventional passive devices—whether undertaken separately or as parts of systems or production contracts.

Dr. W. G. Shepherd, University of Minnesota, is chairman of the AGED. Five civilian members are from private industry and one officer and a civilian represent the Advanced Research Projects Agency (ARPA). The various AGED working units are served by consultants from universities and private industry who have associate member status.

A full-time technical and administrative secretariat is provided AGED under contract with New York University supported by the Army, Navy and Air Force.

The Army is represented on the AGED by Kenton Garoff of Army Electronics Command (ECOM), Fort Monmouth, N.J. A deputy member and associate members also represent each of the following: ECOM, the Army Materiel Command, Frankford Arsenal, The Army Research Office, the Harry Diamond Laboratories, and Army Missile Command.

The Navy and Air Force are similarly represented with members, deputies and associate members from agencies corresponding to those in the Army.

DoD and nonmilitary agencies represented by associate members include the Defense Electronics Supply Center, the Office of Technical Data and Standardization Policy, the Defense Communications Agency, the Weapons Systems Evaluation Group of DDR&E, U.S. Atomic Energy Commission, National Bureau of Standards, National Aeronautics and Space Administration, National Security Agency, and the Institute for Defense Analysis.

Under terms of the DDR&E charter, the AGED is required to:

- Survey and evaluate electron device R&D programs, within and outside of the Department of Defense.
- Review and evaluate projects and programs in electron devices, including those pertaining to the Mutual Weapons Development Program.
- Provide technical advice on a continuing basis to DDR&E on long-range supporting R&D programs for DoD, especially those programs which will reduce lead time needed for development of devices to meet future equipment and systems needs.
- Advise DDR&E on present and planned electron device development programs of the military services, insuring that they reflect equipment and systems requirements with a proper balance between the developing programs and the supporting long-range research program.
- Insure that the long-range program will make available the technology needed to meet planned equipment and systems requirements.
- Advise DDR&E of significant advancements or discoveries or unanticipated difficulties encountered in the electron device field which may affect future availability dates of major equipment or weapons systems.
- Provide a medium for interchange of technical R&D information within DoD, interested Federal agencies and Government contractors.

4 Nations Seek High-Strength Ceramics

Ceramic materials many times stronger than steel are the elusory goal of research by scientists of four nations under contracts awarded recently by the National Aeronautics and Space Administration and the Army Research Office-Durham, N.C.

Scientists from Australia, Canada, the United Kingdom and the United States are pooling their extensive knowledge of ceramics in efforts at the Research Institute for Advanced Studies (RIAS), Martin Co., Baltimore, Md.

NASA studies at RIAS concern microscopic dislocations in titanium carbide in the 0°-1500° C. range. Work for the Army Research Office-Durham is on the fracture characteristics of brittle ceramics at room temperature. Some $60,000 is involved in the current contracts.

Dr. E. Neville Pugh, a Welsh metallurgist, is performing the research for ARO-D, assisted by John Craig, an Australian. John D. Venable, a U.S. solid-state physicist, is in charge of the research on the NASA contract.

Dr. Robert Lye, Canadian solid-state physicist, is conducting theoretical aspects of the RIAS research and Dr. Graham Hollox, an English metallurgist, is studying ceramic-carbide alloys. Dr. A. R. C. Westwood is associate director of the basic research center.

NASA and U.S. Army interest in ceramics for high-strength structural application stems from the search for materials to withstand the high temperatures and other environmental effects associated with nuclear devices and advanced spacecraft.

If research at RIAS succeeds, the nonmetal titanium carbide, for example, may offer strength of 100,000 pounds per square inch at temperatures high enough to melt most metals.

As in alloying metals, scientists hope to mix ceramic alloys and by microscopic examination find a way to control atom-sized defects that eventually cause fracture.

Herbert Brett

AWARD WINNERS Frank A. Brand (second from left) and Dr. I. R. Senitzky (third from left), selected from among 10 R&D nominees, pose with presiding officials at recent fifth annual awards ceremonies held at ECOM Headquarters, Fort Monmouth, N.J. Flanking the winners are Brig Gen Wesley C. Franklin, deputy commander for Operations, and W. L. Doxey, director of the ECOM Research and Development Directorate.

Johann Holzer

Josef Anderl

George Hogelin

Dr. Gernot Winkler

Paul T. Wilson

David G. Eyre

Bernard Reich

ECOM Honors Dr. Senitsky, Brand For Outstanding R&D Achievements

Newly emblazoned on the permanent honorary plaque prominently posted at Headquarters of the U.S. Army Electronics Command, Fort Monmouth, N.J., are the names of Dr. I. R. Senitzky and Frank A. Brand, in recognition of outstanding R&D achievements.

Selected from 10 nominees for technical and leadership achievement awards for 1965, the two scientists were honored at the recent fifth annual ECOM awards banquet. Brig Gen Wesley C. Franklin, ECOM Deputy CG for Operations, presented the awards.

The other nominees are: Technical achievement—Bernard Reich, David G. Eyre, Josef H. Anderl, and Herbert Brett. Leadership—Johann Holzer, Paul T. Wilson, Dr. Gernot M. R. Winkler, and George Hogelin.

As a team leader in the Institute for Exploratory Research, Dr. Senitzky was commended for technical achievement. Mr. Brand, deputy director of the Solid State and Frequency Control Division, Electronics Components Laboratory, was cited for leadership of technical programs. Their names join eight others inscribed during the past four years on the plaque in the Hexagon Building.

DR. SENITZKY was acclaimed for research that includes the phenomena and processes of Masers as well as Lasers. Other leading scientists in the field have given his findings wide recognition. By invitation, he has presented papers at national and international scientific meetings.

Maser is the acronym for Microwave Amplification by Stimulated Emission of Radiation, while Laser stands for Light Amplification by the same method.

Dr. Senitzky obtained his bachelor's degree from City College of New York, master's degree from New York University, and doctorate from Columbia University. He is a member of the American Physical Society.

MR. BRAND was honored for his "dynamic and progressive" leadership of R&D programs, in addition to his direct research contributions. As an executive of the Electronic Components Laboratory, his work has been principally in the field of semiconductor and quantum electronic devices, used in such equipment as microwave radio, Lasers, and improved amplifiers.

Graduated from Polytechnic Institute of Brooklyn with BS and MS degrees in physics, he is part-time instructor of electronic engineering at Monmouth College. Author of more than 50 scientific papers, he is a senior member of the Institute of Electrical and Electronic Engineers and a member of the Armed Forces Communications and Electronics Association. He serves on a number of Federal Government advisory panels devoted to specialized electronics areas.

BERNARD REICH, chief of the Semiconductor Devices Branch, Electronics Components Laboratory, was commended for a number of contributions related to improving the reliability of transistors and diodes.

DAVID G. EYRE, a mechanical engineer in the Engineering Support Services Department of the R&D Directorate, designed simplified equipment for inflating and launching meteorological balloons in the field, and a meter that accurately records the volume of hydrogen or helium during inflation.

JOSEPH H. ANDERL was commended for a major part in a tactical radios study directed by the Department of Defense. Resulting in improved national defense, the study became the basis for commonality of Army and Marine Corps equipment and provided data for future development of U.S. and NATO combat communications equipment. He is an electronic engineer in the Communications and Automatic Data Processing Laboratory.

HERBERT BRETT, an Electronic Warfare Laboratory engineer, was commended for discovering and developing a new type of what is known as a phase shift amplifier which is highly effective for intercepting weak radio signals.

JOHANN HOLZER, leadership winner from the Technical Plans and Operations Office, Communications and Automatic Data Processing Laboratory, was cited for his direction of technical programs planning.

PAUL T. WILSON, an electronic engineer on the technical staff of the Equipment Analysis Division, R&D Directorate, formulated the Command's engineering design evaluation format for electronic materiel.

DR. GERNOT WINKLER was commended for conceiving and leading electromagnetic propagation experiments in the Arctic and Antarctic that have demonstrated new potentials in global communications. He was also cited for organizing a balanced research program and providing a quality of leadership that has induced colleagues to make numerous contributions in nuclear physics, plasma physics, and geophysics. Dr. Winkler is director of Division "S" Institute of Exploratory Research.

GEORGE HOGELIN, an electronic engineer in the Avionics Laboratory, was commended for work that encompasses continuing coordination between the Army and Navy in technical studies dealing with a joint avionics system development, and the development of the Army's Advanced Aerial Fire Support System.

Col Gauvreau Named Air Defense Board Deputy

Col David G. Gauvreau, who in July terminated nearly a 4-year tour in the Office of the Chief of Research and Development, the last three years as executive officer, is the new deputy president of the Army Air Defense Board, Fort Bliss, Tex.

Before he became OCRD executive officer, Col Gauvreau served nearly a year in the OCRD International Division, first as deputy and the last six months as chief of the Division. To OCRD associates, he is known as one of the pioneers in Army missilry development, having worked on both the Redstone and Jupiter missiles.

Immediately prior to assignment to OCRD, he was a liaison officer to the Viet Namese chief of staff and secretary of defense as a member of the U.S. Military Assistance Advisory Group.

Graduated from the U.S. Military Academy in 1941 with a BS degree in military engineering, he was commissioned an Artillery officer. In 1948 he received an MS degree in mechanical engineering from the University of Michigan.

During World War II, he served with antiaircraft Artillery battalions in Germany. He returned more than five years after war's end to serve in France as a plans and operations officer at Headquarters Allied Forces Lands Central Europe.

Later, Col Gauvreau was responsible for converting the 79th Battalion to the Nike-Ajax missile system in his assignment to the Chicago-Gary defense area.

He has attended the Army War College, Carlisle Barracks, Pa., and the Command and General Staff College, Fort Leavenworth, Kans., in addition to various missile, artillery and nuclear courses and the senior Air Defense Artillery Officer Course.

Col David G. Gauvreau

66 Officers Take Course In Operations Research

General Staff elements and major Army commands were represented at an Operations Research Appreciation Course offered recently at the U.S. Army Research Office, Arlington, Va.

The purpose was to give senior staff and action officers a better understanding of operations research capabilities, limitations, methods and techniques, especially as they may be applied to Army studies; also, to increase the overall quality of effort in the initiation, conduct, monitoring, review and use of studies.

Sixty-six attendees (59 military, 7 civilian) were selected from Offices the Deputy Chiefs of Staff for Personnel, Operations and Logistics, Assistant Chiefs of Staff for Intelligence and Force Development; Chief of Research and Development, Chief of Engineers and Chief of Communications-Electronics; Office of Reserve Components, Office of Personnel Operations, Comptroller of the Army; the U.S. Army Materiel Command and Army Combat Developments Command.

Sponsored by the Chief of Research and Development, Lt Gen William W. Dick, Jr., the course was taught by Eugene E. Newnam of the U.S. Army Management Engineering Training Agency (AMETA), Rock Island, Ill.

Initiated at the request of Lt Gen Charles H. Bonesteel, Director of Special Studies, Office of the Chief of Staff, the course was introduced by Maj Gen F. W. Norris, Director of Army Programs, Office of the Chief of Staff.

Basically, the course covered the following areas: definition and concept of Operations Research; the purpose of the Army Study System; Operations Research approach and personnel; statistical inference and the role of statistical design of experiments; common areas of application such as queuing processes, simulation, inventory allocation, competitive strategy; consideration of a case history.

Army Research, Development, Testing, Evaluation Cycle Traced

The purpose of this article is to clarify the complex process of Army research, development, test and evaluation and its relationship to Army requirements—through use of a hypothetical need for an Army Land Vehicle Module.

All projects do not follow exactly the same pattern. Some systems require very little exploratory or advanced development, depending on the state of the civilian art. In order to show the RDTE cycle at its fullest, however, a system as complex and sophisticated as the hypothetical ALVM was chosen.

The article was prepared from briefing material presented originally at an R&D seminar for Reserve Officers by Lt Col Stephen L. Conner, Jr., Review and Analysis Division, Office of the Chief of Research and Development (OCRD); Maj Albert F. Green, Plans and Programs Division, Materiel Directorate, U.S. Army Combat Developments Command; and Dale P. Butcher, Development Division, Research and Development Directorate, U.S. Army Materiel Command. The original briefing was subsequently condensed and restructured by Col Conner and Lt Col W. E. Coleman, Review and Analysis Division, for presentation to foreign visitors.

The Army research and development life cycle begins with expression of the need for a certain item and ends with its acceptance into the Army system as standard materiel or equipment.

These are the broad, basic steps involved: preparation of the Qualitative Materiel Development Objective (QMDO); Research; Exploratory Development; issuance of the Qualitative Materiel Requirement (QMR); Advanced Development; Contract Definition Phase; Engineering Development; and Type Classification.

One of the basic tools used in determining how the Army should be equipped is the Qualitative Materiel Development Objective, which is a Department of the Army document. The QMDO states the need for a system or item of materiel that is not currently technically feasible.

The Army Land Vehicle Module (ALVM) will be used as a hypothetical project to illustrate the research and development process as it normally progresses in reality.

In this fictional example, ALVM may have begun as a general materiel objective pertaining to earth exploration in the Army Concept Program-70. QMDOs are generated to satisfy the specific materiel objectives of such broad, long-range concepts. The statement which generated the QMDO for ALVM may have read:

"With the advances made in science and technology, in conjunction with the U.S. Air Force, the Army must be prepared to assume a mission of earth mapping. Specifically, the mapping of the earth's surface will be accomplished by use of a manned land vehicle."

This QMDO for the land vehicle is prepared by the Combat Developments Command Engineer Agency, which has the responsibility for all engineer-type developments, to include mapping. Normally these statements originate from a CDC agency but may, in some cases, come from major Army commands.

Each QMDO is a brief study aimed at a specific item of equipment rather than a broad concept. Major divisions of the QMDO are a statement of the research or development objectives to be achieved; a brief description of the organizational, operational or logistical concepts involved, including probable personnel and training implications; justification for the item and why other QMDOs will not satisfy the objective and priority to be assigned; and a miscellaneous section which contains any additional information necessary for responsible agencies to understand objectives.

Before the proposed document is submitted for Department of the Army approval, extensive coordination is completed with Army agencies and the other military services. The Assistant Chief of Staff for Force Development (ACSFOR) receives the final proposed document and studies it to determine tentative Army approval.

Army staff elements then evaluate the QMDO in light of Joint Plans, Army Plans and Army roles and missions. It must be thoroughly justified within the context of the total future resources requirements of the Army as provided for in the Five-Year Force Structure and Financial Plan. It must also be compatible with those QMDOs relating to land operations which already have been approved.

After Department of the Army approval of the proposed QMDO, notification is given to the Combat Developments Command and a statement of the objective is printed as a paragraph in the Combat Development Objectives Guide (CDOG).

The Office of the Chief of Research and Development must then select the appropriate developing agency for the Army Land Vehicle Module. In this case, both the Chief of Engineers, with his responsibility for mapping and geodetic systems, and the Army Materiel Command (AMC), with sole responsibility for R&D of all materiel not specifically assigned to another developing agency, would be considered as candidates for the job.

Since the major problem involves the vehicle itself, rather than the mapping aspects, AMC would be designated the developing agency. The AMC then would prepare and coordinate with the Chief of Engineers and CDC a brief but specific QMDO plan covering Research and Exploratory Development on the Army Land Vehicle Module.

This plan contains alternate development approaches, with problems expected to be encountered; a summary of existing research projects and tasks and new ones needed to solve the problem; feasible approaches with priorities and estimates of required time frames and costs.

RESEARCH—The Army Research Program contains a wide variety of activities covering many scientific disciplines. Generally speaking, research programs are funded at a level of effort rather than on an individual project basis so that there is always a foundation of knowledge upon which to build.

These research elements would ordinarily be able to handle full-scale development of ALVM, but sometimes additional research projects have to be established within these elements.

In the case of materials for ALVM, for example, it might be advisable to establish a new funded project in this subelement, which may require submission of a Program Change Proposal (PCP) to the Director of Defense Research and Engineering.

The funds could be shifted from some other projects in the same subelement, depending on the priorities involved. From a practical standpoint, this transfer can be done only when the new project is very small. A more reasonable approach might be to establish a completely new subelement, grouping together all of the required projects for ALVM research.

The projects would then be included in the Department of the Army Project Listing, a document submitted to the Director of Defense Research and Engineering several times a year. DDRE uses this volume to keep track of the Military Services' financial plans.

The Army Project Listing is published by the Programs and Budget Division, Office of the Chief of Research and Development, several times a year to correspond with requirements for documentation in support of the budget formulation. This list is also used extensively in budget reviews and congressional hearings, since it contains the entire R&D program funding requirements and forecasts.

Upon receipt of the approved QMDO, the Army Materiel Command assigns a monitor for all actions pertaining to the ALVM. After review by the AMC staff, the QMDO is assigned to the appropriate subagency for action. In this case it is the Army Tank Automotive Center in Warren, Mich. There a QMDO manager is appointed as central contact man for actions pertaining to the ALVM.

Initially, a QMDO plan is prepared to schedule technical efforts, complete with estimated costs and probability of success for each effort, in order to determine the feasibility of this QMDO. A search is conducted to ascertain what related or contributing research has already been conducted.

Potential constructive input from other AMC or Army elements is then determined. AMC facilities having probable technical input for the Army Land Vehicle Module are selected as follows:

Engineer Research and Development Laboratories (ERDL)—Fort Belvoir, Va., responsible for generators, night vision, fuel cells, air condiitoners, heaters, dehumidifiers, fans, blowers, electrical propulsion systems and position indicators.

Electronics Command (ECOM), Fort Monmouth, N.J. —air filtering and associated equipment.

Natick (Mass.) Laboratories—clothing, special wearing gear, food and all other individual items.

Human Engineering Laboratory (HEL), Aberdeen Proving Ground, Md.—all equipment for noise levels, equipment control layout, safety aspects and all other man-machine relationships.

Army Materials Research Agency (AMRA), Watertown Arsenal, Mass., and the Army Chemical and Coatings Laboratory (ACCL), Aberdeen P.G.—support for the entire subsystems development, with materials and coatings as required.

U.S. Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency (GIMRADA), Fort Belvoir, Va.—responsible for detailed mapping, surveying equipment and establishment of geodetic reference points.

Assignments are made for each facet of the research and a schedule is prepared. The feasibility of developing the ALVM to satisfy the QMDO is thoroughly investigated and the resulting determination is reported to the Combat Developments Command. If certain requirements are found not feasible, appropriate modifications are recommended.

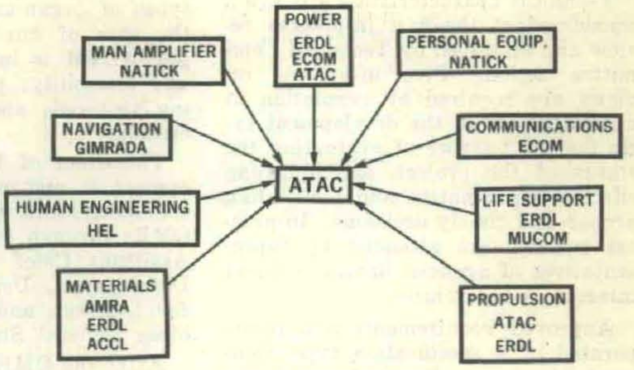


Figure 1. Facilities

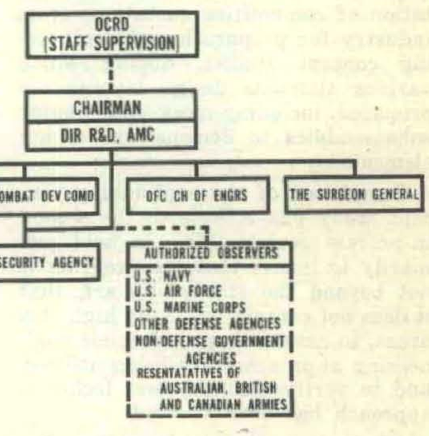


Figure 2. AMC Technical Committee

EXPLORATORY DEVELOPMENT—All findings must be carefully documented and reported as a guide for exploratory development and as a basis for a future Qualitative Materiel Requirement. The nature and complexity of the ALVM is such that extensive studies of many subsystems are required.

Some of these include possible power sources, means of propulsion or locomotion, drive-line components, body structure, temperature controls, navigational systems, safety provision and materials.

In the performance of these investigations, it is necessary to supplement the capabilities of the Army by tapping the resources of industry. Specialists in the field of each subsystem are issued contracts for each task.

Each contract is monitored by a technical representative of the Army who maintains close liaison with the contractor, observers work accomplished, and interprets the scope from a technical point of view.

Just where exploratory development stops and advanced development begins has been called a "gray area." By definition, however, advanced development "includes all projects which have moved into developing hardware for experimental or operational use. . . ."

When it has been determined through research and exploratory work that development of the ALVM as prescribed by the QMDO is feasible, a development project is formally initiated and made a matter of record by the AMC Technical Committee. This is the official committee which considers major actions on all AMC R&D projects and records decisions.

Organization of this group is prescribed by Army Regulation, which designates the AMC Director of Research and Development as chairman. An OCRD key staff member represents the Secretary of the Army and the Army General Staff as a whole and exercises DA staff supervision over the Technical Committee.

ADVANCED DEVELOPMENT—One of the first actions after project initiation is to prepare technical characteristics based on the QMDO and results of the exploratory development. Although the TC may expand

(Continued on page 24)

Army R&D, Testing, Evaluation Cycle Traced

(Continued from page 23)

on the requirements contained in the QMDO, they must not delete or relax the approved requirements except with permission of the Army staff, They provide the basis for specifications and assure development of an acceptable military item at a predictable cost.

Technical characteristics are again considered at the first in-process review and approved by Technical Committee action. Five in-process reviews are required by regulation at critical points in the development cycle for the purpose of evaluating the status of the project, accomplishing effective coordination and facilitating proper and timely decisions. In-process reviews are attended by representatives of agencies having a direct interest in the vehicle.

Approved requirements are incorporated in a specification type document known as a Research and Engineering Purchase Description (REPD). This is the basis for solicitation of competitive quotations from industry for preparation of engineering concept studies, during which various alternate design layouts are prepared, including mock-up of major subassemblies to demonstrate design elements.

Completion of the engineering concept study phase leads to the second in-process review. This is held primarily to insure that the program is not beyond the state-of-the-art, that it does not contain too many high risk areas, to assure that all feasible engineering approaches are being utilized, and to verify that the best technical approach has been selected.

After the contractor's engineering concept has been approved, he fabricates test-beds for engineer design tests. Upon receipt of the first test-bed, the third in-process review is made to evaluate the entire design.

The fourth review follows completion of the engineering design tests to evaluate results before proceeding into final phases of development. The fifth review, following completion of service tests, evaluates results and provides a basis for classification.

The Combat Developments Command must keep a watchful eye on the reports of advanced development. Once development of an item is determined to be feasible, CDC initiates the Qualitative Materiel Requirement (QMR), which is the basic guide of developing agencies in fulfilling desires of the user. It is the authority for engineering development of an end item of materiel.

Initiated, coordinated and staffed in a similar manner to the QMDO, the QMR states the mandatory minimum performance requirements and additional desirable features which will not disproportionately increase costs, complexity or lead time. It prescribes operational requirements and types of organizations for which, in the case of our hypothetical example, ALVM is intended; justification and feasibility; personnel and training required; and associated considerations.

The Chief of Research and Development is responsible for developing the Army staff position on proposed QMRs through coordination with the Assistant Chief of Staff for Force Development, Deputy Chief of Staff for Logistics and, when appropriate, other General Staff elements.

After the QMR for the ALVM has become an approved Army requirement, a paragraph summarizing the QMR, along with its priority, is included in the Combat Developments Objectives Guide (CDOG).

The Office of the Chief of Research and Development then provides the approved QMR to the Army Materiel Command as the appropriate developing agency, with instructions to initiate an Engineering Development project and to prepare a Technical Development Plan.

CONTRACT DEFINITION—Formerly called the Project Definition Phase, the next step in the development process is one in which preliminary engineering and contract and management planning are accomplished.

In the case of the ALVM this phase is required because of cumulative RDTE funding in excess of $25 million or estimated production costs in excess of $100 million.

The definition phase is intended to provide an adequate basis for management to decide to proceed with, cancel or change the project; also, to select the contractor for full-scale development. The CDP provides realistic cost and schedule estimates for the total project, including operation and maintenance and achievable performance specifications.

The AMC project manager for ALVM is appointed about this same time. Working directly under the commanding general of AMC, he provides centralized management authority for the execution of the project tasks, gives the project 4-star authority, and insures that development of the ALVM is carried out in accordance with the project master plan.

The Combat Definition Phase is conducted by competitive contractors compensated through fixed-price contracts. Each contractor develops his plan to obtain the optimum balance between total cost, schedule and operational effectiveness. Selection of the contractor to carry out full-scale development is based on their competitive proposals. This process is called source selection.

ENGINEERING DEVELOPMENT—From six to 12 prototypes are fabricated by the contractor to complete engineering and service tests. In the case of the ALVM, durability and reliability tests, climatic tests and complete engineering tests are necessary to assure QMR compliance.

Engineering tests are conducted by the U.S. Army Test and Evaluation Command (USATECOM) at Aberdeen Proving Ground, Md. Conditions of the scientifically designed test course there can be carefully controlled and complete instrumentation is available.

Durability and reliability testing is performed at Fort Knox, Ky., where the terrain is favorable, and at Yuma, Ariz., which is the best site available for testing under high temperatures and arid conditions.

Low-temperature tests are conducted in the cold room at Aberdeen Proving Ground, Eglin Air Force Base, Fla., or the Army Tank Automotive Center. The environmental control unit is tested in chambers at the Army Engineer R&D Laboratories, Fort Belvoir, Va., where extensive facilities are available to monitor unit performance.

Fort Knox and the Human Engineering Laboratory conduct exhaustive tests to establish optimum man-machine relationships. Navigation and communication equipment is tested at Fort Huachuca, Ariz. Fort Bragg, N.C., facilities are used to evaluate air-drop characteristics.

Complete documentation is prepared on all of these tests for the Combat Developments Command and the Office of the Chief of Research and Development even though the Army Materiel Command is the action agency for development.

Engineer design tests are conducted at the Army Tank Automotive Center (ATAC). Errors in human judgment are eliminated through the utilization of laboratory equipment, statistical methodology and highly skilled personnel.

These tests collect design data, confirm preliminary concepts and calculations, and determine the compatibility of components. With the completion of engineer design tests, the ATAC design agency should be able to demonstrate the engineering feasibility of the ALVM system.

The engineering tests serve to delineate the technical performance and safety characteristics of the ALVM and its associated equipment; they also ascertain whether the requirements as described in the QMR, technical characteristics and the Contract Definition are met.

Service tests, conducted by USATECOM as nearly as possible under field conditions, are designed to determine to what degree the ALVM and equipment will perform the mission described in the QMR and its suitability for use by the Army. The tests are characterized by qualitative observations and judgment of selected personnel with a broad background of field experience.

Engineering and service tests together provide the basis for determining whether ALVM is ready for type classification. After completion of engineering and service tests, the final in-process review is held.

TYPE CLASSIFICATION is the formal procedure in which the AMC Technical Committee judges the current qualitative adequacy of an Army materiel item and records its status in relation to its overall life history. Plans for procurement, issue, maintenance and disposal also are determined.

Categories of type classification include: *Standard A*—the most advanced and satisfactory item to fill a given need; *Standard B*—limited acceptability and is a substitute for a Standard A item; *Standard C*—marginal acceptability and is phased out of the system as stocks of better items become adequate.

Limited Production Type—restricted to exceptional cases for which an urgent operational requirement exists and for which no other item is adequate. Procurement is limited to a specified number.

Toward the latter stages of engineering development, the ALVM would be subjected to advanced production engineering to prepare the system for production.

Upon type classification, production of ALVM would begin in quantities required by the users. New equipment training would be conducted to prepare operators and maintenance personnel for deployment. With proper planning, the ALVM would be ready for use by qualified personnel as soon as it rolled off the production line.

Now the useful life of the ALVM begins. Before it could, however, it had to be developed according to the Army requirement and carefully tested to insure that the user gets a standardized, completely reliable vehicle capable of performing all mission requirements.

Picatinny Invention Finds Underground Duds

Army explosive ordnance disposal teams may expect their dangerous work will be eased in the future by recent invention of a dud-finding system at Picatinny Arsenal, Dover, N.J.

Tests of a screw-type device that can weasel its way underground as much as 150 feet in any direction to ferret out and position an unexploded round began last November.

An inertial guidance system, eventually to be a part of the dud-seeker, follows the path of the projectile in the earth. No more than five minutes should elapse from the start of its "journey" until the contact sensor automatically stops forward movement. A proximity of five feet from the "target" is anticipated as the maximum.

In operation, a special-purpose computer at ground surface would receive data from the self-propelled screw head via a "dragging" cable that provides accurate readout of range, azimuth and depth of the contact. At present, disposal crews can only estimate roughly the position of an unexploded artillery round or air-dropped bomb and dig blindly until it is found.

Invention of the subterranean position indicating (SPI) system was prompted by Maj Henry Stupakewicz of the Explosive Ordnance Disposal Center who asked researchers if inertial equipment could provide position data on buried munitions. The feasibility study by SPI's inventor Nicholas D'Eri of Picatinny's Nuclear Engineering Directorate affirms the use of inertial components in subterranean environments and notes that the proposed system is simply a new use of an established concept.

Inertial guidance, which is immune to jamming by outside interference, is commonly used for attitude sensing and navigation of missiles, satellites, aircraft, sea-going vessels and land-combat vehicles.

This is the first known application of inertial components for positioning underground objects. D'Eri reports that the inertial component requirements of the position indicator system "are not of the ultra-high quality demanded for space probes, but of a grade directly suited to the benign environments involved."

AMMUNITION DUD-SEEKING ferret head is explained by inventor Nicholas L. D'Eri of Picatinny Arsenal's Tactical Atomic Warhead Laboratory. Standing are Herbert Grundler, chief, Guided Missile Section; Vincent Suozzo of the TAW Laboratory, who worked with D'Eri on the system's concept; and George I. Jackman, chief of the TAW Laboratory.

The indicator system development program is an in-house effort at Picatinny. First experiments were with the screw head only, driven by an external cable. Engineers have since fabricated self-driven dud-seekers based on D'Eri's specifications, but without the inertial components.

The head, or vehicle, in final form will contain inertial position sensors, a contact sensor and a propulsion unit supported by surface equipment. Five major subsystems will make up the overall position indicator device:

The reference table and theodolite, manually leveled and north-south oriented with gyroscopes to establish a burrowing-start coordinate accuracy of less than .5°; the boring screw and drive assembly with contact sensor inertial platform and distance-measuring ssytem; a special-purpose, simple computer; electrical power supply; readout system to translate data for locating faulty ammunition.

The inventor predicts that a self-driven vehicle and distance-tracking system will be operable in less than six months. By the fall of 1966, he estimates the entire Inertial Position Indicator system will be operative.

Cost of a prototype system sufficiently advanced for actual field testing and practical use is estimated at from $10,000 to $15,000.

Human Engineering Labs Seek Man-Machine Design Compatibility

Successful human engineering of military materiel, centralized in the Army at the Human Engineering Laboratories, Aberdeen Proving Ground, Md., has been described facetiously, but with admirable accuracy, as a "wondrous wedding of warriors and weapons."

Human engineering, as one of the newer sciences now being applied to nearly every phase of modern living, including military requirements, is the carefully considered design of any equipment used by man so that it will operate with maximum effectiveness while requiring a minimum of effort on his part.

Making control of machines or operation of military materiel scientifically simple for man is the prime objective of human engineering. That calls for all the knowledge that can be gathered relative to the human factors involved with respect to the machine or materiel—man's physical and mental capabilities as they may be affected by environmental conditions in using the materiel.

"Man-machine compatibility" is a favorite term among those engaged in solving the problems of human engineering. With a very simple weapon, like a rifle, for example, men may be able to adjust to a design which does not really suit them. Even though the rifle may be difficult to use, the rifle is flexible; within limits, he can find a way to use it somehow. Yet these limits are much narrower than most people realize.

Let us look back into history for a moment. After the Battle of Gettysburg, more than 100 years ago, squads of men gathered up abandoned muskets. What they found was truly startling. Of 26,000 muskets collected from the battleground, 2,000 had never been loaded; 13,000 or one-half, had two charges in them; 6,000 had three or more charges in them. Only about 5,000 muskets—not even one out of five—were in firing condition, it was reported.

HEL commanding officer Col Charles D. Y. Ostrom, Jr., and technical director John D. Weisz discuss HEL recommendations for new tank design.

ANECHOIC ROOM helps HEL study weapon noises in a "free field" without disturbing factor of reverberation.

Clearly, these muskets were too difficult and time-consuming to be used under the stress of combat. Soldiers simply could not load them and fight with them effectively. Human engineering was needed then and is even more essential to the successful waging of modern war, because as weapons become more and more sophisticated, they demand more and more of the man—the combat soldier—under varying environmental factors.

Man's abilities, however, are limited by the heritage of his physical and mental capabilities; he can only do so much. Although the weapons have become more complex, the human user has not. He still has about the same abilities and limitations as his great-great-grandfather had in 1863. Some present-day weapons demand so much of the man that he is literally the weakest link in the operational chain.

The Human Engineering Laboratories at Aberdeen Proving Ground cope continually with this problem of man-machine compatibility. Activated in 1951, the HEL are now organized, staffed and equipped to achieve the success that has rewarded their efforts. Since 1962, the HEL have been an element of the U.S. Army Materiel Command, and are presently under the command of Col Charles D. Y. Ostrom, Jr. Dr. John D. Weisz is techical director.

Scattered attempts to fit machines to men have been made since the late 1800s. Human engineering, however, did not become a field in its own right until World War II, when some of the human factors problems took on tragic proportions.

For example, one type of transport aircraft crashed repeatedly on landings because harried pilots confused two identical handles: flaps and landing gear. When they meant to adjust flaps, they sometimes accidentally raised the landing gear. To solve this problem, the two controls were coded with different shapes of handles.

Incidents like this convinced the Armed Forces, particularly the Air Force, that they could not merely assume people would be able to operate equipment. They needed a realistic, scientifically based program to guarantee that equipment would be compatible with human abilities.

From this need, there emerged a discipline that combines the engineer's knowledge of how equipment operates with the psychologist's understanding of human capabilities and limitations—human engineering.

Human factors engineers now participate in system development from the early concept stage through production, contributing to at least two major areas: allocating functions to the man and the machine as a result of concept studies and/or data available in the literature, and helping to design the actual equipment.

Some of the most important decisions in early development of any system are the task allocations—deciding which things the machine should do and which the man should do, as related to their respective unique capabilities and limitations.

Machines, for example, can do routine computations much more quickly and accurately than men can; but men have an invaluable versatility in meeting novel, unexpected situations and inventing new solutions that are more reliable and achieved with simpler accessories than can be done by a complex computer.

By helping designers allocate tasks, the human engineer makes sure that the equipment does the routine, brute-force or specialized jobs it can do best, leaving the man free to make decisions and judgments that he can do best.

Later in development, the human engineer works with design engineers in studying the ways the man and the machine interact with each other.

There are two of these man-machine links: the man must tell his machine what to do, by operating controls, and the machine must give the man information about its status, through displays.

The human engineer, then, studies these man-machine links to assure that the man can operate control mechanisms quickly and accurately enough to meet system requirements; also, that users can reach controls easily, without cause to confuse controls with each other. Displays are checked to make sure they give users just enough information in readily usable form.

Because variable environmental conditions change effectiveness of both man and machine, the human engineer must see how it affects their performance. His knowledge of what humans can tolerate helps him pinpoint environmental factors—such as noise, heat, vibration, or toxic gases —that might endanger the man or keep him from doing his job. If the environment threatens to degrade system efficiency, the human engineer will recommend remedial action.

Even if the human engineer examined only these basic areas—just making sure that all the details of a simple system are compatible with what science knows about human performance—he would have a complex, time-consuming job. But science does not always have ready "on-the-shelf" answers. Often the human engineer must assume a new task that has not been studied experimentally, or one with so many interacting variables that there is no way to predict how people will react.

Then the human engineer must be capable of making his own experiments. He simulates the system's performance to see how men will perform or, sometimes, even builds laboratory mock-ups of ways the equipment could be designed. He may conduct studies in the field to get a better sample of the actual conditions users will work under, as pertinent to human performance and engineering feasibility.

The Human Engineering Laboratories are responsible for both of these areas: *application*—helping AMC major subordinate commands resolve their human factors problems, which includes attending in-process reviews and monitoring contractors—and *research*, both long-range and short-range. Training in human engineering for the major subordinate commands, liaison with other human factors agencies, and specially assigned duties are assigned to the HEL.

Under the office of the technical director, the organization comprises three main laboratories: Systems Research, Supporting Research, and Engineering Research.

Systems Research helps incorporate human engineering into weapon systems under development. Backed by a library that is the Army's central storehouse of human factors information, with a definitive collection of more than 10,000 books and documents, the Laboratories' four groups have helped optimize weapon systems ranging from Redeye, fired by a single man, to Nike-X, manned by a large number of highly trained personnel.

The systems Research Missile, Communication and General Support Branch did extensive work on the Pershing missile system throughout development. The fire-control pack was improved to save both money and manpower. Other successes included:

- Reducing warhead heating by developing handling procedures that prevent scratching of the warhead's ablative coating,
- Protecting the communication-terminal operator from harmful radiation by moving him to a safer area and adding a remote-control link,
- Rearranging cab components to narrow the system's carrier two full inches for better portability while actually providing more operator space inside the cab,
- Streamlining difficult and time-consuming procedures so missiles can be loaded 25 percent faster,
- Adding an interlock in the firing sequence to avoid a dangerous error that could destroy the launcher and abort the mission.

The Weapons Branch helped guide the development of the Special Purpose Individual Weapon (SPIW).

RESULTS of experimental mount tests completed in recent HEL field studies point the way to more effective designs for future weapons systems.

LAW launcher design was checked by HEL to assure fast and effective use despite severe environmental conditions and burden of protective clothing.

By carefully establishing how various small arms design features—such as sights, stocks, recoil, off-hand shooting, and automatic or semiautomatic fire—affect accuracy and effectiveness, information was gained to improve future small arms. The branch investigated more complex problems, such as reducing the noise and improving aiming accuracy of the AR-15 rifle, and worked closely with the project team on the M79 light infantry assault weapon (LAW).

Human factors consultation during LAW's early concept stage, as well as during later development, helped avoid costly redesigns and retrofits. An ingenious rocket-launcher mount for the TOW and MAW systems also was developed by the Weapons Branch of the Laboratories.

A patented viscous-damped mount to improve tracking accuracy for aerial targets won research and development achievement awards for two HEL inventors. The faster you try to turn this mount, the more it resists, or "fights back." With slow movements, it responds easily and smoothly, almost completely eliminating the troublesome jerks of former mounts and thus greatly improving accuracy on far-away, slow-moving targets.

The relatively new Aviation Branch is the third Systems Research group applying human factors data to weapon development. The branch has pioneered use of missions analysis, a forward-looking research technique that helps establish the capabilities an aircraft must have to complete its mission successfully.

Well back in the concept stage, before hardware design begins, human engineers analyze typical missions—

(Continued on page 28)

Human Engineering Labs Seek Man-Machine Blend

(Continued from page 27)
such as radar surveillance or aerial photography—to find out just what pilots will have to do under normal and selected emergency conditions.

Because even relatively simple missions involve so many interacting requirements, the human engineer catalogues the pilot's activities in block flow-and-functional diagrams. These analyses give the basic facts that human engineers then use to select the kinds of controls, displays, and equipment the pilot needs, find where they should be located, and help guide other design decisions with unprecedented accuracy.

The branch has worked also on important individual components, such as a control handle which may become standard for all Army helicopters. In the past, each model of helicopter has had its own unique control handle, different from—and often conflicting with—control handles in other Army helicopters.

For instance, the cargo-release button on one model might become the firing button on another model. These inconsistencies not only made the pilot's job harder, but actually encouraged him to make dangerous errors. Standardizing the handle will make it considerably easier to train helicopter pilots—and reduce accidents.

The Systems Laboratory Technical Specifications Office has a more general mission: Preparing human engineering design manuals to guide engineers developing different kinds of systems. Manuals dealing with wheeled vehicles, combat vehicles, and missile systems have been published. In preparation is a manual that will spell out combat-vehicle design even more comprehensively.

While the Systems Research Laboratory applies human factors engineering to specific weapon systems, the Supporting Research Laboratory conducts more general research and collects facts to guide designers of future weapon systems. Seven project teams have investigated such problems as:

• How can we use television as a secondary sensor, to supplement a man's eyes? Television has attractive advantages: it can see in dimmer light than a man can and it can be emplaced where men could not remain as observers. But what kind of television camera should we use? How good must picture quality be? Precisely what assures picture quality?

• How accurately can men locate targets they can hear but cannot see?

HEL Systems Research led to design of standard helicopter control grip.

It's vitally important for soldiers to detect helicopters and other targets, yet these targets are often concealed by trees and vegetation. If the man can't see a helicopter, can he hear where it is?

• How do a man's senses interact with each other? When a man must detect faint stimuli, he often does better with stimuli to more than one sense—for example, both a light and a sound. But sometimes the two interfere with each other and make the stimulus harder to detect. What qualities make the stimuli interfere, confusing the man? Which qualities reinforce each other, to improve the man's sensitivity?

• How do people keep track of changing information? Very often people must memorize facts only temporarily, then erase them and update the information as new facts come in. Yet learning theories do not predict this behavior very well. How do men do this kind of job? And how can we help them do it better?

• What happens in the ear when loud noises damage hearing? We know that loud noises do damage hearing. But what is it about a sound that produces the damage? And how does it produce damage? Can a response of the middle-ear bones—the acoustic reflex—help protect people from damage? How much protection can it give? How can we use the acoustic reflex in combat?

By answering these and other questions, the Supporting Research Laboratory fills in gaps on the intricate map of human abilities and limitations that designers need to plot the course of future weapons.

HEL's Engineering Research Laboratory (ERL) supports the other two laboratories in their research and application of human factors engineering. But it does some engineering research in its own right, too.

Complete facilities are available for designing and fabricating equipment tailored to experiments, field evaluations, and photographic documenting.

The ERL Acoustical Research Branch specializes in measuring all kinds of sound and noise. Facilities include an anechoic chamber and a reverberant room for analyzing sounds and calibrating equipment. As noise has mushroomed into a major problem in the last few years—by interfering with communication and damaging hearing—the branch has sent personnel into the field to measure actual weapon noises and record them for laboratory analysis.

Where noise levels are too high, acoustics specialists evaluate the problem and recommend realistic ways to solve it. Their measurements of the early M113 armored personnel carrier prototype, for instance, revealed noise levels so high that personnel in M113's would not be able to converse and might even develop hearing losses.

A series of relatively minor design modifications reduced the overall noise level considerably. Also, some of the noise in the middle frequency range, which sounds loud because the human ear is so sensitive to it, was given higher or lower frequencies.

These human factors studies succeeded in eliminating the noise problem in production-model M113s, giving much greater tactical efficiency without the difficulty and expense of modifying production hardware.

The branch has prepared a standard that details permissible loudness

HEL engineers use mock-ups to evaluate concepts in early design phases, which reduces costly production changes and retrofits. Mock-up shown above, with movable parts, can simulate almost any arrangement of controls and displays for design studies.

for continuous noise and engineers are now broadening their research to get a similar standard for impulse-noise. These documents, intended as guides to help designers minimize hearing loss, will assume greater importance in coming years as weapons become still more powerful and, at the same time, louder.

The Human Engineering Laboratories' balanced program of application of scientific knowledge based on well-rounded, progressive research has recently been supplemented with a training program to orient design engineers to human factors engineering.

Two appreciation courses are offered. A 5-day orientation course for designers presents some of the basic principles and facts, together with information about how to find further human factors data and when to ask professional human engineers for help with difficult or unusual problems. A 2-day executive orientation concentrates more on demonstrating what human engineering can contribute to system effectiveness by showing how to establish and manage a realistic human factors program. Both courses are open to qualified Army personnel.

In the 14 years since the Human Engineering Laboratories were founded, they have grown to an organization with 144 military and civilian scientific and professional specialists, operating on a current annual budget of $2,200,000.

More than $1,250,000 worth of technical research equipment, and some 68,000 square feet of technical and administrative space in 10 buildings are used in helping designers fit their machines to the human user. By making sure that equipment is designed to suit the human user—by optimizing control and display links and the environment—the Human Engineering Laboratories help the Army Materiel Command to develop superior weapons that are the easiest-to-use and easiest-to-maintain.

SATCOM Selects Col Warren as Deputy CO

Col Robert E. Warren is the new deputy commander, U.S. Army Satellite Communications Agency (SATCOM), Col Mitchel Goldenthal, SATCOM commander, has announced.

Director of the SATCOM Engineering Department since June 1964, Col Warren came to the Agency after five years with the National Aeronautics and Space Admiinstration (NASA) as deputy director of Communication and Navigation Programs, Office of Space Science and Applications.

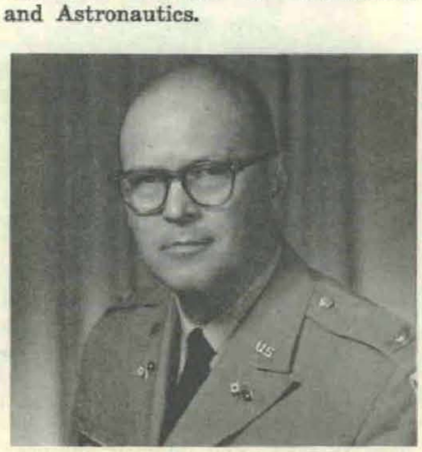
Outstanding contributions to the success of the Echo, Relay, Telstar and Syncom satellites earned him NASA's Special Service Award.

Col Warren was also commended by NASA for many special assignments as a member and secretary to the Technical Committee on Communications Satellites, and for service abroad in connection with the joint US-USSR telecommunications experiments using the Echo II satellite.

During the past year and a half as director of SATCOM's Engineering Department, Col Warren was responsible for the engineering and development of two new satellite communication ground terminals. The AN/MSC-46 air-transportable terminal, of which eight are now being constructed by Hughes Aircraft Co., and the AN/TSC-54 lightweight air-transportable terminal for which a contract was awarded recently to Radiation, Inc., were both developed under Col Warren's direction.

A native of Pittsburgh, he entered active duty in 1941 after civilian experience as a research engineer with Westinghouse Research Labs, and as an assistant professor of physics at Carthage College. He earned a PhD in physics from the University of Wisconsin, and bachelor and master's degrees in physics from Carnegie Institute of Technology.

Col Warren left military service following World War II, completed his doctorate studies and then became an associate professor at Thiel College, where he was head of the Physics Department. He returned to Westinghouse Research Labs in 1949 as a research engineer, but reentered the Army during the Korean conflict. He is a member of Sigma Xi and the American Institute of Aeronautics and Astronautics.



Col Robert E. Warren

DoD Appoints 4 Deans To Aid Supply Training

Four deans of business schools have been appointed to a committee established by the Department of Defense to assist in managing the Defense Logistics Management Training Program.

Assistant Secretary of Defense (Installations and Logistics) Paul R. Ignatius announced that the group will provide advice on training policies and problem areas and on the extent to which Defense and Service logistics schools meet training needs. Members are:

Dean S. Paul Garner, School of Commerce and Business Administration, University of Alabama; Dean Paul V. Grambasch, School of Business Administration, University of Minnesota; Dean Karl A. Hill, Amos Tuck, School of Business Administration, Dartmouth College; and Dean Clark E. Myers, School of Business Administration, University of Miami.

Dr. Nathan Brodsky, of Mr. Ignatius' office, will serve as chairman of the advisory committee.

The Department of Defense began an intensive joint program in 1963 to provide common training in logistics management to the Army, Navy, Air Force and Defense Supply Agency. Substantive progress has been reported in curricula improvement, in utilization of training resources, and in training for better job performance.

Studies of higher education for civilian business showed many problem areas similar to those encountered in training for Defense logistics management. The selection of deans with responsibilities for managing business schools reportedly will provide the Department of Defense with professional assistance to improve further logistics management training.

STRATCOM Appoints Heads Of 2 Special Field Commands

Two special field commands of the Army Strategic Communications Command (STRATCOM) have new commanding officers.

Col John B. Corbly, Jr., former Senior Signal Adviser to the First Republic of Korea, has succeeded Maj Ellis A. Palmer as head of STRATCOM's Radio Propagation Agency, Fort Monmouth, N.J. Maj Palmer is his deputy.

Col John W. Therrell, who was deputy to the Signal Officer for the Eighth Army in Korea, is now commanding officer of the Interagency Communications Agency of Arlington Hall Station, Va. He succeeded Col Bruce W. Caron, now retired.

President Picks 7 R&D BGs for Promotion

Seven U.S. Army research and development brigadier generals selected by President Johnson for promotion to major general are:

Raymond B. Marlin, Walter E. Lotz, Jr., William C. Gribble, Jr., Kenneth H. Bayer, Charles W. Eifler, William B. Latta and George B. Pickett, Jr.

GENERAL LOTZ is serving as J-6 (Communications-Electronics) on General William C. Westmoreland's Joint Staff, Headquarters, U.S. Military Assistance Command, Viet Nam.

★★General Lotz

Before his tour as Director of Army Research from October 1963 to September 1965, he was acting CG of the U.S. Army Electronics Command, Fort Monmouth, N.J. From 1959-62 he was assigned to the U.S. Army Electronic Proving Ground (USAEPG), Fort Huachuca, Ariz. There he served successively as chief of Electronic Warfare, director of Systems Development, commanding officer of the Combat Developments Command element and USAEPG deputy commander.

A 1938 graduate of the U.S. Military Academy, he also received an MS degree from the University of Illinois in 1947 and a PhD from the University of Virginia in 1953. He graduated from the Industrial College of the Armed Forces in 1956.

GENERAL MARLIN has served as director of Plans and Programs, Office of the Chief of Research and Development, Washington, D.C., since July 1963. He previously served as chief of staff, Infantry Center, Fort Benning, Ga., March 1963-July 1963.

Other assignments have included: director of the Weapons Department at the Infantry School, 1961-63; a year as deputy comptroller, Comptroller Division, U.S. Army Europe and two years as deputy brigade commander, 3rd Infantry Division, U.S. Army Europe; staff officer, Office of the Comptroller of the Army, and in the Office of the Chief of Staff, Washington, D.C.

A 1939 graduate of the U.S. Military Academy, and later of the Command and General Staff College and the Army War College, he served in the European Theater during World War II. His decorations include the Distinguished Service Cross, Silver Star, Legion of Merit, Bronze Star Medal with Oak Leaf Cluster, Purple Heart and the Army Commendation Medal.

★★General Marlin

GENERAL GRIBBLE has been director of Research and Development, U.S. Army Materiel Command, Washington, D.C., since September 1964, after serving six months as deputy director of R&D and a year as chief of the Development Division in the Directorate.

Graduated from the U.S. Military Academy in 1941 and assigned to the U.S. Army Corps of Engineers, he has had recent assignments as director, Army Nuclear Power Program and

★★General Gribble

CO, U.S. Army Engineer Reactor Group; deputy director, Military Construction, office of the Chief of Engineers; district engineer, Alaska Engineer District; and division engineer, N. Central Engineer Division, Chicago.

He also has served with the Los Alamos Scientific Laboratory, Nuclear Power Division of the Office of the Chief of Engineers, and the Reactor Development Division, U.S. Atomic Energy Commission.

He received a master's degree in physical science from the University of Chicago in 1948 and is a graduate of the Oak Ridge (Tenn.) School of Reactor Technology, Command and General Staff College and the National War College.

His decorations include the Legion of Merit and the Army Commendation Ribbon.

GENERAL BAYER has served as deputy director of Research and Development (Operations), U.S. Army Materiel Command, since September 1964. He previously served with the Headquarters of the III Corps Artillery, Fort Chaffee, Ark., and in Korea with the 7th Infantry Division, U.S. Army Pacific.

From 1960-62 he was assistant executive to the Secretary of the Army after serving as executive, then chief, Air Defense Division, Office of the Chief of Research and Development, 1958-60.

During a 3-year tour with the Anti-Aircraft Artillery and Guided Missile Center, Fort Bliss, Tex., he served first as chief of the Weapons System Section, then as assistant G3, followed by appointment as acting G3 of the Center and finally as deputy chief of staff for operations, Air Defense Center.

General Bayer received a BS degree in electrical engineering from the University of Alabama in 1940 and an MS in the same field in 1949 from the University of Pennsylvania. He also is a graduate of the Command and General Staff College, Armed

★★General Bayer

Forces Staff College and the National War College.

Among his decorations are the Bronze Star Medal, Army Commendation Medal with Oak Leaf Cluster and Navy Commendation Medal.

GENERAL EIFLER, deputy commanding general for Land Combat Systems at the U.S. Army Missile Command, Redstone Arsenal, Ala., since April 1963, previously was commanding officer of Frankford Arsenal, Philadelphia, Pa.

Earlier assignments were: commandant of the Ordnance Guided Missile School, Redstone Arsenal, 1959-61; group commander, headquarters, 57th Ordnance Group Europe, 1956-59; chief of the Guided Missile Section and chief of the Rocket Branch, R&D Division, Office of the Chief of Ordnance, Washington, D.C.

★★General Eifler

Backed by a BS degree from Pennsylvania State College in 1936 and an MS from the Massachusetts Institute of Technology in 1948, he also is a graduate of the Command and General Staff College and the Industrial College of the Armed Forces. He wears the Bronze Star Medal and a number of service medals.

GENERAL LATTA was recently assigned as commanding general of the U.S. Army Electronics Command, Fort Monmouth, N.J., after three

★★General Latta

years as deputy chief of staff for Communications and Electronics, Headquarters, Continental Air Defense Command/North American Air Defense Command, Colorado Springs, Colo.

Previous assignments have included: Army signal officer, Headquarters Seventh Army, Stuttgart, Germany, 1961-62; chief, Materiel Maintenance Division, Office of the Deputy Chief of Staff for Logistics, Washington, D.C., 1957-61; chief signal adviser, Army Section and MAAG, Taiwan, and signal officer, U.S. Forces, Taiwan, 1954-56.

A 1938 graduate of the U.S. Military Academy, General Latta has an MBA from Harvard University and is a graduate of the Command and General Staff College and the Industrial College of the Armed Forces.

GENERAL PICKETT is chief of

★★General Pickett

staff at the U.S. Army Combat Development Command. Earlier he was with the Office of the Deputy Chief of Staff for Military Operations, Washington, D.C., and served two years as commander of the 2nd Armored Cavalry in Germany, where he also was with the G3 Section at Headquarters, Seventh U.S. Army.

A 1941 graduate of the U.S. Military Academy, he has completed the Command and General Staff College, the Armed Forces Staff College and the National War College. His many decorations include the Silver Star, Legion of Merit, Bronze Star with two Oak Leaf Clusters and the Purple Heart with Oak Leaf Cluster.

The Joint and Combined Staff Officers Manual, which he coauthored, earned recognition from President Eisenhower, who stated in 1959 that it was the first of its type and filled a need in military career literature.

MICOM Scientists Offer Papers at Conference

Army Missile Command Research and Development Directorate scientists presented papers at several conferences in November and December.

At the Southeast-Southwest Regional Meeting of the American Chemical Society at Memphis, Tenn., Dec. 2-4, H. W. H. Dykes, research chemist in the Propulsion Laboratory, presented "Rapid Determination of Oxidation Inhibitors and their Homologs."

Larry C. Atha presented a paper coauthored with Thomas G. Wetheral, "Fluerie Controls, a Description of Available Components and Current Applications," at the Annual Meeting of the American Society of Mechanical Engineers in Chicago, Ill., Nov. 8-10. Atha and Wetheral work in the Army Inertial Guidance and Control Laboratory.

E. M. Pierce, of the Propulsion Laboratory, spoke on "Crosslinking of Nitro Cellulose and Polybutadiene," at a seminar on Crosslinking of Nitro Cellulose for use as Propellant Binders, held at Picatinny Arsenal, Dover, N.J., Nov. 3.

Seven men from the Physical Sciences Laboratory presented papers at the Southeastern Section Meeting of the American Physical Society at Charlottesville, Va., Nov. 1-3. Dale R. Koehler discussed "A New X-ray Spectrometric Technique"; Thomas G. Miller, "Diamond as a Neutron Scintillation Counter"; John T. Grissom, "Special Information and the Experimental Resolution Problem"; Romas A. Shates, "Vibrational Spectrum of Neutron Irradiater MgO"; David W. Howgate, "Local Phonon Spectrum in F-Center Absorption"; Ronald W. Mitchell, "The Infrared Spectra of Normal, Imine-Deuterated and N-15 Ethyleneimine"; Thomas G. Roberts, "Intense Pinched Beams of Relativistic-Electrons."

Brig Gen Irvin Joins DoD as Deputy for Reserves

Brig Gen Jefferson J. Irvin, U.S. Army, is the new Deputy Assistant Secretary of Defense (Reserve Affairs) under Assistant Secretary of Defense (Manpower) Thomas Morris.

General Irvin is responsible for advising Secretary Morris on matters pertaining to Reserve components of all four Military Services.

General Irvin was deputy CG at Fort Jackson, S.C., immediately before his new assignment and has served in the Pentagon twice previously: in the Office of the Deputy Chief for Personnel 1956-58; and the Office of the Assistant Secretary of Defense (Manpower, Personnel and Reserve).

A 1938 graduate of the U.S. Military Academy, he has completed the Infantry School, Command and General Staff College and the Army War College in advancing his career.

Thousands See Versatility of MUST Units at AUSA Meeting

MUST became meaningful as more than an acronym for the U.S. Army Medical Service's phenomenally advanced new field hospital complex when it was shown to thousands of visitors at the recent 11th meeting of the Association of the United States Army.

Prototypes of the MUST (Medical Unit Self-contained, Transportable) presented compelling evidence of the tremendous improvement the Army Medical Service has achieved in capability for prompt treatment of critically wounded men with the modern facilities of the new unit. MUST is expected to save the lives of many who might otherwise die.

Recognizing that field hospitals currently in use are not much different from those used in World War II, the Army Medical Service (AMEDS) long ago began a thorough study of various concepts. Results of these studies were incorporated in the design phase when a contract was awarded in 1963 to the AiResearch Division of Garrett Corp.

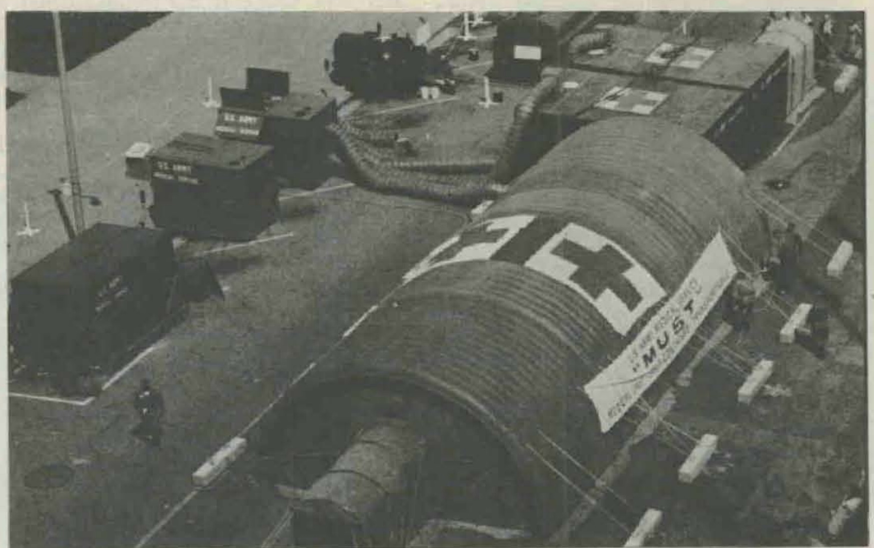
Specifications outlined basic requirements for surface and air mobility, short setup time, high reliability, and the capability of maintaining all-weather operation in any kind of environment.

The MUST unit consists of a combination expandable shelter shipping container, a ward-type inflatable shelter, and a self-contained utility system providing electric power, air conditioning, heating, hot and cold running water, and air pressure. Its elements are compact, lightweight, easily transportable.

Various types of field hospitals can be assembled by combining equipped functional elements.

The expandable container features

MUST Surgery-Expandable Element



MUST prototype photos indicate what visitors at AUSA meeting observed while touring the display. Inflatable ward unit is in foreground, utility elements at left, and the expandable surgical and supply units in the rear.

modern facilities for performing the most complex and delicate surgical operations. Folded into a compact package which serves as a shipping container and holds all equipment, it can be carried by a 2½-ton truck or mounted on detachable highway transporters for towing. It is air-transportable by cargo aircraft, and can be moved by helicopter.

Each hospital ward shelter is capable of providing intensive medical treatment for 20 combat casualties, together with all basic hospital ward equipment. Two wards can be carried on a 2½-ton truck.

The utility (power) element, weighing 3,600 pounds, is designed around a gas-turbine engine that can furnish 90 kilowatts of 400-cycle electric power generation. Capable also of furnishing 10 kilowatts of 60-cycle current, it can maintain 4 ward elements or 11 surgical elements at a temperature of 65° F. at —65° F. ambient and of 80° F. at 140° ambient. This unit also provides ward element inflation air, compressed air for positive pressure in shelters, and hot and cold running water, and waste water disposal services.

Fuel for the power unit is supplied by a collapsible, 340-gallon capacity, aluminum container, specially designed by the U.S. Army Natick (Mass.) Laboratories. Lined with fuel-resistant rubber, it is 46 inches high when erected and 11 inches when collapsed. Rectangular-shaped, it is 52 inches long and 42 inches wide. It weighs 240 pounds when empty, and about 2,300 pounds filled.

The utility element, 5 feet 10 inches wide, 8 feet 8 inches long, and 7 feet 4 inches high, also has storage space for air ducts, electric cables, and water distribution hoses. As with the expandable and inflatable supported functional elements, the utility pack can be transported by a variety of methods available to the field Army.

Principal advantages of the MUST system are that it will provide a worldwide operating capability under any environmental condition, improve medical treatment capability, allow maximum use of physicians' and nurses' skills, and increase mobility of combat support units.

In outfitting the MUST, the American Hospital Supply Corp. has developed new items of equipment, refined and adapted other components, and devised new methods of storing and handling supplies.

To increase the effectiveness of the various MUST elements under field conditions, equipment and parts have been standardized to make the most efficient use of space. Storage cabinets, for example, are the same in the surgery, laboratory, and central material supply elements.

Other standard items developed for MUST include folding work tables, a double sink unit, and plastic "tote boxes" designed for storing and transporting supplies within the hospital. These boxes slide in and out of cabinets, stacks without tipping, and nest to conserve space.

An all-new operating table, lightweight yet sturdy, adjusts to all nine standard surgical positions. It has the added feature of stability found only before in tables used in fixed medical installations.

Stability is provided by its unusual base—a ballast tank filled with 100 pounds of water that can be drained or removed by vacuum when the table is transported. Complete with accessories, the table weighs less than 200 pounds. Folded for shipping, it forms a 28 x 28 x 23-inch package.

Illumination for the surgical field comes from three light heads which deliver a minimum of 1,500 foot-candles. Suspended from adjustable arms, the lights are mounted independently to illuminate more adequately one or more surgical sites, a common need during combat conditions. If the normal electrical current is interrupted, the lights operate from a 24-volt battery to ensure no break in illumination during an operation.

Other items specially designed for the MUST operating room include a single piece of equipment that serves a 4-fold purpose as instrument stand, basin stand, backtable, and kick bucket; and a double-basin scrub sink whose hot and cold running water facilities are controlled by knee mixing-valves.

For the MUST laboratory two special refrigerators were fashioned—one provides the controlled temperatures of the blood bank, the other the different temperature ranges required for biologicals. An emergency power source is also available to maintain refrigeration should the current fail.

Among the other improvements in the laboratory are a drying oven and

CENTRALIZED MATERIEL section in expandable shelter of MUST shows combination cabinet/shipping container concept and doors of a container being used as a work table.

Interior of MUST Inflatable Element Ward

incubator that have been built into the MUST cabinetry.

Functions of the MUST hospital system not demonstrated at the convention include the clinical laboratory, dental operatory, X-ray clinic, and the pharmacy, which also can be adapted to one of the basic elements.

ASAP Slates Meeting at WRAMC, Limited War Lab

Plans are being developed by the Army Scientific Advisory Panel executive committee to hold the quarterly ASAP meeting in February, with sessions at Walter Reed Army Medical Center, Washington, D.C., and the Army Limited War Laboratory, Aberdeen Proving Ground, Md.

Design Criteria, Future Armored Vehicles is the subject of a study to be made by a new ASAP ad hoc group. Chaired by Dr. Allen E. Puckett, executive vice president of Hughes Aircraft Co., Culver City, Calif., the group was briefed recently at its first meeting by representatives of the Combat Developments Command (CDC). The briefing covered studies the Army has made on armor design for conventional and nuclear environments.

The first formal meeting of another new ad hoc group studying Army Tactical Air Defense was convened recently at the Pentagon, Washington, D.C. Prof. Lawrence H. O'Neill, associate dean of the School of Engineering and Applied Science, and director of Electronics Research Laboratories, Columbia University, is chairman. The group was briefed by CDC personnel on current and past tactical air defense systems and users' desires for future systems.

The Barrier Research ad hoc group, chaired by Maj Gen Leslie E. Simon (USA, Ret.), recently completed a study report which was forwarded to Assistant Secretary of the Army (R&D) Willis M. Hawkins and to Chief of Research and Development Lt Gen William W. Dick, Jr.

The ad hoc group on Combat Vehicle Weapons met early this month. Dr. William C. Tinus, vice president of Bell Telephone Laboratories, Inc., Whippany, N.J., is chairman of this group, which witnessed a Shillelagh firing at Aberdeen Proving Ground, Md., during its fall session.

Dr. John D. Baldeschwieler, ASAP consultant and professor of chemistry at Stanford University, proffered advice on personnel detection developments to Limited War Laboratory representatives at Aberdeen. His presentation prompted LWL to initiate a feasibility study.

Dr. Hornig Cites Need For Social Scientists in Federal Government Work

Presidential Science Adviser Dr. Donald F. Hornig, in a speech marking the recent dedication of the American Psychological Association's new headquarters in Washington, D.C., stressed the Federal Government's need for the help of social scientists in research and development.

Social and behavorial scientists should organize studies that would indicate more precisely the types of assistance they are prepared to offer not only to the Federal Government, he said, but also to state and local government administration.

Although it is recognized that behavioral sciences "affect every aspect of our lives and interact with every function of the Government," he said, "they have not been applied to Government problems in the same systematic way as have the natural sciences."

Army Moves Ahead in R&D for CB Warfare Defense

Another major step toward completing the first significant change in U.S. Army protective clothing since World War II was made recently at the Natick (Mass.) Laboratories.

An engineering concept review by all interested U.S. Army agencies resulted in approval of an overgarment intended to complete a new Army protective clothing system which has been in the R&D process for about three years. A protective "liner" designed for wear under conventional field clothing was standardized last June and is scheduled for type classification in 1967.

Intended for issue to personnel in forward combat areas, the overgarment is designed as an expendable item worn over normal clothing. It will provide protection for six hours after contamination.

Specifications require that it be sufficiently durable to be worn for at least one week, so it can be worn routinely prior to a chemical attack.

The liner would have the same protective qualities as the overgarment but it is not expendable; the protective qualities can be rejuvenated in the field by Quartermaster laundries.

These garments will reduce the heat load on individual soldiers and at the same time require less logistic support than the current 2-layer impregnated clothing they will replace.

REAL, LIVE GIRL is Ann Fowler of Edgewood Arsenal's Chemical R&D Laboratories (Md.) between the two mannequins wearing protective liner (left) and overgarment (right) still in development stage. The liner, already standardized but not yet in production, will be worn as an intermediate garment between underwear and outer clothing. The new "wardrobe," which marks the first major change in protective clothing since World War II, is designed to shield personnel from chemical agents injury.

The overgarment, but not the liner, is on the Priority Standardization List of the ABCA Quadripartite R&D Program. An ad hoc working group of the American, British, Canadian, Australian organization is considering the material to be used. The basic design is reported to be acceptable to the ABCA working group.

The possibility of chemical and biological (CB) warfare has continued as one of the most controversial subjects since World War I. Political, military, scientific and public opinion circles have labeled CB warfare as moral and immoral, humane and inhumane, but the controversy does not concern the defense against it.

Even the most violent opponents of CB operations generally will admit that an adequate defense is an absolute necessity, which explains why the U.S. Army is continuing to develop an adequate and effective system against the variety of CB threats posed by modern weapons.

U.S. Army "system" development is concerned with that type and amount of equipment which, used collectively, will enable the individual soldier to operate continuously and effectively in the most hostile environment.

As a minimum, it is generally agreed that a CB defensive system must combine the following:

- Individual protection with a comfortable and rugged mask and protective clothing which assures survival without adding excessively to the soldier's burden;
- Decontaminants for the soldier's person, his equipment and the limited areas he must occupy;
- Detection and warning devices to provide an early awareness of toxic hazards which cannot be detected by the human senses;
- Shelters to provide a haven from the rigors of wearing individual protection will permit certain operations —such as aid stations and command posts — to be performed unencumbered by individual protection devices and clothing;
- Phophylaxis and treatment to reduce the soldier's susceptibility to these weapons and to restore his effectiveness if the other means of protection are overwhelmed.

Each item of equipment necessarily represents a compromise between the conflicting requirements of protection versus operational freedom. Current Army R&D efforts seek to provide adequate protection without imposing undue physical, operational or logistic burdens on the Army in the field.

Although it is believed that the U.S. has the best masks in the world, the Army is providing two important modifications. One would permit the drinking of water while wearing the mask; the other would allow the individual soldier to administer resuscitation while the mask is worn.

The adaptation for drinking water extends the time the mask can be worn, especially in hot weather. With the resuscitation device, a victim of nerve gas poisoning may be kept alive until professional medical assistance is available without the risk of the administering mask-wearer becoming a casualty.

In addition to the protective overgarment and liner uniforms, a hood, gloves, socks and boots are required to cover all skin surfaces. In the CB R&D program the standard M-6 hood is being modified to include a zipper which allows ventilation without complete removal of the hood.

Most recently standardized among a variety of U.S. Army CB decontaminants is the M-13 individual Decontamination and Reimpregnation Kit. This can be used to restore the protective qualities of the liner for an additional 7-day period and for decontamination of skin and individual equipment.

Current Army R&D effort is directed toward development of new decontaminants. These would ease the logistic problem by reducing the amount of decontaminant required for terrain, structures and equipment.

Simplified, multipurpose detection and warning kits to replace the numerous special kits now used are another R&D objective. Researchers have determined that, because of the diverse scientific principles involved in automatically detecting airborne chemical or biological agents, at least two types of instruments will probably be required—one for chemical and one for biological agents.

The major R&D effort for chemical detection is to develop a small instrument that is sensitive, reliable, and rugged enough to withstand combat conditions.

Researchers say there is a paucity of detection principles for biological agents of sufficient sensitivity that can be instrumented for field use. Design and fabrication of experimental models is continuing, despite this difficulty, to develop a field alarm.

A continuous U.S. Army exploratory development program seeks to discover and develop new principles or approaches applicable to chemical or biological warning systems.

Protective CB shelters, both stationary and mobile, have undergone considerable development in recent years. The newest R&D shelter unit is the "CB pod," an air-inflatable self-contained structure that is impermeable to all CB agents.

Stored in a ¾-ton trailer, a CB pod can be readied for occupancy in 20 minutes. Each pod can house 10 men and is so constructed that several pods can be connected to form larger shelters.

The new pods will complement the MUST (medical unit, self-contained, transportable) system in filling such roles as battalion aid stations and can be used as rest and relief shelters.

Prophylactic and theraputic methods are undergoing extensive medical R&D to provide new and more effective methods of treating chemical casualties and to develop new vaccines.

Engineers 'Fight' Sand at Cam Ranh Bay

Unusual Cam Ranh Bay sand—relentless, shifting enemy of U.S. Army Engineers in South Viet Nam—has been almost "conquered" by ingenuity aided by research at the Army Waterways Experiment Station, Vicksburg, Miss.

Nature fashioned the sand particles in this major staging area of U.S. military operations to be adverse in almost every conceivable way. Unlike the jagged grains of ordinary beach sand, Cam Ranh Bay sand is round and fine, almost like dust.

Foot soldiers slide in it. Vehicles struggle through it with deflated tires. The sand blows into the moving parts of machines, doubling normal lubrication requirements. Even when supplemented by gravel, it can be used only in low-strength concrete.

Men of the U.S. Army Corps of Engineers, 35th Engineer Group, encountered real problems as they attempted to work and live with the "incredible" soil. Col William F. Hart, Group Commander, sent samples from different sections of Cam Ranh Bay beach to the Engineer Waterways Experiment Station (WES) for analyses and a possible solution to construction problems.

The samples arrived at Vicksburg July 5, 1965. One week later they had been analyzed and recommendations sent to the Army Chief of Engineers. Various additives, sprays and methods for containing the shifting sand were suggested.

Dissatisfied with long-distance study of the problem, A. H. Joseph, chief of the WES evaluation section, visited Cam Ranh Bay last August and spent a week observing the area from the air and on the ground.

While the scientific approach was taken to establish more stable airstrips, roadways and storage areas, the sand-slogging engineers tackled immediate problems of livability with an age-old method—sandbags.

At the rate of 13,000 cubic yards a day, the sand of Cam Ranh Bay has been turned against itself. Sandbags have become sidewalks as well as bunkers, walls as well as gun emplacements. Chairs, footstools, paperweights and windbreaks were made of bagged sand. Even a stairway was built with sandbags.

Companion Engineer cadres joined in "mining" a nearby rock quarry for gravel to mix with the sand and concrete. In one week, an Engineer battalion poured more than 50 slabs and built a causeway in the harbor.

A little city of U.S. Army Engineers is growing above the tricky soil as scientific knowledge from faraway Vicksburg is being employed to ease the burden imposed by the sands of Cam Ranh Bay.

Sweeney Succeeds Durrenberger as Springfield CO

Springfield (Mass.) Armory's new commander is Col Arthur H. Sweeney, Jr., successor to Col William J. Durrenberger, reassigned to command the U.S. Army Tank-Automotive Center, Warren, Mich., after two years at Springfield.

Most of Col Sweeney's 23 years of military service have been in ordnance assignments, including an initial World War II 2-year tour at Picatinny Arsenal and assignment to Watertown Arsenal in 1947. During World War II, he also served in the Asiatic-Pacific Theater.

Graduated from the Massachusetts Institute of Technology with a BS degree in chemical engineering, Col Sweeney later earned a master's degree in business administration from Harvard University. He has completed courses at the Industrial College of the Armed Forces, the Command and General Staff College, Ordnance School, Strategic Intelligence School, and the Army Language School.

In 1956 he was assigned to the Army Ballistic Missile Agency at Huntsville, Ala. There he organized the Industrial Planning Office, responsible for procurement of production quantities of Redstone and Jupiter ballistic missiles.

In 1963 he was assigned to the U.S. Army Control and Disarmament Agency with the Department of State. As a representative of the Weapons Evaluation and Control Bureau of the Antarctic Staff Committee, he was awarded the Joint Services Commendation Medal for his work in planning and implementing the first U.S. Antarctic Inspection.

Other assignments during his career have included assistant military attache to Switzerland, and chief of the Ordnance Branch of the Logistics Division, U.S. Military Assistance Advisory Group to Cambodia.

Col Arthur H. Sweeney, Jr.

CRD's Christmas Message

Once again it is my privilege to be able to wish each of you and your families a very happy Christmas and a New Year filled with personal success, happiness, and good health. I would also like to take this opportunity to thank each of you for your continued loyalty and for the extremely high quality of work you have produced over the past year in the face of an increased workload.

May God guide each of us in the coming year in our efforts to preserve the American way of life for ourselves and those who will follow us in the years to come.

Kudos

Exceptionally meritorious service has earned the Legion of Merit for Col David G. Gauvreau, Col Lawrence A. Robbins and Col Nelson S. Irey.

Col and Mrs. David G. Gauvreau

Col Gauvreau, deputy president of the U.S. Army Air Defense Board, Fort Bliss, Tex., was cited for performance of duties as executive officer to the Chief of Research and Development from July 1962 to July 1965. The citation stated that he contributed "in great measure" to the Army's research and development mission and to the national defense.

The Air Defense Board has responsibility for service-testing the latest air defense weapons and their electronic command systems.

COL ROBBINS, deputy commandant of the U.S. Army Logistics Management Center, Fort Lee, Va., received his award upon retirement from the Army after 31 years of service. He was cited for his "exceptional professional competency and contributions to the development and furtherance of logistical doctrine and logistics managerial techniques," termed of "far-reaching importance for many years to come."

COL IREY, also retiring, was cited for achievements in positions of responsibility from 1954 to 1965. The inclusive assignments were: assistant chief, Laboratory Service, then chief, Pathology Service, Letterman General Hospital, San Francisco; CO, 65th Medical Group and Surgeon, 7th Logistical Command, Korea; chief, Laboratory Service, and later, concurrent with that assignment, assistant executive officer, Walter Reed General Hospital, Washington, D.C., and finally chief of the Pathology Service at Walter Reed.

The citation acclaimed his "inspiring leadership, professional acumen and sound judgment" and outstanding effectiveness in directing these medical activities.

The Department of the Army Exceptional Civilian Service Award was presented by Maj Gen W. B. Bunker, deputy CG, U.S. Army Materiel Command, to Dr. Boris G. Karpov, who retired after 23 years of service with the Ballistics Research Laboratory, Aberdeen Proving Ground, Md.

Dr. Karpov was chief of the Research Technique Office. Achievements which earned him the Army's highest civilian decoration include: research on liquid propellants and development of a fin-stabilized supersonic antitank projectile. Born in Russia, he came to the United States in 1921.

The Department of the Army Meritorious Civilian Service Award was presented to six Army research and development civilian employees at three widely scattered installations.

Four civilian employees at the U.S. Army Missile Command received the Meritorious Award from Maj Gen John G. Zierdt, MICOM CG. They were: John Robins, deputy project manager for the Lance Missile system; Robert O. Black, of the Quality and Reliability Management Office; and Paul Schaeppi and Norman Schaeffer, both of the Procurement and Production Directorate.

One of the original members of the Lance team, Robins has played an important role in the development of the Army's newest battlefield missile. He began his Redstone career as a production engineer in 1951 on the Honest John system.

Black came to Redstone as an ordnance officer, remained in a civilian capacity, and progressed to his present position as chief of the Systems Assessment Division.

Schaeppi, a 14-year veteran of the Federal service after 17 years in industry, is deputy director of the Procurement and Production Directorate. Schaeffer came to Redstone in 1956 as a contracting officer and is now chief of the Field Activities Division. He has become a nationally recognized authority in the field of procurement and missile system management for contributions which have resulted in "immeasurable savings" to the Government.

The Meritorious Civilian Service Award also was presented to Carlos M. Ordonez, U.S. Army Electronic Proving Ground, Fort Huachuca, Ariz., and Morris D. Kaplan, U.S. Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

Ordonez, an electrical engineer assigned to the Test Directorate, was cited for his work in the USAEPG Spectrum Signature Program. This involves highly accurate and detailed measurement of all energy radiating from a piece of electronic equipment and identification of all responses to outside sources of energy.

Kaplan, chief technical assistant to the director of field artillery materiel

Army Sergeant Wins DA Award for Seamanship

A Regular Army sergeant first class who did a 2-year hitch in the U.S. Navy in World War II has been awarded a Department of the Army Certificate of Achievement for seamanship.

SFC (E-7) Charles O. Crabtree, assigned to the U.S. Army Materiel Command Engineer Research and Development Laboratories (ERDL), Fort Belvoir, Va., was cited recently for "exceptional performance" as a landing craft bosun. Col Frank Milner, ERDL commander, presented the award.

(In Navy parlance, a bosun is a warrant officer grade boatswain, the officer in charge of a ship's rigging.)

SFC Crabtree participated in offshore experimental work with the Marine Terminals Branch, Petroleum Equipment Division of ERDL from June 1, 1962 to October 15, 1965. As bosun of a modified LCM (landing craft, mechanized), he was required to navigate the boat over long distances to and from test areas located as far as 1,200 miles from home station, often under adverse sea conditions.

Crabtree entered the Army in 1949 after serving in the Navy from 1944 to 1946, part of this time in the South Pacific.

testing, was singled out for major contributions to the USATECOM field artillery testing and evaluation programs during the past three years. He came to Aberdeen 24 years ago as a chemical engineer and has served as chief of the Artillery Rocket Branch, Development and Proof Services; and as chief of the Nuclear Weapons Office, in addition to duties as chief engineer, Artillery Division.

Col James O. Daulton, deputy director of General Equipment Testing, U.S. Army Test and Evaluation Command, Aberdeen Proving Ground, Md., was a recent recipient of the DoD Joint Service Commendation Medal.

He was cited for meritorious service from August 1962 to July 1965 as Joint Research and Development Coordinator with the Military Assistance Advisory Group, Federal Republic of Germany. His advice and assistance to both governments, according to the citation, resulted in specific cooperative research and development coproduction agreements and plans and significant progress in cooperative logistic arrangements.

TECOM Fills News Post Of Electronics Adviser

The U.S. Army Test and Evaluation Command, Aberdeen Proving Ground, Md., has established a job of technical adviser on electronics.

John M. Bialo, a 43-year-old New York consulting engineer, has been selected to fill the post.

His responsibilities include planning, execution and analysis of test results and evaluation processes involving all aspects of electronics systems and subsystems developed by or for the Army.

Bialo received a BS degree in mechanical engineering (1943) and an MS in electrical engineering (1949) from the Stevens Institute of Technology. He has served in the graduate school since 1954 as a visiting lecturer on computers. In World War II, he operated fixed station radioteletype installations in the Philippines and on New Guinea.

A member of the Sigma Xi scientific research fraternity, he is also affiliated with the Institute of Electrical and Electronics Engineers, Association for Computing Machinery, and Society of Professional Engineers.

AVCOM Awards Contract

The U.S. Army Aviation Materiel Command, St. Louis, Mo., recently awarded a $212,486 contract to Pioneer Aerodynamics Systems, Inc. for production and delivery of nylon personnel parachute harnesses.

Lt Gen William W. Dick, Jr., Chief of Research and Development, recently presented decorations to seven OCRD staff officers. In center, he pins Bronze Star and Army Commendation Medal on Col Frank A. Bates, Jr., Nuclear-Chemical-Biological Division. Awards were presented also to (counterclockwise, from top left) Maj Stan R. Sheridan, Combat Materiel Division, Army Commendation Medal; Lt Col Harold C. Friend, who retired from the Physical Sciences Division, U.S. Army Research Office, Army Commendation Medal, Col Friend is now employed by the Goddard Space Flight Center at Greenbelt, Md., working in the field of quality assurance engineering; Maj Rufus E. Lester, Jr., Life Sciences Division, USARO, Bronze Star Medal; Lt Col Joseph E. Houseworth, III, Physical Sciences Division, USARO, Air Medal; Maj Patrick W. Wilson, Nuclear-Chemical-Biological Division, Army Commendation Medal. Next is recently promoted Col John C. Raaen, CO, U.S. Army Research Office-Durham. General Dick also officiated at promotion ceremonies for (new rank) Col William M. Calnan, chief, International Office; Col Edward J. Bruger, Special Warfare Division; Lt Col William S. Vargovick, Life Sciences Division, USARO; Lt Col Orton F. Spencer, Nuclear-Chemical-Biological Division; Lt Col Edwin S. Townsley, Combat Materiel Division; and Maj Edwin Santos, U.S. Army Personnel Research Office.

Scientists Check Seismic Signals in Project Long Shot

A deep underground nuclear detection experiment termed Project Long Shot was conducted recently by the Department of Defense at Amchitka Island, near the western end of the Aleutian Chain, Alaska.

The purpose was to provide scientific information and data on the nature of seismic signals from underground nuclear tests and their long-distance travel time.

The project was designed also to furnish scientific data which may assist in discriminating between earthquakes and man-made seismic disturbances. Development of such a capability has been a major goal of U.S. scientists in support of arms control and disarmament negotiations. The Advanced Research Projects Agency's Vela Uniform project is linked to this effort.

The United States offered, during recent sessions of the 18-nation disarmament conference, to furnish scientific data from the Long Shot test to any interested nation.

Amchitka was selected because of its geological location in the seismically active areas extending from the Aleutian Islands down the Kamchatka Peninsula and the Kuril Islands to Japan.

The Department of Defense, in cooperation with the Department of the Interior and the Atomic Energy Commission, conducted extensive studies prior to the experiment to insure that no damage would be done to the island. Appropriate measures were taken to minimize any hazard to wildlife.

Experiments were conducted according to Greenwich Time to give seismologists throughout the world a common time reference, and to ensure that recording instruments were ready at the moment of detonation.

Electric Power Needs Reviewed for Advances in Weaponry

By Donald J. Looft

Modern weapons technology has made electric power one of the critical commodities of all U.S. Army operations. Past, present and estimated future daily electric power consumption for the total Army and supporting Air Defense elements, based on a 25 percent utilization rate of available generating capacity, is shown in Figure 1.

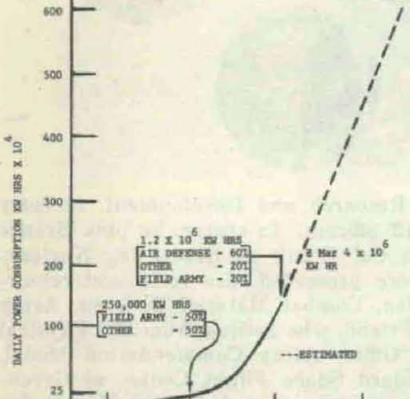


Figure 1. U.S. Army electrical power consumption

Power furnished by storage batteries is not included. Though batteries satisfy a significant and vital portion of the overall Army electrical power requirement, this discussion will deal only with continuously fueled power sources which satisfy the bulk power requirement.

Consumption rates shown in Figure 1 are indicative of the rapidly growing dependence of the Army on electrical energy. No indication has appeared that this trend will change; rather, every indication is that it will continue to grow at even greater rates.

Prior to the evolution of a highly mobile Army—based on use of weapons and equipment largely dependent on electrical energy—the electric power that was consumed was provided by procuring various makes and models of commercially available power sources adapted for military use.

During World War II and until approximately 1955, this practice was continued. However, as requirements in terms of numbers of equipments increased astronomically, the problem of maintenance and spare parts support for a large number of makes and models became wholly untenable.

In addition, new missile surveillance and communication systems gave rise to requirements for precise performance and immunity to environments which commercial equipment could not satisfy. Development programs to evolve initially rigid performance specifications and ultimately military designs were, therefore, initiated as rapidly as resources permitted.

Further, families of generator sets and batteries were established to minimize the number of different types of equipments in the system. During the development period, however, procurements of various make and model equipments on performance specifications were continued to meet pressing demands.

The overall result was that as of 1962, some 400 makes and models of generator sets were in use in the Army system. Many were of World War II design and are still in use.

In late 1963 the U.S. Army Materiel Command designated a project manager for engine generators to accelerate delivery of generator sets on order urgently needed by operational forces; also, to consolidate requirements to eliminate critical shortages, and implement improved procurement practices based on use of military design procurement documentation.

Current Army Policies. Recognition of electric power as a critical commodity area prompted a formal Department of the Army policy statement in July 1964. This policy was published as an interim statement, pending the availability of results of a detailed study of current and projected electric power requirements for the Army in the field. The study is currently being accomplished by the U.S. Army Combat Developments Command. Principal guidelines set forth in the Army policy statement included:

- Aggressive research and development will be undertaken in storage generation, conversion and transmission of electric power to meet current and future requirements.

- Families of general purpose power sources will be established with the smallest possible number of ratings to meet high-density requirements.

- Primary emphasis will be given to reliability, versatility, multi-fuel capability, weight and size reduction, and minimizing logistic support, and solid-state control/conversion technology will be exploited to permit the highest possible degree of versatile employment.

Powered industrial type equipment for general purpose Army use, the statement said, will be designed to be electrically driven unless clearly impracticable; also, military designs will be developed in preference to relying on performance specifications for procurement of commercial items.

Further, it was stated that electrical power requirements for Army materiel will be considered when requirements for development of materiel are established.

In response to the Department of the Army policy statement, the Army Materiel Command (AMC), responsible for research, development, testing, supply and support of electric power for the Army, took action as follows:

- Revised the Army generator set family of 41 different sets to an interim family of 25 military design sets.

- Prepared AMC regulations covering the selection and use of power sources from established families by AMC system design agencies. This requires AMC approval of use of non-family types of special power sources.

- Increased RDT&E program effort in all areas pertinent to electric power, with emphasis on completing military designs of current equipment, advanced energy conversion research and study of solid-state conversion techniques.

Uniform policies regarding critical environmental characteristics also were established by the AMC, specifically: all power sources will be designed to deliver rated output at 8,000 feet 90 degrees F. and at all temperatures in the range of minus 25 to plus 125 degrees F. under all conditions of humidity possible within that temperature range.

Military Standard 633 published by the AMC sets forth performance characteristics and application data on engine generator sets for use by system designers. AMC regulations assign respective areas of development responsibility to the subordinate Mobility Command and Electronics Command for carrying out the Army electric power program.

The Electronics Command is responsible for storage batteries and all power sources (except engine generators) with ratings of one kilowatt and less. The Mobility Command is responsible for all engine generators and all power sources with ratings greater than one kilowatt.

AMC Regulation 700-28, dated Mar. 16, 1965, prescribes a Fuel Logistics Policy pertinent to electric power sources. Liquid hydrocarbon fuel used by U.S. Army tactical and combat units will be motor gasoline (MOGAS 86/95 Mil-G-3056) and Compression Ignition Turbine Engine fuel (CITE Mil-F-46005). The latter is stipulated as the primary fuel for tactical ground vehicle engines of over 100 net horsepower, and the preferred primary fuel for all electrical power sources.

Requirements. Electrical power sources for the Army are required in a variety of sizes with a variety of performance characteristics. Power sources ranging from miniature primary batteries to multi-megawatt generating plants are essential for equipment which ranges from a simple light source to the most sophisticated surveillance, data processing and weapons systems that one can conceive.

Despite the variety of power sources needed, it is possible to categorize current Army requirements into three general types as shown on Figure 2. The underlined principal characteristics are the overriding design requirement based on stated user needs. Obviously, many other characteristics are needed, but the design trade-offs are heavily weighted in favor of the characteristic indicated:

Figure 2. *Categories of Requirements*

Type	*Power Level*	*Principal Characteristics*
A. Tactical	0.05 to 5.0 Kw.	*Silent* *Portable* Reliable
B. Multi-Purpose	0.5 to 200 Kw.	*Mobile* *Reliable* Low Noise Level
C. Strategic	500 to 10,000 Kw.	*Efficient* *Reliable*

Types of power sources represented by Category A are normally employed in *areas of contact with the enemy* to power communication and surveillance devices and certain weapons, where silent operation is a critical requirement. At the same time, these must be readily transported by foot soldiers or light vehicles and therefore must be small and lightweight.

These two requirements tend to be mutually exclusive and present one of the most difficult requirements to meet. Power sources even marginally acceptable for this category are not now in the hands of troops.

Small engine generators with acoustical enclosures currently in use are by far too heavy and large and are considered only stop-gap measures. Batteries are the only silent power source available, but are limited to short duration missions and low power levels.

The power sources covered in Category B are utilized for a multiplicity of purposes in large numbers throughout the Army. To meet the requirements of the mobile Army of today, they must be as lightweight and compact as possible with a high degree of available on-demand reliability.

Listed in Category C is the large fixed-plant type of system, emplaced for extended periods of time as contrasted with "shoot and scoot" operational concepts of the first two categories. Because of high power levels involved and almost continuous duty cycle, fuel consumption and long life are overriding required characteristics.

Army policy requires that all Army power sources as delineated above are required to operate from the bulk fuels (hydrocarbons) available in the field Army. Consideration is being

(Continued on page 40)

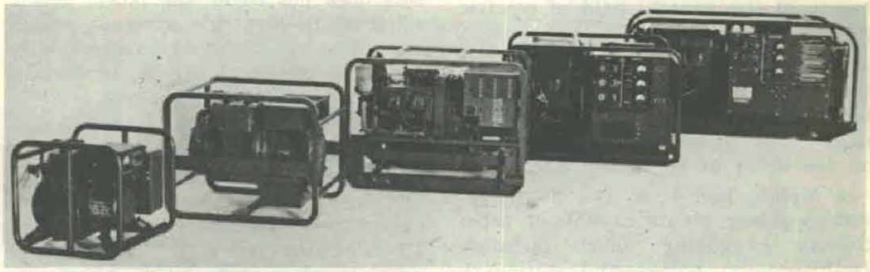


Figure 3. Military standard gasoline engine-driven generator sets rated from (l. to r.) 0.5 Kw., 1.5 Kw., 3.0 Kw., 5.0 Kw., and 10.0 Kw.

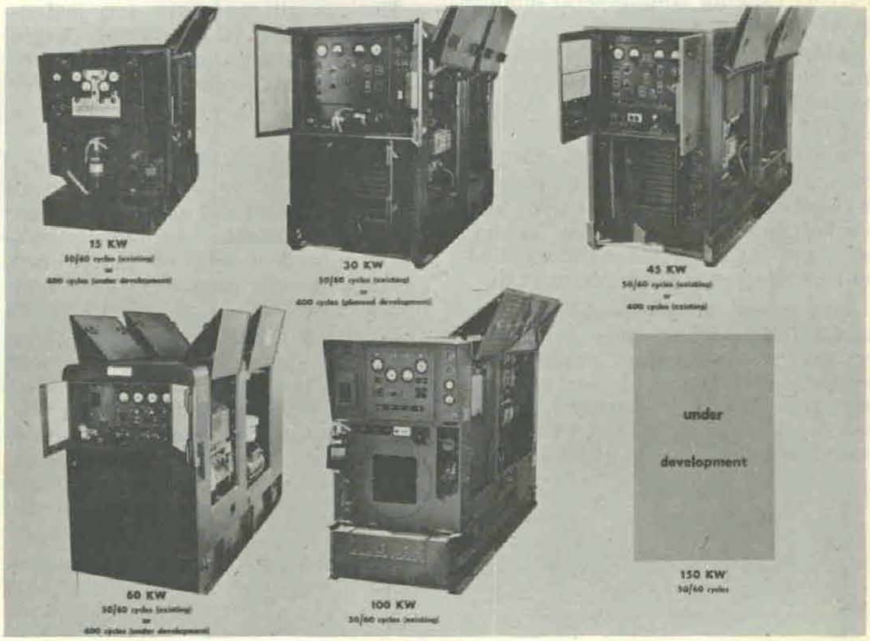


Figure 4. Multi-purpose diesel engine-driven generator set family, ranging from 15 Kw. to 150 Kw., which is now under Army development.

Figure 5. Military gas turbine engine-driven generator sets rated from (left to right) 5/10 Kw., 15/30 Kw., 45/60 Kw., and 100/150 Kw.

Power Needs Reviewed for Weaponry Advances

(Continued from page 39)

given to accepting special fuels to meet immediate requirements for small, silent power sources.

Hydrazine-hydrate, for example, is currently being seriously considered for use in hydrazine-air fuel cells to meet urgent requirements. This, however, is clearly an interim solution.

In addition to the power sources already described, which are intended for multiple applications, there are other relatively new Army requirements in the general field of electric power. These are:

• "On board" power for missile surveillance and communication systems mounted on tactical vehicles. In most cases these electrical loads are on the order of 60 to 100 Kw.

• Mobile high-level (ca 25 megawatts) power plants capable of repetitively producing short duration (milliseconds) pulses, and stationery versions of the same plants capable of producing similar power levels for periods ranging from several minutes to several hours.

• Lightweight power transmission and distribution equipment capable of emplacement and removal in fraction of hours.

• Devices and techniques for protection of electric power sources, transmission and distribution networks, and system controls against effects of the electromagnetic pulse resulting from a nuclear detonation.

Equipment Available. Equipment available to meet the bulk Army power source requirement described is comprised of heat-engine-driven generators. The high-density requirements (Category B) are being met with a standard family of 25 different generator set ratings which include 28V d.c., 50/60-cycle and 400-cycle outputs. These are described in detail in Military Standard 633 (MO) dated Feb. 8, 1965.

These sets, or adaptations of these sets fitted with acoustical enclosures, are being used on an interim basis to meet silent-power needs typified by (A) in Figure 2—where the weight penalty of a battery is too great for any but short duty cycles.

The standard family of generator sets does not cover the power levels required in strategic systems, which are met by adapting commercially available power plants or, in certain cases, nuclear reactors.

Representative samples of the generator sets which comprise the Army family are shown on Figures 3, 4 and 5. Figure 3 shows spark-ignition engine sets to meet requirements for 10 kilowatts and less. The engines are all air-cooled, 3,600 r.p.m., 4-stroke cycle, and are designed for 1,500 hours life without overhaul.

The overall generator set, including the engine, is a military design so that repetitive procurements provide identical equipment and 28 V. c.c., 60- and 400-cycle versions are available.

Some silent-power requirements have been met by use of acoustical enclosures on the 0.5 and 1.5 Kw. ratings of these sets. In those cases, the size and weight of the overall package is approximately twice that of the basic set.

Figure 4 shows compression ignition-engine-driven sets which are applied over the range of 15 to 200 Kw. with 50/60-cycle outputs and 400-cycle designs up to 100 Kw. These sets utilize 1,800 r.p.m. liquid-cooled engines selected from the Qualified Products List of commercial engines established under Military Specification Mil-E-11276. The overall set less the engine is a military design.

Figure 5 shows turbine generator sets which cover the range of 15 to 200 Kw. with 400-cycle output only. The overall turbine sets are also military design except for the engines. They are selected from commercially available industrial type single shaft turbines, and all include speed reduction gears to reduce engine shaft speed to a synchronous speed of the alternator (6,000 r.p.m.).

Figures 6 and 7 show power density of the available engine generator sets in terms of volume and weight per kilowatt of output. Figure 8 shows rated load fuel consumption of these sets. Though other characteristics are pertinent, the power density and fuel consumption offer a good measure of the state-of-the-art in electric power sources which supply the Army's bulk power requirements.

The relative merits of each type of prime mover are evident. Spark-ignition engines are the best available at low-power levels without the severe fuel consumption penalty of turbines. Compression ignition engines offer power density penalty, but are desirable because of fuel economy and life and are applied at levels of 15 Kw. and up. Turbines offer striking power density gains, but suffer from poor fuel economy and can only be justified in cases where high power density is essential to accomplishing operational missions.

These three types of generator sets are the backbone of the Army's electric power capability. They represent the best military power sources the current state-of-the-art can provide in terms of performance, power

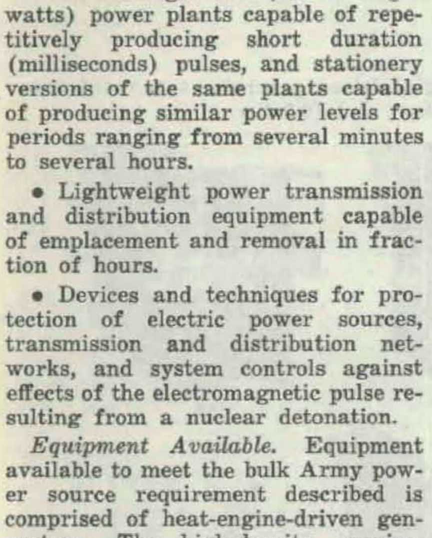


Fig. 6. Power density of Army family of generator sets—volume/kilowatt.

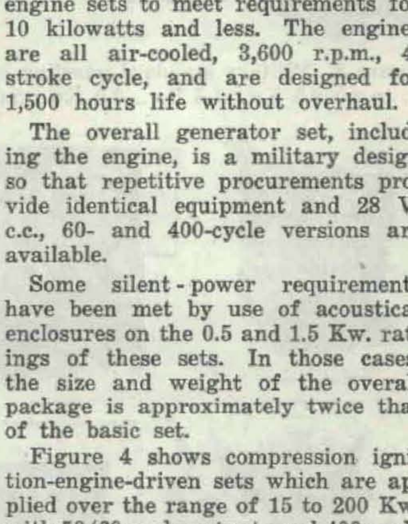


Fig. 7. Power density of Army family of generator sets—pounds/kilowatt.

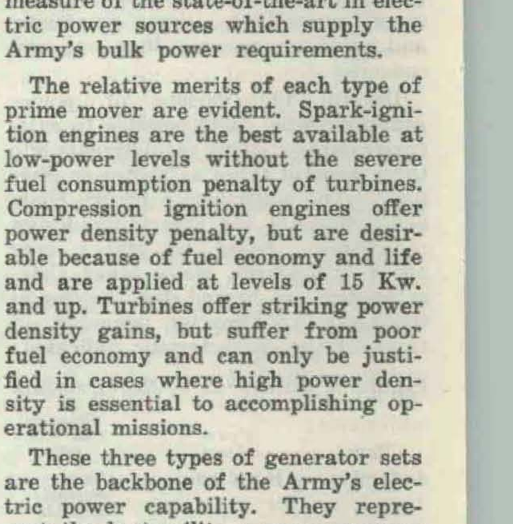


Fig. 8. Full load fuel consumption of Army family of generator sets.

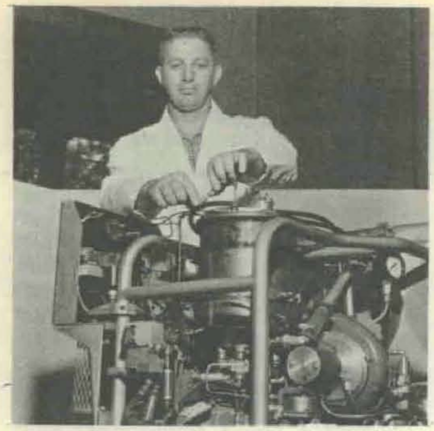


Fig. 9. Stirling Cycle Engine.

density, life and reliability at a reasonable cost. However, they are deficient in three significant respects: (1) fuel use efficiency, (2) audible noise level, and (3) power density (lbs/Kw. ft^3/Kw.).

Major development effort on new energy-conversion techniques and associated electrical machinery and controls is therefore directed toward minimizing these deficiencies.

R&D Programs. An examination of the electric power equipment available versus requirements and current Army guidance clearly suggests the results Army research and development programs in electric power must produce in the near future and over the long term. The following sections cover a statement of specific objectives and the current status of RDT &E programs aimed at meeting those objectives:

Multipurpose Power Sources. There is and will be a continuing need in the Army for a series of family of basic power units required in large numbers in the approximate size range of 0.5 to 200 Kw. These power sources are required to be as small and lightweight as possible, utilize the fuels in the Army system, provide maximum versatility in application (output, frequency voltage, etc.), operate at low noise levels (less than speech interference) and, because of large numbers required, be procured at lowest possible cost.

Long-term Army Materiel Command RDT&E programs bearing on this overall requirement are, in the main, concentrated on gas turbines as the prime power source because of their very attractive power densities, inherent multi-fuel capability, simplicity, and potential long life.

Programs underway are directed toward military design turbines driving direct connected high-frequency alternators whose output is converted by static devices to any desired frequency from direct current to 400-cycle alternating current.

Systems such as these are technically feasible and much progress has been made; however, major problems still exist in system size and weight, noise level and cost.

In the interim, piston engines similar to the currently available family will be widely utilized and commercial developments adopted as appropriate, but no major Army development effort in other than turbines for the long term is planned.

The impact of advanced energy-conversion techniques on the basic Army family is difficult to predicate. Depending on future developments, particularly of fuel cells, these may one day become an across-the-board power source. For the moment, however, they are being considered in the category of special silent power sources.

Silent Power Sources. Over and above the basic multi-purpose family here described, the Army has critical needs for a series of silent power sources. The silencing level required in general entails greater costs and complexity than can be accepted for the multi-purpose high density family. Silent power sources, therefore, are considered a separate special requirement.

Closed-cycle heat engines, flame-fired thermionic, thermoelectric and thermophotovoltaic converters and fuel cells are all under intensive study to meet this critical requirement.

In the interim, design of acoustical enclosures for conventional air-cooled engine generators is being continued to reduce the size and weight of enclosures by use of new acoustical materials and by attempting to minimize the noise at its source (i.e., mufflers, reduced gear and fan noise, etc.).

Fig. 10. Rankine-Mercury Vapor Cycle Engine

Figure 11. Proposed configuration of a flame-fired thermo-electric system.

Other open-cycle engines are not being considered because of excessive size and weight involved in eliminating noise.

Closed cycle or external-combustion heat engines being studied include the Rankine-Mercury vapor cycle and Stirling cycle. Figures 9 and 10 show 6-horsepower experimental models of these engines coupled to 3-Kw. load units. These engines inherently operate at low noise levels.

Based on test results of the 6-horsepower models to date, the Stirling cycle engine is the most advanced in terms of being suitable for application to electric power sources. Both, however, are relatively complex and large and heavy compared to other approaches.

Recently, a study of the Rankine-steam cycle has been initiated because of the potential for scaling down the steam engine to fractional kilowatt outputs. The steam engine appears to be the most attractive heat engine possibility at this time.

Hydrocarbon flame-fired converters being considered are in various stages of research and development. Thermoelectric systems operated at 1200° F. appear practical to power levels up to 0.5 Kw. A joint development program with the U.S. Air Force for a 35-pound, 500-watt 28V c.c. flame-fired power source to be available for troop test by FY 68 has been initiated.

Principal problem areas involved are degradation of thermocouples with time, and burner reliability. Figure 11 shows the proposed configuration of a 500-watt flame-fired thermoelectric system. Thermionic converters with high temperature (2500° F.)

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burners are being constructed for experimental studies.

Solutions to several significant problem areas, such as reduced converter performance resulting from permeation of the combustion gases, high-temperature burner materials, efficient use of the inherently low output voltage and means for providing relatively large amounts of cooling, must be found before hardware designs planned for early FY 67 are initiated.

Flame-fired thermionic converters have the potential for very attractive power densities over the entire range of silent power sources of interest to the Army.

Thermophotovoltaic (TPV) converters operate at temperatures similar to the thermionic systems. Burner problems are essentially the same except that temperature control is more critical in TPV systems. TPV systems have potential for highest conversion efficiency and power density of all flame-fired systems, provided basic photo cell performance of 0.8-1.0 watts/cm^2 can be achieved; current performance is on the order of 0.5 watts/cm^2. No TPV systems are being constructed, pending results of research on the basic photo cells.

Major effort is being expended on fuel cells because of their inherent high conversion efficiency and potential for meeting not just silent power requirements, but the majority, if not all, Army power source requirements.

Fuel cells which utilize special fuels and air as the oxidant have been developed and can be applied to meet Army silent-power requirements. The most advanced of these is hydrazine (N_2H_4)—air system, of which 300-watt, 3-kilowatt and 40-kilowatt systems have been constructed and are under test.

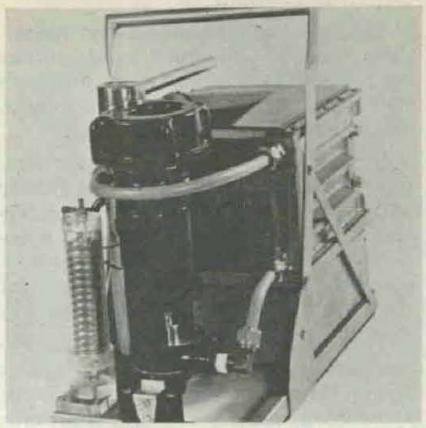

Fig. 12. 300-watt system, holding 8 hours of fuel, weighs 36 pounds.

Figure 12 shows a 300-watt system with a total weight of 36 pounds, including 8 hours of fuel. Figure 13 shows a 40-Kw. system used as the main power plant for an electric drive in a ¾-ton vehicle. The 40-Kw. plant weighs a total of 1,000 pounds.

Despite the attractiveness of these fuel cell systems, they involve the penalty of a special fuel logistic problem. Fuel cells capable of utilizing Army hydrocarbon fuels are in the research and early development stage. Three basic approaches are being actively studied. These approaches and their status are:

(1) *Direct Oxidation.* Oxidize the fuel directly at a fuel anode in a low-temperature system with oxidant supplied from ambient air. This is the ideal fuel cell system because of high efficiency, but is also the most difficult to achieve. Cells have been operated which show that direct oxidation can be achieved. However, extensive research is required to achieve practical power densities and reduce amounts of noble metal catalysts required to attain reasonable cost levels. Currently, single cells will provide 10 watts/ft^2 on CITE fuel. In order for a practical direct oxidation fuel cell power plant to be developed, power densities of at least 100 watts/ft^2 are required;

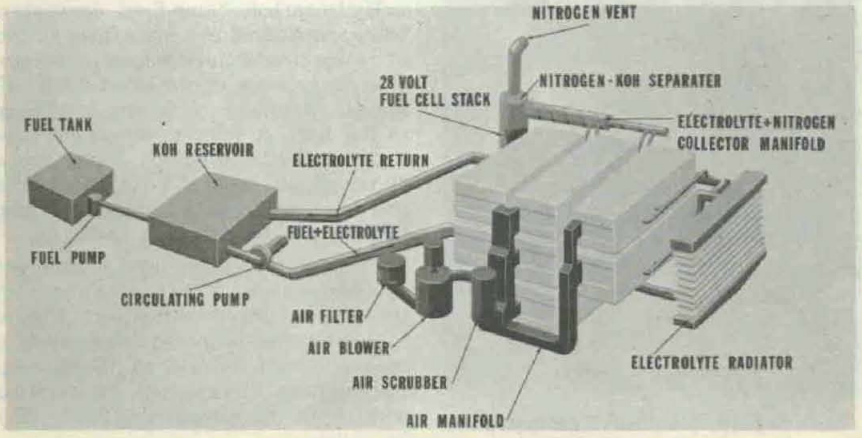

Fig. 13. 40 Kw. Hydrazine-Air Fuel Cell System.

(2) *Reformer-Fuel Cell.* Reform or treat the hydrocarbon fuel to extract relatively pure hydrogen and oxidize the hydrogen in a hydrogen-air fuel. This is the most advanced approach in terms of yielding practical power plants. Current AMC programs involve construction of 500-watt and 5.0-kilowatt systems of this type.

The 500-watt system will weigh a total of 75 pounds arranged in two 35-40-pound man-transportable loads. Troop test models are expected to be available in FY 68. A breadboard of the 5.0-Kw. system has been constructed and is under test. Figure 14 shows the reformer and Figure 15 one of the fuel cell stack modules.

Based on results of the design studies and tests of this first breadboard, a follow-on engineering development of a 3-Kw. reformer fuel cell system which will provide 28V d.c. and 60 and 400 cps a.c. outputs is planned. The total 3-Kw. system will weigh 300 pounds and will utilize CITE fuel. It is expected that models will be available for troop test in Fiscal Year 1968.

(3) *High-Temperature Fuel Cell.* Partially oxidize the fuel and supply an impure hydrogen stream to a high temperature (1200° F.) molten carbonate electrolyte fuel cell. This approach has the distinct advantage of utilizing a wide range of impure fuels and does not require precious metal catalysts. It is probably limited, however, to relatively large power plants (ca 10 Kw. and greater) because of high temperature insulation and accessories which result in excessive size and weight penalties at low power levels.

Tests of laboratory models of cell stacks and a 100-watt system have proven feasibility of this approach. An exploratory development model of a 15-Kw. system which will weigh approximately 2,000 pounds (currently available diesel-engine-driven 15-Kw. sets weigh approximately 2,500 pounds, unsilenced) will be developed by 1967.

Electric Propulsion of Army Vehicles. Electrical propulsion of vehicles is of interest to the Army for a number of reasons. First, electric drives have been demonstrated to provide better utilization of the prime mover power, since better control can be accomplished than by other types of drive systems. Second, there is

Fig. 14. Reformer

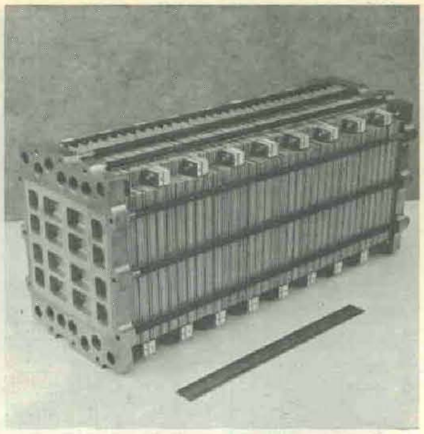

Fig. 15. Fuel Cell Stack Module

a growing requirement for substantial amounts of on-board electric power for weapons, communications and surveillance systems mounted on vehicles. Third, the most efficient energy conversion techniques currently known provide energy in the electrical form directly; therefore, to exploit the conversion efficiency, work should be extracted by electrical means.

Initially, electric-drive systems are being developed based on the use of gas turbines as the prime mover because of the very attractive power densities of turbines. Since turbines are high-speed prime movers, high-frequency high-speed generators have been developed for direct connection to the turbine. Also, high-frequency high-speed motors to minimize motor size have been developed.

Advanced static conversion and control devices based on the use of newly available controlled rectifiers have been developed to provide a high-performance means of control to apply the high-speed high-frequency machinery to dynamic loads.

The Army Materiel Command has under design and construction both wheeled and tracked electric propulsion test-bed vehicles to establish design criteria and to confirm performance predictions for this type of system.

One of the most advanced of these test-beds utilizes a direct-connected turbine-generator developing 200 Kw. at 39,000 r.p.m. and 3,200 cps. This high-frequency power is connected to four static power converters which control four induction motors, one for each wheel of the vehicle. These motors are rated at a constant 50 horsepower over a speed range from 3,000 to 30,000 r.p.m. The test-bed articulated vehicle weighs 20 tons.

This advanced system uses digital control logic to coordinate the major elements of the propulsion system with the operator. SAE paper Number S431, "AC Electric Drive for Off-Highway Electric Vehicles," R. E. Hopkins, contains a description of a propulsion system closely resembling the one above.

For the long term, the ideal power plant for the vehicle electric-drive system is the fuel cell because of its very attractive conversion efficiency. Since vehicles consume 60 percent of the total fuel logistics supply of the Army, any major impact in reducing the overall Army fuel supply must affect vehicle propulsion systems. Fuel cell-powered electric-drive systems clearly offer this potential.

Figure 16 shows a 40-Kw. fuel cell power plant which operates on hydrazine-hydrate and air as the fuel and serves as the prime propulsion power for an electric-drive system on this vehicle. This is a first of its kind and uses a special fuel, but is indicative of the types of systems that fuel cells ultimately can provide.

Mobile High-Energy Power Plants Rapidly increasing demands for millions of watts of electrical energy produced by mobile power plants, and compact stationery plants to satisfy duty cycles which range from millisecond pulses to several hours continuously, have given rise to the study of radically new energy-conversion techniques.

Conventional heat engine and nuclear power plants are prohibitively costly (see Figure 17) and involve excessive size and weight. Rocket-driven magnetohydrodynamic (MHD) generators have been studied for this application (USAERDL Reports Number 1784 and 1798 RR). These studies show that rocket-driven MHD generators with superconducting magnets to produce the main field are feasible and will meet mobility and cost objectives. Therefore, studies of fuel properties and design of a scale-model generator have been initiated. Figure 18 is a schematic diagram of such a design. Full-scale power plants can be constructed by the 1970 period.

Power Transmissions. In many applications, large central power plants are the most economical or are essential for synchronized control. In these cases, a major problem is encountered in the associated power transmission or distribution system from the standpoints of the bulk and weight and the time required to emplace and remove the transmission system. This is one of the neglected areas in the overall Army electric power field.

In the past, militarized commercial equipment (cables, switches, transformers) was satisfactory. However, technological changes and emphasis on mobility clearly preclude use of existing equipment. Studies of all possible transmission techniques have been completed. These show that, for the short-term, minor gains can be made by use of special lightweight

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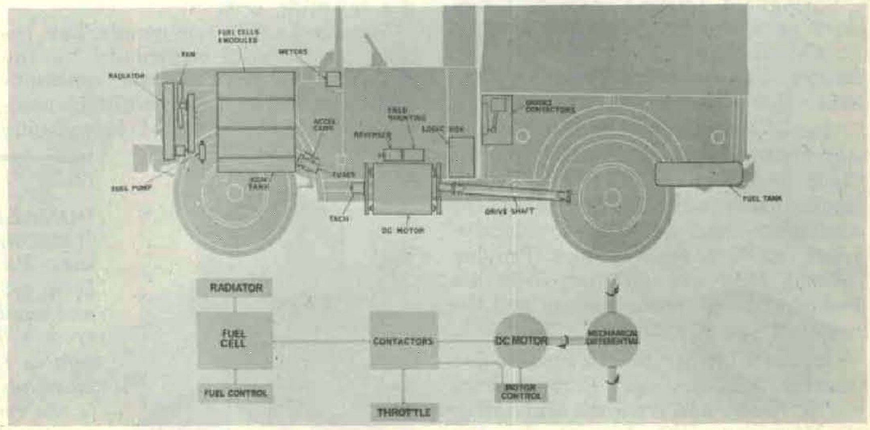

Fig. 16. M-37 Fuel Cell Truck

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wire transmission systems. These will be developed as required. However, for the long-term ultimate solution, radically different means, such as superconductors and microwave wireless transmission, must be considered.

Nuclear Electromagnetic Pulse (NEMP). This is a nuclear weapon effect which is a potential threat to Army electric power systems. Analysis of available nuclear weapons test data and results of analysis of simulated electric and magnetic field effects have established military significance.

Research is in progress to understand better the mechanism by which the NEMP energy is coupled into typical Army systems, determine the effect of weapon yield variations, and evolve protective measures as required. Results to date show that proper shielding and application of lightning arrester technology offer a high degree of protection.

Basic Research. In order to provide a continual flow of new knowledge particularly pertinent to the Army Electric Power Program, continuing directed research is required. The AMC has underway, in-house and by contract with research establishments research and exploratory development efforts in fields such as super conductivity, magnetic materials, basic electrochemistry, a electromagnetic phenomena, advanced electric machinery, the physics of plasmas, and energy storage.

Results which offer revolutionary possibilities, such as lossless electrical

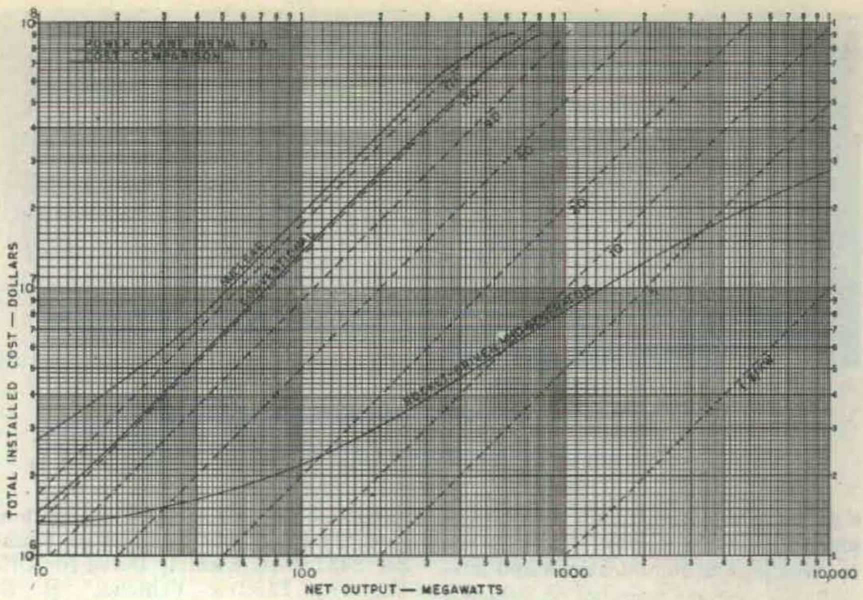


Fig. 17. Power plant installed cost comparison

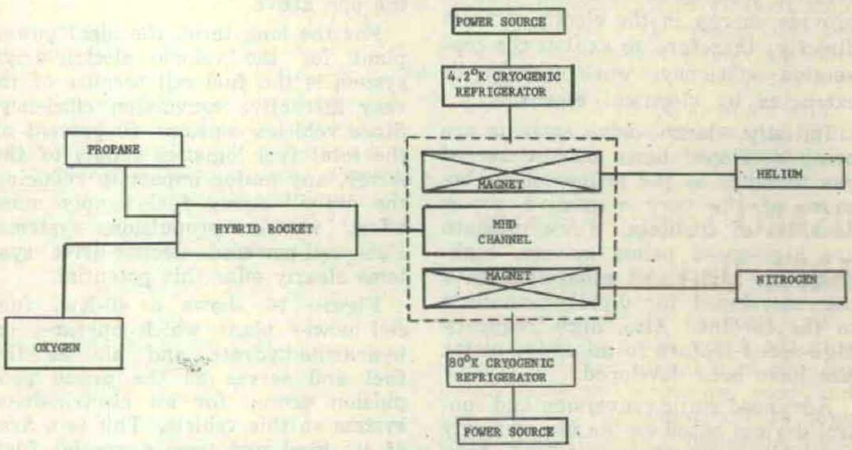


Fig. 18. Schematic diagram of scale model generator design.

machinery and transmission systems, have already accrued from this type research. The promise of even greater achievements lie ahead in a very fertile scientific area.

Summary. Electric power has become an essential commodity for the Army in the field. Power consumption in the Army is rapidly increasing and can be expected to continue to increase as new military material is introduced and new uses of electrical energy are developed. The Army has recognized the Electric Power Problem and established policies and programs to meet the need. Many difficult scientific and technical problems are being actively pursued. Progress is encouraging but much remains to be accomplished.

DONALD J. LOOFT, chief of the Electrical Power Division, Electrical Department, U.S. Army Engineer R&D Laboratories, Fort Belvoir, Va., has been associated with the ERDL, in a military and civilian capacity, since 1945. Upon release from military duty, he accepted a civilian position in 1946. He was named winner of the Commanding Officer's Leadership Medal in 1959, and is the recipient of a number of Outstanding Performance Awards. He attended the University of Dubuque (Iowa) and University of Wyoming.

Former OCRD Officer Selected Springfield Armory R&E Chief

Springfield (Mass.) Armory's new chief of research and engineering is Lt Col Howard E. Ammerman, Jr., former commander of the 83rd Ordnance Battalion, Korea.

One of Col Ammerman's earlier assignments was in the Office of the Chief of Research and Development. He has served in the Office of the Assistant Chief of Staff for Intelligence, as G-1 at Aberdeen Proving Ground, Md., and with the Ordnance Technical Intelligence Agency and the Army Missile Command.

Graduated from the Command and General Staff College, Fort Leavenworth, Kans., and from the University of Maryland (BS degree), he has served in Korea, Japan and Italy.

AUTODIN Communications Network Expanding

Expansion of communications facilities for the Military Departments and the Department of the Defense through the AUTODIN (Automatic Digital Network) within the Continental United States began early in December.

The Defense Communication System Automatic Electronic Switching Center was opened at Hancock Field, Syracuse, N.Y. As the first increment in the planned AUTODIN expansion program, it is operated by the Naval Communications System for the Defense Communications Agency.

AUTODIN is planned as a worldwide network to accept, relay and deliver data, teletypewriter and computer communications between various types and combinations of transmitting and receiving equipment.

The Defense Supply Agency, a large user of AUTODIN, has been added most recently to the system. Similar but less modern facilities were provided previously within each Service's own networks.

The Hancock Field AUTODIN facility is the sixth such center in operation. Three additional centers are planned. The Naval Communications System will operate the Albany, Ga., facility and the U.S. Army Strategic Communications Command will control the centers at Fort Detrick, Md., and Fort Leavenworth, Kans.

Already in service are the Air Force-operated AUTODIN centers at Norton AFB, Calif.; Tinker AFB, Okla.; McClellan AFB, Calif.; Gentile AFB, Ohio; and Andrews AFB, Md., from which the present system is being expanded.

AUTODIN and its complementary system, AUTOVON (Automatic Voice Network), are the result of a Department of Defense decision in 1963, directing the Defense Communications Agency to modernize its system to provide automatic switching systems for voice, teletypewriter, and data communications among continental United States and overseas bases.

The overseas portion of AUTODIN is now being implemented with three switching centers planned in Europe and seven for the Pacific area, including Alaska and Panama.

The European AUTODIN net is planned for completion in 1967 and the Pacific net about a year later.

Overseas AUTODIN will be integrated with the nine centers in continental United States to provide global coverage automatic digital communications service.

The AUTODIN implementation program is under direction of the Defense Communications Engineering Office, a field activity of the Defense Communications Agency.

Prime contractor for work and services in the United States for AUTODIN is the Western Union Telegraph Co., with the Radio Corp. of America as manufacturer of major equipment. The Philco Corp. is prime contractor for overseas centers.

USARO Scientist Heads ARPA Unit in Thailand

Dr. Leonard E. Wood, geologist with the Army Research Office Headquarters staff for the past three years, has been appointed program manager of Environmental Sciences for the Advanced Research Projects Agency (ARPA) at Bangkok, Thailand.

Dr. Wood will leave for his new Department of Defense assignment on Jan. 22 from San Francisco, accompanied by his family, and is expected to remain in Thailand from two to four years. Currently he is participating in a DoD familiarization program on ARPA and studying the Thai language in Washington, D.C.

BS and MS degrees in geology from the University of Kentucky and a PhD from Michigan State University were among the qualifications he offered when he joined the Geophysical Sciences Branch of the Environmental Sciences Division of the Army Research Office in January 1963.

Previously, he served as a geologist with the International Mineral and Chemical Corp., Chicago, Ill.; the Wabash Iron Co., Montreal, Canada; the Military Geology Branch of the Geological Survey, and Mobile Oil Co. in Texas, Venezuela and Libya.

STRATCOM Chiefs Weigh Global Readiness

Command readiness and the Army's ever-expanding global responsibilities received in-depth probing at the recent second Annual Commanders' Conference at Headquarters, Strategic Communications Command (STRATCOM), Washington, D.C.

Operational objectives were discussed during the 4-day meeting in some 30 talks given by STRATCOM headquarters staff and key overseas commanders.

Maj Gen Richard J. Meyer, CG of STRATCOM, presented two guest speakers: Maj Gen David P. Gibbs, chief of Communications-Electronics, Department of the Army; and Maj Gen George E. Pickett, deputy director for the Defense Communications System.

General Pickett said establishment of STRATCOM in 1964 was "a necessity in an age of worldwide military commitments," and that its early accomplishments have revitalized the Army's role in strategic communications. General Gibbs joined in praising STRATCOM growth and progress.

General Meyer estimated that by mid-1966 STRATCOM personnel strength will have grown nearly four times since the command's creation in March 1964.

Other key speakers were Brig Gen J. E. Kelsey, STRATCOM's deputy CG; Brig Gen W. B. Bess, newly appointed CG of STRATCOM-Europe; Col John N. Medinger, CO of STRATCOM-CONUS; Col L. W. MacMillan, CO of STRATCOM-Pacific; Col John F. Jenkins, outgoing CO of STRATCOM-mid-East; and Lt Col R. J. Emerson, CO of STRATCOM-South.

TTC Assigns Microbiologist to Miraflores Laboratory

The U.S. Army Tropic Test Center has appointed George W. Gauger as a microbiologist at its new laboratory at Miraflores, Canal Zone.

Gauger is working with USATTC life scientist Dr. Robert S. Hutton on a project titled "Environmental Data Base for Regional Studies in the Humid Tropics."

The project is designed to establish a detailed base of information on the natural physical and biological environmental factors that influence testing and other tropics military activities.

Gauger is a graduate of Lakeland College, Sheboygan, Wis., holds an MS degree from West Virginia University, and has done graduate work at Indiana University. He has served at the Battelle Memorial Institute, Columbus, Ohio, Rahr Malting Co., and Merck and Co., Inc.

George W. Gauger

Military Night Operations, Human Capacities, Equipment Compromises

By Dr. George S. Harker

The Viet Nam situation has once again put emphasis on night operations. But what are night operations? The detection and identification of military targets? The laying of direct fire and the adjusting of indirect fire? The guiding of vehicles over strange routes, cross country, to a map point not previously seen? The conduct of squad and platoon actions, assembly, transport, dispersion, and control in tactical advance?

Night operations are all of these, yet none is possible without the visual capacity of the individual soldier. A review of critical aspects of the human visual function is possibly most meaningful against a background of the efforts to maximize its utility for night operations.

The ability to select the individual soldier for special night-vision capabilities has been demonstrated by personnel researchers. Specialized training to further enhance native ability is also a very meaningful possibility. The preponderance of current effort, however, involves the selective addition of light to the battlefield and the development of night-viewing devices.

In broad category, the human visual function may be considered in terms of the characteristics of the photosensor, the processes of image formation, and image interpretation. The photosensor in human vision is a composite of intermingled unitary elements which vary in sensitivity and in the character of the light to which they respond.

The combined range of sensitivity of photosensor elements, the rods and cones, extends from bright daylight to dim starlight. The utility of the composite retina, however, is not uniform over this entire range. Rather, it is a function of the characteristics of the retina at different levels of illumination.

In moderate daylight, the entire retina is functional and probably to best advantage. The peripheral retina composed of rods and cones serves as a movement detector to refer stimuli to central vision. The central retina, which has a high cone density, mediates color vision and the fovea provides maximum visual acuity coincident with the center of attention.

At night vision levels of illumination, only the rods are functional. One consequence of this, since the cones are necessary to color vision, is that all observers are color blind. Thus, color codes are useless and tactile or auditory codes are necessary on ammunition and adjustable delay fuses.

Further, since the fovea is entirely cone, it is functionally blind. This blindness of the fovea is most subtle in its consequences. The act of attending to a faint stimulus, an object which is barely seen to the left or right, brings that object to the fovea.

In daylight this would give maximum visual resolution but at night the fovea is blind. Thus, the faint stimulus to which one must respond is lost to view by the act of attempting to see it more clearly.

The response of attending can be dissociated from its concomitant eye movements by specialized training. However, the preponderance of experience in our society, where night is lighted like day, is heavily against any but the most determined individual developing such proficiency.

A more evident limitation of the retina, a limitation which is shared by other photosensors as well, is the inability to function at both daylight and night levels of illumination simultaneously or even in rapid succession.

The processes of dark and light adaptation in the retina—the processes by which the retina in the dark increases in sensitivity to light and vice versa—meet this limitation to a remarkable degree, but the process takes time.

Relatively complete dark adaptation takes place in 20 to 40 minutes. Fully complete dark adaptation takes days, and even months. Even the process of light adaptation of the eyes to an increase in light, takes 20 seconds to 20 minutes.

Glare, the scatter of light within the eyes, reverses the process of dark adaptation as does a flash of light or any light in the field of view. Only at intermediate levels—low daylight levels—can the eye sustain moderate changes in illumination level with minimal loss of sensitivity.[1]

Any light to a fully dark-adapted eye results in a corresponding loss of absolute sensitivity and the requirement to dark adapt once again to reestablish the lost sensitivity.

Use of a red filter with selective illumination offers a limited possibility for effective simultaneous operation at two levels of illumination. A properly selected filter can preserve sensitivity of the rods for functioning in the dark while permitting use of the cones in moderate illumination.

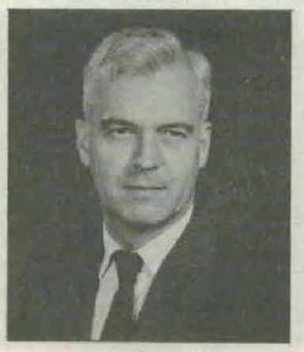
Much research has been directed toward optimizing the specialized conditions necessary to this approach to operations requiring free movement from a dark environment to the light and back again.

It was mentioned earlier that the process of dark adaptation can take months. Subjective reports of loss of night vision by pilots exposed to direct sunlight on long, high altitude flights are confirmed by the work of R. H. Peckham.[2] He measured the dark adaptation thresholds of members of the Atlantic City Beach Patrol before, during and following the summer season.

Measurement he recorded indicate that the routine wearing of 10-12 percent transmittance sunglasses is necessary to preserve the night vision of an individual continuously exposed to full sunlight. Guards who did not wear the very dark glasses did not recover their preexposure levels

Director of the Psychology Division, U.S. Army Medical Research Laboratory (USAMRL), Fort Knox, Ky., since 1961, Dr. Harker conducts individual research in binocular vision and supervises an Army program of research in sensory psychology related to military operations.

Prior to joining USAMRL as head of the Vision Section in 1950, he served as a graduate research assistant at the University of Iowa (1948-50), Tufts College (1947-48), and the University of New Hampshire (1945-47).



Dr. G. S. Harker

He received his BS degree from Temple University in 1941 and worked as a junior electrical engineer with the Philadelphia Electric Co. until 1942. Then he joined the Army Signal Corps as an enlisted man, later was commissioned as an officer, and served until 1945.

He then earned an MA degree in education from the University of New Hampshire (1947) and PhD from the State University of Iowa (1950). Dr. Harker is the author of numerous scientific and technical articles and publications and holds a patent on a stereoptometer.

BASIC RESEARCH on the neurophysiological mechanisms in the retina and thalamus that underlie the processes of dark and light adaption, retinal sensitivity, and color vision, is conducted at Army Medical Research Laboratory, Fort Knox, Ky.

of dark adaptation until the following winter.

Processes of image formation and maximizing the image quality of the eye are relatively well understood. The visual function of concern is that of accommodation, which is the immediate and direct response of the eye to a blurred image.

The accommodative response of young eyes is rapid, ready, and achieved with little indication to the observer that it has occurred. The point of concern is that, given a choice, as in the focusing of an instrument eyepiece, an observer will set the eyepiece to require excess accommodation as the preferred conditions for precise seeing.

The excess minus lens before the eye stimulates the accommodation of the eye. Frequently this is the source of eyestrain and resultant headache. For this reason, one must always focus an eyepiece from full plus toward minus, stopping when the image first comes clear.

Instrument to instrument variability among optical devices is frequently such that a previously determined eyepiece setting cannot be transferred from one to another. Daylight settings are not adequate at night. Typically, one to one-and-a-half diopters of additional minus is required when the eye is dark adapted.

Similarly, more minus lens in the eyepiece of night-vision devices which present a phosphor image may be necessary. However, the potential of minus lens to produce eyestrain and concomitant headache must not be overlooked.

In addition to the wide range of image interpretation problems inherent to daylight operations, night operations involve perceptual problems specifically associated with the manner of delivery of the available light.

The inability to see in the absence of light is generally accepted, as is the inability to see in the light when airborne material such as smoke, intervenes between the observer and his field of view. However, most observers are disturbed by their inability to "see" in the presence of light and the absence of visible objects.

This condition, which is identified in the arctic as "Whiteout," is more common as a perceptual condition than is generally recognized.

Vision in man is relative and as such is dependent upon discernible objects in the field of view. The existence of visually discernible objects is dependent upon contour to delimit the objects from their background.

Contour, in turn, is dependent upon contrast rendition which, in most instances, is the result of luminous intensity differences between the light reflected from an object and the lack of reflected light from its surrounding environment and shadow.

Consequently, when no shadows exist, the available contrast is reduced to that inherent to the coloration present. Contours within and between areas of common coloration disappear and, with them, the objects they delimit. The consequence for the human observer is that he is unable to "see," though the light levels may be high, even blinding.

Consider the illumination of an area by the use of chemoluminescent compounds. If the material is sprayed upon the area, all objects within the area will be covered in the direction of the spray and will return a uniform diffuse light toward the source of the spray.

The chemoluminescent compound so distributed becomes a diffuse light source, each part of which disappears into the whole. Objects within the area are illuminated, but at the same time are lost to sight for lack of contrast with their surroundings.

Similarly, when an area is illuminated by a direct, head-on searchlight, the light reflected to an observer from objects present in the beam differ very little. Thus, in the absence of coherent shadows to provide contrast and contour, the objects present differs very little. Thus, in the absence fade into the lighted background.

Overhead flares present something of the converse situation in that shadows predominate. But the shadows tend to be unrelatable to the areas of reflected light. Thus they do not serve to provide meaningful contour and to aid object recognition.

The application of light does not alone assure the ability to see. Illumination to be effective must be applied in a manner to maximize the conditions for seeing. This means it must be applied in a manner to enhance edge contrast and provide meaningful contour to facilitate object recognition. The presence of both directed and diffuse illumination seems to be necessary.

The relation of the use of added illumination to dark adaptation and the absolute sensitivity of night vision should be obvious, as well as the effect of glare when the light source is within the observer's field of view. "Seeing" cannot occur if the adaptation level of the observer's eyes is inappropriate to the level of the illumination present.

It should be evident at this point that compromise is the rule in the utilization of vision in night operations. The availability of night-viewing devices utilizing photosensors of infrared and visible light, in addition to the limitations they share in common with the eye, adds dimensions to trade-offs in night operations.

The use of an active system poses the problem of directional illumination, that is, the searchlight problem; the use of a passive system, in the sense of night sky radiation or starlight, involves the problem of diffuse illumination, the "Whiteout."

Both systems entail the problem of unfamiliar contrasts and the recognition of familiar contours in an unfamiliar surrounding. The use of

(Continued on next page)

In VISUAL SURVEILLANCE test, ability of humans to discriminate incremental changes in position, movement and target intensity is compared with their powers of auditory discrimination at Army Medical Research Lab.

Operations, Capacities, Equipment Compromises

(Continued from page 47)

self-emitted radiation involves the observer in the problem of "signatures." This is the problem of identifying a jeep, tank, truck, etc., by radiation from the muffler. For general use, will certainly require extensive training to establish familiarity with multiple variations that may occur.

Night-vision devices currently in use present some interesting opto-mechanical compromises, the understanding of which can materially affect their utility.

The individual Night-Vision Weapon Sight is one of a family of optical devices which utilize an electron-image tube with a phosphor screen to present to the operator the field of view. A series of available light, image-intensifier tubes precedes the final image surface. A schematic of such a sight as well as a conventional glass optic is presented in Fig. 1.

A comparison of these two systems will show that the focus adjustment, with the glass-optic for objects at different distances, is shared by the observer's eye and the eyepiece focus. Each can substitue for the other, with the accommodation of the observer's eye actively adjusting for the distance of observation as the observer scans the field of view.

Focus with the electron-optic sight is a twofold process. Unlike the glass optic, the function of adapting the instrument to the observer's eye is mechanically independent of the focusing of the instrument for the distance of the target. These functions interact visually, and either or both can blur the image and limit the ability of the observer to use the instrument.

As illustrated in Fig. 1, the eyepiece adustment provides for the observer's refractive requirements, plus some minus lens to satisfy the psychic requirements of the phosphor image, pupil dilation, etc. The objective lens adjustment provides for target distance and must be actively by hand to shift clear vision from near to far and vice versa.

Accommodative adjustment of the operator's eye cannot improve the image on the phosphor screen. Initial adjustment of the instrument is accomplished by the successive adjustment of the eyepiece focus and the objective focus.

The use of the recticle as an intermediate focus may simplfy or complicate the process, depending upon the individual instrument.

Other more subtle compromises are present in both the electron-optic and glass-optic instruments consequent to the use of an objective lens to gather light. The gathered light is ordered by the objective lens to form an inverted image of the field of view which is distributed in depth along the optical axis of the instrument.

The inversion of the image is basically unwanted, but since the electron tube re-inverts the image, this limitation of the objective lens in an advantage in current night-vision devices.

In the glass optic, the image must be reinverted by an erecting system which is not shown in the schematic drawing. The distribution of the image along the optical axis is also unwanted, but is accepted as the "depth of field" of the lens and is compensated by focus adjustment of the objective lens.

The value of the light-gathering feature, in terms of the reduced demands upon the light amplification system, is amply attested by the increase in functional range with increase in diameter of the objective lens in the various models of night-vision instruments.

Consider the design of a helmet-mounted item for the individual soldier to be used at the short ranges which characterize squad and platoon activities. In such an instrument, the objective can be quite small since the reduced viewing distance reduces the need for gathered light.

Unwanted features of the objective lens can be disproportionately demanding. The necessity to reinvert the image adds length and bulk to the ultimate item and a helmet-mounted item is not easily focused, particularly if the observer's hands are occupied.

In this regard, it is interesting to note that there is in biology a method of image formation which does not use an objective lens. Consequently it has an infinite depth of field and does not invert the image.[3] This method of image formation occurs in the compound eye of crustacea and insects and is illustrated in Fig. 2.

The principle of image formation employed here is that of selection as distinct from refraction. The drawback of this approach to image formation is that rather than gathering light this process throws light away. Only those rays are retained which are naturally ordered in their emission paths from the object.

The effective functioning of this approach to image formation is dependent upon a highly efficient light detector and amplifier which in biological examples is provided by the omatidium of the compound eye.

Recent developments in the fields of solid-state light amplification, and the availability of selective coatings, challenge one to hope that one day the engineering art will be sufficiently advanced to provide the individual soldier with a night-viewing device based upon this principle of image formation.

In summary, it might be concluded that the human is really a diurnal not a nocturnal animal and that the conduct of night operations will, at best, be a multifaceted compromise.

[1] Wulfeck, J. W., et al. Vision in military aviation. WASC Tech Rept. #58-399, Astia Doc. #AD 207780, Nov. 1958.

[2] Peckham, R. H. and Harley, R. D. The effect of sunglasses in protecting retinal sensitivity. *Amer. J. Ophth.*, 1951, *34*, 1499-1507.

[3] The Eye, Vol. II, Davson (Ed.), Academic Press: New York and London, 1962.

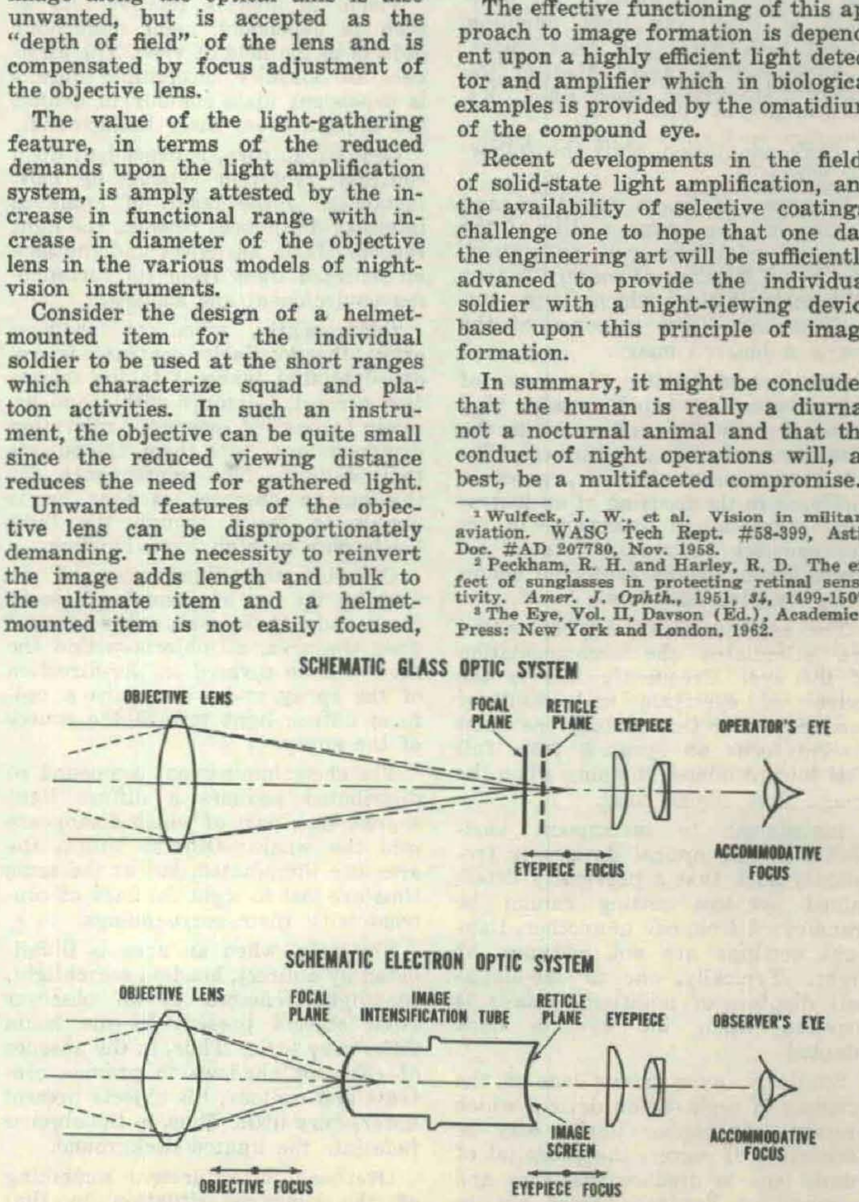
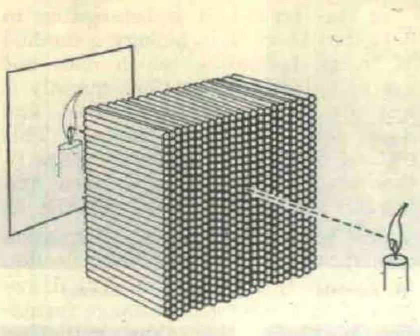


Fig. 1. Schematic of conventional glass-optic and electron-optic sight.

Coauthors Revise 'Basic Bacteriology' Text



Reproduced from Dartnall in *The Eye*, Davson (Ed) 1962, p. 328, Academic Press, Inc.

Figure 3. Formation of image by a bundle of parallel "ray selectors." A good demonstration of this device can be made using, as the ray selectors, drinking straws (of 1/8-inch diameter and about 7 inches length) that have been dipped in black paint. Seventeen thousand such straws bundled together give an "insect eye" about 18 inches square. In front of a well-lit scene, this bundle presents a clear image.

OCRD Officer Earns Plaque For Aviation Digest Article

Lt Col John G. Cleveland, Air Mobility Division, Office of the Chief of Research and Development, received the monthly award from the *U.S. Army Aviation Digest* for his article "Professionalism" in the October 1965 issue.

The award consisted of a Bronze plaque, presented recently by Lt Gen William W. Dick, Jr., Chief of Research and Development. In the article, Col Cleveland points out that an aviation battalion commander should strive for the goals of motivated people, quality maintenance, a low accident rate and effective training.

"Probably the greatest catalyst in a unit," he observes, "is the commander's personal interest."

Basic Bacteriology—Its Biological and Chemical Background is the title of a new 1,001-page third edition textbook coauthored by Dr. Carl Lamanna and Dr. M. Frank Mallette.

The authors, closely associated in professorates at Johns Hopkins University for several years, describe the advanced textbook as one of "intermediate complexity."

Dr. Lamanna is Deputy and Scientific Adviser, Life Sciences Division, Army Research Office, OCRD. Dr. Mallette is professor of biochemistry, Pennsylvania State University.

The first edition was published in 1953 and reprinted in 1954 and 1956 when it was translated into Japanese. The second edition, published in 1959, was not translated into Japanese but the publisher, The Williams and Wilkins Co. of Baltimore, Md., reports great quantities of the textbook were sold in that country. Similar foreign sale of the new edition is expected.

Each of the 14 chapters of the new version has been revised, but not equally. This is indicative, the authors say, "that new developments have been unequally distributed among the subject matters discussed."

Major additions or revisions have been made in the areas of numerical taxonomy, enzyme biosynthesis and nomenclature, metabolism of nitrogen compounds, photosynthesis, genetics, and permeability phenomena.

"Basic Bacteriology" approaches being a misnomer but is adequately explained by the authors as being a volume bridging the gap between the large number of elementary-level texts and the numerous monographs and reviews written at the most advanced level.

The authors have assumed that the reader has mastered the basic vocabulary of biology and chemistry and has had some laboratory experience in bacteriology. The volume is written in an unpretentious yet scholarly style and can be used as a reference work. Papers outside of bacteriological journals which may be useful to the advanced bacteriologist are included.

The authors admit to injecting their own opinion into the text in addition to new ideas, even though they may be unpopular ideas, explaining: "We do hope to identify for the reader what is fact and what is opinion so that he may perceive unsettled problems and make his own judgments."

About the authors:

Dr. Lamanna received his BS, MS and PhD degrees from Cornell University. After his doctorate was conferred in 1939, he taught bacteriology and public health at Washington State University and a year later at Oregon State University.

From 1942-44 he was on the medical faculty of Louisiana State University. For nine years he was a professor of microbiology at Johns Hopkins University. He earned the Department of the Army Exceptional Civilian Service Award at Fort Detrick, Md., for work from 1944 to 1948 leading to the first crystallization of bacterial protein.

Dr. Mallette received a BS from Iowa State College in 1940, was a Fellow at Columbia University from 1943 to 1945 and received his PhD in chemistry from Columbia in 1945. From 1945-47, he was a Fellow at Cornell University and then was an instructor in chemistry for one year at the University of Wyoming.

From 1948-50, he was assistant professor of biochemistry in the School of Hygiene and Public Health at Johns Hopkins and was associate professor from 1950-55. At Pennsylvania State from 1955-60, Dr. Mallette was professor of agricultural and biological chemistry and has since been professor of biochemistry.

Colonel Goldenthal Assigned To R&D Specialist Program

NEW APPOINTEE to the Army Research and Development Officer Specialist Program is Col Mitchel Goldenthal, CO of the U.S. Army Satellite Communications (SATCOM) Agency. The program is designed to advance the scientific and technical proficiency of career officers; also, to assure planned availability of military personnel with qualifications for research and development assignments comparable to the education and experience of professional civilian scientists.

Col W. L. Clement

Col Van Harlingen

Col J. R. Guthrie

Col T. H. Barfield

Col J. J. Kenney

President Approves Promotion Of 55 Colonels to General Rank

Col I. O. Drewry

Col R. D. Terry

Col B. R. Luczak

Thirteen of 55 U.S. Army colonels approved by President Johnson late in November for promotion to brigadier general have a background in Army research and development. Nominations will be submitted to the Senate in January for confirmation.

Assistant Director of Army Research Col Wallace L. Clement, five former Office of the Chief of Research and Development (OCRD) personnel and seven Army Materiel Command R&D officers are on the list. Four are AMC project managers, reflecting the "cream of the crop" type of officers selected for these assignments. Of the 45 project managers in AMC, 29 are full colonels.

The OCRD veterans are Colonels William M. Van Harlingen, Jr., John R. Guthrie, Thomas H. Barfield, John J. Kenney, and Robert D. Terry. AMC nominees are Colonels Ivey O. Drewry, Jr., Bernard R. Luczak, Edwin I. Donley, Kenneth M. Gonseth, Thomas M. Rienzi, William J. Durrenberger, and John L. Klingenhagen.

COL CLEMENT, a graduate of the U.S. Military Academy and the Army War College, joined the U.S. Army Research Office, OCRD, in July 1964 as Assistant Director of Army Research, after 15 months as commander of the 14th Armored Cavalry in Germany.

Earlier he served as Senior Standardization Representative, U.S. Army Standardization Group-United Kingdom, London, England; staff officer and assistant course director, U.S. Army War College; military adviser to the Operations Research Office, Washington, D.C.; and staff officer with the Deputy Assistant Chief of Staff, G-3.

COL VAN HARLINGEN, deputy chief of staff, J-6, Communications-Electronics, Continental Air Defense Command, Colorado Springs, Colo., served in OCRD as chief of the Communications and Electronics Branch, 1955-58.

Three years with the U.S. Army Europe then preceded two years as a student at the National War College and Harvard Business School. Subsequent assignments, all in Washington, D.C., have been: chief, Office of Plans and Programs, Office of the Chief Signal Officer; chief, Plans, Policies and Programs, Office, Chief of Communications-Electronics; director of Army and Defense Supply Agency Division, Office of Technical Data and Standardization Policy, Office of the Secretary of Defense.

A graduate of the U.S. Military Academy, the Command and General Staff College (equivalent), and the National War College, he also holds an MA degree from George Washington University, and an MSE degree in electrical engineering from the University of Michigan.

COL GUTHRIE, assigned to the U.S. Army element, Office of the Joint Chiefs of Staff, Washington, D.C., since July 1965, served as a staff officer with OCRD from 1956 to 1958. Next he served as military assistant then as assistant executive to the Secretary of the Army.

A succession of recent assignments with the U.S. Army Pacific in Hawaii culminated in appointment as CO, 25th Infantry Division, Artillery, then chief of staff, 25th Infantry Division, U.S. Army Pacific. He has an AB degree from Princeton University and has completed the Command and General Staff College (C&GSC) and National War College courses.

COL BARFIELD, chief of staff, U.S. Army Air Defense Center, Fort Bliss, Tex., since July 1965, served in OCRD as deputy director of Special Weapons (1961-62).

Subsequent assignments have included CO, 40th Artillery Brigade, Presidio of San Francisco; deputy chairman, Advanced Tactics Project, then chief, Air and Missile Defense Division, U.S. Army Combat Developments Command, Fort Belvoir, Va.

His educational equalifications include an AB degree from the University of Alabama, MA degree from George Washington University, and graduation from the C&GSC and the National War College.

COL KENNEY, executive, Office of the Assistant Chief of Staff for Force Development, Washington, D.C., served with OCRD as senior standardization representative in Canada and also as chief of the U.S. Army Standardization Group, Ottawa, Canada (1957-60).

He also has served as deputy director, then acting director of Plans and Programs, Office, Assistant Chief of Staff for Force Development, Washington, D.C., preceded by assignments at the U.S. Army Artillery and Missile School, Fort Sill, Okla.; director, Office of Combat Development and Doctrines; director, Artillery Plans and Policy, Office, Deputy Assistant Commandant.

His educational equalifications in addition to graduation from the U.S. Military Academy include the C&GSC (equivalent), Armed Forces Staff Col-


Col E. I. Donley


Col K. M. Gonseth


Col T. M. Rienzi


Col Durrneberger


Col Klingenhagen

lege, Air War College and an MA degree in meteorology from the University of California.

COL TERRY, chief of staff, U.S. Army Electronics Command, Fort Monmouth, N.J., served with OCRD at the original U.S. Army Research Office at Fort Belvoir, Va., as chief of the Scientific Information Branch, Research Division; later he was assistant chief of the USARO liaison group, 1957-59. More recently he has been assistant Army member, Mutual Weapons Development Team, Office of the Secretary of Defense, in Washington, D.C. and Paris, France, and Signal Officer, Headquarters, 18th Airborne Corps, Fort Bragg, N.C.

He is a graduate of the U.S. Military Academy, C&GSC, U.S. Naval War College, and the University of Illinois, with an MS degree in electrical engineering.

COL DREWRY, AMC Nike-X project manager, assigned to the U.S. Army Missile Command, Redstone Arsenal, Ala., previously served there as project manager for Zeus. He has served as senior ordnance adviser to the Ordnance Officer, First Republic of Korea Army, U.S. Army Advisory Group, Korea, and special assistant to the Chief of Ordnance for Ordnance Commands and Arsenals, Office of the Chief of Ordnance, Washington, D.C.

From 1956-58, he commanded Picatinny Arsenal, Dover, N.J. He holds a BS degree from Georgia Institute of Technology and has completed the C&GSC (equivalent), Armed Forces Staff College and Industrial College of the Armed Forces.

COL LUCZAK, project manager for SAM-D, U.S. Army Missile Command, has served there also as Mauler project manager; Nike Hercules project manager; deputy to the Deputy CG, Air Defense Systems; and operations director, Operation Hole Card; and commander, Task Unit 8.1.7., Joint Task Force Eight.

He has a BS degree in industrial engineering from the University of Pittsburgh, MBA degree in industrial management from Stanford University, and has completed the C&GSC (equivalent and the National War College.

COL DONLEY, Pershing project manager, U.S. Army Missile Command, since October 1963, previously served as special assistant to the Deputy CG, Land Combat Systems, U.S. Army Missile Command. Earlier, he was executive officer, then deputy commander of Picatinny Arsenal, Dover, N.J., and directed the Samuel Felton Research Laboratories at Picatinny.

He is a graduate of the U.S. Naval Academy, Command and General Staff College and the Industrial College of the Armed Forces.

COL GONSETH, project manager for UNICOM/STARCOM, Fort Monmouth, N.J., has served in the U.S. Army Communications Zone Europe: deputy chief and later chief, U.S. Army Supply and Maintenance Agency; chief, U.S. Army Systems Development Office, and Signal Officer.

He has a BS degree in electrical engineering from the University of Illinois, an MBS degree from Harvard University, and has completed the C&GSC (equivalent) and the National War College courses.

COL RIENZI, chief, Combat Surveillance Office Headquarters, U.S. Army Materiel Command, Washington, D.C., since January 1965, has served in recent years as: executive, Office of the Chief Signal Officer; executive officer, Office of the Chief of Communications Electronics; and Signal Officer, XVIII Airborne Corps, Fort Bragg, N.C.

His education includes graduation from the U.S. Military Academy, C&GSC, and the Army War College, University of Illinois (MS degree) and George Washington University (MA degree).

COL DURRENBERGER is commanding officer of the U.S. Army Materiel Command Tank-Automotive Center, Warren, Mich. He has served as CO of Springfield (Mass.) Armory and as deputy commander, and chief of staff, U.S. Army Ordnance Weapons Command, Rock Island (Ill.) Arsenal. He has a BS degree from the University of Maryland, an MBA degree from Syracuse University, and is a graduate of the C&GSC and the Industrial College of the Armed Forces.

COL KLINGENHAGEN is commander of the U.S. Army Aviation Materiel Laboratories, Fort Eustis, Va. In recent years he has served as deputy commander, U.S. Army Support Command, Viet Nam; chief, Logistics and Communications Section, Army Concept Team, Viet Nam; and assistant chief of staff for Research, Development and Engineering U.S. Army Transportation Materiel Command, St. Louis, Mo.

He has a BS degree from the University of Maryland, and an MA degree from George Washington University, and has completed the C&GSC (equivalent), and the National War College.

His decorations include the Silver Star, Distinguished Flying Cross and Army Commendation Medal (each with Oak Leaf Cluster), Purple Heart and Bronze Star Medal (each with two OLCs), Legion of Merit, and Air Medal with 24 OLCs.

Other colonels on the brigadier general nomination list are: James J. Gibbons, James F. Hollingsworth, Donald H. McGovern, George B. Webster, Jr., Orwin C. Talbott, Burnside E. Huffman, Jr., Kenneth L. Johnson, Warren K. Bennett, Arthur L. Friedman, Willis D. Crittenberger, Jr., George W. Young, Jr., William T. Bradley, Salve H. Matheson, Harris W. Hollis, James M. Shepherd, Robert M. Williams, C. Craig Cannon, Allan L. Leonard, Jr., Frederick C. Roecker, Jr., Albert R. Brownfield, Jr., Daniel A. Raymond, Leo B. Jones, William A. Burke, Francis P. Koisch, James L. Baldwin, Alfred J. F. Moddy, William A. Becker, Edward Bautz, Jr., William M. Mantz, James H. Keller, Morgan G. Roseborough, Karl W. Gustafson, Charles G. Fredericks, James K. Terry, Henry A. Rasmussen, Glen C. Long, William R. Desobry, Felix J. Gerace, William E. Shedd, III, John P. Traylor, George S. Blanchard, and Earl F. Cole.

ASAP Chairman Appointed As New Principal DDDRE

President Johnson announced early in December that Dr. Finn J. Larsen has been appointed the Principal Deputy Director of Defense Research and Engineering. He has resigned as chairman of the Army Scientific Advisory Panel (ASAP).

Dr. Larsen served as Assistant Secretary of the Army for Research and Development from 1961 to 1963, winning the Exceptional Civilian Service Award in 1962 and Distinguished Civilian Service Award in 1963.

Since his resignation as Assistant Secretary of the Army (R&D) to return to Honeywell Corporation of Minneapolis, Dr. Larsen has directed the R&D efforts as Vice President for Research and Development.

In his new position, Dr. Larsen succeeds Dr. Eugene G. Fubini, who served as Assistant Secretary of Defense (Deputy Director of Defense Research and Engineering) until July 1965. The position has since been redesignated the Principal Deputy Director of Defense Research and Engineering.

Born in Bergen, Norway, in 1915, Dr. Larsen received a bachelor of science degree in 1939 from Mankato State Teachers College, Minnesota, and a master's degree in 1941 from Drake University, Des Moines, Iowa. During World War II, he was an officer in the Navy engaged in design work on radar equipment.

Following his discharge from active duty, he returned to Iowa State College and received a PhD degree in physics in 1948. While studying for his doctorate, he was an instructor in physics.

Dr. Larsen joined Honeywell, Incorporated soon after receiving his PhD degree and served as a research physicist and assistant to the Director of Research until he became Honeywell's Director of Ordnance Engineering in 1952. From 1954 to 1959, he was Director of Research and was Vice President of Honeywell from 1959 until he accepted appointment as Assistant Secretary of the Army (R&D).

Dr. Larsen and his wife Valerie have a son David, 23, and two daughters, Nancy, 15, and Valerie, 10.

6 U.S. Military Teams Assist Viet Nam Medics

Six mobile U.S. medical teams representative of the Army, Navy and Air Force were dispersed to the Republic of Viet Nam early in November to augment the medical staffs of civilian provincial hospitals.

Under what is known as the Military Provincial Hospital Assistance Program, the teams will expand health and medical services for the civilian population. The Army is executive agent for the program.

President Johnson, recognizing the need for these services, stated in a recent message to Congress.

"We are contemplating the expansion of existing programs under which mobile medical teams travel throughout the countryside providing on-the-spot medical facilities, treatment and training in rural areas."

The U.S. teams will help to alleviate the acute shortage of medical personnel in Viet Nam. Less than 1,000 Viet Namese physicians serve a population of 14 million, or about one doctor for each 20,000 persons. A doctor is available for each 700 persons in the United States.

The teams, three Army, two Air Force, and one Navy, completed a 2-week orientation course at the Brooke Army Medical Center, Fort Sam Houston, Tex., prior to departure for Viet Nam. Each team has three Medical Corps officers, one Medical Service Corps officer, and 12 enlisted men.

400 Scientists Discuss Fluerics at HDL

Nearly 400 scientists from the U.S., Europe, Asia and Africa heard 49 papers relative to fluerics, presented at the recent third Fluid Amplification Symposium at the Harry Diamond Laboratories (HDL), Washington, D.C.

Dr. Henry Coanda of France, 78-year-old internationally known scientist-inventor and discoverer of the "Coanda Effect" in aeronautics, made the keynote address. Given a standing ovation, he also walked away with a plaque of appreciation presented by Lt Col M. S. Hochmuth, HDL commanding officer.

Dr. Coanda described in a fascinating manner his work in aeronautics, biology and meterology. The invitation to give the keynote address followed a visit he made to HDL several months ago for a briefing by Billy M. Horton, HDL technical director and inventor of the Laboratories' fluid amplification system.

In addition to the technical papers, a panel discussion was held on Standardization and Nomenclature. It provided an exchange of information on the relatively new scientific field of fluid amplification, which controls energy sources without the use of moving parts.

Scientists in U.S. and foreign private industry, U.S. Government agencies, the Armed Forces and leading educational institutions contributed to further understanding of current and potential application of fluid amplification controls to industrial and military requirements. Topics presented at the Symposium included: signal-to-noise ratio, new device concepts, new or improved types of sensors, and applications to systems. Four papers, in particular, illustrated the ever-widening range of the applications of fluid amplification—one from a manufacturer of children's toys, one concerning railroad locomotives, one describing an artificial respirator and an explanation of the application of fluerics to missile attitude control.

THE HARRY DIAMOND LABORATORIES, Washington, D.C., have had only three commanding officers over a span of 12 years since they were established. The Association of the United States Army annual meeting provided a rare meeting of all of them. Left to right are Col Robert W. McEvoy, now commander of the U.S. Army Limited War Laboratory, who served at HDL from 1959 to 1963, Lt Col M. S. Hochmuth (1963-present) and Col John A. Ulrich (USA, Ret.), HDL's first commander who remained for six years (1953-1959).

Civil Service Sets 11 Executive Seminars

Eleven seminars for Federal Civil Service career executives are scheduled for the balance of this Fiscal Year at the Executive Seminar Center, U.S. Merchant Marine Academy, Kings Point, N.Y.

The average attendance is 35 employees for each of the 2-week sessions at the interagency training facility. Army R&D agencies are normally well represented.

Some seminar topics are repeated during the year to accommodate selectees. Subjects are planned to keep careerists abreast of new Government programs, scientific findings, technological developments, and the application of new tools and concepts to management.

The schedule follows:

Jan. 3-14—Environment of Federal Operations. This is an exploration of how economic conditions, social needs and international problems give rise to responsive public programs. The seminar is designed to give each participant a better understanding of his job, his agency's mission, and missions of other agencies as well as the influences of nongovernmental segments of American life on governmental activities.

Jan. 17-28 and May 2-13—Skills and Goals of Management. This course furnishes career managers with current information about the organizational environment in which they work, their roles as managers, and the nature of staff operations at their disposal.

Jan. 31-Feb. 11 and June 13-24—Federal Program Management. This seminar offers a pragmatic examination of Federal policies and interagency management practices applicable to the administration of public programs. The course also examines the broad operating principles and practices which guide traditional and recent relationships between various branches of the Government.

Feb. 28-Mar. 11—International Affairs and Federal Operations. This course acquaints career executives with basic concepts associated with the development of American foreign policy, conduct of foreign affairs, and with the international pressures which influence domestic policy-makers. It is considered well suited to the needs of research and development scientists and administrators who participate in international activities.

Mar. 14-25 and May 31-June 10—Administration of Public Policy. These sessions focus attention on the role of career administrators in carrying out public policy. They offer increased understanding about the current and potential involvement in the public nature of the employees' own agency's mission.

Mar. 28-Apr. 7.—Social Programs and Economic Opportunities. Diverse social and economic needs in American society are explored in this seminar. Important to most career executives, the course is of greatest relevancy to those with assignments oriented toward the principal socioeconomic programs of Government.

Apr. 18-29—The National Economy and The Federal Executive. This seminar deals with the theory and substance of Government involvement in various areas of economic life. Intended for career executives with little or no background in economics who find understanding of economic principles and practices useful for their general requirement, this course also serves as a "refresher" for mid-careerists in the economics field.

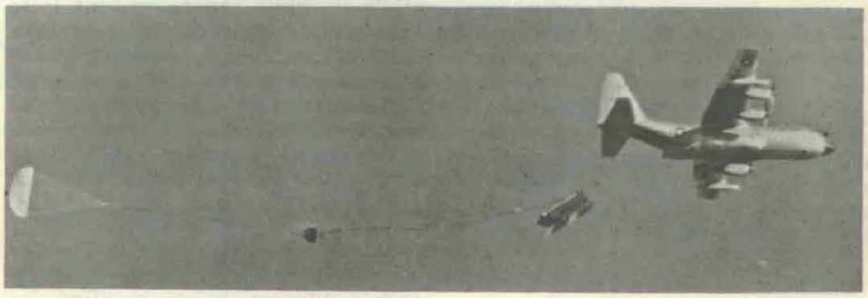
May 16-27—Effects of Technological Development. Dealing with the rapidly growing role of the Federal Government in scientific undertakings, this course considers the effect of technological change on national goals and objectives. Federal programs in a number of vital research and development fields are viewed in terms of their short- and long-term impact on society.

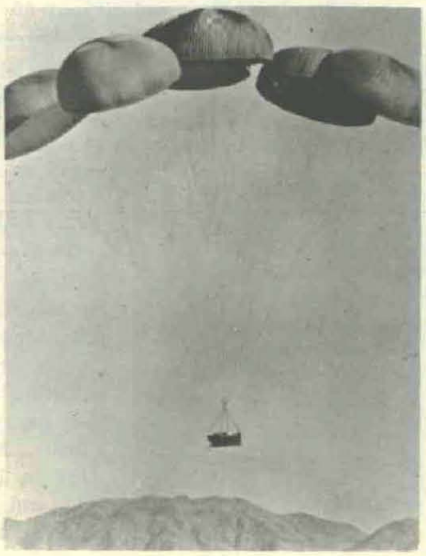
FAA Joins Armed Forces In Quarterly Meeting on Inertial Guidance Studies

High-level aircraft navigation experts from the Armed Forces and the Federal Aviation Agency joined in exchange of technical information at the Tenth Quarterly Meeting of the Army Technical Panel on Inertial Guidance.

More than 50 representatives assembled at the U.S. Army Electronics Command Headquarters, Fort Monmouth, N.J. ECOM's Avionics Laboratory, directed by Lt Col Leslie G. Callahan, Jr., was host to the meeting. One of the Avionics Laboratory's prime missions is development of aircraft navigation methods for Army aircraft.

Inertial guidance aids navigation by providing position and course information from the inputs of acceleration measurement equipment and gyroscopes, fed into computers. In many instances the computer readout acts directly on aircraft controls, providing the automatic guidance essential particularly in space vehicles.





LANCE HITS THE SILK during tests at the Army's Yuma Proving Ground, Ariz. The parachuting of more than 10 tons of Lance missile system marked the first time a ballistic missile system had been air-dropped as part of its planned development program. The equipment, including the self-propelled launcher with missile, was dropped from an Air Force C-130 at an altitude of 1,500 feet. Shortly after it hit the ground, Army troops derigged the vehicle, moved it from the drop zone and conducted tests simulating a tactical situation. Lance is the first Army missile to use prepackaged, storable liquid propellants. It has a modified inertial guidance and control concept conceived and developed by MICOM.

McMorrow Missile Laboratories Opening Inertial Guidance Wing

By John L. McDaniel

The Christmas stocking at the U.S. Army Missile Command will contain a real goody this year. This long-awaited gift will be a new, fully equipped building for inertial guidance and control work—better than anything now existing in the Army, and second to none in the world.

Scheduled date for delivery of the new wing to the Army is Dec. 17, when it will become a part of the Francis J. McMorrow Missile Laboratories complex dedicated when a "high bay" area and two office/laboratory wings were completed in the spring of 1964.

Heart of the new guidance and control facility will be the air-supported isolation pads used for evaluating the most critical inertial components. Since pads of this nature have to be specially built from bedrock up, there's no possibility of installing isolation pads in an existing building.

When inertial guidance components are evaluated for accuracy, the isolation pad used for mounting must be absolutely free from vibration. Vehicle traffic near the building, and even foot traffic within the building, can throw delicate instruments out of balance so that a valid evaluation is impossible.

To solve this problem, the isolation pads were designed with girder supports mounted in bedrock found 50 feet below ground level. These girders support a base slab, which houses compressed air lines with appropriate outlets to support the main pad or working platform.

Thus the pads, the largest of which weighs some 370 tons, are literally suspended on air. This eliminates contact with the ground, and the resulting vibrations from vehicle traffic.

The air cushion supporting the isolation pads is about one-sixteenth of an inch thick. This space is small enough so that the pads or mounted instruments would not be damaged in case of sudden termination of air pressure.

Because of the huge mass of the isolation pad, possible sudden load changes cause no noticeable movement. Servo controls compensate for sudden changes in weight or weight shifting. Other types of platforms would require manual leveling after such load changes.

The servo controls will also maintain stability of the pads in case one of the air ducts become inoperable. These controls adjust the air flow so that the pad remains level, and the air cushion remains the same thickness throughout the base area.

Sudden malfunctions of the air ducts would, of course, spoil results of any test in progress at that time, but tests could be run from the beginning with one air duct blocked off and there would be no degradation of data.

Another important feature of the new guidance and control facility is an ultra-clean room, which filters dust particles out of the air up to 50 times smaller than is possible with the clean room now in use. The clean room complex has a smaller room within its area with additional filters to reduce the air contamination level even further.

Laminar air flow work tables will be located inside this inner room to provide small (approximately 3½ by 5 feet) work areas with additional protection from dust particles. These tables have a filtered air flow system independent of the rest of the room, and will be used for the most critical small component work.

Workers in the inner clean room will appear more like doctors in an operating room than missile scientists. White coats will be donned by everyone entering this area, topped off by a white cap to prevent loose hair or dust particles from contaminating the air. A shoe cleaner is used to remove dust from shoes.

Before entering, each worker will go through an "air wash" room, which will be like taking a dry shower. Each worker will raise his arms and turn a full 360 degrees to make sure all clothing areas are exposed to the air flow. If the air velocity in the air wash is 60 miles per hour, approximately 12 seconds are required for proper cleaning. At a velocity of 40 miles per hour, cleaning time goes up to 22 or 23 seconds.

The employee then walks on a sticky mat to remove dust particles from shoe soles, and is finally ready to enter. Although the process sounds complicated, it takes only 60 seconds or so. The entire process must be repeated whenever anyone goes into the inner clean room, even if he has just left it.

The temperature in the clean room will be controlled to not more than one degree Fahrenheit variation. Relative humidity will be controlled with less than five percent variation.

A flight simulation room is designed with a hollow space under the floor. Connecting instrumentation cables thus can be attached at any points between this room and the adjoining computer room. Inertial components to be evaluated can be mounted on the test stands, and the computers can be programed to simulate flight conditions.

This is the next best thing to actually placing the component in a missile and sending it down a test range. Using these flight simulation techniques, scientists can work the "bugs" out of a new design in the laboratory, cutting down the number of expensive missile firings required.

Another reason for the hollow space beneath the floor of these two rooms is so that special air-conditioning ducts can be run directly to the base of the computers. Because computers need cooler air than that needed by operating personnel, these ducts keep the computers at the desired temperature without excessive cooling of the entire room. This, of course, reduces air-conditioning costs.

Environmental facilities in the new building will produce simulated ex-

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Technical Director John L. McDaniel of the Army Missile Command's R&D Directorate at Redstone Arsenal, Ala., has worked with the Arsenal since 1942, except for a 2-year tour of duty with the Navy during World War II. Most of his service has been in research, working as an aeronautical research engineer until he was named deputy director for Research and Development Operations for the Army Ballistic Missile Agency.

John L. McDaniel

With creation of the Army Missile Command in 1962, he was appointed to his present position. He has received a number of awards for his contributions to the Army's missile programs. Included are the R&D Achievement Award for scientific and engineering leadership (1961) and the Army Meritorious Civilian Service Award (1963). McDaniel received a BS degree in chemistry in 1939 from Berry College in Mt. Berry, Ga., and taught school in LaFayette, Ga., for three years prior to joining Redstone's staff.

tremes of vibration, acceleration, altitude, humidity and temperature. The equipment will allow components, subsystems or complete inertial guidance systems to be subjected to conditions exceeding those found in any climate on earth or in space.

As an example, the altitude-temperature chamber will simulate altitude conditions of 250,000 feet at normal temperatures. At a simulated 65,000-foot altitude, temperatures from minus 100 to plus 300 degrees Fahrenheit can be obtained.

An anechoic chamber has been included in the new guidance and control facility for electrical antenna tests, such as impedance measurements and antenna pattern work. This chamber has the same intrinsic impedance as space (377 ohms), and can be used to simulate the electrical conditions encountered in space.

Walls of the chamber are designed to make it a completely radio-frequency "quiet" room. Absorbent material is used, and the walls are fabricated in a non-reflective shape. Radio-frequency waves are absorbed and converted into heat energy without being reflected or transmitted through the walls.

An electronic test shelter on the roof of the new wing is for projects where radio-frequency transmissiveness is desired. This air-supported shelter is inflated by low-pressure blowers, and is approximately 30 by 60 feet in size.

Because of the thinness of the material and its dielectric properties, radio-frequency waves will be transmitted through the shelter with very little reflection. This will provide almost an outdoor environment as far as electrical properties are concerned, but will allow antenna pattern measurements during bad weather. Working in an enclosure will also prevent wind movement of the test tower.

The power supply of the new building is also tailor-made to furnish the precise power levels required for various laboratory equipment. The main supply comes from a 44-kilovolt feed line, with appropriate transformers to convert power to the desired levels. The power supply also includes a 28-volt, 500-ampere, direct-current system, and a minus 60 to plus 60-volt battery system.

A variety of specialized equipment such as compressed air systems, hydraulic systems and building alarms will fill the requirements for the most intricate missile-age defense work. A central vacuum system will help control contamination in the clean room; while providing convenience and high performance for cleaning operations.

The combination of facilities in the new building provides fully for the precise evaluation which has been so vitally needed for centralized Army inertial guidance and control work. For years inertial guidance scientists here have been doing an outstanding job with outdated equipment. This talent and past performance were recognized when the Missile Command was selected for the Center to coordinate and regulate all Army guidance and control work, including navigation systems for land vehicles and aircraft.

When the McMorrow Missile Laboratories' new wing and equipment are turned over to the Army, a vital facet of the Inertial Guidance organization in the Missile Command's Research and Development Directorate will have been completed. The skilled personnel have been here all along. With the new instrumentation, future research and development work on inertial components at Redstone Arsenal should prove spectacular.

GIMRADA Shows Fast 5-Color Map Printer

Electrostatic printing of 5-color military topographic maps, direct from 70mm microfilm — providing high-speed, high-mobility mapping for field forces—was publicly demonstrated recently for the first time by GIMRADA at the annual meeting of the Association of the United States Army.

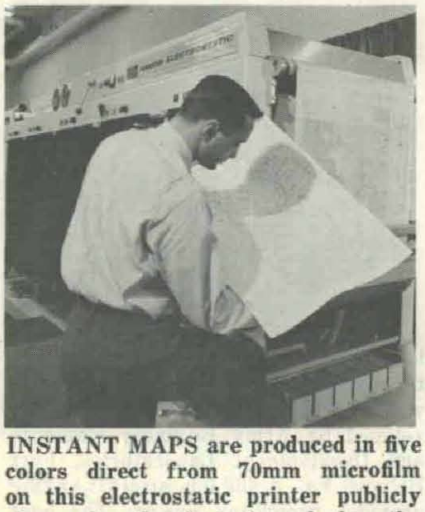
GIMRADA stands for Geodesy, Intelligence and Mapping Research and Development Agency, which is part of the Army Map Service, Corps of Engineers. The exhibit showed how maps of Viet Nam, 22½ x 30 inches, could be produced at the rate of 2,000 an hour.

Weighing 4,200 pounds and less than 15 feet long, the new unit can be rapidly moved to forward military areas in a van for fast production of up-to-date maps to guide troops.

Using a high intensity light and electrostatic energy, the printer reproduces maps on a moving web of specially coated paper and automatically cuts them into sheets for pile delivery. Electronic devices insure that the register is accurate within five thousandths of an inch.

GIMRADA officials explained that the mobility of the unit eliminates the necessity for preprinting and worldwide storage of quantities of maps that may become quickly outdated; it also voids need for warehouse storage of map drawings and printing plates.

The 5-color unit—standard mapping colors of red, blue, green, brown and black—is a further refinement of the single-color electrostatic map printer produced for GIMRADA in 1961. Both were engineered and built for the Army by Harris-Intertype.



INSTANT MAPS are produced in five colors direct from 70mm microfilm on this electrostatic printer publicly shown for the first time during the annual meeting of the Association of the United States Army, Oct. 25-27.

FCST Report Reviews National Data Programs

Increased Federal Government leadership in accomplishing long-range scientific and technical information needs of the United States is advised in a report issued Dec. 8 by the Federal Council for Science and Technology (FCST).

The report also recommends increasing support of both government and nongovernment information activities contributing to improved national systems.

Titled "Recommendations for National Document Handling Systems in Science and Technology," the report was prepared by a task group of the Federal Council's Committee on Scientific and Technical Information (COSATI). Members of the task group, chaired by William T. Knox of the FCST, are senior managers and coordinators of Federal agency information programs.

Currently being reviewed by Federal organizations and groups concerned with science and technology, the report recommendations at this time are advisory. A major purpose of releasing it now is to encourage active participation by nongovernmental groups.

The report, in three volumes, is available from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va., 22151. It carriers the number PB 168 267 and costs $3.50.

167 In-House Scientists Listed as Authors

(Continued from page 2)

and two of which are on the supplemental list.

Military personnel evidenced greater interest in preparing papers this year, perhaps due to the successes of both officers and enlisted personnel in the 1962 and 1964, when they walked off with the top awards. Forty-nine were listed as authors or coauthors in the narrative summaries and 26 are in the list of those selected.

A disciplinary breakdown of the narrative summaries shows the predominance of research effort in the physical sciences—a total of 317 of the total of 428 summaries submitted. Life sciences accounted for 61 of the summaries and the environmental sciences for 36. Miscellaneous fields accounted for the remainder.

Tentative titles of the 96 papers to be presented and the authors are:

CORPS OF ENGINEERS—*Determination of Gamma-Induced Sensitivity Loss in Proportional Counters in a Nuclear Power Plant*, by J. K. McNally, U.S. Army Engineer Reactors Group, Fort Belvoir, Va.; *Procedure for a Geometric, Simultaneous Multistation Determination With Constraints, Using Optical-Electronic or Electronic Data from Geodetic Satellites*, by L. A. Gambino, GIMRADA; *Static and Dynamic Tests of Buried Unreinforced Concrete Arches*, W. J. Flathau and G. D. Meyer, U.S. Engineer Waterways Experiment Station (WES), Vicksburg, Miss.;

The Elastic Response of Buried Cylinders-Critical Literature Review and Pilot Study, by G. E. Albritton, J. L. Kirkland and T. E. Kennedy, WES; *Water Shock Waves Resulting from Explosions Above an Air-Water Interface*, by J. M. Pinkston, Jr., WES; *Development of a Formula for Towing Resistance for a Wheel in Soft Soil*, by J. L. McRae, WES; *Ultra-High Vacuum Adhesion*, by E. S. Gall, WES; *Geodetic Uses of Star Coordinates and a Method for Constructing More Accurate Star Catalogues*, by Carl F. Lukac, Army Map Services (AMS), Washington, D. C.; *Structural Control at Cape Kennedy, Fla.*, by Norman B. Taney, Army Coastal Engineering Research Center, Washington, D. C.

OFFICE, SURGEON GENERAL—*The Impact of Acute Infection on Metabolism in Human Subject*, by Lt Col William R. Beisel and Col Dan Crozier, U.S. Army Medical Unit (USAMU), Fort Detrick, Md.; *The Influence of an Arbovirus Infection on the Host-Cell Ribonucleic Acid and Protein Synthesis*, by Capt George Lust, USAMU; *Pattern of Physiological Variables in Slow Blood Loss Shock*, by Capt Karl Stecher, Walter Reed Army Institute of Research (WRAIR), Washington, D. C.;

Anopheles Vectors of Malaria in Southeast Asia, by Douglas J. Gold, U.S. Army-SEATO Medical Research Laboratory, John E. Scanlon and Ronald A. Ward, WRAIR; *Synthesis and Degradation of Alpha Cyanoacrylate Tissue Adhesives*, by Fred Leonard, R. K. Kulkarni, George Brandes and J. Nelson, U.S. Army Medical Biomechanical Research Laboratory, Washington, D.C.;

Hemodynamic Alterations in Humans and Animals During Chronic High Altitude Exposure, by James A. Vogel, John P. Hannon and Lt Col James E. Hansen, Medical Research and Nutrition Laboratory, Fitzsimons General Hospital, Denver, Colo.; *Red Cell Fragility and Blood Preservation*, by Maj Charles E. Shields and Maj Frank R. Camp, Jr., Medical Research Laboratory, Fort Knox, Ky.

OTHER R&D AGENCIES—*Determining Aircraft Survival Probabilities*, by Lt Col George Nabors, Combat Developments Command Experimentation Center, Fort Ord, Calif.; *Studies on Spray Droplet Spin*, by Clyde S. Barnhart, Limited War Laboratory, Aberdeen Proving Ground, Md.; *A Model for Determining Target Location Accuracy Requirements*, Otis S. Spears, Combat Developments Command Artillery Agency, Fort Sill, Okla.; *On a Relationship Between the Errors of Position, Velocity, and Acceleration*, Theodore W. Schmidt, U.S. Army Research Office-Durham, N.C.

ARMY MATERIEL COMMAND—*Asymptotic Analysis of the Axisymmetric Vibrations of Shells*, by Edward W. Ross, Jr., AMRA, Watertown, Mass.; *The Microbial and Chemical Content of Tropical Atmospheres of the Data Presented*, by Dr. Robert Hutton, Tropic Test Center, Fort Clayton, Canal Zone, Panama; *Truck Collision Study*, by 1/Lt J. A. Kasuba & Mr. J. C. Kelton, Development & Proof Services, Aberdeen Proving Ground, Md.; *Persistence of VEE as affected by Soil Type and Climate*, by M. A. Levin, Dugway (Utah) Proving Ground;

Helicopter Blade Slap, by F. W. Taylor & J. W. Leverton, Office of Project Manager—CHINOOK, Hqs, AMC, Washington, D.C.; *Cohesive Energies in Organic Liquids*, by Capt E. F. Meyer, R. E. Wagner & M. Rosenfeld, U.S. Army Coating & Chemical Laboratory, Aberdeen, Md.; *Theory of Human Vibration Response*, by Fred Pradko, Richard Lee & Victor Kaluza, Army Tank-Automotive Center, Warren, Mich.; *The Effect of Thermal Pollution on River Ice Conditions*, by S. L. Dingman, W. F. Weeks, Y. C. Yen & M. A. Bilello, CRREL, Hanover, N.H.; *Superconducting Thin-Film Nuclear-Particle Detectors*, by J. B. Greer & W. R. VanAntwerp, Army Nuclear Defense Laboratories, Edgewood Arsenal, Md.;

Examination of the Fatigue Life Characteristics of Large Caliber Gun Tubes, by R. E. Weigle, T. E. Davidson, B. A. Austin, A. N. Reiner, Maggs Research Center, Watervliet (N.Y.) Arsenal; *Acoustical and Visual Attenuation Through Dynamic Regulation of Muzzle Gas Flow*, by W. H. Watling, Springfield (Mass.) Armory; *The Influence of Quality Upon Effectiveness of Shaped Charge Warheads*, R. J. Eichelberger, R. L. Kirby & R. Vitali, BRL, APG, Md.; *High Energy Synthetic Compounds for Future Compact Combat Rations*, by H. A. Dymsza, G. S. Stoews and S. M. Swift, Natick (Mass.) Laboratories; *Waveguide Analog of Tunneling Through Quantum Potential Barriers*, by Morris Compi, Harry Diamond Laboratories, Wash., D.C.; *A Theory of Catering for Multiple Nuclear Underground Explosions*, by Russell Eaton, Engineer R&D Laboratories, Fort Belvoir, Va.;

A New Binder for Composite Solid Rocket Propellants, by Henry C. Allen, Missile Command, Redstone Arsenal, Ala.; *Chemical Laser Pump*, by J. L. Wright, Feltman Research Laboratories, Picatinny Arsenal, Dover, N.J.; *Ferrocene Chemistry of Phosphorus and Boron*, by G. P. Sollot, W. R. Peterson, Jr., & J. L. Snead, Pitman-Dunn Research Laboratories, Frankford Arsenal, Philadelphia, Pa.; *Chemiluminescence as a Tool for Biodetection*, by Dr. Harold A. Neufeld, Samuel Witz & Lee J. Carleton, Army Biological Laboratories, Fort Detrick, Md.; *Isolation and Identification of the Toxic Fractions of Cobra Venom*, by J. A. Vick, H. P. Ciuchta, J. H. Manthei, C. Broomfield & B. Currie, Chemical R&D Laboratories, Edgewood Arsenal, Md.;

Real-Time Meteorological System for Support of Unguided-Rocket Firings, by Louis D. Duncan, Army Electronics R&D Activity, White Sands Missile Range, N.M.; *Novel Laser System Using Very High Magnetic Fields from Superconductors*, by G. K. Gaule and R. G. Buser, Institute for Exploratory Research, Fort Monmouth, N.J.; *Novel Laser System Using Very High Magnetic Fields from Superconductors*, P. Shajenko, Springfield (Mass.) Armory; *A New Microwave Semiconductor Oscillator*, V. J. Higgins, F. A. Brand, & J. J. Baranowski, Army Electronics Command, Fort Monmouth, N.J.; *A Mathematical Model for Air Flow in a Vegetative Canopy*, by Ronald M. Cionco, Army Electronics R&D Activity, Ft. Huachuca, Ariz.; *Advanced Combat Surveillance Radar System*, by Otto E. Rittenbach, Combat Surveillance & Target Acquisition Laboratory, Fort Monmouth, N.J.;

Ballistic Behavior of Ceramic Composite Armors, by C. W. Sample, AMRA, Watertown, Mass.; *Anisotropy and Its Relationship to Deep Drawing of a 5% Cr Tool Steel (H-11) for the Hawk Missile*, by R. M. Colton & J. D. Colgate, AMRA; *Some Studies of Temporary Hearing Losses Resulting from Repeated Exposure to Gunfire Noise*, by Dr. David C. Hodge & R. Bruce McCommons, Human Engineering Laboratories, APG, Md.; *Gelling of Aircraft Fuel*, by Harold W. Holland, Aviation Materiel Laboratories, Fort Eustis, Va.; *Deposition of Particles from a Turbulent Slot Flow*, by Capt

New Army Boat Zips Through Swamps, Marshes

Florida's popular "swamp buggy" principle is incorporated in a boat being developed by the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va.

Three prototypes, built by Hydronautics, Inc., Laurel, Md., are being tested. Production is planned early in 1966 if results are satisfactory.

Powered by a 400-horsepower Lycoming aircraft engine and four-blade propeller, the boat is designed to carry 12 men or 2,000 pounds of supplies at 30 m.p.h. through swamps and weed-infested waters. It would provide troop mobility to fight on water and in marshes.

The aluminum hull is 20-feet long, 9-feet wide and 2½-feet deep. The propulsion system stands 8-feet high and the rudder is 4-feet deep.

The entire unit weighs 3,100 pounds, suitable for airlift by helicopter. The boat is designed to operate in open water with heavy vegetation, such as found in the Florida Everglades, and it can move across small levee breaks.

ARMY "SWAMP BUGGY" has shallow draft to maneuver at 30 m.p.h. through swamps and weed-infested waters. The new boat is being developed by Army Engineer Research and Development Laboratories, Fort Belvoir, Va. A 400 h.p. aircraft engine provides propelling power. The boat can carry 12 men or 2,000 pounds of cargo; does 40 m.p.h. in open water.

H. H. Dobbs, ATAC, Warren, Mich.;

Observation of Short-Lived Species Produced by X-Ray Pulses, by Nathan Klein, Nuclear Defense Laboratories, Edgewood Arsenal, Md.; *Kinematics of a Tracking Gimbal*, by Wright K. Gannett, Army Weapons Command, R&D Directorate, Rock Island, Ill.; *Dynamic Loading Research for Transient Load Applications*, by H. H. Cadle, Springfield (Mass.) Armory; *Aircraft Damage and Casualties from Ground Fire in South Vietnam Operations*, by Roland G. Bernier and Horace C. Smith, Ballistic Research Laboratories, APG, Md.;

Light Attenuation by Photochemical Means; Photochromism, by J. Weinstein, A. L. Bluhm, M. E. Langmuir, Natick (Mass.) Laboratories; *Nuclear Burst Ionization Effects on Fuzing*, by John E. Tompkins, Donald J. McGibney, John A. Rosado, Harry Diamond Laboratories; *Microchannel Electron Multiplier Arrays*, by Stanley L. Carts, Jr., and Lawrence J. Acchione, Warfare Vision Div., ERDL; *A Mossbauer Spectrometer*, by Lt (Dr.) Edward F. Allard, Basic Research Lab., ERDL; *Self-Focusing of Intense Beams of Relativistic-Electrons*, by Thomas G. Roberts, Missile Command, Redstone Arsenal, Ala.;

A Study of Sub-Optimal Control Laws, by Kelly V. Grider, Army Inertial G&C Lab., Missile Command; *A Correlation of the Base Drag of Bodies of Revolution with a Jet Exhausting from the Base*, by Charles E. Brazzel & James H. Henderson, Advanced Systems Lab., Directorate of R&D, Missile Command; *Study of the Low Frequency Molecular Vibrations of Secondary Explosives and Related Compounds by Inelastic Scattering of Neutrons*, by H. Boutin, H. Prask & S. Trevins, Feltman Research Lab; *Friction Studies on Polymer Solutions*, by H. Gisser & M. Petronio, Frankford Arsenal;

The Enzymic Transformation of Secondary Nitrogen Mustards, by Charles E. Williamson, James G. Kirby, Samuel Sass & Benjamin Witten, Chemical R&D Labs, Edgewood Arsenal, Md.; *Ignition Properties of Polyisobutylene—Triethylaluminum Polymer Solutions*, by 1st Lt Herbert B. Scher, Chemical R&D Labs.; *Directions to Advanced ECCM Techniques for Greater Reliabilities of Communications*, by William R. Fuschetto, Electronics Command, Fort Monmouth, N.J.;

The Phase Shift Amplifier, by H. Brett, Electronics Command; *Polarization Sensitivities of Vehicles*, by Ralph L. Dunn, Electronics Command; *The Stratospheric Tidal Jet*, by Willis L. Webb, Electronics R&D Activity, WSMR, N. Mex.; *Biological Combinations for Incapacitation of Man*, by Robert L. Schricker & Henry T. Eigelsbach, Biological Laboratories, Fort Detrick, Md.;

Large Deflections of Thin Shells of Revolution, by John F. Mescall, AMRA; *Walking Machine Studies*, by R. A. Liston, ATAC, Warren, Mich.; *Underground Ice on the Arctic Coastal Plain of Alaska*, by Jerry Brown, CRREL, Hanover, N.H.; *Minimum Weight Design for Composite Tubes*, by J. E. Zweig, M. J. Pascual, Maggs Research Center; *The Air Blast Potential of Fax Devices*, by R. G. Hippensteel & A. J. Hoffman, Ballistic Research Labs., APG, Md.

Synthetic Sapphire as an Armor Material, by Anthony L. Alesi and Morton I. Kliman, Natick (Mass.) Laboratories; *A Proximity Fuze with High Immunity to ECM*, by S. J. Peperone, Harry Diamond Labs; *Clarification of Water with Cationic Polyelectrolytes*, by Maurice Pressman, ERDL, Ft. Belvoir, Va.; *Investigation of Exchange Effects in Ruby by Line Shape Comparisons*, by Richard L. Hartman, Harry C. Meyer, and Jefferson S. Bennett, Redstone Arsenal, Ala.;

Ductility of Refractory Metals Through Thermal Techniques, by Julian E. Bynum, Redstone Arsenal, Ala.; *A Laser Device for Use in Clinical Treatment of Malignant Tumors*, by James R. Dearman, Redstone Arsenal, Ala.; *Hydrodynamic Elastic Plastic Theory and Plane Shock Waves in Metals*, by James C. Pearson, Feltman Research Labs.; *Development of a Mortar Launched Liquid Rocket*, by Louis Jablansky, Picatinny Arsenal; *Determination of Design Parameters for Self-Dispersing Munitions*, by Lawrence E. Callahan and Peter H. Zipfel, Biological Laboratories, Ft. Detrick, Md.; *Regulation of Metabolism in Vivo*, by Bertram Sacktor & Eva Wormser-Shavit, CRDL, Edgewood Arsenal, Md.;

Some Pharmacodynamic Properties of Iris Muscle, by Kenneth M. Wilson, CRDL, Edgewood Arsenal, Md.; *Transmission Mode UHF Magneto-Acoustic Delay Line*, by W. Skudera and R. Sproat, Electronics Command, Ft. Monmouth, N.J.; *A Rechargeable Thin-Film Solid-Electrolyte Battery*, by J. N. Mrgudich, P. J. Bramhall & C. M. Schwartz, Institute for Exploratory Research, Ft. Monmouth, N.J.;

A Mechanism for Controlling the Reactivity of Lead Azide, by V. R. Pai-Verneker and A. Forsyth, Feltman Research Labs., Picatinny Arsenal, Dover, N.J.; *A New Concept in Lightweight Armor—Dual Hardness Steel*, by J. L. Sliney, U.S. Army Materials Research Agency, Watertown, Mass.; *Influence of Electromagnetic Fields on Liquid Crystals*, by John H. Muller, ERDL, Fort Belvoir, Va.; *Precision of Measurement Accuracy and Procedures for Detecting Outlying Observations*, by Frank E. Grubbs, U.S. Army Ballistic Research Labs., APG, Md.; *Tracer Projectile for SPIW Point Target Ammunition*, by W. W. Cavell and F. W. Dietsch, Frankford Arsenal;

Stress-Aging and Its Effects on Tensile Properties of Some Stainless and Ultra-High-Strength Steels, by Dr. R. H. Harrington, Watervliet Arsenal, Watervliet, N.Y.; *Applications of Quantified Terrain Data to Vehicle Design Criteria*, by Robert L. Anstey, Natick Labs., Natick, Mass.; *The Theory of Operation of an Ammonia Burning Internal Combustion Engine*, by 1st Lt John H. Johnson, U.S. Army Tank-Automotive Center, Warren, Mich.

Brochure Outlines Army CIDS Objectives for Users

Versatility required for users to receive maximum benefit from the Army Chemical Information and Data Systems (CIDS) is outlined in a brochure compiled for Edgewood Arsenal, Md., by the University of Pennsylvania.

Prepared by the Institute for Cooperative Research (ICR) and titled "CIDS Use Versatility," the brochure has three categories:

- One part of a normal query which identifies the chemical or other substance in which the inquirer is interested;
- The other part of a normal query which identifies the specific kind of information or data being sought;
- An assortment of 156 hypothetical queries which would be addressed to an operational CIDS, combining the data output of the basic query parts.

The ICR cites the hypothetical queries as simply to illustrate the types of practical man-at-the-bench queries of CIDS system should be capable of handling.

Any necessary translation to machine language will be the responsibility of the data processing operators. One of the primary objectives of the current development is to guarantee that the structure and operation of the system will be to provide potential users with maximal service at minimum expenditure of time.

Typical of simpler, less-involved queries listed is: "What thiacyclic parents other than thiophene are represented, either as such or as derivatives, in the file?"

The brochure suggests as a means of identification programing into the system the chemical structure, molecular formula, nomenclature, properties and application of chemicals.

The kind of data sought ranges from "compound existence" to "foreign literature availability" in 56 categories. Authors of the brochure explain that it is illustrative of the need for CIDS versatility and "no implication of completeness" is intended.

Army Divides CB Missions Between Edgewood, Detrick

Chemical and biological missions of the Department of the Army are being reorganized under separate commodity centers, each responsible directly to Headquarters, U.S. Army Munitions Command, Dover, N.J.

Under this change, the chemical mission is centralized in the Chemical Commodity Center at Edgewood Arsenal, Md., and the biological mission is assigned to the Biological Commodity Center, Fort Detrick, Md.

Establishment of the centers, it was explained, is designed to provide better control over the research, development and engineering activities in each of these major disciplinary areas, in the interest of more economical utilization of resources.

Planning for the change has been in progress for several months and the announcement of the reorganization was made Nov. 1. Assignment of personnel to new positions is expected to be completed by Mar. 1.

The realignment will involve 164 employees currently assigned to Edgewood Arsenal and about 130 are expected to take other positions within the Arsenal. That might mean some 30 would be subject to reduction-in-force procedures, although it is believed normal attrition of personnel through retirements, resignations and other actions will lower this figure.

Personnel affected by RIF actions will receive priority placement consideration under the Department of Defense Priority Placement Program.

Army Logistics Center Adapts Course for Defense Training

For the first time, the Specification Management Course at the U.S. Army Logistics Management Center, Fort Lee, Va., was offered Nov. 29 as "defense" training.

Defense courses are adapted for students from all branches, rather than being only Army oriented. The change is in keeping with the Department of Defense unified approach to training, which precludes establishment of individual courses by each of the Services.

Instruction plans for the 3-week Specification Management Course were approved Oct. 5 by the DoD Logistics Management Board. Ten courses are offered on a defense basis in the 16-course curriculum.

Dr. Weaver Receives Arches of Science Award

The first annual Arches of Science Award of the Pacific Science Center, Seattle, Wash., has been presented to Dr. Warren Weaver, member of the board and consultant to the Sloan Foundation, New York City.

The award carries a $25,000 cash prize, which places it monetarily in the category of the Nobel, Fermi and Atoms for Peace awards. The Department of Defense Incentive Awards Program also provides for a $25,000 maximum cash award for outstanding achievement. Four such awards, all for research and development achievements, have been made—two each to the Army and the Navy.

The Arches of Science Award is bestowed for a lifetime of work in formal science education, adult education and mass media. Funds are donated by the Pacific Northwest Bell Telephone Co.

Dr. Weaver, retired as vice president of the Sloan Foundation, is a past president of the Association for the Advancement of Science. He served four years as a member of the National Science Board of the National Science Foundation.

Participation of Dr. Weaver in the national defense scientific effort has included: chairman of the basic research group, Research and Development Board, Department of Defense, 1952-53; chief of the applied mathematics panel of the National Defense Research Committee, Office of Scientific Research and Development 1943-46; chairman of the Naval Research Advisory Committee; and member of the War Department Research Advisory Panel 1946-47.

During his long distinguished career, he has served in advisory and consultative capacities with numerous public and nonprofit organizations, including: Sloan Kettering Institute; Health Research Council, New York City; the National Advisory Cancer Council, U.S. Public Health Service; associate trustee of the University of Pennsylvania; trustee, chairman of the board, and nonresident Fellow of the Salk Institute.

After receiving BS, CE and PhD degrees from the University of Wisconsin, he taught at Wisconsin for 12 years, rising to chairman of the Department of Mathematics in 1932. He then served the Rockefeller Foundation for more than a quarter century, first as director of the division of natural sciences and from 1955-59 as vice president for natural and medical sciences.

Dr. Weaver is coauthor of several books on mathematics and has contributed numerous papers to scientific journals. He has received the U.S. Medal for Merit, France's Legion of Honor and the Public Welfare Medal of the National Academy of Sciences.

1,000 Attend Wire, Cable Parley

As the largest annual gathering of its kind, the 14th annual Wire and Cable Symposium, Dec. 1-3, attracted about 1,000 engineers, scientists and executives to Atlantic City, N.J.

Sponsored jointly by the Electronics Components Laboratory of the Army Electronics Command and industry, the symposium featured 25 papers presented in five technical sessions.

Milton Tenzer and Jack Spergel of the Electronics Components Laboratory served as cochairmen of the symposium committee.

Yarmolinsky, Steadman Named to Key Defense Positions

Adam Yarmolinsky has succeeded Peter Solbert as Principal Deputy Assistant Secretary of Defense (International Security Affairs).

Secretary of Defense Robert S. McNamara also named John M. Steadman, Deputy Under Secretary of the Army for International Affairs, as Special Assistant to the Secretary and Deputy Secretary of Defense.

Steadman replaced Joseph A. Califano, Jr., who was called to the White House as a special assistant to the President. Solbert has returned to private law practice.

A graduate of Harvard College and Yale Law School, Yarmolinsky served as Special Assistant to the Secretary and Deputy Secretary of Defense from January 1961 until April 1964. Then he was detailed to serve as deputy director of the President's Task Force for the War Against Poverty.

In August 1964, he became Assistant to the Secretary of Defense. In May and June 1965, he served as Chief, U.S. Emergency Relief Mission to the Dominican Republic.

Steadman earned degrees from Yale University and Harvard Law School, and practiced law in San Francisco from 1956 to 1963. Then he accepted a post in Washington with the Office of Legal Counsel, U.S. Department of Justice. In October 1964 he became the Army Deputy Under Secretary.

TEN CIVILIAN SCIENTISTS from four U.S. Army Materiel Command (AMC) installations were honored recently at Munitions Command Headquarters, Dover, N.J., for their contributions to development of a 155mm nuclear artillery projectile for the Army's defensive capability stockpile. Shown with installation commanders who assisted in presentation of congratulatory letters from General Frank S. Besson, Jr., CG of AMC, are recipients of the honors. Top row (l. to r.) are Edward N. Hegge, U.S. Army Materials Research Agency (AMRA); Carmine J. Spinelli, Picatinny Arsenal; Joseph I. Bluhm, AMRA; Bartholomew R. Stang, Picatinny; and Donald R. Lenton, Frankford Arsenal. Second row: Fortunato J. Rizzitano, AMRA; Ferdinand A. Scerbo, Picatinny; J. Cullinane and Charles W. Crickman, Harry Diamond Laboratories (HDL); and Kalman M. Schulgasser of Frankford. Front row: Dr. Reinier Beeuwkes, AMRA chief scientist, who represented Lt Col J. E. Black, CO of the agency; Col H. H. Wishart, Picatinny Arsenal CO; Maj Gen F. A. Hansen, U.S. Army Munitions Command CG; Col George H. Pierre, Jr., Frankford Arsenal CO; Lt Col M. S. Hochmuth, HDL CO.

DSA Managing AAS Operation, Expansion

Responsibility for the operation, refinement and eventual expansion of an Automatic Addressing System (AAS) was recently assigned to the Defense Supply Agency by the Assistant Secretary of Defense (Installations and Logistics).

The AAS is designed to expedite the flow of supply requisitions and related supply management traffic. It features use of a computer facility colocated with an AUTODIN (Automatic Digital Network) Electronic Switching Center.

In the AAS concept, supply transaction messages are addressed or routed through the AUTODIN to their final destination by an automated process that imposes upon the originators of the message only the requirement to address them to AAS.

The Automatic Addressing System was tested at Gentile Air Force Station in Ohio from Mar. 4 through Sept. 15. The service test determined among other things, that the concept of automatically addressing data on the basis of card content was feasible, thereby qualifying the AAS for permanent status in the logistics support complex of systems, programs and facilities.

Evaluation of the test project was conducted by representatives from the Office of the Assistant Secretary of Defense (Installations and Logistics), the Departments of the Army, Navy and the Air Force, Defense Supply Agency, and the General Services Administration, with Defense Communications Agency assistance.

The Defense Supply Agency has been given authority to develop a permanent organization plan for the parent AAS site at Gentile Air Force Station. It also has responsibility for establishing another AAS site to provide back-up capability and ensure around-the-clock operations in the current phase of expanding the system. This site will be located as a tributary to Automatic Electronic Switching Center, Sacramento, Calif.

After the back-up site is established and operating successfully at Sacramento, emphasis will be shifted to longe-range planning to determine the specifications for and number of AAS sites required to service total supply management traffic needs.

It is estimated that the future system will handle several million transactions per year.

Although the back-up site is expected to become operational in late spring or early summer of 1966, the expansion program, coordinated with the current AUTODIN expansion plan, has a tentative implementation target of not later than July 1, 1968.

Army Develops Vehicle Computerized Troubleshooter

READYMAIDS, the Army's new automatic diagnostic system, is a computerized "mechanic" capable of determining the cause of malfunctions of certain types of military wheeled vehicles in less than five minutes.

Developed at Frankford Arsenal, Philadelphia, Pa., READYMAIDS was exhibited in prototype form at the recent annual meeting of the Association of the United States Army. An improved version designed to diagnose the mechanical failures of a broader variety of wheeled vehicles is scheduled to reach the prototype stage of development next spring.

READYMAIDS denotes Ready Multipurpose Automatic Inspection and Diagnostic System. Transportable in a jeep, the system detects the fault, types out in plain English a description of the cause, and lists the parts required by number and repair manual reference.

To start the computer in the diagnostic cycle the operator "punches in" basic data, such as vehicle type and engine serial number. The computer types out a polite request for a corrected input should the operator mismatch vehicle type with an engine number.

The typed data serves as a permanent log for vehicle maintenance.

Transducers attached to 16 major points of the vehicle to be tested translate the various temperatures, pressures, speeds and torques into electrical signals for transmission to the computer-controller. A small console at the test vehicle allows the operator to put in data that he has obtained by inspection, for example, horn and windshield wiper operation, for recording on the print-out.

WSMR Modernizing Instrumentation for Missile Tests

Advanced Range Testing, Reporting and Control (ARTRAC) at White Sands Missile Range, N. Mex., has received a substantial boost for missile testing with the addition of new status-reporting equipment.

Under a 5-year, multimillion-dollar contract, data, control and communications equipment will be installed at ARTRAC to allow for instantaneous collection, processing and use of data.

Most of White Sands' present instrumentation systems are manually operated and data that is gathered must be reduced for the user to analyze. There is no central management control of combined systems.

Under construction as the control point for ARTRAC and the added subsystem is a Range Operations Control building. Approved plans call for 48,000 square feet in three floors. The main data processing operations will be confined to the first floor.

ARTRAC is a combination of range instrumentation which collects, transmits, computes and reports data. As presently planned, the major subsystems of ARTRAC will include status, readiness, control, communications, data and timing.

White Sands Range instrumentation systems and operational management will be unified. Through the data and control subsystem, more accurate data will be obtained at greater speed, permitting concurrent testing of missiles and spacecraft in a vastly improved, standardized test-range atmosphere.

Scientific Calendar

72nd Joint Annual Meeting of the American Mathematical Society and the Mathematical Association of America, Chicago, Ill., Jan. 26-28.

Annual Meeting of the American Physical Society, N.Y.C., Jan. 26-29.

Research Effectiveness as Related to Vehicles, sponsored by MOCOM, Detroit, Mich., Jan. 28-29.

Winter Power Meeting of the Institute of Electrical and Electronics Engineers, N.Y.C., Jan. 30-Feb. 4.

Meeting of the American Society for Testing and Materials, Washington, D.C., Jan. 30-Feb. 4.

7th Solid Propellant Rocket Conference, sponsored by AIAA, San Bernardino, Calif., Jan. 31-Feb. 2.

International Symposium on Information Theory, sponsored by IEEE, Los Angeles, Calif., Jan. 31-Feb. 3.

Structural Engineering Conference, sponsored by ASCE, Miami Beach, Fla., Jan. 31-Feb. 4.

Gordon Research Conference on The Formulation of Research Policies, sponsored by AFOSR, Santa Barbara, Calif., Jan. 31-Feb. 4.

Conference on Numerical Analysis and Computations, sponsored by ARO-D, Dover, N.J., Feb. 2-3.

7th Winter Convention on Aerospace and Electronic Systems, sponsored by IEEE, Los Angeles, Calif., Feb. 2-4.

Meeting of the American Institute of Chemical Engineers, Dallas, Tex., Feb. 6-7.

Solid State Circuits Conference, sponsored by IEEE, Philadelphia, Pa., Feb. 9-11.

Meeting of the Radiation Research Society, Coronado, Calif., Feb. 13-16.

95th Annual Meeting of the American Institute of Mining, Metallurgical and Petroleum Engineers, N.Y.C., Feb. 13-17.

17th Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, Pittsburgh, Pa., Feb. 20-26.

Spring National Convention of the Society for Non-Destructive Testing, Los Angeles, Calif., Feb. 21-25.

40th Congress of the International Anesthesia Research Society, Bal Harbour, Fla., Feb. 27-Mar. 4.

Scenes at 11th AUSA Meeting

PROMINENT PERSONALITIES attended 11th meeting of Association of the U.S. Army, Washington, D.C. (1) AUSA President and former Secretary of The Army Elvis J. Stahr (left) presents "George Catlett Marshall Medal" to General Jacob L. Devers (USA, Ret.). In the center is General Maxwell D. Taylor (USA, Ret.) (2) Secretary of the Army Stanley R. Resor (right) is greeted by Maj Gen. W. E. Garrison, deputy inspector general. Others are Col Winant Sidle, office of Joint Chiefs of Staff; Lt Gen W. W. Weible (Ret.) and Dr. Elvis J. Stahr, AUSA president (3) Lt Gen W. F. Train, 2nd Army CG, and J. E. Johnson, Ling Temco; (4) Gen Creighton Abrams, vice chief of staff; (5) Lt Gen Theodore J. Conway, deputy chief of staff, and Brig Gen Royal Reynolds, Jr., Military Assistance Institute; (6) Lt Gen William F. Cassidy, Chief of Army Engineers; (7) Lt Gen L. J. Lincoln, Deputy COS, and Herbert W. Hecht and T. E. Aughinbaugh, International Harvester; (8) Willis M. Hawkins, ASA; Gen Harold K. Johnson, COS, and Lt Gen Milton G. Baker, AUSA chairman.