ARMY RESEARCH AND DEVELOPMENT

MONTHLY NEWSMAGAZINE OF THE OFFICE OF THE CHIEF, RESEARCH AND DEVELOPMENT
Vol. 6, No. 3 March 1965 • HEADQUARTERS, DEPARTMENT OF THE ARMY • Washington, D.C.

Army Unveils MUST at Brooke Medical Center Demonstration

MUST, the U.S. Army's radically new concept of field hospitalization, was demonstrated Feb. 24 to several hundred key Department of Defense and Federal medical, civic and industrial leaders at Fort Sam Houston, Tex.

MUST stands for Medical Unit Self-contained Transportable. The basic unit consists of three compact, transportable elements — surgical, ward and utility. Elements are designed to be used singly or in multiples to form a field hospital complex. Brooke Army Medical Center at Fort Sam Houston was the scene of this first public demonstration of the concept.

Top-level Department of Defense and Army officials who witnessed the demonstration included: Secretary of the Army Stephen Ailes; Assistant Secretary of the Army (R&D) Willis M. Hawkins; Deputy Assistant Secretary of Defense (Health and Medical) Shirley C. Fisk; Lt Gen Leonard D. Heaton, The Surgeon General of the Army; Lt Gen Dwight E. Beach, CG, U.S. Army Combat Developments Command; Lt Gen James S. Richardson, Army Deputy Chief of Staff for Personnel; and Maj Gen Richard L. Bohannon, Surgeon General of the Air Force.

One of the objectives of the demonstration was to take advantage of the caliber of people in attendance by inviting constructive criticism and the exchange of views so that the MUST concept may be improved.

(Continued on page 6)

Redstone Arsenal to Host Operations Research Meet Under OCRD Sponsorship

High-level officials of the Department of Defense, NASA, industry, and educational institutions will address more than 300 conferees at the fourth annual Army Operations Research Symposium, Mar. 30-Apr. 1, at Redstone (Ala.) Arsenal.

Sponsored by the Chief of Research and Development, the symposium is recognized as one of the Army's most important annual scientific meetings. It will be hosted by the U.S. Army Missile Command. The U.S. Army Weapons Command at Rock Island (Ill.) Arsenal was the host in 1964.

Planning is being handled by the Operations Research Technical Assistance Group (ORTAG), headquartered at the Army Research Office-Durham (ARO-D), N.C. Col Nils M. Bengston, ARO-D commander, presides as ORTAG chairman.

ORTAG was organized as a result of a recommendation made at the first Army-wide Operation Research Symposium held at ARO-D in March 1962. Its mission is to assist Army commands and agencies in identify-

(Continued on page 9)

Chief of Staff Awards Betts Legion of Merit

U.S. Army Chief of Staff General Harold K. Johnson congratulates Maj Gen Austin W. Betts, Deputy CRD, after presenting him with the First Oak Leaf Cluster to the Legion of Merit. (See story on p. 2.)

OCRD Sponsoring 3rd National JSHS April 28-May 1

The U.S. Military Academy, West Point, N.Y., will again set the scene for about 200 high school students, teachers and education representatives attending the Third National Junior Science and Humanities Symposium, Apr. 28-May 1. The climax will be a visit to United Nations Headquarters in New York City.

Dr. Robert Oppenheimer, director of the Institute of Advanced Studies, Princeton, N.J., and winner of the 1963 Enrico Fermi Award, will be the banquet speaker. Col Amos A. Jordan, a professor of Social Sciences at the Academy, will deliver an address in the field of the humanities.

As in previous years, outstanding scientists and educators will participate. The majority of students selected to attend have been chosen from those who have presented technical papers at 22 regional Junior Science and Humanities Symposia sponsored by the Chief of Research and Development, Department of the Army, during the present academic year.

Additional talented students will be drawn from participants at Youth Science Congresses sponsored by the Department of Health, Education and Welfare.

Approximately 70 adults, including high school science teachers, university professors, and representatives of various state departments of edu-

(Continued on page 8)

Featured in This Issue . . .

Army R&D Newsmagazine

Vol. 6, No. 3 March 1965

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Published monthly by the Army Research Office, Office of the Chief of Research and Development, Department of the Army, Washington 25, D.C., in coordination with the Technical and Industrial Liaison Office, OCRD. Grateful acknowledgment is made for the valuable assistance of Technical Liaison Offices within the U.S. Army Materiel Command, the U.S. Army Combat Developments Command, U.S. Continental Army Command, and Office of The Surgeon General. Publication is authorized by AR 310-1, dated 20 March 1962.

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

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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: Accuracy and relevancy of contents of this publication to accomplishment of the Army R&D mission are of constant concern to the editors. 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 made automatically each month based on requirements stated on DA Form 12-4, permitting changes as necessary.

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

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

Changes in requirements of other Government agencies should be submitted directly to the Army Research Office, OCRD, Department of the Army, Washington 25, D.C., ATTN: Scientific and Technical Information Division.

SUBSCRIPTIONS. Public sale of this publication is authorized through the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C. Single copies sell for 20 cents. Subscription rates (12 copies annually) are: Domestic (including APO and FPO addresses), $2.25; Foreign, $3.00.

Chief of Staff Awards Betts Legion of Merit

U.S. Army Chief of Staff General Harold K. Johnson on Feb. 18 presented Maj Gen Austin W. Betts, Deputy Chief of Research and Development, with the First Oak Leaf Cluster to the Legion of Merit.

A Presidential award, the Legion of Merit was bestowed upon General Betts for "exceptionally meritorious conduct in the performance of outstanding services while serving as Special Assistant to the Chief of Research and Development for the Nike-X Threat Analysis Study, from February 1964 to December 1964.

"In this highly responsible position of critical importance to the National defense effort," the citation continued, "General Betts displayed decisive leadership, professional competence, mature judgment, and administrative excellence.

"During this period, he was responsible for integrating all facets of the Nike-X Threat Analysis Study, one which was extremely broad in scope and required the integration of such diverse areas of analysis as: Nike-X system, capabilities, alternative developments, local and national effectiveness, and interaction with other damage limiting measures to include civil defense, terminal bomber defense, strategic offensive forces, enemy responses to deployment, as well as the economic and political impact of the system.

"In order to obtain the best expertise, this study was fragmented over widely dispersed sources to include research organizations and laboratories of private industry, other Government agencies, and many subcontractors and consultants throughout the United States, in addition to the continuing input of Department of Defense elements.

"The coordination, compilation and integration of these complicated data and reports into the complete study depended upon General Betts' extensive military experience, technical knowledge and dedicated devotion to duty. When the final report was presented to the Secretary of Defense, it was highly praised and deeply appreciated as an outstanding study."

General Betts succeeded Maj Gen George W. Power as Deputy Chief of Research and Development July 1, 1964. He came to OCRD as the special assistant for the Nike-X study Feb. 7, 1964 after three years as director of Military Applications, U.S. Atomic Energy Commission, Germantown, Md. The preceding two years, he served as military assistant to the Director of Defense Research and Engineering.

A 1934 graduate of the U.S. Military Academy and holder of an M.S. degree from the Massachusetts Institute of Technology, he began his career in research and development in 1945 at the Los Alamos (N. Mex.) Scientific Laboratory. General Betts received his original Legion of Merit for service in India and China during World War II.

Nike-X MSR Work Pushed by $18 Million Contract

An $18 million subcontract was recently awarded by the Bell Telephone Laboratories to Raytheon Co. for development of the Nike-X Missile Site Radar (MSR) as part of the Nike-X missile defense system.

The agreement was announced by the Nike-X Project Office at the U.S. Army Missile Command, Redstone Arsenal, Ala. Bell Telephone Laboratories is responsible for overall system design and development.

Western Electric Co. was awarded the $309 million prime contract Oct. 1, 1964, for overall work on the entire Nike-X system to Sept. 30, 1965.

The MSR, which Raytheon has been designing for over a year, is one of two radars planned for the Nike-X system. The other is the Multifunction Array Radar (MAR). The major portions of both radars will be buried underground with only their steel reinforced domes exposed.

Both will employ the phased array principle novel to Army missile systems. Instead of heavy rotating antennas, this type of radar accomplishes movement of the radar beam by electronic switching.

The MAR will replace two or more conventional radars such as those designed for the Nike Zeus antimissile missile system. Use of the MAR and MSR will allow the system to minimize the amount of equipment exposed above ground.

The MSR is being designed to handle a number of interceptor missiles simultaneously in case of multiple ICBM attack. The MAR will be capable of handling multiple simultaneous engagements.

Army Relays 7 New York TV Channels on Single Laser Beam

Successful use of a single pencil-thin Laser light beam to relay simultaneously the signals received from all seven of the television channels broadcast from New York's Empire State Building was announced Feb. 17 by the U.S. Army.

The achievement is viewed as a significant step toward realizing the potential of Lasers to relieve overcrowded portions of the radio spectrum, thereby providing a needed enlargement of communications capabilities for general and military use.

The 7-channel television relay research is being carried out at the U.S. Army Electronics Command Laboratories at Fort Monmouth, N.J., with newly developed modulation-demodulation equipment developed under contract by Texas Instruments (TI), Inc., of Dallas.

Combined frequencies of the seven Empire State Building channels are spread over a band width of 200 megacycles. The signals from the New York channels 2, 4, 5, 7, 9, 11 and 13 are fed through a regular TV antenna on the roof of the E-Command Laboratories' Hexagon Building, then through an "off-the-shelf" preamplifier and amplifier.

The Laser beam is then modulated with the television signals by the new TI modulator so that the light beam serves as a carrier for both the picture and audio portions of the programs.

The signal-bearing light from the Laser modulator is received by a companion device, the solid-state TI demodulator, which reconverts the signals into their original form for simultaneous display on seven ordinary TV sets. Army electronics scientists and engineers say the picture and sound qualities are comparable to reception by conventional means.

So far, the path of the transmissions has been contained within a room of the Hexagon Building; however, distances of several miles could be spanned directly in the open atmosphere, and virtually unlimited distances could be achieved by using relay stations or protective "light pipes," the researchers say.

They point out that although single-channel TV signals have been transmitted before on Laser beams, attempts to transmit more than one TV channel by Laser have been unsuccessful because of excessive heating of the modulation crystals, which prevented continuous operation.

This problem has been overcome through the low-voltage operation of the TI device. Dr. Dayton Eden of the TI Apparatus Division explains: "Previously available modulators have limited the use of optics in communications because they require about 1,000 volts to effect the same degree of modulation the TI device achieves with 20 volts."

To achieve such low-power operation, the TI modulator makes use of what is known as the "Pockels Effect" in a pair of matched potassium dihydrogen phosphate (KDP) crystals in a special 45-degree Z-cut.

The demodulator is essentially a standard, but specially selected, TI silicon photodiode. The photodiode is being operated in what is known as the "avalanche" condition, which greatly improves the sensitivity of this type device when used as a photo detector. Sensitivity improvements some 10,000 times (or 40 decibels) greater have thus been obtained in experiments, Dr. Eden says.

The Laser is known as a spectra-physics single mode helium-neon type, whose light beam has a wave length of 6,328 Angstroms. (An Angstrom unit, the standard measure for light wave lengths, equals about one 250 millionths of an inch.)

Dr. Eden stresses that the TI "mod-demod" equipment and techniques developed for the Army could be used with any standard commercially available Laser, amplifier and auxiliary equipment.

For example, "the more than 200-megacycle bandwidth of the TI modulator-demodulator could simultaneously accommodate all the frequencies used in police, ship-to-shore, commercial radio, and citizen's band transmissions, as well as all the VHF television channels."

E-Command project engineers Herbert L. Mette and Claire E. Burke say the demonstrations are a highly promising step toward a practical means for realizing the extremely high information-bearing capacity of Laser beams.

Army and TI researchers believe the demonstrations set a new record for the amount of information transmitted on a single Laser beam, although the capacity of the equipment has not been fully exploited.

The main value of Laser is the ability to transmit large volumes of information from one major terminal to another, from which it would be relayed to final destinations by conventional broadcasts or ordinary lines.

Laser communication is of special military interest because the light beam can be aimed precisely from point to point, and, therefore, cannot be easily intercepted and monitored as with ordinary radio transmissions.

Army Announces 44-Pound Atomic Clock Development

A 44-pound atomic clock capable of marking time down to a 10-billionth of a second has been developed for U.S. Army field use.

U.S. Army Electronic Laboratories project engineer Clarence E. Searles, adjusts control on Army's new atomic clock designed for field use.

A dramatic contrast to many models of atomic clocks weighing hundreds of pounds and suitable for use only in laboratories, the lightweight clock, in a 1-cubic-foot package, can be handled by one man and put into field operation in 15 minutes.

The atomic clock depends on the resonance of the natural element rubidium for its accuracy and stability. It will gain or lose no more than one second in about 300 years.

Such close time measurements are necessary for many scientific and military purposes, such as the setting of frequencies on radios that operate on extremely close frequencies, accurate tracking of missiles and satellites and the synchronization of radar nets.

The new clock runs on standard 110-volt current, the 24-volt output of military vehicles, or both sources combined. Batteries automatically take over without disruption if either of the other power sources fails.

The clock was developed for the U.S. Army Electronics Command by General Technology Corp.

Army Regulation 70-9 Provides Basis for 1498 Report System

Distribution of AR 70–9 in the near future to all Army R&D activities will set in motion the initial influx of DD Form 1498's, the basis for a system of high-speed automatic processing and dissemination of information on research performed at the work unit level.

The new AR 70-9 "Research and Development—Research and Technology Reporting System" implements DoD Instruction 7720.13 of Jan. 27, 1965. It is applicable to *all* organizational elements performing at the *work unit level* in the research and exploratory development categories of the Department of Defense RDT&E program.

The work unit level is defined as the unit into which basic and applied research projects are normally divided for purposes of local administration, and may range from a fraction of a professional man-year to several professional man-years.

It is a subdivision of a task area selected by program management to provide effective control and supervision, and is technically distinguishable from other efforts with which it may be aggregated for financial or administrative purposes.

The new DD Form 1498, which supersedes DA Form 1309-R, is the culmination of several months of intensive studies and an agreement between DoD and NASA for development of a standardized form, suitable for automatic processing, for reporting ongoing work at the work unit level. The agreement was effected as a basis of exchanging information common to both agencies.

All major components have been briefed informally on the new form reporting system so they can expeditiously implement provisions of AR 70-9 to provide guidance and procedures covering any unique problems requiring special treatment.

Heads of agencies and commanding generals of the Office, Chief of Research and Development; Office, Chief of Engineers; The Surgeon General; U.S. Army Materiel Command; U.S. Army Combat Developments Command; and the U.S. Army Security Agency may issue supplemental instructions not in conflict with the Regulation.

The agencies also will insure that contractor or grantee 1498 reporting requirements are incorporated in contracts in accordance with applicable regulations.

Among significant highlights in the reporting instructions of AR 70-9 for submission of DD Form 1498, "Research and Technology Resume" (see Figure 1 on page 5) are requirements that:

- A report on each work unit in progress (on the effective date of AR 70-9) will be submitted for receipt by the Chief of Research and Development, Headquarters, Department of the Army, Washington, D.C. 20310, by June 15, 1965.
- A report on each work unit, initiated after the effective date of AR 70-9, will be submitted for receipt by the Chief of Research and Development within 10 days after the local action being reflected has occurred within the performing organization.
- A revised report on each significant change that occurs in a work unit after a resume and the associated punched cards have been submitted for receipt by the Chief of Research and Development within 10 days after the change occurs.

Appendix I of AR 70-9 gives detailed instructions for preparing work unit level resumes on hard copy DD Form 1498. Appendix II of the Regulation applies to preparation of ADP cards, using a hard copy of Form 1498 as the source of punch information.

The reports, consisting of copies of DD Form 1498 and associated punched cards or magnetic tape, will be maintained for the Army by the Scientific and Technical Information Division of the Office, Chief of Research and Development.

The Division will then transmit copies of the reports to the Defense Communications Center (DDC) in Alexandria, Va., where a data bank containing the work unit data will be maintained for the Director of Defense Research and Engineering.

Geared to an eventual completely automated system of information storage and dissemination, objectives of the DD Form 1498 reporting requirements are aimed at:

- Providing a bank of standardized information regarding work units performed in-house, on contract or under grant.
- Providing ready access to current data concerning work in progress in the research and exploratory development categories.
- Providing answers conveniently and accurately to inquiries relating to research and exploratory development work.
- Providing a basis for exchange of scientific and technical data and information at the work unit level. (The system does not affect in any way the requirements for reporting efforts at the project and task area levels for program planning purposes, which also utilize Form 1498, as prescribed in Change 3 of AR 705-12.)

AUSTRALIAN MINISTER OF DEFENSE, Senator S. D. Paltridge, recently visited the U.S. Army Combat Developments Command (USACDC) at Fort Belvoir, Va., where he was briefed on Command activities. Shown above are (left) Lt Gen Ben Harrell, Assistant Chief of Staff for Force Development, who accompanied the visitor (center), and Lt Gen Dwight E. Beach, CG, USACDC, who welcomed and briefed the Australian Minister.

RESEARCH AND TECHNOLOGY RESUME

1.	2. GOVT ACCESSION	3. AGENCY ACCESSION	REPORT CONTROL SYMBOL
		DA ØA2716	CSCRD-103

4. DATE OF RESUME	5. KIND OF RESUME	6. SECURITY RPT / WRK	7. REGRADING	8. RELEASE LIMITATION	9. LEVEL OF RESUME
22 02 65	A. NEW	U / U	NA	NL	A. WORK UNIT

10a. CURRENT NUMBER/CODE: 62118011 1A013001A039 11 099

10b. PRIOR NUMBER/CODE: NONE

11. TITLE: (U) Atmospheric density measurement by optical means

12. SCIENTIFIC OR TECH. AREA	13. START DATE	14. CRIT. COMPL. DATE	15. FUNDING AGENCY
002200 Atmospheric Physics	03 64	02 66	OTHER DA

16. PROCURE. METHOD	17. CONTRACT/GRANT	18. RESOURCES EST.	a. PROFESSIONAL MAN-YEARS	b. FUNDS (In thousands)
B. Contract	a. DATE 02 65 b. NUMBER DA 49-062-ARO-29 c. TYPE: A. FPF d. AMOUNT P100000	PRIOR FY 64	3	75
		CURRENT FY 65	3	85

19. GOV'T LAB/INSTALLATION/ACTIVITY
NAME
ADDRESS U.S. Army Electronics R&D Activity
White Sands Missile Range
New Mexico
RESP. INDIV.
TEL: Kelly, Col. P.Q.
505-909-3456 Ext. 123

20. PERFORMING ORGANIZATION
NAME
ADDRESS John Doe Associates
123 Smith Street
Cleveland, Ohio
INVESTIGATORS PRINCIPAL ASSOCIATE Jones, J.D.
Winter, C., Smith, Dr. G.L.
TEL 216-304-1236 TYPE: UN

21. TECHNOLOGY UTILIZATION: Weather Forecasting

22. COORDINATION: Marshall Space Flight Center

23. KEYWORDS: Backscatter; Radiation; Searchlight Technique; Rayleigh Scattering; Atmospheric Density Profiles; Rocket Sounding

24. (U) Tech Objective - Develop a technique for the measurement of atmospheric density utilizing backscattered radiation from a pulse of optical energy.

25. (U) Approach - This research is divided into two phases:
1. Ground Phase - Consisting of backscatter measurements of Laser frequency in the White Cell in various controlled atmospheres to reaffirm the theoretical considerations of molecular scattering to be used in the later data reduction. Vertical atmospheric soundings will be made from a mountain site above the haze layer.
2. Flight Phase - A series of test flights will be scheduled to coincide, as nearly as possible with rocket samplings to determine the degree of correlation and establish the minimum application altitude.

26. (U) Progress (Dec 64 - Feb 65) - Equipment has been developed to accomplish the first phase of this project, this includes:
(1) A 100 megawatt R-spoiled Laser with a quarter power pulse width of 15 nanoseconds. The maximum beam divergence will be less than 1.5 milliradians.
(2) A Laser monitor to record both the power and shape of the Laser pulse.
(3) An optical system to provide both the Laser and the photometer with the same geometrical path.

27. COMMUNICATIONS SECURITY	28.	29. OSD CODE	30. BUDGET CODE
☐ a. COMSEC OR COMSEC RELATED ☒ b. NOT RELATED		AR	4

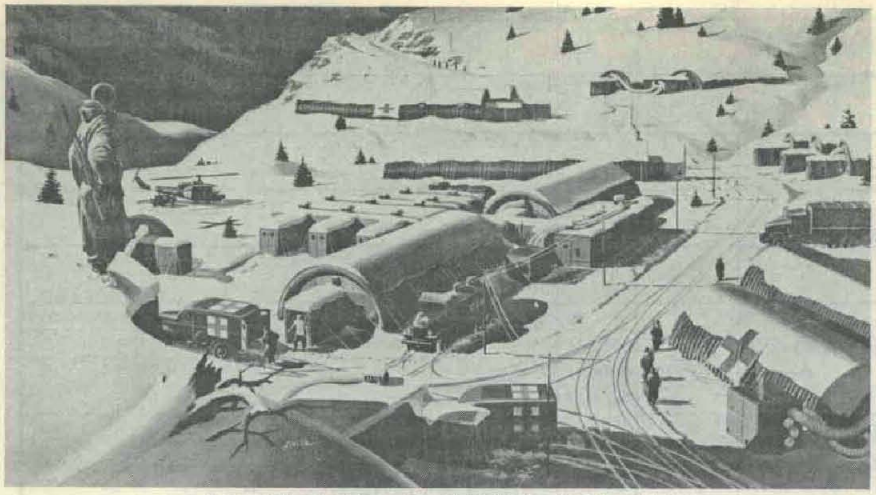
31. MISSION OBJECTIVE	32. PARTICIPATION
CDOG 1612 i	NM 42000

33. REQUESTING AGENCY	34. SPECIAL EQUIPMENT

35. EST. FUNDS (In thousands) CFY+1	36.

DD FORM 1 AUG 64 1498 (Items 1 to 26 identical to NASA Form 1122)

Figure 1. DD Form 1498



Army Medical Service MUST Field Hospital

Army Unveils MUST in Texas Demonstration

(Continued from page 1)

Another objective was to introduce MUST as a new level of medical effectiveness in field hospital care and share the experience and knowledge with civilian medical officials. The MUST concept also lends itself to such nonmilitary application as medical care in remote areas, at the scene of natural disasters, and in civil defense.

The demonstration was arranged in conjunction with the Garrett-AiResearch Corp., prime contractor responsible for design and development of all basic elements, including the environmental control components, and the American Hospital Supply Corp., designer and developer of the majority of the medical equipment for use with MUST.

Part I showed the need for combat support hospitals—the Mobile Army Surgical Hospital and the Evacuation Hospital — by depicting the field medical service in support of elements of the field Army. Portrayed were the role of the medical service and the impact of battlefield use of tactical nuclear weapons.

The demonstration realistically reflected the type and nature of casualties produced by modern weapon systems, as well as the problems involved in the collection, emergency care and evacuation of the combat wounded.

Part II showed MUST equipment established adjacent to an Evacuation Hospital furnished with currently authorized equipment. Guests were conducted on a tour of key elements of each hospital, enabling them to compare the respective capabilities.

AiResearch Manufacturing Co. was awarded a contract on June 28, 1963, to develop and produce a limited number of MUST prototypes because of its experience in developing and fabricating similar environmental control equipment used for space and missile applications.

The ward element in the MUST is a modified version of an inflated tube structure developed and produced by Garrett for the U.S. Army Pershing Missile System.

The MUST unit consists of an expendable shelter, a ward-type inflatable shelter, and a self-contained utility system providing electric power, air conditioning, heating, hot and cold running water, and waste water service.

Elements are compact, lightweight, easily movable and, by combining functional units, can be assembled into various types of field hospitals.

The expandable element features modern facilities for performing the most complex and delicate surgical operations. It can fold 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, is air transportable by cargo aircraft, and can be moved by helicopter.

The hospital ward container holds an inflatable ward shelter and all basic medical equipment. Two wards can be carried on a 2½-ton truck. Each ward is capable of providing intensive medical treatment for 20 combat casualties.

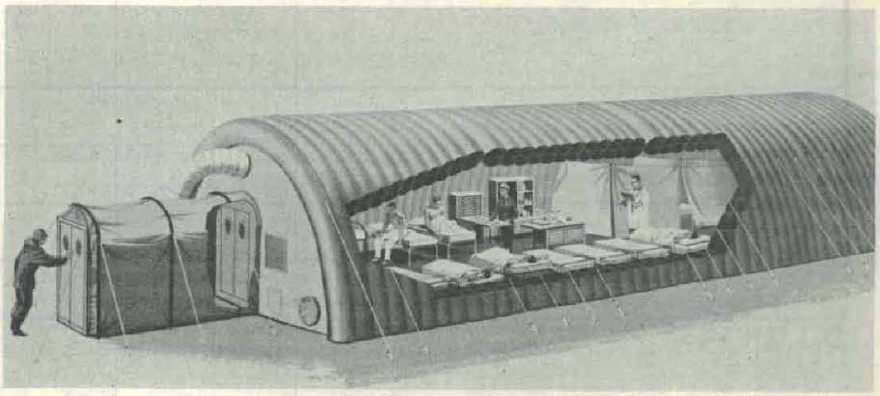
The utility element, weighing 3,600 pounds, is designed around a gas turbine engine that can generate 85 kilowatts of 400-cycle electric power. It has the capability of furnishing 10 kilowatts of 60-cycle current, and can maintain 4 ward elements or 11 surgical elements at a temperature of 65° F. in —65° F. environment and of 80° F. at 140° environment. This unit also provides ward element inflation air, hot and cold running water, and waste disposal services.

The utility element, 5 feet 10 inches wide, 8 feet 8 inches long, and 7 feet 4 inches high, has storage space for air ducts, electric cables, and water distribution hoses. When in transport, it is secured on a M-104 trailer or M-35 truck, and can be operated on or off these vehicles.

Principal advantages of the 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 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



MUST Field Hospital Inflatable Element

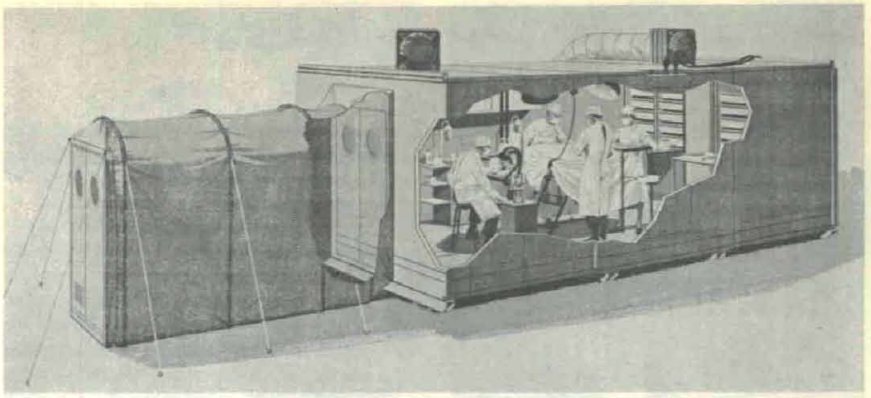
conditions, equipment and parts have been standardized to make the most efficient use of space. Storage cabinets, for example, are the same in the surgery, laboratory, and central materiel supply elements.

Other standard items developed 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, stack without tipping, and nest to conserve space.

An all-new operating table is included in special equipment designed for the MUST surgery element. The table adjusts to all nine standard surgical positions, and has stability previously found only 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 28x28x23-inch package.

Illumination for the surgical field consists of a light that operates on 24 volts furnished by trickle-charged batteries. Each of the three 4-source light heads delivers a minimum of 1,500 foot-candles at the surgical field.



MUST Field Hospital Expandable Element

Ceiling-suspended from adjustable arms, the lights are mounted independently to illuminate more adequately one or more surgical sites, a common need during combat conditions. Due to the battery operation, there is no loss of surgical light if the normal electrical current is interrupted.

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 range required for biologicals.

Electrical power is fed to them during times of storage and transit as well as during operation. 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 incubator that have been built into the MUST cabinetry.

ERDL Studies Exhaust Gas As Emergency Water Source

Emergency drinking water from exhaust gases to support U.S. Army tactical units in the field is being studied by the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va.

Preliminary tests have shown that essentially one pound of gasoline can be converted into one pound of water which normally would be lost to the atmosphere in a gaseous state. If it can be reclaimed and purified, it would yield a limited supply of emergency water in arid or other water shortage areas.

The laboratory study at USAERDL to date has included the investigation and collection of basic information relative to the heat transfer or gas condensing characteristics for obtaining water from engine exhaust gases; the physical and chemical properties of the water produced, and the treatment processes required to render the water potable.

In addition to various water purification processes studied, analytical procedures have been established for identification of trace elements in the condensate.

Equipment being used in the study includes a 3 kw. military engine-generator and a condenser that is an improvised adaptation of a copper-cored radiator from a ¾-ton weapons carrier, using air from a fan for cooling.

Army, Costa Rica Begin Snake Anti-serum Research

The U.S. Army and the government of Costa Rica will jointly undertake a research program to produce an anti-serum effective against each of the major species of poisonous snakes in Costa Rica.

Personnel of the U.S. Army Medical Research Laboratory at Fort Knox, Ky., will provide biochemical and pathological assistance to Costa Rica. The expectation is that a trained staff of Costa Ricans will continue independent work in the anti-snake serum program.

New techniques or therapeutic agents to be used will be administered only by Costa Rican medical representatives. U.S. officials will not participate in the treatment of patients.

Further objectives of the program include the development of techniques for improvement of first aid and hospital treatment of snake bites; evaluation of chemical agents, such as dihydrolopoic acid and tetracycline, known to have some detoxifying action on snake venoms; and development of other compounds for this purpose.

Venom from approximately 200 snakes will be used to venomize horses. Serum collected from the blood then will be processed by the Biochemistry Department, School of Medicine, University of Costa Rica. Present estimates are that two to four months will be required to produce an anti-serum.

Capt Hershel H. Flowers, Veterinary Corps, of the Army Medical Research Laboratory at Fort Knox, will head the program and will work with scientists designated by the Costa Rican Ministry of Health.

He has been engaged in U.S. Army medical research concerned with development and evaluation of methods for treating poisonous snake bites for several years. He will be transferred to San Jose, C.R., where he will be attached to the U.S. Military Group for one year.

Lt Col A. Lavite, Jr.

Maj W. C. Goessling, Jr.

2 Assignments to OCRD Staff Positions Announced

Lt Col Anthony Lavite, Jr., and Maj Ward C. Goessling, Jr., are new staff additions to the Office, Chief of Research and Development.

Col Lavite was assigned to the Program Review Branch, Review and Analysis Division and Maj Goessling was assigned as a project officer in the High Altitude Systems Branch, Air Defense and Missile Division.

LT COL LAVITE, after a tour (1963-64) in Korea as deputy aviation officer, Eighth U.S. Army, served in an Army advisory and liaison capacity with Research Analysis Corp.

He joined the Army in 1942 and was commissioned in 1945 after serving with the 82nd Airborne Division during World War II. He then served in various assignments with Airborne and Infantry divisions in Germany and the U.S. until 1952, when he was assigned to the Infantry School Tactical Department as an author-instructor and as a board member of the Airborne-Air Mobility Department (1954-59).

Col Lavite then served as a division aviation officer with the 1st Armored Division and supported operations in southwest Texas during Hurricane Carla, moving with the division to the East Coast during the Cuban missile crisis.

He holds a B.A. from Louisiana State University (1963) and has attended the University of Georgia. He is a graduate of the Command and General Staff College and the Army Aviation Fixed/Rotary Wing School. His decorations include the Bronze Star with Oak Leaf Cluster, Army Commendation Ribbon with Oak Leaf Cluster, Purple Heart, Combat Infantry Badge and Master Parachutist Badge.

MAJ GOESSLING completed a tour as project officer for AADS-70 at the U.S. Army Combat Developments Command activity at Fort Bliss, Tex. For the preceding two years, he was a student at the University of Oklahoma, where he received his master's degree in electrical engineering. He also is a graduate of the U.S. Military Academy and the Command and General Staff College.

From July 1958-60 he taught military science and tactics at the Pennsylvania Military College, Chester, Pa., and was liaison officer for the 101st Airborne Division, Artillery, Fort Campbell, Ky., 1956-57.

Maj Goessling entered the Army in 1949, served in Korea from 1950-51 and as Assistant S-3 with the 675th Airborne Field Artillery Battalion at Fort Campbell. From 1953-54 he served with the U.S. Forces in Trieste, Italy and then in Austria and Germany as a battery commander.

Fort Monmouth Activates New CS/TA Laboratory

Research capabilities for improving combat surveillance and target acquisitions were enhanced recently with the activation of a new Army laboratory at Fort Monmouth, N.J.

Established as a major subordinate element of the U.S. Army Electronics Laboratories, the new Combat Surveillance/Target Acquisition Laboratory will employ about 250 persons.

Col Robert K. Saxe, deputy director of the Electronics Laboratories, said the top personnel and team leaders in the new laboratory would be allowed great freedom of action because the problems to be faced in the dispersed and diffused ground warfare envisioned today require "particularly imaginative and creative solutions."

Technical areas of investigation will include radar, passive surveillance, electro-optics, image interpretation, advanced systems and development. It will be the investigative teams' duty to come up with solutions to combat surveillance and target acquisition problems in the exploratory development category to be translated into little "black boxes."

By far the greatest part of the work done by the teams will be in-house. Actual contract work for production of hardware will be the job of the development technical area groups.

V. L. Friedrich, director of the Electronics Laboratories Surveillance Department, has been named acting technical director of the new laboratory. The director, a colonel not named at this time, will report directly to Maj Gen F. W. Moorman, CG of the Electronics Command.

The greater part of the personnel for the Laboratory will be drawn from the present Surveillance Department of the Electronics Laboratories, which will act as a staff office for the new organization, and give administrative and logistical support.

OCRD Sponsoring 3rd National JSHS April 28-May 1

(Continued from page 1)

cation and the U.S. Office of Education, will attend.

Arrangements are being made by the U.S. Army Research Office, Durham, N.C., under the sponsorship of the Office of the Chief of Research and Development. A Department of the Army speaker will be among the distinguished scientists and educational leaders programed to speak at the symposium.

An engineering address will be given by J. Carlton Ward, chairman of the Board of Advisors, Industrial College of the Armed Forces, and chairman of the Engineering College Council, Cornell University. The tentative title of his talk is "Science and Engineering in Perspective."

Dr. J. Ned Bryan, director of Project Talent, U.S. Office of Education, and Dr. Elizabeth Drews, professor of Education at Michigan State University, will address the group of adult teachers during an Educators' Seminar covering various aspects of the sciences and humanities.

As a finale to the symposium, participants will visit the United Nations, where they will hear addresses by Lt Gen R. W. Porter, CG, First U.S. Army, and by Brian Urquhart, principal officer in the Office of the Under Secretary for Special Political Affairs.

STRATCOM Activates Command in Canal Zone

The U.S. Army Strategic Communications Command (STRATCOM) established and activated on Mar. 1 a new subordinate command for strategic operations in Central and South America.

Creation of the new element was announced by Maj Gen Richard J. Meyer, commanding general, on the first anniversary of STRATCOM's activation as the Army's newest major field command.

The new subcommand—U.S. Army Strategic Communications Command-South—is headquartered at Fort Clayton in the Canal Zone. It is under the command of Lt Col Robert J. Emerson, formerly the deputy commander of STRATCOM's old Southern Field Office in Panama.

Formation of the new unit, which supervises the operations of seven STRATCOM facilities in Central and South America, completes a worldwide reorganization of the Army's communications-electronics initiated by the Army's Chief of Staff early last year.

It is one of five major subordinate commands in STRATCOM's global communications complex that now extends to more than 30 countries overseas.

Other major sub commands are located in Suitland, Md., Heidelberg, Germany, Schofield Barracks near Honolulu, Hawaii and Asmara, Ethiopia.

The primary mission of the new element at Fort Clayton, C.Z., will be to establish, engineer, install and operate the Army portion of the Defense Communications System (DCS) within the geographical area of the Commander in Chief, Southern Command, and to provide the Unified Commander and the Army Component Commander strategic and nontactical communications support as required.

USASCC-South will operate and maintain automatic switches (AUTODIN and AUTOVON) and other Defense communications facilities for which the Army is assigned responsibility in the area.

Included among Col Emerson's subordinate units are the STARCOM facility in the Canal Zone, commanded by Lt Col J. E. Barrett, and facilities at La Paz, Bolivia, commanded by Maj G. C. Falk; at Guatemala City, commanded by Capt C. J. Montisano; and San Jose, Costa Rica, commanded by CWO W. L. Putman.

Included in USASCC-South are the STRATCOM facility at Managua, Nicaragua, commanded by CWO L. F. Collins; at Tegucigalpa, Honduras, commanded by CWO R. E. Ward, and the facility at Quito, Ecuador, commanded by CWO V. L. Durante.

With headquarters in Washington, D.C., STRATCOM's mission includes not only the installation, operation and maintenance of the Army's strategic communications, but also the development, engineering and modernization of such facilities.

In addition to directing the operation of all STRATCOM stations (including STARCOM-DCS units), STRATCOM also controls a number of subordinate activities such as the Joint Support Command (Fort Ritchie, Md.), the Interagency Communications Agency (Arlington Hall, Va.), and the Radio Propagation Agency, headquartered at Fort Monmouth, N.J.

The personnel strength of STRATCOM today numbers more than 11,000 and its annual operating budget totals more than $350 million.

STI Officials Honor Carlson's Leadership

More than 25 Army, Air Force, Navy and other Federal agency coworkers of Defense Director of Technical Information Walter M. Carlson honored him at a Feb. 26 luncheon that marked the start of his third year of leadership in developing an integrated program.

Judged by the spontaneity of sparkling humor, the theme of the occasion might well have been "Wit Works Wonders" in easing troublesome problems. The Army was host to the meeting, initiated in 1964 with the Navy as host. Army Director of Technical Information Col Dale L. Vincent presided.

Top leaders of STI programs in the military services attended the luncheon at the Fort Myer (Va.) Officer's Club. The ladies were represented by Miss Hope Dillent and Miss Donna Spiegler of Mr. Carlson's staff.

Speakers in addition to the guest of honor included Col Andrew A. Aines, executive secretary of COSATI (Committee on Scientific and Technical Information, Federal Council on Science and Technology); Dr. Robert B. Stagmaier, Jr., administrator of the Defense Documentation Center; Edward K. Grimes, STI program manager at Headquarters, U.S. Air Force; Robert Hayes, research coordinator, Office of Naval Research; and Maj Fred Brooks, National Security Agency. ARPA was represented by Director of Technical Information Kred Koether.

Redstone Arsenal to Host Operations Research Meet

(Continued from page 1)

ing problems and planning operations research.

The Operations Research Symposium is the Army's principal forum for an annual broad-gauge discussion and presentation of Army operations research activities carried on in-house or by outside contractors. It serves as a means of briefing Army scientists on current developments and as a clearinghouse for information concerning training programs in operations research.

Thirty operations research technical papers will be presented this year, covering the areas of cost effectiveness, special warfare, air mobility and effectiveness, medical sciences, and human factors. Attendance is by invitation only.

Keynote speaker will be Dr. Alain C. Enthoven, Deputy Assistant Secretary of Defense (Systems Analysis). Other speakers include Maj Gen William B. Bunker, Deputy CG of the U.S. Army Materiel Command (AMC), Seymour J. Deitchman, Office of the Director of Defense Research and Engineering, Dr. George E. Kimball of Arthur D. Little Co. and president of the Operations Research Society of America, and Dr. Werner von Braun, National Aeronautics and Space Administration.

Feature of the agenda will be a panel session on Cost Effectiveness, moderated by Dr. C. M. Mottley, executive director, Center for Naval Analyses, Office of Naval Research. Session chairman will be Dr. Wilbur B. Payne, special assistant for Operations Research Office, Assistant Secretary of the Army (Financial Management).

Panel members include: Dr. Stewart P. Balke (Col USA-Ret.), senior systems analyst, Stanford Research Institute; Patrick J. Parker, study director, Naval Warfare Analysis Group, Center for Naval Analysis; Dr. Alexander Slafkosky, scientific adviser to the Deputy Chief of Staff (RD&S), Headquarters, Marine Corps; Dr. Robert N. Gross, head, Economic and Costing Division, Research and Analysis Corp.; Dr. Edward S. Quade, Rand Corp.

The summary and critique address will be given by Dr. George E. Nicholson, Jr., chairman of the Department of Statistics, University of North Carolina.

Medical Corps Scientist Reviews Germfree Research Progress

By Dr. Albert Einheber

Dr. Albert Einheber served as a scientific research analyst with the National Research Council, National Academy of Sciences (1949-52), prior to joining WRAIR as a physiologist with the Department of Surgical Physiology. As chief of the Department of Germfree Research since 1962, his endeavors have embraced the fields of local and systemic mechanisms and manifestations of injury and shock following burns, limb ischemia, hemorrhage, x-irradiation, superior mesentoric artery occlusion, cold exposure, bacterial endotoxins, as well as germfree animal research. He earned B.S., M.S., and Ph. D. degrees from George Washington University in 1948, 1950, and 1956, respectively.

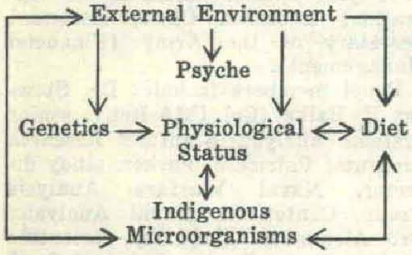
Dr. Albert Einheber

The wisdom and foresight of the Army Surgeon General a decade ago in establishing the Army's germfree facility at the Walter Reed Institute of Research is attested to by the tremendous upsurge of interest and activity in gnotobiotics that is prevalent today on an international scale. The Army has, in no small measure, contributed to this increasing awareness of the exclusive potentialities of germfree biotechnology as a research tool.

The unique methods of the germfree laboratory enable the rearing, maintenance and study of animals free from microbes (axenic) or of such animals purposely contaminated with one or more known microorganisms (gnotobiotic).

Under these conditions of rigid control, one can more directly and systematically explore the complex and intimate role of living bacteria and their products on the body economy in health, injury and disease. Hopefully, investigators thereby can delineate the nature and mechanisms of the microbial factors, both beneficial and detrimental, and differentiate these from the nonmicrobial (host) factors that are involved.

Germfree biotechnology is a giant step in ultimately achieving the classical research goal of obtaining an experimental animal that is characterized with respect to its genetics, environment, nutrition and exposure to foreign antigens. Diagramed below are some of the broad parameters and their interactions which are amenable to controlled study with the tools of germfree research.



The results of germfree research to date have served to underscore the evidence accumulating from various sources that the responses of animals to various stressors and stimuli may be conditioned to a large degree by their microbiologic and immunologic experience and makeup. Ordinary laboratory animals and man live in a metastable equilibrium with their ever-present but ever-changing indigenous flora.

To the extent that the latter (and those impinging from the external environment) influence the physiologic status of the host, they may be of importance but not adequately controllable under ordinary laboratory conditions of experimentation; the difficulty is promptly revealed when one attempts to compare the "normal" animal flora of several laboratories.

The present state-of-the-art of germfree research, the aftermath of more than half a century of effort, represents the international product of remarkably few investigators. Much of the time has been spent in perfecting equipment, diet, sterilization procedures, the rearing and production of animals, and developing the associated techniques.

Until a few years ago, much of the information on germfree and defined-flora animals was sketchy, largely anatomic and descriptive. This was largely due to the paucity of experimental animals which necessitated isolated observations rather than carefully controlled experiments with statistically suitable numbers of animals.

In consequence, necessary information on many of the classical parameters of nutrition and metabolism for germfree animals is yet to be obtained and, on this basis, one can say that germfree research is in its infancy. Perusal of the first textbook on germfree research, entitled "Germfree Life and Gnotobiology," by T. D. Luckey, published by Academic Press in 1963, gives evidence for this.

The vistas of germfree and defined-flora animal research are presently infinite and the investigative opportunities are rife with exciting rewards. Because of these circumstances, virtually all valid basic observations that are made are classical. By the same token, while many specific problems can be tackled, and novel and important observations made, full interpretation of results must, in many instances, await the obtainment of basic information of the type that is readily available for ordinary open-laboratory animals (conventional).

Moreover, new observations on germfree and defined-flora animals often raise questions of the validity of information and concepts based on conventional animal work, thus challenging the solidity of generally accepted notions, and creating new problems for consideration. When this happens, we must begin all over again, and await further developments and answers from the germfree laboratory.

The point I am trying to make is that it is presumptuous and hazardous at the present time to predict the direction and course that germfree research will or should take. It is safe to say that all such information obtained, whether basic or otherwise, will, I think, be of inevitable fundamental importance to biology. For this reason, the doors to germfree research require that they be left wide open. I say this because the eventual realization of novel information from these portals may not always ring a bell of familiarity.

Germfree research should be a full-time, not a part-time, endeavor and is the proper labor of specialists. I say this because the standardization of methods is more critical than under open laboratory conditions, if results are to be reproducible and valid from one laboratory to the next. I have already alluded to the fact that germfree biotechnology is not a research tool in search of problems.

Enough ideas for investigations are conceived during one's morning ablutions to fill many life-times.

In view of the relatively expensive and involved nature of germfree work, the average greater time invested per experiment, and the need for basic information, it is more essential, than ordinarily, to obtain as much information as possible from each experiment, irrespective of, and in addition to, the primary research objective.

To achieve such economy of effort and coordination of information requires a closely knit, multidisciplinary approach to each and every problem. The Department of Germfree Research at Walter Reed has the basic elements of such an organization, namely, integration of the disciplines of physiology, biochemistry, pathology, microbiology, surgery and germfree technology.

Regarding germfree animal availability, it is important to note that the commercial suppliers are in the throes of birth pains and should be able to deliver soon. Right now, their first product is that of unskilled labor. Improvement is expected with experience.

The assumption is that the commercial supply will be able to meet the ever-increasing demands for germfree animals. Even should commercial sources become ideal, the germfree laboratory requires its own breeding and rearing facilities to provide the full gamut of age, sex, species, strain, etc., of animals in adequate number to meet the needs that research dictates.

For example, we are now well on the road to establishing a breeding colony of germfree hairless mice that we derived ourselves for use in studies of burns, skin grafting and wound healing. It is doubtful that commercial sources will be able to meet all our needs. Neither can we expect to achieve modifications of equipment as these may become necessary and desirable without untoward delays.

Thus, a proper development setup is a must to keep pace with such requirements. The need for animals and equipment is inflationary and is a product of successful experimentation. Such needs cannot be interdicted with the expectation of steady progress.

There are several pressing basic needs for investigations in nutrition and surgery. The first of these is for a suitable gnotobiote—an animal with defined-flora that, as far as we can judge, satisfies the criteria of an open-laboratory conventional animal. The problem, of course, is that there are no "conventional" conventional animals.

For this reason, we must apply all criteria of difference we can derive from comprehensive comparative, multidisciplinary studies of normal germfree and conventional animals in order to establish a defined complement of microbial species, adequate to effect suitable conventionalization of germfree animals, and the derivation of a closed-reproducing colony of such animals.

Even though intensive investigations towards these ends are in progress in our laboratory, as well as elsewhere, at present, to my knowledge, there is as yet no such animal. The known flora thus far used singly or in combination to contaminate germfree animals have not as yet recreated an acceptably conventional state, the standards for which are still to be established.

The availability of a suitable gnotobiote is essential to evaluate the specific role of the microbial species on host nutrition and metabolism. It is also essential to establish a standard diet which is, so-to-speak, tailored for the gnotobiote's normal needs and for other experimental circumstances.

The rapidity of advances towards this goal is predicated on the rate of accrual of points of difference between germfree and conventional animals, that can serve as criteria for the gnotobiote we are seeking, and on the testing of a variety of combinations of flora in germfree animals to discover which of these most closely accomplish these criteria and result in satisfactory conventionalization. It is not anticipated that only one set of microorganisms will do the trick. The obtainment of suitable defined-flora animals is a basic problem for all areas of research.

A second need stems from the fact that, in retrospect, the rat, which has been the standard for nutritional research, is a poor animal for this purpose. This holds true for other animal species that practice coprophagy. The rat, unfortunately, has a most voracious appetite for feces. Recent studies with special tail cups which prevent coprophagy have revealed, in part, the degree to which this practice may confound nutrition studies.

Ingestion of feces, for one thing, recycles nutrients produced by bacteria which have not been directly absorbed from the intestinal tract. Moreover, Gustaffson, in Sweden, has shown that prevention of coprophagy modifies the intestinal flora of the rat. Raised screen flooring apparently does not prevent coprophagy, as has in many instances been assumed, because there is evidence that rats on a diet complete as to all known requirements still consume 35-50 percent of their fecal output directly from the anus.

On the optimistic side, comparative studies of germfree and conventional animals with and without tail cups may provide interesting information that would otherwise not be possible. The main point is that there is a need for germfree mammalian species that are not coprophagists. At Walter Reed, we presently make use of rats, mice and guinea pigs.

An additional need, which relates in part to the latter, and which is pertinent to surgical and metabolic studies, is that for a breeding colony of large germfree mammals. The non-coprophagic dog and monkey would be obvious choices. Apart from the greater ease of their performance, surgical procedures could be more varied and complex.

Furthermore, instead of the necessity of serially sacrificing groups of animals to obtain blood chemistries or other measurements and observations, sequential observations and patterns of changes could be determined for individual large animals which would enable a more precise correlation of these changes with clinical course and fate.

The response of the individual to injury, especially in military situations, is frequently the vector sum of the direct effects of the particular injury per se; under-nutrition; climatic conditions; and infection. The superimposition of radiation to the picture from the new weaponry greatly complicates matters.

Separation of the individual contributions of these factors on the overall response of the untreated or treated casualty or experimentally injured animal is a formidable challenge. The greater and ever-increasing definition of the research animal in the germfree laboratory should hopefully provide the basis for a greater resolution of the many facets of the gross problem.

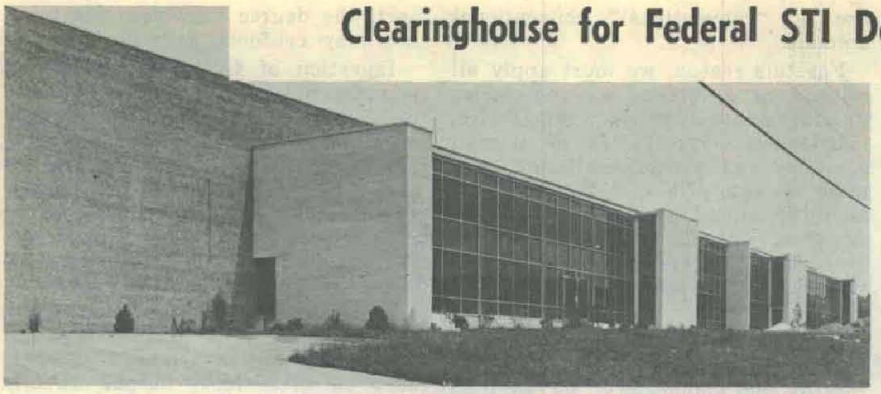
The Department of Germfree Research at the Walter Reed Army In-

(Continued on page 34)

Armed Forces Day Set May 15

"Power for peace" will be the theme of U.S. military installations throughout the world when they observe the 16th annual Armed Forces Day, May 15, with open house events designed to give Americans and international neighbors a close look at the Nation's defense capabilities and military readiness.

Clearinghouse for Federal STI Dedicates New Headquarters



Clearinghouse for Federal Scientific and Technical Information

The Clearinghouse for Federal Scientific and Technical Information (formerly the Office of Technical Services) of the National Bureau of Standards, U.S. Department of Commerce dedicated its new facility Jan. 27, near Springfield, Va.

Consolidating and centralizing services designed to facilitate distribution of scientific documents estimated to increase yearly at the rate of 50,000, the new Clearinghouse employs the latest in computers and reproduction devices. It will expedite distribution of more than 350,000 unclassified research reports to the public and Government activities.

At the dedication, U.S. Senator (Ark.) John L. McClellan, who heads the Senate Committee on Government Operations, and Secretary of Commerce John T. Connor commented on the Government's awareness of science's role in the Nation's development and stressed the importance of the Clearinghouse in the dissemination of scientific and technical information.

The original enabling Act authorizing the establishment of a federal clearinghouse was passed by Public Law 776-81st Congress. This resulted in distribution of Government science reports to the public through the Office of Technical Services (OTS), an activity of the Department of Commerce, National Bureau of Standards (NBS), Institute for Applied Technology.

Further development of the Clearinghouse was endorsed in February 1964 by the Federal Council for Science and Technology (FCST) to serve as an agency through which unclassified technical reports and translations (generated by all Government agencies) could be uniformly indexed and made available to the public.

Headed by Dr. Donald F. Hornig, the FCST consists of senior policy officials from eight Federal departments and agencies who serve with the Office of Science and Technology to assist the President in developing Government-wide plans and policies relating to scientific research and development.

The OTS was formally renamed the Clearinghouse for Federal Scientific and Technical Information on Oct. 30, 1964.

According to Department of Commerce officials, the newly dedicated Clearinghouse has completed consolidation of personnel, equipment and facilities formerly spread throughout buildings widely located in Washington, D.C. and Alexandria, Va. It was estimated that savings of $500,000 will be realized during the first year of operation as a result of reducing duplication of documents processing and distribution within the Government.

Through the streamlining of all phases of the Clearinghouse system —microprinting, order processing, inventory control, indexing and publication preparation—copies of reports are expected to be available on microfilm or in pamphlet form within a matter of a few hours.

As part of the new Institute for Applied Technology, the Clearinghouse is directed by Bernard M. Fry, formerly with the National Science Foundation, Atomic Energy Commission, and former director of the Technical Documentation Center, Office of Technical Services. The Institute is headed by Dr. Donald A. Schon.

Working in conjunction with State universities, commerce and development agencies, and similar organizations, the Clearinghouse now serves as a national center for disseminating Government-generated information in the physical sciences and engineering, comparable to similar centers in agriculture and health research.

Information is supplied largely through two regular services. One is the "Fast Announcement Service" designed to inform industry promptly of new Government Research and Development reports determined by NBS scientists and engineers to be of special significance to industry.

The other service is a "package" program for the retrospective presentation of Government R&D. Under this program, technical information contained in selected Government re-

INVENTORY CONTROL keeps records of reports and orders for more than 70,000 new titles each year, some of which are shown above in the receiving area where they begin their journey through the Clearinghouse process system.

search reports is examined, reviewed, and is "packaged" for industry use.

The resulting packages are distributed to local groups, such as universities, technical assistance organizations, state and regional economic agencies, professional technical consultants, and others. The packages consist of selected abstracts, indexes, literature reviews, and other information aimed at specific industrial needs —e.g. metal working, textiles, chemical processing.

Typical of local organizations now participating in the new Federal technology program are Associated Industries of Georgia; Tennessee Industrial Research Advisory Service; Pennsylvania Department of Commerce; Connecticut, Pennsylvania, and Tennessee Manufacturers Associations; Pennsylvania State University; Mellon Institute; North Carolina State College, and the University of Tennessee.

While both of the services are distributed by local organizations in many states, any company or individual can obtain the services directly from the Clearinghouse.

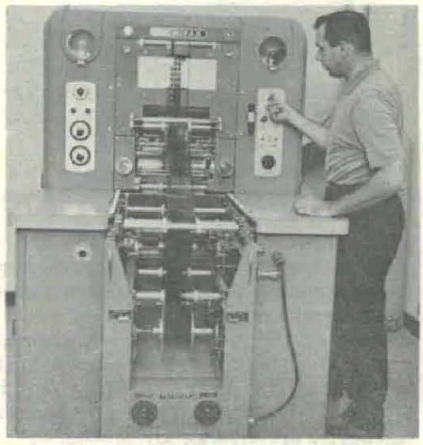
Beginning in July 1965, the Clearinghouse will act as a point of public contact for information on current Government - supported unclassified R&D work in progress. The aim is to help the industrial and technical community avoid duplication of technical work in the physical sciences, engineering, and related technology, by announcing who is doing what in Government research.

The Science Information Exchange (SIE) of the Smithsonian Institution is cooperating with the Clearinghouse in this effort. The SIE will notify the Clearinghouse of new research projects, which are then cataloged and made available to the public. The Clearinghouse will also negotiate directly with other Federal agencies with R&D programs to obtain reports on current development projects not furnished SIE.

This service will offer listings by project, title, performing organization, principal investigators, term of contract or grant, and descriptive terms for the new research reported. The file created through input of current research will also be used in general Clearinghouse reference services on inquiries in specific areas.

The Clearinghouse has also broadened its literature-searching service to include unclassified research reports on defense, atomic energy, space and other agency projects, as well as technical translations and information on Government-owned patents.

TANDEM OFFSET PRESSES, with automatic sorters attached, print both sides of a page simultaneously and collate in the same operation.



MICROFICHE (sheet form of microphotography) is rapidly duplicated in a continuous role on the Clearinghouse diazo film-processing machine.

This service is operated by the Clearinghouse in cooperation with Departments of Defense, Agriculture, Interior, and the Science and Technology Division of the Library of Congress.

The program provides a fast and economical method by which a large segment of the public with special, often urgent, needs for research information can tap these four major Government literature resources.

It offers "tailor-made" bibliographies suited to day-to-day as well as long-range information requirements of scientists, engineers, and technical administrators. Steps are also underway to make available the literature resources and specialized information services of other Government agencies.

The literature-searching provides both "current awareness" bibliographies for keeping subscribers abreast of new developments in their fields of interest on a periodic basis, and "retrospective" bibliographies listing literature available on a subject at the time a request is made.

Beginning this month, the Clearinghouse will issue a monthly consolidated index to Government-sponsored technical literature, consisting of the standard points of access to report literature—subject, author, source, and report number indexes.

The index will be made up from machinable document records prepared by the Atomic Energy Commission, National Aeronautics and Space Administration, Department of Defense, and the Clearinghouse for their own document announcement journals, avoiding duplication of data preparation.

The Clearinghouse also is setting up a master file of sources of information in the physical sciences and engineering, whereby inquirers will be referred to both Government-sponsored centers and private industry sources most likely to have in the information on a given subject.

Further information regarding activities of the Clearinghouse for Federal Scientific and Technical Information should be addressed to Clearinghouse, U.S. Department of Commerce, Springfield, Va. 22151.

Army Retiree Gets $40,000 Post

Maj Gen Rush B. Lincoln, Jr., 54, former Chief of Army Transportation and head of the traffic management service of the Department of Defense for the past 18 months, joined the Massachusetts Bay Transportation Authority in February as general manager at $40,000 a year.

DIAC Discusses DoD Procurement, Contract Costs, Policies

The Defense Industry Advisory Council (DIAC) held its ninth meeting Jan. 29-30 at the Pentagon, Washington, D.C. Discussion covered Department of Defense policies and practices related to procurement, contract costs, independent technical efforts and military exports.

Established May 23, 1962, the Council provides a direct and immediate contact between the Secretary of Defense and his principal management assistants and representatives of industry.

Cyrus R. Vance, Deputy Secretary of Defense, is chairman of DIAC and Paul R. Ignatius, Assistant Secretary of Defense (Installations and Logistics) is alternate chairman. Dr. Ruben F. Mettler, of Thompson-Ramo-Woolridge Space Technology Laboratories, is industry vice chairman. Samuel W. Crosby, Assistant to the Deputy Secretary of Defense, is DIAC executive secretary.

A preliminary draft of a directive designed to establish more effective policies and procedures in the selection of contractors was read at the meeting and sent to the Military Departments for review. Issuance of the directive is expected this month.

The most discussed item on the agenda was a subcommittee report on CITE—Contractor Independent Technical Effort. Included in the report are results of the Logistics Management Institute survey, Bureau of the Budget interest, work of the Tri-Industry Association Committee on CITE and the relationship of CWAS (Contractor Weighted Average Share) to CITE.

Before CITE can be worked into Armed Services Procurement Regulations (ASPR), present differences must be resolved. They involve the ratio of a contractor's independent technical effort, that which is performed under contract, and the relative sharing of costs. It is anticipated that six weeks to three months of further work will be required before a CITE policy can become part of ASPR.

A working group established by industry to develop a new concept for cost principles policy—allowable and unallowable costs in Government contracts—reported that questions still to be resolved include allowability and the definition of cost principles reasonableness.

Another working group made a progress report on the role of the audit function in procurement. The group hopes to work out procedures for centralized management of contracts and uniform field contract activity for the newly created Defense Contract Audit Agency within the next month or two.

A reporting system relating to competition between subcontractors as promoted by the prime contractor will be of valuable assistance to management of the prime contracting firm, rather than just another burdensome reporting system.

This opinion of a DIAC working group was reported after studying a pilot test of the plan by the Air Force. It was indicated that good advanced planning and procurement and increased competition among subcontractors will further cost reduction.

The effects of interest cost on the leasing of facilities was reported by a DIAC working group appointed at the Council's eighth meeting, Sept. 11-12, 1964. It was decided that the concept was part of the policy of unallowable costs, which still must be resolved.

The group reported that if interest is not an allowable cost in Government contracts, it would have a big impact on leasing. Important factors involved in the basic question of "Lease or buy?" still must be studied, the working group indicated.

A DoD in-house study on policies and practices in the utilization of contract support services should be completed by the end of March, another working group reported.

Details are being worked out to establish a new Joint Industry-Defense Training Program in addition to present programs. The objective of the training program would be to pave the way for new policies before they are initiated so that Defense-industry relationships in light of new policies like CWAS will function smoothly. It would be an "informed quick-reaction training," one Department of Defense official said.

A very brief report on progress of the Department of Defense Economic Impact Project was made by Dr. Eu-

Maryland Businessmen Honor CRDL Scientist

Dr. Edward H. Polley of the U.S. Army Chemical Research and Development Laboratories (CRDL) was honored recently by the Federal Business Association of Maryland for his scientific contributions in neurophysiology and neuropharmacology.

Chief of the Neurology Branch of the Laboratories' Directorate of Medical Research, Dr. Polley was named first runner-up for the title "Federal Civil Servant of the Year" in Maryland in the scientific field. First place went to Mr. William G. Fink, an electronics engineer at the National Security Agency, Fort George G. Meade.

Presentation of the awards was made by Eugene A. Curry, chairman of the Federal Business Association of Maryland, at a banquet at the Park Plaza Hotel in Baltimore.

"Dr. Polley," the citation stated, "through his superior performance, leadership and scientific contributions, has made possible the accomplishment of the mission of the Experimental Medicine Division of the U.S. Army CRDL and has contributed materially to the scientific knowledge in the field of neurophysiology and neuropharmacology."

Second runner-up for the scientific award was Dr. Walenty Nyka, a research physician at the Veterans Administration Hospital in Baltimore.

Final selection of the award winners was made by a committee composed of United States Senator Joseph D. Tydings, Mayor Theodore R. McKeldin of Baltimore, and L. Mercer Smith, vice president of the Chesapeake and Potomac Telephone Co.

A native of Chicago, Dr. Polley received a bachelor's degree from DePauw University in 1947, and a master's degree from St. Louis University in 1949. He earned his Ph. D. as a graduate Fellow in anatomy at St. Louis University in 1951 and later completed a post-doctoral fellowship in neuroanatomy and neurophysiology at Washington University in St. Louis.

Prior to joining the Army CRDL in 1959, he was an assistant professor of anatomy at Hahnemann Medical College in Philadelphia and an officer in the U.S. Navy.

While employed at the Army Laboratories, he taught histology at the Edgewood Arsenal extension Branch of the University of Maryland.

Dr. Edward H. Polley

gene G. Fubini, chairman of the working group and the Assistant Secretary of Defense (Deputy Director, Research and Engineering). Further details are expected at the May meeting of the Council.

A report on the second phase of the Study of Structure and Dynamics of the Research and Development Industry was cancelled from the agenda until the May meeting.

Another working group has been trying to develop ways Government can further deal with industry, particularly industrial associations, to isolate, identify and resolve what industry people claim are conflicts in AFSR. More groups such as DIAC are needed to discuss new policies in the formulation stage, it was stated.

Last on the agenda was a report on military exports and the work of the United States Defense-Industry Export Advisory Group in Europe. It was estimated that 46 percent of all military exports will be offset with military sales this year—an important factor in halting the drain on U.S. gold reserves, a Defense official indicated.

New Testing Device Checks Missile for Go, No Go

To insure that a missile will fly when the firing button is pushed, two scientists of the U.S. Army Missile Command's Directorate of Research and Development, Redstone Arsenal, Ala., recently invented a pulse energy discriminator.

James B. Wright and J. Darryl Holder, both electrical engineers with the Army Inertial Guidance and Control Laboratory, said that their invention's most outstanding feature is its ability to test accurately the status of the missile's firing system.

This system consists of firing units and pulse cables that connect the units to the ordnance items. These consist of rocket motor igniters, explosive bolts for stage separation and sectors for motor shutoff.

Methods previously available for testing circuits were crude and it was impossible to ascertain that the circuit was in perfect firing order even after the test was completed, the scientists explained. Dead circuits could be spotted without difficulty, but other malfunctions could remain undetected and cause an abortive firing.

For purposes of safety and reliability, a special type of electrical impulse is required to fire a missile. In the firing sequence, voltage is fed into the firing circut, which ionizes a spark gap in the ordnance item to make it a good conductor of current. At the instant the spark gap becomes a conductor, the voltage and current combine in a surge of power that explodes the item's bridgewire.

Older test methods might indicate a "go" condition when the voltage peak was too low for firing, or when the voltage-current peak was of too short a duration.

The Wright-Holder test system uses a spark gap which simulates the one used in the ordnance item, so that electrical patterns required to operate the test system behave in the same way. As an indication of output of the firing circuit, the system uses a fuse similar to the ones in automobiles. If the test fuse is blown, missile engineers know they have sufficient power in the proper pattern to result in proper firing.

Holder said that the new system may use dials or lights to indicate a go or no-go condition. With only a few modifications, the test device will be used to check the various electronic commands which are fed into the firing circuit, such as safing, arming and firing commands.

Holder said the test unit could be used for any missile system using the exploding bridgewire principle, or any system using a high-voltage surge of power for operation.

Wright is a veteran of 11 years with the Missile Command, all spent in the research and development of various electrical systems for the Army's missiles. He received a B.S. degree in mathematics and physics from the University of Southern Mississippi in 1950.

Holder joined the Missile Command in 1962, after receiving a B.S. degree in electrical engineering from Auburn University in 1961.

INVENTORS James B. Wright (left) and J. Darryl Holder of the U.S. Army Missile Command explain pulse energy discriminator which checks out missile system firing circuits.

Scientific Calendar

Space Vehicle Reliability Seminar, sponsored by IEEE, Los Angeles, Calif., Apr. 2.

Oil and Gas Power Conference and Exhibit, sponsored by ASME, Houston, Tex., Apr. 4-8.

National Meeting of the American Chemical Society, Detroit, Mich., Apr. 4-9.

Rubber and Plastics Industries Conference, sponsored by IEEE, Akron, Ohio, Apr. 5-6.

6th Structures and Materials Conference, sponsored by AIAA, Palm Springs, Calif., Apr. 5-7.

2nd Conference on Laser Technology, sponsored by ARPA, ONR, USA and USAF, Chicago, Ill., Apr. 6-8.

Cleveland Electronics Conference, sponsored by Cleveland Electronics Conference, Inc., IEEE, Case Institute of Technology, Instrument Society of America and Cleveland Physics Society, Cleveland, Ohio, Apr. 6-8.

Conference on Impact of Batch-Fabrication on Future Computers, sponsored by IEEE, Los Angeles, Calif., Apr. 6-8.

Western Electrical Exposition and Electrical Maintenance Conference, sponsored by the Electrical Maintenance Engineers Assn. of Calif., Los Angeles, Calif., Apr. 6-9.

Region 3 Meeting of the Institute of Electrical and Electronics Engineers, Winston-Salem, N.C., Apr. 7-9.

Organic Crystal Symposium, sponsored by ONR, Chicago, Ill., Apr. 12-14.

Annual Meeting of Region 6 of the Institute of Electrical Electronics Engineers, Las Vegas, Nev., Apr. 13-15.

Telemetering National Conference, sponsored by IEEE, ISA and AIAA, Houston, Tex., Apr. 13-15.

Electronics and Instrumentation Conference and Exhibit, sponsored by IEEE and ISA, Cincinnati, Ohio, Apr. 14-15.

Conference on Thin Film Active Devices, sponsored by USA, USAF, USN, Johns Hopkins University and IEEE, Baltimore, Md., Apr. 14-15.

1st International Conference on Programing and Control, sponsored by AFOSR, University of California and Frank J. Seiler Research Laboratory, Colorado Springs, Colo., Apr. 15-16.

High-Power Microwaves Symposium, sponsored by USA Electronics Command, Advisory Group on Electron Devices and ODDR&E, Fort Monmouth, N.J., Apr. 19-20.

International Conference on the Mechanics and Physics of Solid Propellants, sponsored by ONR, Lafayette, Ind., Apr. 19-21.

3rd National Biomedical Science Instrumentation Symposium, sponsored by ISA, Dallas, Tex., Apr. 19-21.

10th Annual Data Processing Conference, Birmingham, Ala., Apr. 20-21.

19th Annual Frequency Control Symposium, sponsored by USA Electronics Laboratories, Atlantic City, N.J., Apr. 20-22.

International Symposium on System Theory, sponsored by Polytechnic Institute of Brooklyn, AFOSR, ONR, USARO, Society for Industrial and Applied Mathematics and IEEE, N.Y.C., Apr. 20-22.

Southwestern Institute of Electrical and Electronics Engineers, Dallas, Tex., Apr. 21-23.

Flight Support Conference, sponsored by AIAA and AF Systems Command, Wright Patterson AF Base, Ohio, Apr. 21-23.

6th Symposium on Engineering Aspects of Magnetohydrodynamics, sponsored by ASME, University of Pittsburgh, Carnegie Institute of Technology and IEEE, Pittsburgh, Pa., Apr. 21-23.

11th Annual Institute of Environmental Sciences Technical Meeting and Equipment Exposition, Chicago, Ill., Apr. 21-23.

International Conference on Nonlinear Magnetics, Washington, D.C., Apr. 21-23.

Quality Control as Applied to Plastics, sponsored by the Society of Plastics Engineers, Binghamton, N.Y., Apr. 22.

Symposium on Error in Digital Computation, sponsored by the Mathematics Research Center, USA and University of Wisconsin, Madison, Wis., Apr. 26-28.

4th Symposium on Advanced Propulsion Concepts, sponsored by AFOSR and the United Aircraft Corp., Palo Alto, Calif., Apr. 26-28.

National Meeting on Fast Reactor Technology, sponsored by the American Nuclear Society, Detroit, Mich., Apr. 26-28.

Hot-Cycle Helicopter Passes Flight Tests

Plans for an operational heavy life rotorcraft equipped with a hot-cycle pressure jet propulsion system are under way, following the recent successful test flight of an XV-9A helicopter.

The experimental XV-9A hot-cycle pressure jet is one of several advanced rotorcraft concepts being studied and evaluated by the U.S. Army Transportation Research Command (USATRECOM), Fort Eustis, Va.

Although the XV-9A has no operational capability, the knowledge derived by the Army from the tests is expected to be applied to future design studies that could lead to development of a heavy-lift helicopter capable of transporting equipment which cannot be carried by current aircraft.

The hot-cycle pressure-jet system eliminates requirements for heavy gear boxes, complex mechanical drive components and an anti-torque tail rotor. Aircraft based on this concept can carry loads greater than the empty weight of the aircraft, while current operational helicopters have a useful load equivalent to the empty weight of the aircraft.

The unique propulsion system is powered by diverting high-energy gases from two turbojet engines through the rotor blades and exhausted out the blade tips. Conventional helicopters are powered by drive shafts similar to those on automobiles and are heavier than the pneumatic system on the hot cycle.

XV-9A hot-cycle pressure jet helicopter

The XV-9A test demonstration was made at the Hughes Tool Co. plant in Culver City, Calif. Earlier tests of the concept were completed in 1962 with a successful whirl test of a hot-cycle-powered rotor funded by the Army, Navy, Air Force and Hughes.

E-Command Assigns Projects Under Commodity Management

The BA-398 Vest-Type Dry Battery and the KS-57 Camera System recently became the first two electronic commodities to be placed under the Commodity Management Master Plan (CMMP) by the U.S. Army Electronics Command at Fort Monmouth, N.J.

A CMMP is a document scheduling the activities of all elements of the Electronics Command to assure the release of important electronic and auxiliary equipment at the right time and in the right quantity to troops anywhere in the world.

In signing letters of implementation for the battery and camera system, Maj Gen F. W. Moorman, commanding the U.S. Army Electronics Command, started the first two of approximately 150 CMMPs that will be developed eventually by the Command.

The vest-dry battery uses body heat to maintain operating temperatures of power sources for man-pack radios under Arctic conditions. The KS-57 System is a sophisticated airborne photo surveillance system using two interchangeable cameras, automatic processing and electronic scanning for radio transmission of pictures to ground bases.

STRATCOM-CONUS Relocates Headquarters

The U.S. Army Strategic Communications Command Continental U.S. headquarters was recently relocated from the Munitions Building, Washington, D.C., to nearby Suitland, Md.

One of five major subordinate commands in USASCC, STRATCOM-CONUS has a personnel strength of nearly 2,600 military and civilian communications technicians who operate and maintain 16 Army components.

Some 175 of the total personnel strength are quartered throughout a 9-building complex at the Suitland site, formerly occupied by an Army Air Defense Command post.

Total plant value of STRATCOM's U.S. facilities, under the command of Maj Gen Richard J. Meyer, approximates $100 million. Col John N. Medinger, commanding officer of STRATCOM-CONUS, said the recent move was taken in the interest of economy and more efficient operations.

USASCC-CONUS provides the majority of long distance record communications required by the Department of the Army within the continental U.S. and to and from overseas. A large portion of the communications support for the Joint Chiefs of Staff, the Defense Department, Department of State and other Government agencies is provided by the Command.

Additionally, CONUS personnel and facilities provide electronic and teletypewriter support for 39 other activities located in the Pentagon and scattered throughout the Military District of Washington.

Personnel of two CONUS detachments are located at fixed communications satellite ground terminal stations. The units are Detachment 10, at Fort Dix, N.J., and Detachment 11, at Camp Roberts, Calif.

Other field units include Detachment 1 (the East Coast radio transmitter station) at Woodbridge, Va.; Detachment 2 (the East Coast Relay station) at Fort Detrick, Md.; Detachment 3 (the East Coast radio receiving station) at La Plata, Md., and Detachment 4 (the South East Relay) at Fort Bragg, N.C.

Detachment 6 (the Mid West Relay) is located at Fort Leavenworth, Kans. Detachment 7 (the West Coast Relay) is located at Davis, Calif., with Detachment 8 (the Northwest Relay) at Lynnwood, Wash. Carlisle Barracks, Pa., is the home of Detachment 12, where a communications center is operated.

The East Coast Relay station at Fort Detrick is the largest and most advanced relay center of its type in the world. It is the net control station for the worldwide strategic Army communication network.

The Department of Army Communications Center in the Pentagon, two communications Security Regional Issuing Offices at Sacramento, Calif., and Lexington, Ky., are other key CONUS operations.

Serving under Col Medinger at Suitland as deputy commander for Operations is Lt Col S. S. Ashton, Jr. The deputy commander for Support is Lt Col James F. Thornley; 1st Lt Michael J. Cronin is the installation commander and CO of headquarters and Headquarters Company at the Suitland site.

USAEPG Contract Heads $96.5 Million Army Total

A $17,903,185 contract for operation, maintenance and development of the U.S. Army Electronic Proving Ground's Field Test Facilities at Fort Huachuca, Yuma and Gila Bend, Ariz., was awarded Feb. 17 to Textron's Bell-Aerosystems, Corp.

The facilities are involved with the investigation of electromagnetic interference in Army communications and other electronic systems. Manned and unmanned U.S. Army surveillance aircraft are tested at the Yuma systems test facility, which will be operated by a subcontractor, Dyne Lectronics Corp., Washington, D.C.

U.S. Army contracts in recent weeks, of which the one to Bell-Aerosystems was the largest, totaled $96.5 million.

Global Associates, Oakland, Calif., received a $17,334,517 modification to an existing contract for support services at the Kwajalein Test Site, Pacific.

Harvey Aluminum Co., Inc., Torrance, Calif., was issued two contracts totaling $12,347,761 for loading, assembling and packing of various types of ammunition and for a classified quantity of supplementary hardware for use with the 8-inch projectile.

Sylvania Electronic Systems, Sylvania Electric Products, Inc., Needham Heights, Mass., was awarded a $7,500,000 modification for classified electronic equipment.

Canadian Commercial Corp., Ottawa, Canada, received two contracts totaling $7,062,368 for lightweight airborne Doppler Navigation sets for Mohawk aircraft and for fabrication of five experimental Army gas turbines. Hercules Powder Co., Wilmington, Del., was awarded a $6,638,-864 contract for loading, assembling and packing of miscellaneous propellants, including Honest John, Little John and Nike boosters.

General Dynamics/Pomona division of General Dynamics Corp., Pomona, Calif., received a $3,522,518 contract for three months continuation and completion of the Feasibility Validation Program of the Mauler weapon system. Sperry Rand Corp., New York, N.Y., will load, assemble and pack various types of ammunition for $3,537,148.

Chamberlain Corp., Scranton, Pa., was awarded a $3,518,719 contract for 8-inch projectiles. Bell Helicopter Co., a division of Bell Aerospace Corp., Fort Worth, Tex., was issued a $3,469,510 agreement (Navy funds) for UH-1E helicopters. Scovill Manufacturing Co., Waterbury, Conn., received a $2,257,685 modification for metal parts for bombs.

Collins Radio Co., Richardson, Tex., was issued a $2,125,000 contract for radio terminal sets, AN/TRC-80. Hesse Eastern Division, Norris Thermador Corp., Everett, Mass., will produce 105 mm. projectiles for $1,735,696.

Teledyne Systems Corp., Los Angeles, Calif., was awarded a $1,708,-520 contract for AN/ARC-73 radio sets. Belock Instrument Co., College Point, Long Island, N.Y., received two contracts totaling $1,311,000 for manufacture of Hawk simulator stations to train personnel in firing the ground-to-air missile.

Butler Manufacturing Co., Minneapolis, Minn., was issued a $1,257,564 contract for 101 4-wheel semitrailer tanks. Instruments for Industry, Inc. (a small business firm), Hicksville, N.Y., was awarded a $1,089,-197 agreement for Electronic Countermeasure sets (AN/MLQ-26) with ancillary items and repair parts.

General Motors Corp., Cleveland, Ohio, received a $1,085,000 modification to an existing contract for vehicle engineering services for the M109 self-propelled howitzer, with 155 mm. gun. Esso Research and Engineering Co., Linden, N.J., received a $1,082,511 (Advanced Research Projects Agency funds) contract for continuation of a research program leading to development of hydrocarbon air fuel cell batteries.

MARSH SCREW AMPHIBIAN is tested in mud and water by the U.S. Army General Equipment Test Activity, Fort Lee, Va. The experimental 2,300-pound vehicle is driven by rotation of two pontoons with spiral blades that cause forward or reverse motion. Sideways travel also can be performed by disengaging one pontoon and rotating the other. Developed by Chrysler Corp., the vehicle can transport cargo or personnel through water, swamps, rice paddies, sand beaches or snow. The vehicle can travel at 8 m.p.h. in water.

Army Develops Instrument To Speed Map Compilation

A new instrument that automatically marks and measures common points in overlapping aerial photographs is under development by the U.S. Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency (GIMRADA), Fort Belvoir, Va.

Essentially an electronic device for observing points on aerial photographs stereoscopically, the automatic instrument eliminates the need for human judgment in the selection of common points on photos made during succeeding passes of an aircraft. It also performs more rapidly than standard manually operated instruments now in use.

In operation, the new instrument matches small photographic image areas electronically, marks the selected image points on each photograph by means of a heated die, and measures and records the rectilinear coordinates of the points. The marked and measured points can then be identified rapidly and accurately for use in the map compilation operation.

The instrument consists of an operator's console with reference scanner, a 3-unit electronic rack, two comparator units and a Flexowriter readout device. The console contains all the controls necessary to operate the instrument.

The model was built by Link Division of General Precision, Inc., under contract with GIMRADA.

Relationships of Environmental Research and Testing

By Dr. L. W. Trueblood, Chief, Regional Branch
Environmental Sciences Division, U.S. Army Research Office

Research in Review...

DR. LESTER W. TRUEBLOOD, chief, Regional Branch, USARO, since 1959 . . . B.S. degree, Indiana State Teachers College, M.A., Ph. D., geography and international affairs, Clark (Mass.) University . . . lecturer in geography and head of department, Judson College, University of Rangoon, Burma . . . geography consultant, Secretary of War, 1942 . . . research specialist, G-2, S.E. Asia . . . progressive assignments with Army Map Service, Army Corps of Engineers, 1950-59 . . . member various geographical societies.

An executive in one of our large corporations once said, in a lecture on management, that "all decisions and actions, whether we realize it or not, spring from a theory." Even though the decision-maker may never have put his theory into words, it was explained, he nevertheless has one in the back of his mind which guides the decision.

The theme of this article is that, because the relationships between environmental research and environmental testing are complex, both on the management side and the technical side, it is vital that these two research and development activities have a common theory as a basis for working more closely together.

Such a theory might be that each activity is working on a separate facet of the same job. Benefits would accrue to the total R&D environmental program if systematic procedures were worked out whereby research elements were able to review representative environmental test plans and test performance reports; also, if development and test elements were brought more closely into the planning of research and into the potential uses of the research results at an early date.

An article in *Missiles and Rockets*, Mar. 30, 1964, by an editorial task force under the direction of the Military Editor, states that the Office of the Director of Defense Research and Engineering (ODDR&E) is attempting to document the part that research plays in the development of weapons and equipment, by tracing back from the piece of equipment to the research findings which made it possible. Closer working relations between research and development and test personnel through the development cycle could be an effective method, and perhaps even the primary method, of such documentation.

One of the most fundamental needs of the Army is to have available a thorough knowledge of the physical and cultural environment in all parts of the world. Some of this area knowledge is acquired by intelligence agencies, some by research foundations and universities, some by industry, and some by research effort of Government R&D elements.

Characteristic of much of the area analysis and environmental research by intelligence agencies, research foundations and universities is that results are presented as qualitative description, and in the case of the intelligence agencies must cover every country in the world.

Area research by Government R&D agencies focuses upon a few selected regions typical of conditions over extensive areas and goes into greater detail, particularly in quantitative terms.

Measurements of environmental factors are required in R&D as a basis for the design and modification of equipment. Consequently types and methods of measurement are emphasized. Regarding climatic factors, it is necessary to know not only the magnitude or nature of the factor (or combination of factors), but also the frequency of occurrence, and the duration before accurate guidance to the design and test engineers can be provided.

Considerable work has been done on the distribution and occurrence of temperatures in extreme regions, but unfortunately the areas of extremes are the areas where we have fewest observations. Other climatic factors are even less well known.

Research on terrain is proceeding but the heterogeneity of ground conditions has thus far prevented the generalization of masses of collected data into a framework of criteria readily usable by design and test engineers. We have check lists of important terrain factors, such as percent of slope, soil conditions, size and density of trees. We also have developed analytical techniques. But we do not have suitable tables of critical measurements required for design and testing for the various terrain types in the world.

Environmental factors, like human factors, impinge upon every facet of Army activities. The diversity of environments on the earth's surface is so great that extended research effort must be made to understand their nature, as a guide to design and development of materiel and techniques to meet the stresses they impose. Even though there is great diversity in environment, it is possible to select a relatively few major regional types which are sufficiently homogeneous throughout to serve as a world frame work of materiel design regions.

According to the Department of Defense definition, research "includes all effort directed toward increased knowledge of the natural environment and efforts directed toward the solution of problems in the physical, behavioral and life sciences that have no clear direct military application. It would include all basic research and that applied research directed toward expansion of knowledge in various scentific areas."

For the purpose of this discussion, some exploratory development must be included since this covers "all effort directed toward the solution of specific military problems, short of major development projects. This type of effort may vary from fairly fundamental applied research to quite sophisticated breadboard hardware, study, programing and planning efforts."

In addition to the division of effort described as research and exploratory development, environmental research is conducted in two distinctly different ways. Some of the effort is focused on the subject fields, such as

meteorology, geology, seismology and earth physics. Effort focused on the total environment of extreme regions attempts to evaluate the interrelated effects of all the environmental factors associated in a region. Some of the research in the regional field and in the scientific disciplines involves laboratory work. Much of it, depending upon the scale of the investigation, requires the outdoors as the laboratory.

When the environmental criteria necessary for design and test of materiel are determined for the extreme regions, the next step is to translate more accurately the environmental data into sound engineering specifications for design. Along with this is the requirement to insure that environmental tests are scientifically valid; also, that the test results are properly utilized (recorded, analyzed, distributed and applied) in research and development.

Thus there is a distinct field of environmental engineering, fitting logically between environmental research and exploratory development on the one hand and environmental testing on the other, that bridges the gap between them. The job of the research man is to investigate ideas or problems in one or more of the scientific disciplines within the earth sciences or in the association of environmental factors in a region. The job of the environmental engineer is to work toward the effective application of environmental data to design and testing.

Another potential area for work by the environmental engineer is to relate the natural physical environments on the earth's surface to the many facets of induced environments, i.e., man-made or equipment-made environments. It is well to emphasize that though the factors of induced environments are of a different order than those of the natural environment, they are of the same general type.

Much of the present environmental engineering is concerned with induced environments and with laboratory and chamber testing. Generally the environmental engineers and the scientists concerned with study of the physical environment do not speak the same technical language. This situation can and should be improved. It is highly desirable that individuals trained in the environmental sciences give more attention to the engineering aspects of design and testing; it is equally desirable that those engaged in environmental engineering pay more heed to physical and cultural environment and to field testing.

To increase the effectiveness of the total R&D effort in the environmental area, it is important that there be a systematic feedback of test performance results to the research personnel. Analysis of test performance reports by research personnel could produce a gold mine of results in tieing research and development more closely together. It could make research more directly applicable to Army problems. It could make design and testing better able to use research results.

Environment tests are an integral part of all the standard tests—engineer design, engineering, service and troop tests. Army Regulation 70-10, Army Materiel Testing, states that type classification should not normally be delayed for tests in extreme environments unless the item is to be used exclusively in an extreme environment. Only limited production should be accomplished prior to completion of environmental tests at sites representative of all areas of intended use.

The fact that environmental tests are involved in all the various types of tests has considerable import to the research elements of R&D. First, there is the problem of choosing test sites. They must be selected carefully to insure that they have climatic and terrain conditions representative of large regional types.

For instance, are the environmental conditions at Fort Greely and Fort Wainwright sufficiently severe to be representative of the cold regions in which the Army might have to mount sizeable operations. Even when conditions of representative severity do occur, do they occur with sufficient regularity to insure that materiel can be tested in a given test season against those conditions?

Similarly, is the Yuma Proving Ground sufficiently represenative of desert areas of the world? Does the Panama Test Center adequately represent the humid tropics? These are questions which have to be answered by research.

The question of the scientific validity of the environmental test comes second. This involves selection of environmental factors to test against, the time of the test, whether or not the conditions of terrain and weather are sufficiently extreme, and an interpretation of the environmental causes of failure.

Environmental testing is done in laboratories, in test chambers, and in the field. Tests of components and initial tests of end items may and should be made in laboratories or chambers. The final tests, both engineering and service, must be done in the field.

Economies can be effected by testing in chambers against single environmental factors, such as temperature, and even against a combination of several factors. It is not possible now, nor will it be in the foreseeable future, to stimulate the entire complex of environmental conditions.

Simulation techniques are being improved but some major problems are unsolved: simulating the combined effects of weather conditions in their diurnal and seasonal variations, and in the non-periodic variations of meteorological parameters, and the combination of weather and terrain conditions.

Much emphasis is being placed upon combining engineering and service tests. Tests have been reported generally successful. Problems are associated with such combining, one being the tendency to make one report for both tests. Actually these tests are sufficiently different to warrant separate reports.

Engineering tests are performed by the developing agency, using highly trained personnel familiar with the item. Service tests are performed by testing specialists who are well trained but less familiar with the item than the engineers doing the engineering test. Troop tests are conducted by operator personnel and are a necessary part of the testing program but do not test against carefully measured environmental criteria.

Another problem is the scheduling of the engineering and service tests in the period when conditions are severe enough to give a valid test for the regional type. Generally, it is feasible to combine only the final tests and end items since the environmental part of the tests must be done at Fort Greely, Yuma Proving Ground, or Fort Clayton. It is not economical to ship items to these places for initial or intermediate tests.

Relations between environmental research and environmental testing, it was stated at the outset, have both management and technical aspects. One of the major problems of management in an R&D program is to weld the research, development, test and evaluation efforts closely together. Often the separate organizational elements for these efforts are doing an excellent job in their own field, but care must be given to close integration if the total RDT&E effort is to achieve the maximum.

(Continued on page 29)

ARMY FLAME PROGRAM PARTICIPANTS (left to right, seated) Dr. Max Anlicker, Stanford University; Wilbur S. Hinman, Stafford, Va.; Dr. Hoyt Hottel, MIT; Dr. Antonio Ferri, NYU; Dr. Ralph Gibson, Johns Hopkins University; Dr. John W. Dawson, ARO-D; Dr. Paul Gross, Duke University; Dr. Peter Debye, Cornell University; Dr. Henry Eyring, University of Utah; Dr. John D. Ferry, University of Wisconsin; Dr. Dietmar Seyferth, MIT; Dr. Charles Harman, Duke University; Dr. John J. Grebe, Dow Chemical Co. Standing, l. to r., Martin Delao, Buehler Corp.; Col William G. Willmann, CRDL commanding officer; Dr. Seymore D. Silver, CRDL technical director; George Somerville, Southwest Research Institute.

Top Civilian Scientists Meet to Aid Flame Program

A group of the Nation's foremost scientific and engineering authorities met recently with Army officials at the U.S. Army Edgewood Arsenal (Md.) Chemical R&D Laboratories (CRDL) in an effort to advance the Laboratories' flame program.

Members of the group, each an expert in a particular field of chemistry, engineering or physics, examined the Laboratories' research and development efforts encompassing flame throwers, fire bombs and other incendiary items and materials.

Held under the joint auspices of the Army Research Office, Durham (ARO-D), N.C., and the Chemical R&D Laboratories, the meeting was attended by Nobel Prize winners Dr. Peter Debye and Dr. Henry Eyring and former Deputy Assistant Secretary of the Army (R&D) Wilbur S. Hinman.

Dr. Paul Gross of the Department of Chemistry at Duke University served as chairman. Dr. Gross, who is also a member of the U.S. Army Munitions Command Advisory Council, and Saul Hormats, the Laboratories' director of Special Projects, originated the plan for the "brainstorming" meeting.

Recommendations of the participants for possible new avenues of research and development were forwarded to the U.S. Army Munitions Command for study and possible implementation.

Technical Information Briefings Held at Redstone

The Defense Documentation Center (DDC) and the Redstone Scientific Information Center (RSIC) have presented a series of briefings on technical documents available to Government agencies and their contractors at Redstone Arsenal, Ala.

Spanning a 4-day period (Feb. 8-11), the 1½-hour briefings were given at the Huntsville City Utilities Building, Brown Engineering Co., Chrysler Corp., Boeing Co., Lockheed Co., the IBM Corp. and Wyle Laboratories, as well as at the Arsenal.

Slanted to information librarians and technical personnel involved in testing, design, development, specification writing, contract preparation and technical procurement, the briefings were given by Lt Col Ray Dinsmore, Army liaison officer for DDC; John M. Berry, chief of DDC Field Services; and James P. Clark, chief of Reader Services at DDC.

The DDC is the central depository of the Department of Defense for research and development reports. The RSIC is jointly funded by the Army Missile Command and the Marshall Space Flight Center, and is administered by the Command's Directorate of Research and Development.

The collection of the DDC contains more than 700,000 scientific and technical reports. A field office collection of this material is maintained by RSIC, which acts as the local agent for DDC in servicing demands in Huntsville and the surrounding area.

Flight Testing Conference Draws Two Missile Command Executives

Two top-level executives of the U.S. Army Missile Command participated in a Flight Testing Conference, sponsored by the American Institute of Aeronautics and Astronautics and the National Aeronautics and Space Administration, at Redstone (Ala.) Arsenal, Feb. 15-17.

Dr. W. W. Carter, chief scientist of the Missile Command, spoke at the luncheon and John L. McDaniel, technical director of the Directorate of Research and Development, chaired the classified session on Methods of Analysis.

Lt Col Lindell Assigned as Chief Of Nuclear Power Field Office

Lt Col Kermit O. Lindell, formerly assistant chief of the Nuclear Power Division, Office of the Chief of Engineers, has been assigned as chief of the Nuclear Power Field Office (NPFO), Fort Belvoir, Va.

NPFO is the Corps of Engineers agency responsible for training nuclear power plant operators and for providing technical engineering support to military power and research reactors.

The SM-1, one of the first reactor plants in the United States to provide power for an electrical grid, is maintained as an NPFO training facility.

A 1944 graduate of the U.S. Military Academy, Col Lindell earned his M.S. in civil engineering from the University of Minnesota in 1953. Experienced in the field of nuclear weapons, he was assigned to the Nuclear Power Division, Office, Chief of Engineers in August 1963, originally as project manager for the Nuclear Powered Energy Depot. In 1953, he served biefly with the Army Nuclear Power Program.

3 Experienced in OCRD Nominated as Generals

Selected for promotion to brigadier general are one officer currently serving with the Office of the Chief of Research and Development and two previously assigned to OCRD.

They are Col Alvin E. Cowan, newly assigned Director of Developments, who served as chief, Plans Division, OCRD, since September 1963; Col John R. Deane, Jr., executive assistant to the Deputy Director of Defense Research and Engineering; and Col George P. Seneff, Jr., commanding officer, 11th Air Assault Aviation Group, 11th Air Assault Division, Fort Benning, Ga.

Col A. E. Cowan

Col J. R. Deane, Jr.

Col G. P. Seneff, Jr.

COL COWAN, who entered the U.S. Army in 1941, is a member of the Atomic Energy Officer Specialist Program. He previously served with OCRD from 1956-59 as chief of the Atomic Division.

He holds B.A. (1950), M.A. (1950), and Ph. D. (1953) degrees in physics from the University of Texas and is a graduate of the Command and General Staff College and War College.

From 1950-51, he was technical operations officer, J. Division, Los Alamos Scientific Laboratory, Los Alamos, N. Mex. and, for the next two years was assigned as chief, Technical Operations Branch, J-3, JTF-7, Operation Castle, Nuclear Weapons Tests, Eniwetok, Bikini.

He was chief of the Weapons Schedule Section, Production Branch, Division of Military Application, U.S. Atomic Energy Commission, Washington, D.C., from 1954-55. After his first OCRD assignment and a year as a student at the Army War College, Col Cowan served as commanding officer of the 2nd Battle Group, 12th U.S. Cavalry, 1st Cavalry Division and from 1961-62 in the Nuclear Branch, J-5, Plans and Policy Directorate, U.S. Army Element, Office of the Joint Chiefs of Staff.

The year before his present assignment, Col Cowan spent as a student at the U.S. Army Aviation School, Fort Rucker, Ala. During World War II, he served in seven campaigns in Africa and Europe, receiving the Silver Star and Bronze Star with Oak Leaf Cluster.

COL DEANE has been in his present assignment since the summer of 1962 except for a period during 1963 when he attended the Harvard School of Business Administration's Advanced Management Program.

He served with OCRD from 1956-58 as chief of Programs and Budget after graduation from the Armed Forces Staff College in 1955. From 1958-59 he attended the National War College, after which he became assistant to the Chief of Staff for Programming at Headquarters, U.S. Army-Europe, Heidelberg, Germany, until February 1961. For the 18 months preceding his present assignment, he was commanding officer, 2nd Battle Group, 6th Infantry in Berlin.

In 1937, Col Deane enlisted in the 16th U.S. Infantry. After one year, he entered the U.S. Military Academy. Upon graduation in 1942, he joined the 104th Infantry Division as a platoon leader. By the end of the war, he had advanced to the position of battalion commander.

Col Deane held the position of Intelligence Officer in Europe from 1945-47, when he returned to Washington to work in the Joint War Plans Division of the Department of Army G-3. After attending the Command and General Staff College, he was assigned to Korea (1952-55) as chief of plans on the Military Armistice Commission.

COL SENEFF served two consecutive duty assignments with the Office of the Chief of Research and Development. From May 1956 to May 1957, he was assigned a assistant chief and later as chief of the Aircraft and Electronics Division. From June 1957 to August 1959, he served as deputy chief of the Aircraft and Electronics Division and chief of the Plans and Requirements Branch.

He previously had served as chief, Officers Section, Distribution Branch, Office, Assistant Chief of Staff, G-1, Washington, D.C. Col Seneff attended the National War College from August 1959 to June 1960. After graduation, he served nearly three years as the Army member, Mutual Weapons Development Team and later as deputy director, Research and Development Division, Office of the Secretary of Defense in Paris before his present assignment.

He holds the Legion of Merit, Bronze Star Medal with Oak Leaf Cluster and the Army Commendation Medal. A veteran of over 24 years of Army service, he is a graduate of the Command and General Staff College and the Army Aviation and Armored Schools.

HDL Paper Earns Gravity Research Foundation Award

"A New Gravity Meter," a paper by Dr. Henry P. Kalmus, chief scientist at the Army Materiel Command's Harry Diamond Laboratories (HDL), was rated among the top five essays for 1964 by the Gravity Research Foundation, New Boston, N.H.

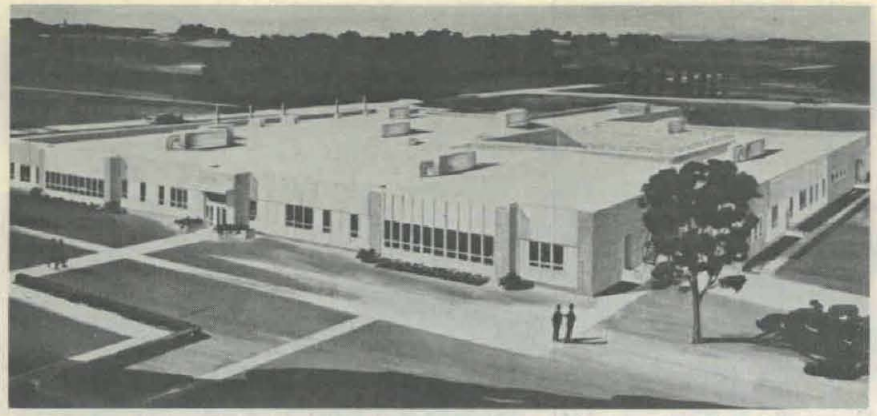
Earning a $100 award, the paper was selected among essays on the gravitational field, submitted from England, Sweden, Austria and Japan, as well as all parts of the U.S.

Chief scientist at HDL since June 1962 (then known as the Diamond Ordnance Fuze Laboratories), Dr. Kalmus was born in Vienna and received early training at the Technical University of Vienna. He served as an engineer with various radio corporations before joining the Ordnance Electronics Division of the National Bureau of Standards in 1948.

He is a member of various scientific and technical societies and organizations, has written many technical papers, and holds more than 30 patents in the field of electronics and applied physics.

Other top gravitational field essay awards announced by the Gravity Research Foundation are: "Negative Mass as a Gravitational Source of Energy in the Quasi-Steller Radio Sources," by Prof. Banesh Hoffman, Queens College, Flushing, N.Y.; "Quantum Theory and Gravity," by Prof. R. Utiyama, Osaka U., Japan.

"The Nature of Sources of a Gravitational Field," by Prof. Ezra T. Newman, University of Pittsburgh; "Detection of Non-Newtonian Gravitational Effects With Quantum Fluids," by Robert L. Forward, Hughes Research Laboratories.



General John R. Wood Laboratory under construction at Edgewood Arsenal.

Work Begins on $3 Million CRDL Laboratory

Ground was broken Feb. 18 for a new $3 million research facility at the U.S. Army Edgewood (Md.) Arsenal Chemical Research and Development Laboratories (CRDL).

Designated the General John R. Wood Laboratory, the new building will provide work areas for 240 persons. When completed in July 1966, the facility will yield added scope to the Army's capabilities in the increasingly important field of clinical research.

Key officials taking part in the groundbreaking ceremonies at the site included:

Brig Gen Joe H. Blumberg, director of the Armed Forces Institute of Pathology; Brig Gen Fred J. Delmore, commanding general of Edgewood Arsenal; Col Tyrone E. Huber, chief of the Life Sciences Division, U.S. Army Research Office; Col William G. Willman, commander of CRDL; Col Joseph P. Blair, director, and Dr. Van M. Sim, deputy director of the Laboratories' Directorate of Medical Research; and Lt Col Vincent J. Perricelli, Jr., representing the Baltimore District Engineer.

The construction contract, in the amount of $3,039,800, was awarded to the Arthur Venneri Co., Washington, D.C. The architectural engineering was performed by Sanders and Thomas, Inc., Philadelphia, Pa.

Col Roy S. Kelley, Baltimore District Engineer, U.S. Army Corps of Engineers, is supervising the construction contract, along with resident engineer Hamilton J. Washburn and the Edgewood Arsenal Director of Engineering and Industrial Services.

"Scientifically planned for scientists, the building will provide facilities for advancing the modern Army's clinical research mission," Col Kelley said.

The one-story masonry building will be basically a rectangular structure 316 feet across the face and 222 feet long, with an addition at the rear of the center line measuring 61 by 51 feet. The total area will be approximately 72,700 square feet.

When completed, the research facility will provide the Army activity with 62 additional mission laboratories, 78 support laboratories and 23 offices. It also will include a center courtyard.

Air expelled from the laboratories will be filtered to remove contaminants before being exhausted to the atmosphere. The structure will be steam heated through the use of an existing plant. Emergency electrical generators will provide against possible power failure.

Designed for safe and efficient clinical research, experimental medicine, pathology, psychology and human engineering, the facility is expected to be one of the most modern of its type. Activities supporting the clinical research work will include both basic and applied research in the fields of aerosols, basic and field toxicology and neuropharmacology.

The laboratory will stand as a memorial to Brig Gen John Ruxton Wood (1901-1963), the first director of Medical Research at Edgewood Arsenal. He specialized in the study of the medical problems of military chemistry and became a noted authority in that field.

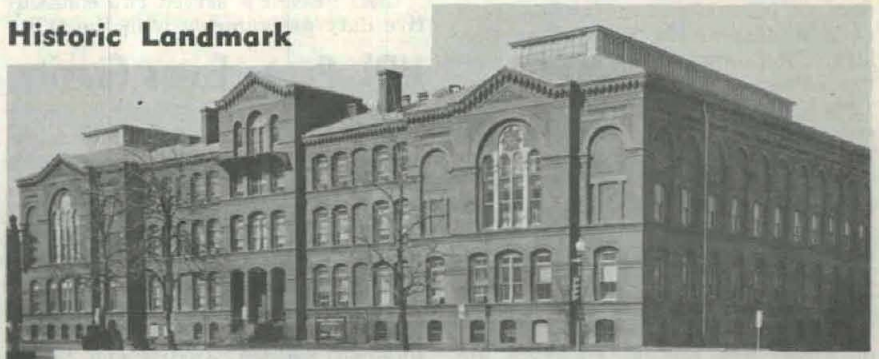
From 1942-45, he served as director of the Medical Research Laboratories, and subsequently as chief of the Army Chemical Corps Medical Division, director of the Research and Development Division, Office of The Surgeon General of the Army and director of the Walter Reed Army Institute of Research. After retiring from the Army in 1956, he spent seven years as an executive in private industry. He died in 1963.

Edgewood Man Heads RESA Unit

Dr. Henry J. Wills, of the Chemical Research and Development Laboratories, U.S. Army Edgewood (Md.) Arsenal, has been elected to head the Edgwood Arsenal branch of the Scientific Research Society of America (RESA) for 1965.

Dr. Wills, chief of the Physiology Division of the Laboratories' Directorate of Medical Research, succeeds Elmer Engquist, director of Defense Systems at the Laboratories.

Historic Landmark



Medical Museum, Armed Forces Institute of Pathology

THE MEDICAL MUSEUM of the Armed Forces Institute of Pathology (AFIP) was among 27 buildings and sites recently declared eligible to become national historic landmarks for significant scientific discovery and invention. Founded as the Army Medical Museum during the Civil War, the Museum was the forerunner of the present AFIP. Located at 701 Independence Ave. on the Nation's Capital Mall, the Museum moved into the "old red brick" in 1887, one year after it was constructed as an early Washington landmark.

Army Accepts 2 XV-5A V/STOL Aircraft

The U.S. Army formally accepted two research XV-5AV/STOL lift-fan aircraft from the contractors after a recent demonstration of flight capabilities at Edwards AFB, Calif.

A team of engineers from the U.S. Army Transportation Research Command (USATRECOM), Fort Eustis, Va., watched the experimental aircraft demonstrate vertical landing and takeoff capabilities, hover like a helicopter, and transition from vertical flight to conventional subsonic jet flight.

The demonstration signified that the aircraft had completed the first phase of the test program and will enter the second phase—a 6-month Army flight evaluation at Edwards, managed by USATRECOM.

Purpose of the Army flight test program is to evaluate the lift-fan propulsion concept and to conduct research to obtain design criteria for application to future V/STOL development programs.

The test director, additional test pilots and flight test engineers will be provided by the U.S. Army Aviation Test Activity (USA-ATA) at Edwards. Both USATRECOM and USA-ATA are part of the U.S. Army Materiel Command, Washington, D.C.

The aircraft were designed, built and tested for USATRECOM by the General Electric Light Propulsion Division, Cincinnati, Ohio, and the Ryan Aeronautical Co., San Diego, Calif. Both GE and Ryan will continue to support the flight tests.

As the Army flight evaluation progresses, test pilots from the National Aeronautics and Space Administration, U.S. Air Force, U.S. Navy and the Federal Aviation Agency will assist in the evaluation.

The XV-5A is one of several V/STOL research efforts being studied by USATRECOM. Results derived from these programs ultimately will be utilized by the U.S. Army Aviation Materiel Command, St. Louis, Mo., to provide the Army with advanced integrated systems.

XV-5A V/STOL

U.S. Army Board to Begin Starlifter Service Testing

The U.S. Army Test and Evaluation Command's Airborne, Electronics and Special Warfare Board, Fort Bragg, N.C., is scheduled to begin, in May, evaluation of the Air Force's C-141A Starlifter in a jointly coordinated 4½-month Service Test Program.

Objectives of the testing are to determine suitability and to develop procedures for transport and parachute delivery of Army personnel, supplies and equipment; obtain early training for Army personnel; and provide interchange of information so the plane can be readily integrated into operational use as a troop carrier.

To insure acceptability and suitability of the C-141A pure-jet troop carrier, the Army has participated in the developmental processes of early planning for the testing.

The craft, which forged a new epoch in the fast-moving military science of strategic airlift last year, will provide an increased capability for movement of personnel and cargo to deploy U.S. units. It is designed to carry in excess of 60 percent more, almost twice the number of combat equipped parachutists than the standard C-130 aircraft.

Responsibility for the test program has been assigned to the Joint Test Force at Edwards AFB, Calif., and to more than 200 people from nine different military and civilian agencies. Representatives of the Airborne, Electronics and Special Warfare Board have been working with the Test Force Headquarters in early phase testing.

The evaluation phase will include approximately 2,300 personnel parachute jumps, air portability and aerial delivery of varied combat loads and will encompass the Army's wide spectrum of weights and dimensions of equipment and cargo needed to sustain fighting forces in a combat area.

U.S. Army Aviation Test Activity

The U.S. Army Aviation Test Activity (USA-ATA), located at Edwards Air Force Base, Calif., is the only engineering flight test organization in the U.S. Army.

A tenant activity at Edwards, USA-ATA is an element of the U.S. Army Test and Evaluation Command, U.S. Army Materiel Command. USA-ATA shares with the Air Force and various contractors at Edwards one of the most sophisticated of aircraft test facilities. Flying weather of the area is considered ideal. Edwards also is the home of the U.S. Air Force Flight Test Center.

USA-ATA recently was assigned responsibility to provide personnel for the 6-month Army flight evaluation program on the experimental aircraft, XV-5A V/STOL.

USA-ATA also will participate with the Air Force on the testing of the new VC-142, a 4-engine, tilt-wing, V/STOL aircraft and will conduct the Army's portion of flight testing of the Tri-Service Program on the X-19, a flying fuselage with four propellers that tilt for vertical and horizontal flight.

Although the Activity is equipped for and is designated to participate in the testing of these exotic aircraft, the majority of its work is concentrated on aircraft that either are, or soon will be, in the Army inventory.

One of the Activity's most important recent projects was the Light Observation Helicopter (LOH) competition. USA-ATA furnished quantitative data on the performance and flying qualities of each of the six helicopters entered in the competition to the Selection Board.

As with most organizations involved in the testing of Army hardware, the talents of USA-ATA personnel are devoted in a large degree to the testing of modifications to existing aircraft. Their job is the methodical, logical and documented clearance of aircraft for user tests.

The scope of USA-ATA's activities is as wide as aviation itself, extending even to space exploration. In support of the National Aeronautics and Space Administration's Apollo-Gemini program, USA-ATA is furnishing pilots and helicopters to aid in the development of the lifting re-entry bodies to be flown by astronauts on their return from space.

In addition, the Activity has accomplished quantitative performance tests of foreign airplanes, such as the Swiss Pilatus Turbo Porter. USA-ATA test teams have also participated in programs at other service installations and contract facilities, in this country and overseas. They have provided the Army with quanitative data to assist decision-making in an area of aeronautical R&D.

Journal of Nutrition Publishes Dr. Forbes' Article

A technical article by Dr. Allan L. Forbes, Life Sciences Division, U.S. Army Research Office, Arlington, Va., was published in the January 1965 issue of the *American Journal of Clinical Nutrition.*

The article, "Some Characteristics of the Disappearance from Serum of Intravenously Infused Triglyceride in Man," was one of 25 articles published by the journal as a "Symposium on Intravenous Fat Emulsions." The subject consumed the entire issue of the periodical.

Dr. Forbes' article concerned his personal research with an intravenous fat emulsion from 1958-62 at the Medical Research Laboratory, McGuire Veterans Administration Hospital, Richmond, Va., and the Medical College of Virginia. His studies were aimed at obtaining a better understanding of the way the body removes fat from the blood.

A preface to the collection of papers on the subject of intravenous fat emulsions was prepared by Lt Col John E. Canham, commanding officer, U.S. Army Medical Research and Nutrition Laboratory, Fitzsimons General Hospital, Denver, Colo., and Dr. John F. Mueller, Brooklyn-Cumberland Medical Center, Brooklyn, N.Y.

The preface traced the history of efforts to develop an effective intravenous fat emulsion. The authors point out that the U.S. Army Surgeon General's Office, through its Research and Development Command, "has been the prime mover in the search for an intravenous fat emulsion in this country."

The Army has been seeking a satisfactory fat emulsion to be administered intravenously to patients who cannot take food by mouth for prolonged periods, such as those who suffer serious wounds. In current medical practice, a solution of glucose in water (5 grams of glucose per 100 cc. of water) is administered intravenously. Since a human can tolerate only so much water, a maximum of 100 to 150 grams of glucose can be administered per day. A gram of glucose contains only about four calories, which limits a patient's caloric intake to 400 to 600 calories per day, much less than desirable over a period of time in many cases.

Fat, which contains nine calories per gram, is the richest source of calories—more than double glucose. In addition, the caloric intake can be further increased by the high concentration of fat possible when put into emulsion form.

An intravenous fat emulsion answers the Army's need for a source of large numbers of calories in a small volume to maintain or achieve caloric intake requirements. Emulsions which have been developed, however, have presented problems of toxicity.

The U.S. Army is presently seeking newer emulsions with less toxicity in studies being conducted in-house at the U.S. Army Medical Research and Nutrition Laboratory at Fitzsimons General Hospital, Denver, Colo., and by groups of investigators at universities and medical schools under U.S. Army contract. In addition, the Army is keeping a close watch on efforts in West Germany and Sweden.

The preface to the symposium, while tracing historical development in the field, gives credit to another distinguished U.S. Army Research Office scientist, Col Tyrone E. Huber, chief of the USARO Life Sciences Division, and his early leadership of a group of investigators called the Task Force on Intravenous Alimentation.

"Until the present time," the autors of the preface observe, "the Army has continued to support the vast majority of work in this area."

SARS Award Leads to Project Management Study

James O. Jensen, associate director of the U.S. Army Management Engineering Agency at Rock Island (Ill.) Arsenal, recently completed studies at the University of Iowa under a $20,000 Secretary of the Army Research and Study Fellowship (SARS).

The Fellowship, the first (SARS) and largest scholarship awarded in the history of the State University of Iowa, included salary, tuition, books and material, travel and other incidentals for the 1-year study.

While enrolled in the Department of Labor and Management at the University, Jensen conducted research on the weapon system acquisition process now being used by Government and industry. His thesis, leading to an M.A. degree in labor and management, explored the advantages of the vertical project management concept as opposed to traditional forms of management.

In his conclusions, he noted that the vertical project management concept was superior to all other forms because of the operationally defined objectives, close relationships among technical specialists, the application of small group theories, and the consultative leadership practices of the project manager.

James O. Jensen

Before enrolling at the university, Jensen participated in Department of Defense efforts to improve the acquisition process. He assisted in the development and implementation of the Project Management organizational concept within the Department of the Army and assisted in the design of a management control system for major weapon systems.

He also has served as chairman of the Army PERT/COST Implementation Team which supervised the testing of the PERT/COST techniques on the Mauler and Lance weapon systems.

Col Diercks Takes Post In Medical R&D Command

An Army immunologist who has spent considerable time with medical R&D teams fighting diseases in foreign countries has been assigned to U.S. Army Medical Research and Development Command headquarters, Washington, D.C.

Lt Col Fred H. Diercks is the new project officer in the Command's Preventive Medicine Research Branch, after serving three years as commanding officer of the U.S. Army Medical Research Unit in Panama, a Class II activity of the Command. From 1958-61 he was a research virologist at the Walter Reed Army Institute of Research.

Col Diercks has served three years with the U.S. Army Medical Research Unit in Kuala Lumpur, Malaysia, four previous years at WRAR, during which he participated in short-term field medical research team efforts in Malaysia, and three years at the Fort Sam Houston (Tex.) Medical Field Service School. His early military service during World War II was spent with the U.S. Navy.

He holds a B.A. degree in biology from East Texas State College, an M.S. in bacteriology from the University of Maryland, and a master's degree in public health and doctor of science degree in hygiene from the University of Pittsburgh. Last year he was made a Diplomate of the American Academy of Microbiology and, in 1962, a Fellow in the Epidemiology Section of the American Public Health Association.

Army Math Center Sets Computation Symposium

Prominent mathematicians and scientists from the United States, England, Germany and Switzerland will speak at the "Symposium on Error in Digital Computation," Apr. 26-28, at the University of Wisconsin, Madison, Wisc.

Sponsored by the U.S. Army Mathematics Research Center (MRC), the meeting is part of a series of lectures, advanced seminars and symposia scheduled by the MRC to keep Army mathematicians abreast of the most advanced techniques adapted to meet military requirements.

Dr. J. Barkley Rosser, director of the MRC, will introduce Dr. James W. Cleary, assistant provost of the University of Wisconsin, who will welcome the group.

Among 11 speakers and topics scheduled for the symposium are: Prof. Robert L. Ashenhurst, University of Chicago, Experimental Investigations of Unnormalized Computation; Dr. F. W. J. Oliver, National Bureau of Standards, Error Bounds for Asymptotic Expansions of Special Functions in the Complex Plane;

Dr. James H. Wilkinson, National Physical Laboratory, Teddington, England, Error Analysis of Orthogonal Similarity Transformations by Elementary Hermitian Matrices of the Form $1-2ww^H$; Dr. Philip Wolfe, The RAND Corp., Error in the Solution of Linear Programming Problems;

Prof. Lothar Collatz, Institut fur Angewandte Mathematik, University of Hamburg, Germany, Applications of Functional Analysis to Error Estimation; Dr. Robert W. Brown, Boeing Airplane Co., Upper and Lower Bounds for Solutions of Integral Equations;

Prof. Philip M. Anselone, Oregon State University, Error Bounds for Solutions of Integral Equations Obtained by the Use of Numerical Quadrature; Dr. Ramon E. Moore, MRC, Automatic Local Coordinate Transformations to Reduce the Growth of Error Bounds in Interval Computation of Solutions of Ordinary Differential Equations;

Prof. Peter Henrici, Harvard University and Eidgenossische Technische Hochschule, Zurich, Switzerland, Error in the Numerical Integration of Ordinary Differential Equations; Prof. John Schroeder, Boeing Scientific Research Laboratories and University of Hamburg, Germany, Error Bounds and Inverse Monotonic Differential Operators;

Prof. David M. Young, Jr., University of Texas, Discrete Representations of Partial Differential Operators.

Chairmen for the nine sessions include Prof. N. C. Metropolis, Los Alamos Scientific Laboratory and University of Chicago; Prof. Ben Noble, MRC and University of Wisconsin; Prof. Hans Schneider, University of California and University of Wisconsin; Prof. J. Ben Rosen, MRC and University of Wisconsin;

Prof. Johannes Weissinger, MRC and Institut fur Angewandte Mathematik, University of Karlsruhe, Germany; Prof. A. T. Lonseth, Oregon State University; Prof. Preston C. Hammer, University of Wisconsin;

Prof. Emeritus William E. Milne, Oregon State University; and Prof. Pentti Laasonen, University of Helsinki, Finland.

Questions and/or requests for invitation should be directed to Dr. J. B. Rosser, Director, Mathematics Research Center, U.S. Army, University of Wisconsin, Madison, Wis. 53706.

USAPRO Commander Retires, Accepts Civilian Job

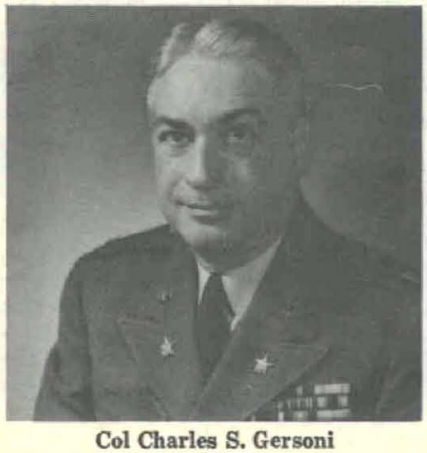
Col Charles S. Gersoni, commander of the U.S. Army Personnel Research Office, Washington, D.C., since July 1962, retired from the Army Feb. 28 after 24 years of service.

Col Gersoni's new position is associate executive officer of the American Psychological Association headquarters in Washington, D.C., an organization of 25,000 psychologists from Government, industry and educational institutions.

A behaviorial scientist with a Ph. D. degree in psychology from New York University (1937), he organized and commanded from 1959 to 1962 the U.S. Army Research and Development Group in Japan. His work there earned him a Department of the Army Certificate of Achievement in April 1962. He also holds B.S. (1933) and M.S. (1935) degrees from the University of Virginia.

Since he began active duty with the Army in 1941, Col Gersoni has held a series of responsible positions as administrator of behavioral science activities. He was with the Office of The Surgeon General as chief of the Psychology Branch (1947-51) and chief of the Human Resources Research Branch, Research and Development Division (1953-57).

For the next two years he was involved in physical standards and psycho-physiological research at Walter Reed Army Institute of Research. During that period, he invented a "Biological Window for Internal Observation," for which he received a patent.



Col Charles S. Gersoni

CSC Office Offers Courses For Top Federal Managers

The Office of Career Development, U.S. Civil Service Commission is offering two short courses in April for Federal managers.

The Advanced Seminar in ADP and Financial Management is scheduled Apr. 26-29 for accountants, budget personnel, auditors, management analysts and others in the financial management field in grades GS-12 through 15 or equivalent. Nominations close Apr. 2.

The general objective of the seminar is to provide new insight into how Automatic Data Processing (ADP) systems have been and can be designed in order to achieve maximum management effectiveness. Emphasis will be specific ADP applications in the financial management area. Nominees should have attended either an ADP Orientation or the Introduction to ADP in Financial Management, other CSC short courses, or have equivalent knowledge.

The Personnel Officer and the Administrative Process will be offered Apr. 21-23 for persons serving in personnel management positions in grades GS-13 and above or equivalent. Nominations close Apr. 5.

The objective of this seminar is to provide the personnel officer with a stronger working knowledge of the duties and responsibilities of other members of the management team in order that he may more effectively relate to them and assist them in the performance of their functions.

Included in the course will be discussions of the budget process, management analysis, public information, planning, organizational controls and management services.

Hot-Gas Generator Aids Missile Control Testing

An unusual hot-gas facility is enabling Jack Clayton and other engineers and scientists at the U.S. Army Missile Command, Redstone Arsenal, Ala., to perform important studies in missile guidance and control.

Clayton is an engineer in the Control Systems Branch, Inertial Guidance and Control Laboratory. By using a hot-gas generator, actually a miniature rocket engine, Clayton and his coworkers can test and evaluate any missile control system that uses hot or cold gas as a power source.

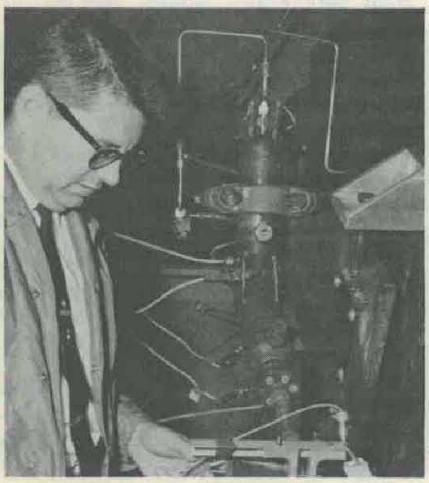
The pressure and flow of the gas can be used as a source of power, much the same as an air compressor for air brakes. At present, the lab is involved in extensive testing of pure fluid control components. These components use streams of air, or gas, directed by tiny channeled plates carried inside the missile to control its course. They differ from conventional components in that they have no moving parts except for the working fluid.

One test instrumentation missile, using a pure fluid control system, was fired successfully on one of the Missile Command ranges late last year. Another shot is scheduled for July.

"We are now designing the hot-gas jet reactors and driving circuits for this next shot," Clayton said. "Naturally, we will test these devices on our facility before they will be fired on the range."

In addition to its research in pure fluid systems, the Control Systems Branch designs and develops many fluid amplifiers. The lab evaluates in-house developed hardware as well as industrial components.

This branch of the Research and Development Directorate has two test cells. Both areas are separated from a control room, which has monitoring equipment and a closed circuit TV system, by 12 inches of reinforced concrete.



Jack Clayton

One area has a liquid gas generator where various pressures and flow rates can be used to check the hardware. The second area is set up for solid hot-gas generators and high-pressure, cold-gas testing. In this area, an almost limitless number of propellants for gas generators can be utilized.

"Some hardware works better under certain pressures and flow ranges than others," Clayton explained. "We try to find the optimum operating limits."

Why is hot gas used in the first place?

Many of the Army's smaller missile systems use hot gas generators as part of their guidance and control packages because hot gas gives more energy, can be packaged in a smaller volume and has less weight than stored cold gas. It is more desirable for many of the higher performance missiles.

"There are certain disadvantages, however," Clayton explained. "Any time you have moving parts in a hot-gas system you have potential problem areas—such things as erosion caused by exposure to high gas temperatures and clogging of vital parts by residue."

In actual hardware tests, cold gas is used first because it is cheaper, allows us greater ease of handling and is not as dangerous for checking such things as instrumentation circuits.

Next comes the liquid gas generator and, if all functions well here, the hardware goes to the solid test bay, where it is operated in its flight configuration.

"We are not in the propulsion business," Clayton explained, "but we do have to be familiar with many different types of hot-gas generators in our operations."

Clayton has been at Redstone Arsenal more than three years and has been working with the hot-gas facility for about two years. He is a graduate of Texas A&M with a degree in electrical engineering.

Springfield Armory Develops Cost-Cutting Cartridge Clip

A simplified 7.62 mm. 5-round cartridge clip, intended for use in recharging empty or partially loaded M14 rifle magazines in the field, is being developed by the Springfield (Mass.) Armory.

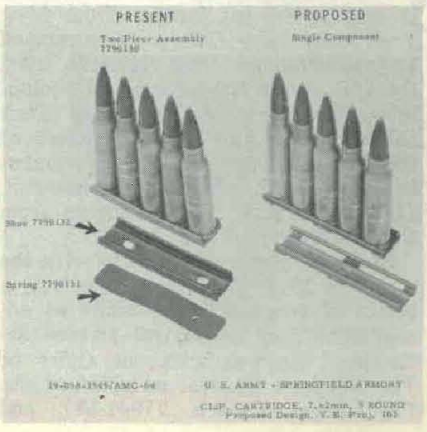
The clip is a spring-loaded clamp which retains five rounds of ammunition in position for simultaneous feeding into the M14 magazine. In the current 2-piece design, the clamping force is applied to the rim of the cartridge through the interaction of the shoe, and the flat spring which bears longitudinally on the base of the round.

The proposed design eliminates the need for a separate spring by specifying a one-piece clip fabricated from spring steel, suitably heat-treated to provide the necessary gripping force on the diameter of the round rather than on the rim.

The new design fulfills all functional requirements of the present clip but at a 30 percent reduction in manufacturing cost. Additional economies are anticipated in lower tooling and tool maintenance costs, the elimination of assembly costs due to the one-piece construction, and reduced cost of logistics.

Based on normal U.S. Military Services requirements for this item, officials conservatively estimate a yearly savings of $200,000 upon adoption of the new design. Experimental prototypes are currently undergoing extensive testing to demonstrate functional suitability and to establish confidence in the new design under all field conditions.

Development of the new item is a project of the Value Engineering Section of the Armory's Research and Engineering Division, in support of Defense Secretary McNamara's program to reduce the cost of military hardware without sacrificing required performance, quality or reliability.



New Camera Cuts Artillery Weapons Testing Cost

A new high-speed camera, conceived and developed at the U.S. Army Test and Evaluation Command (USATECOM), is expected to save approximately $15,000 per year per unit in artillery weapons testing at Aberdeen Proving Ground, Md.

The drum-type ballistic syncro camera was devised by L. E. Davidson while employed by the Aberdeen (Md.) Proving Ground's Development and Proof Services. He is now chief of the Instrumentation Division, Logistics Directorate, USATRECOM.

The testing of artillery weapons at Aberdeen requires ballistic syncro photography and the technique used heretofore required large quantities of processed film (100 feet of film per shot). This was caused by the limiting conditions of being unable to accelerate film to its required velocity and to decelerate it quickly to zero. The new camera circumvents rather than overcomes these limitations.

The new concept evolves from a standard rotating-prism, high-speed camera, with the prism removed and a narrow slit installed near the focal plane, adjusted to approximate the corresponding projectile speed so that the image velocity corresponds to the film velocity.

The camera uses a rotating drum assembly which holds the entire film supply, part of which is carried on its outer periphery. A programed shutter action is initiated by the passage of the projectile and the entire shutter cycle occurs in less than one revolution. This provides approximately 20 shots per 100 feet of film, thus representing a 20-fold improvement over the former method.

Photographs are made of test-fired projectiles while they are still in flight to make certain that the ammunition complies with established accuracy standards. When a test round fails, the photographs can be used for qualitive analysis of the reasons it did not hit the target. Pitching and yawing can be detected along with the interference of discarding parts of the breakup of the round.

In a recent 12-month period, a total of 1¼ million feet of 35 mm. film was exposed, developed and edited. Using a realistic figure of 10 cents per foot, the cost was $125,000 for film. The one new camera could not expose this amount of film. However, in those tests in which it would be used, film costs and processing should be reduced by $15,000.

In addition to being designed for film economy, the camera has been devised for simplicity, ease of field operation and results equal to the method it will replace.

The drum weighs about 8½ pounds and has a 14½-inch outside diameter with the slit at one point through which the film passes. The exterior of the drum is covered with a Teflon band to reduce friction when the film is advanced. A standard solenoid controlled shutter is used for masking.

To photograph a projectile at 6,000 feet per second from a distance of 10 feet, using a 6-inchs lens, a paripheral speed of 300 feet per second is required. This therefore dictates a maximum drum speed of 4,800 r.p.m. driven by a 1/3 horsepower, direct-current motor. Design criteria of 300 feet per second could not be accomplished due to inability to hold film on the drum in excess of 240 feet per second.

The initial field tests, for acceptance of the prototype camera, have provided a satisfactory basis for ordering five additional cameras. These cameras, with the prototype, should provide savings on film costs of approximately $90,000 per year.

Performance specifications for the additional cameras will go out for competitive bidding and delivery is expected by July 1965. The prototype was supplied by the Fred C. Henson Co. of Pasadena, Calif.

ERDL Develops Environmental Control Units

A family of compact horizontal heat removing and heat producing Environmental Control Units (ECU) is being developed by the U.S. Army Engineer Research and Development Laboratories (USAERDL), Fort Belvoir, Va.

Designed for general purpose usage in military mobile and air transportable electronic systems, 11 different ECU's are being developed in four capacity sizes, 9,000, 18,000, 36,000 and 60,000 b.t.u./hr., and four electrical versions, 115 volt, 60 cycles; 208/416 volt, 60 cycles; 115 volt, 400 cycles; and 208/416 volt cycles, having 11 electrical versions.

They will be used in missile fire control vans, communications shelters and others housing electronic systems.

Design requirements include low noise level, small volume and lightweight, plus the capability of withstanding extreme environmental conditions of vibration, shock, humidity, salt fog, rain, fungus and sand and dust.

The design also requires that the evaporator air be brought in and out of the front face and the condenser air brought in and out of the back face. This air flow arrangement will permit installation of multiple units side by side and/or over and under.

These ECU's will have the capability of providing cooling and dehumidification in outdoor temperatures, down to 0° F. for the two larger capacity units, when operating in conjunction with a collective filtering system.

In addition to the requirement for providing cooling in low ambient temperature, the ECU's will produce heat when operating in outdoor temperatures down to —50° F. Also they will be required to provide ventilation air in outdoor temperatures ranging from —50° F. to 120° F.

Although the units will be required to provide cooling, dehumidification, ventilation and heating, along with other extreme design requirements, the units will be smaller in volume and lighter in weight than conventional military air conditioners.

The contract for development and fabrication of the units is held by the Stratos Division of Fairchild-Hiller Corp. It will be monitored by the Environmental Control Branch of the Laboratories, which completed the feasibility studies and definitive drawings. The family of ECU's is scheduled to be available on a production basis by July 1968.

Dr. Drucker to Represent Army At Personnel Guidance Meeting

Dr. Arthur J. Drucker, assistant director, Research Laboratories, U.S. Army Personnel Research Office, Washington, D.C., will participate in a panel presentation Apr. 12 at the 1965 American Personnel and Guidance Association convention in Minneapolis, Minn.

The general theme of the panel presentations is "Civilian Applications of Military Personnel Research." Dr. Drucker will represent the U.S. Army with a summary of 25 years of APRO activity in selection and classification research.

Representing the Navy will be Dr. Earl I. Jones, director, U.S. Navy Training Research Laboratory, "Vocational Training and Aptitudes." Dr. Eli S. Flyer, chief, Retention and Utilization Branch, U.S. Air Force Personnel Laboratory, will present "Human Reaction to Stress."

USAEPG Officer Discusses Advancing Computer Technology

By 2nd Lt Clifford R. Holland
Test Operations Department, USAEPG, Fort Huachuca, Ariz.

Computers play a vital role in testing space-age electronic communications equipment and systems at the U.S. Army Electronic Proving Ground (USAEPG), Fort Huachuca, Ariz.

An IBM 7090 daily digests information on such varied projects as avionics, automatic processing of equipment parameters, deviations in systems and other factors in environmental testing.

Before one can understand how computers are applied, an understanding of the various types is necessary. Electronic computers are generally divided into two classes, analog and digital.

A third quasi-class of hybrid computers has been created, but actually the hybrid devices are a combination of the desirable features of both analog and digital machines. It should be remembered that the mathematical functions performed are the same, regardless of the class of computer, except as to number and the method of function generation.

It is helpful to consider the use of computers in evaluation of collected test data first, because this area has received heavy emphasis in the past few years.

The digital computer has received top honors in the field of evaluation of test data, primarily because of its ability to handle tremendous amounts of data at high processing speeds. Memory access time of one microsecond and simple arithmetic calculations at rates of a million per second are not uncommon.

In addition, digital computer programing is fairly straightforward. Newer compilers allow selection of complex mathematical functions or commonly used sub routines upon simple command. Because of the digital computer's ability to store information, extreme flexibility results.

The digital computer can perform input, output, computation, storage, and programing simultaneously. The digital machine, however, cannot easily perform parameter studies, or equipment simulations for the purpose of evaluating new or proposed designs.

The analog computer lends itself to parameter studies and equipment simulations with relative ease. Analog programing, however, requires a knowledge of electronics as well as mathematics.

In addition, an analog machine cannot achieve the accuracies (not even remotely) of the digital machine. The analog computer does produce a continuous solution to any problem; a product not within the capability of the digital computer.

In the field testing at USAEPG, the analog computer is at the forefront. Because of its simulation capability, the analog machine can be utilized to represent different subsystems of a larger system. The subsystems simulated usually have many design parameters, the variation of which can greatly affect the functions performed by each subsystem.

As mentioned earlier, parameter variation is easily achieved with an analog computer and the results of a change are available for analysis almost instantaneously. Proposed equipment can be designed, tested, and evaluated on an analog computer easily and quickly before a prototype is ever built.

The digital computer can accomplish the same equipment simulation feats as the analog computer but not nearly as easily or quickly. In addition, the digital machine cannot simulate a subsystem, while physically connected to the total system, as the analog machine can.

Perhaps the major application of digital computers in the field of testing is that of real time data sampling and storage for later computation and analysis. In the case of testing which occurs over a large area of land or space, such as satellite or missile tracking, digital computers at various tracking sites can communicate with each other and the point by point results displayed on most any type of console desired.

The future holds great promise for the hybrid computer, which would combine the best assets of both the digital and analog machines. Once the hybrid computer has been properly developed and tested, and proven programs are available, the computer could accomplish both test and evaluation functions unassisted.

Suppose that an engineer or scientist desires to have a piece of equipment not currently in existence. His design criteria and design ideas would be entered into the hybrid computer under control of an appropriate program. The digital portions of the computer would then control the analog functions to provide a parameter study.

The hybrid computer would utilize the results of the parameter study to simulate a prototype having as nearly as possible maximized design criteria. The simulated prototype would be tested against the criteria and, if found acceptable, the digital evaluation function of the computer would instruct the program function to create a program for automated construction of a prototype model.

The model could then undergo engineering field service tests and the results analyzed by the hybrid computer. When the desired prototype has been created, the hybrid computer could command slave computers for implementation of production, marketing and inventory.

Is this the ultimate? Definitely not! This type of common utilization of computers in design, test and evaluation is just a few years off and is already being used by the most sophisticated testing activities.

When applications computers will be put to in the areas of test and evaluation beyond the example described only the future will tell. Whatever they are, they will make the achievements of today seem small by comparison.

Army Orders Feasibility Study On Heavy Equipment Transporter

The U.S. Army awarded a $47,482 contract to Chrysler Corp. in mid-February for initial concept and feasibility studies for a new Heavy Equipment Transporter (HET) for use by the U.S. Army and the Federal Republic of Germany.

The German Government also is conducting studies with German firms for the HET and later this year both countries will consider results of studies and merge them into a single joint HET concept for joint development and production.

Both Germany and the U.S. have agreed to the military characteristics desired. The HET will be designed to carry the new U.S./German Main Battle Tank as well as general cargo and engineer type equipment normal to both armies.

Operating at 400 hp., it will be sufficiently maneuverable to negotiate 30-foot intersecting streets with buildings flush on all four corners. The axle load will be kept under 25,000 pounds to avoid undue damage to road networks.

Research In Review...

(Continued from page 19)

Research and development at the higher levels are generally in separate organizational elements, but at the laboratory level they are often not separated. Organizational compartmentation is done, theoretically, to gain greater specialization and is sound, provided the compartmentation is not too rigid and there is close teamwork among the elements.

Testing at the General Staff level is a part of development. Staff supervision is done by the various action officers assigned to individual development items. The Army Materiel Command has established the Test and Evaluation Command which, in addition to giving greater specialization to the T&E function, provides central coordination and control to the testing program.

The T&E Command does not have a research mission. Experience, however, shows a strong need for environmental research at or near the test centers to undergird and increase the accuracy and validity of environmental testing. Here is an interesting example of the relationship between environmental research and testing running into a problem. The idea of compartmentation arises again. Certain types of environmental research or "investigation" need to be done at or near the test sites, on a continuous basis, to obtain the necessary measurements of environmental factors against which tests are to be performed.

Management, therefore, has to insure that there is input from the regular programs of environmental research for support of environmental testing and that, in addition, there is effort of "investigation" on the borderline of research and exploratory development done by the test organizations themselves.

Another example may be used to show the interrelationship among research, development, test and evaluation. Evaluation has two main facets: evaluation of the performance of individual items following tests, and evaluation of materiel by meaningful groups of items, such as that in the Table of Equipment of a STRAC unit for the various types of environment.

Testing without careful evaluation of performance in both categories is a futile exercise. Evaluation of individual items following environmental tests is a well-established program in Army R&D, but evaluation by groups of items assigned to specific military units should be further encouraged.

Systematic evaluation of the environmental capability of materiel in the Table of Equipment of specific military units could serve a useful purpose in the Army R&D organization as a further guide to its own programs. These types of evaluation are essential not only to planners and commanders, but to designers, developers, testers and researchers.

One of the best guides to research and exploratory development is the analysis of test performance results. Yet our organizational theory makes difficult a timely interchange of information and ideas between research personnel and development/test personnel.

The project manager idea practiced in the development and engineer testing fields results in performance reports being scattered among the many project officers. Thus it is difficult for research personnel to assemble and analyze reports.

Research elements are organized according to a different theory—that of scientific disciplines for the most part—and it is difficult for the development project managers to assemble and analyze the pertinent research results.

The role of research should not stop with the publication of findings. Research elements should have a voice in the way design and test criteria are used. Without such a voice and without close cooperation with the development elements, research can become "ivory tower."

Development should have a voice in the planning of the research effort. Deprived of this type of relationship with research, development personnel may become too much obsessed with hardware. It is not conducive to effective teamwork when research people regard development people as just "hardware boys" and development people think of research people as just "long haired dreamers."

Perhaps a system of ad hoc committees for total planning from research to user would pay dividends, particularly in helping to provide requirements for research at the right time and to give guidance on priority and sequence of effort.

Establishment of a central place where environmental test performance reports could be analyzed, and a vigorous program of research and analysis of the test results, both of individual items and of Tables of Equipment for Specific Combat Units, would go far toward improving the effectiveness of both environmental research and testing.

Research is theoretically supposed to show the way to improvements in materiel and techniques. Testing is a principal method of making sure the way has in fact been found. The job of increasing the effectiveness of Army materiel and techniques for use in the varied environments of the world, on an economical basis, demands of research and testing that always the twain shall meet.

Army Surveillance Unit Photomaps California Flood Area

A highly specialized 5-man crew from the U.S. Army Combat Surveillance School, Fort Huachuca, Ariz., performed photomapping services in the California flood disasters area in mid-February.

Under orders from the U.S. Continental Army Command (CONARC) headquarters, Fort Monroe, Va., and in response to a request from the U.S. Sixth Army, the team manned a Mohawk (OV-1) aircraft. The plane was specially fitted with the Army's latest combat surveillance sensor equipment and cameras.

Commanded by Col Harold F. Via, the Combat Surveillance School at Fort Huachuca is a CONARC activity. Arcata, Calif., was the base of operations for the photographic mission.

The team took pictures and developed a photographic map to be used in the prediction of possible future slide or flood trouble spots. This is expected to assist in the direction of corrective actions and development of a program to prevent recurrence of the disaster.

Members of the crew are Capt Marvin L. McDonald, pilot; Sp5 Stanley Nakama, crew chief; Sp5 Fred M. Craven, sensor equipment operator; Sp5 Ray A. Foote, film processing technician; and Sp4 Arthur W. Scott, camera equipment maintenance and repairman.

Kudos

The suggestion of a civilian employee at the U.S. Army Electronic Proving Ground (USAEPG), Fort Huachuca, Ariz., is eliminating 20 electronic equipment failures a year for each of 350 communications vans.

Emil J. Ross, chief of the Electronic and Fabrication Branch, received $1,000 for his suggestion with the possibility of more to come. Ross discovered that the breakdowns were caused by overheating of the sensitive electronic equipment which could be halted by a modification to the ventilating system.

Implementation of the modification saved the Army $97,650 in the first year. Ross' modification also has been put into use at Fort Bliss, Tex., and Fort Lewis, Wash. Reports indicate that the idea is being adopted Army-wide. Total savings well over $1 million are anticipated.

In addition to the $1,000 presented Feb. 11 by Maj Gen Benjamin H. Pochyla, USAEPG commander, Ross also has been named Suggestor of the Month for January and Manager of the Second Quarter, FY 65, honors highly prized at the facility. As top manager, Ross is slated to receive an extra $100 and a certificate of achievement.

Further honors for USAEPG personnel came when a Presidential Citation was presented to the maintenance section by General Pochyla. Signed by President Lyndon B. Johnson, the award was in recognition of the section's outstanding participation in the post's Incentive Awards Program during FY 64. It was the first such award for Fort Huachuca. Receiving the award for the section were Lt Col John A. Reilly, Jr., chief of Maintenance, and his civilian deputy, Henry C. Kincaid.

SSgt Rufus W. Gore, Jr., was awarded the First Oak Leaf Cluster to the Army Commendation Medal for outstanding performance of duty in Viet Nam last year.

Now a medical laboratory technologist in the Division of Communicable Disease and Immunology at the Walter Reed Army Institute of Research (WRAIR), Washington, D.C., Sgt Gore served in Viet Nam as Chief Medical Laboratory Specialist, U.S. Army Medical Research Team, WRAIR.

The citation read: "Sgt Gore demonstrated outstanding professional ability, competence and initiative in performance of his duties which involved establishment of the U.S. Army Medical Research Team's research laboratory facilities."

A veteran Armor officer of more than 24 years' Army service, Lt Col Arthur F. Mitchell, was officially commended and awarded the Army Commendation Medal for his exceptionally meritorious service as U.S. Armor representative to the United Kingdom. He also served as U.S. representative on the NATO Armament Committee's Sub-Group on the main battle tank.

The citation commends his performance of monitoring and keeping the U.S. apprised on all United Kingdom doctrines, policies, requirements and developments in the broad field of armored combat vehicles.

Col Mitchell presently is commander of the U.S. Army Combat Developments Command Experimentation Center's 194th Armored Brigade, Fort Ord, Calif.

Four employees of the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., were recently honored for their achievements as inventors.

Richard G. Robinson, an employee of the Standardization Engineering Division, and William E. Avery, a former employee who recently retired, received letters of patent and a $50 award, as coinventors of an "exhaust gas purifier."

They invented the device for use in automobiles to help reduce air pollution. A cylindrical cartridge, the device is installed in the tailpipe and uses a catalytic agent such as copper oxide in pellet form to convert carbon monoxide to carbon dioxide.

The cartridge, which has a removable cap at one end, has a multiplicity of small holes to permit the escape of gas. A vibrating rod inside the cylinder helps agitate the catalyst.

Department of the Army Certificates of Achievement were presented to two employees of the Nuclear Power Field Office (NPFO), also at Fort Belvoir, Va.

Walter C. Best and G. Brian Rodda were recognized for their work as members of a technical, health physics and safety inspection team. The certificates were presented by Lt Col Kermit O. Lindell, chief of the NPFO.

Dr. Housewright Heads Society for Microbiology

Indicative of the respect and esteem in which he is held by his professional colleagues, Dr. Riley D. Housewright was recently elected president of the American Society for Microbiology (ASD) for 1965-66.

With a membership of more than 8,000 professionals in the microbiological field, the ASM promotes the scientific knowledge of bacteriology and related subjects through discussion, reports and publications.

Objectives include the stimulation of scientific investigations and their applications; the planning, organizing and administration of projects for the advancement of knowledge in the field; and the improvement of professional qualifications.

Scientific Director for the U.S. Army Biological Research Laboratories, Fort Detrick, Md., since 1956, Dr. Housewright joined the staff at Detrick in 1943 as a medical consultant with the War Research Service, Federal Security Agency.

He earned his Ph. D. degree from the University of Chicago in 1944, M.A. in bacteriology from the University of Texas in 1937, and B.S. in biology in 1934. He also attended the Graduate School, U.S. Department of Agriculture (1947), and Cambridge University, England (1950).

His principal civilian positions include four years of college teaching and two years of high school teaching (1940-46), branch chief and deputy division chief of the Medical Bacteriology Division (1946-52), then chief of the division at Fort Detrick (1952-56).

Elected as a Fellow of the New York Academy of Sciences in 1962, Dr. Housewright is a member of various professional societies and organizations including the American Academy of Microbiology, Society for Experimental Biology and Medicine, Society for General Microbiology (England), and the AAAS.

Dr. Riley D. Housewright

Industrial Design Studies Sought for MOL Development

Design study proposals are being sought for a program to determine military man's potential usefulness in space, Secretary of Defense Robert S. McNamara recently announced.

Industry has been requested to submit design studies to assist in developing the cost and technical information required to proceed with full-scale development of the military manned orbiting laboratory (MOL). Three contractors will be selected.

The design studies will be guided by the new broadened MOL program which has resulted from intensive studies carried out by the Air Force during the past year.

The program will encompass development of technology to improve the capabilities for manned or unmanned operations of military significance. It will also include development and demonstration of manned assembly and service in orbit of large structures with potential military applications and may include intermediate steps toward operational systems.

The industry studies and other Department of Defense studies will consider equipment configurations which might meet this objective.

Upon completion of the design studies, a decision will be made whether to proceed with full-scale development of the military manned orbiting laboratory system and what the specific developments and vehicle configurations are to be.

It is the intent of the Department of Defense to choose the contractor who will develop and build the MOL from one of the three selected to do the design studies. For this reason, all of the contractors chosen for the studies must have the capability to carry out the completed program.

The DoD program continues to represent a unified approach to a national program of research and development on manned earth-orbital flight in accordance with the agreements reached by the Secretary of Defense and the Administrator of the National Aeronautics and Space Administration in August 1962.

MICOM Engineers Test Miss Distance Indicator

Engineers at the U.S. Army Missile Command, Redstone Arsenal, Ala., recently tested a Miss Distance Indicator (MDI), designed to determine how far an attacking missile is off target.

The "attacking missile" was an artillery shell fired from a 105 mm. cannon. The equipment itself is designed to be carried on target-guided missiles and eventually will be used in the scoring of missilemen who are being trained in the operation of air defense missile systems.

Since target missiles are costly, the MDI saves money. It permits gunners to fire off target intentionally and gain experience in shooting without having to destroy targets. The new device also can determine miss distance information during early stages of missile development.

Joe Smith, test engineer of the Missile Command's Test and Reliability Evaluation Laboratory, explained the operation of the MDI, which can test surface-to-air or air-to-air weapons.

"It radiates a signal, much like radar, that will bounce off an attacking missile and return to the unit," Smith said. "This returning signal is changed to telemetry frequency and picked up by a ground station. The information then is assembled and studied by a data reduction system, which interprets the miss distance."

To test the system, the MDI unit is suspended high in the air between two wooden poles—some 80-85 feet off the ground. The poles are guyed with nylon ropes and the unit is suspended on a nylon rope which links the poles. Nylon is used to eliminate any unnecessary metal which could give a measurable signal.

Artillery rounds are fired close to the unit from a distance of about 500 feet. The accuracy of the MDI then can be checked against the known actual miss distance.

Army Evaluating Multitorque Wheel Drive

A multitorque wheel drive being evaluated for military potential appears to offer significant savings in overall vehicle weight and an increase in design flexibility.

The U.S. Army Engineer R&D Labs, Fort Belvoir, Va., report that the self-contained unit can be mounted as an integral part of the wheel. The drive is designed to provide power to the wheels in vehicles with complex configuration. In many instances, this may eliminate the use of mechanical drive trains.

The drive can serve either as the main driving system or provide auxiliary wheel drive where additional traction is needed. It also can be mounted as an assist drive for trailed equipment.

Consisting of a 4-speed transmission, utilizing double-acting hydraulic clutch packs, the present unit is powered by a lightweight, high-pressure hydraulic motor. The motor derives its power from a pump driven by a power takeoff on the main transmission.

The auxiliary drive wheels are synchronized with the main driving wheels, when operating both in forward or reverse gears. The wheel drive system is small enough to be built into the rim of large rubber-tired equipment.

The 4-speed transmission at the wheel eliminates the need for large and heavy axles, differentials and final drives. The multitorque wheel drive can be driven mechanically, hydraulically or electrically. With a relatively minor change, the drive can be converted to an 8-speed transmission.

Applications where the multitorque wheel may improve equipment include loading scrapers where heavy drawbar loads are required; bull-dozing; and cross-country travel involving stream fording, climbing steep slopes, and traversing loose sand and soils where the coefficient of traction is low and all-wheel drive mandatory.

Ten Tips for Supervisors

The supervisor holds the key to good employee relations. His job is so important that hundreds of books and articles have been published about it. But their wisdom can be summed up in 10 short sentences:

1. Give clear directions—ahead of time. 2. Commend an employee for a job well done. 3. Never criticize within hearing of third parties. 4. Speak politely to employees. 5. Listen to them attentively and without interrupting.

6. Give top attention every day to any employee communications that require a reply. 7. Exchange ideas with subordinates; enlist their cooperation and suggestions toward developing better methods and procedures. 8. Within the limits of your responsibility, delegate as much as you can. 9. Give every worker a chance to train for promotion. 10. Make all employees feel they "belong" and are valued members of your team.

R&D Reservists Expand CRD Support of Student Science Fairs

U.S. Army Reserve R&D Units across the Nation again will take an active role in U.S. Army support of local and regional student science fairs leading to the 16th National Science Fair-International (NSF-I), May 5-8, in St. Louis, Mo.

Army Reserve R&D Units have helped in promoting and assisting local and regional high school science fairs since 1963, under a policy initiated by the Chief of Research and Development. Nearly all local and regional fairs are held in March and April.

The NSF-I is sponsored by Science Service, a nonprofit organization representative of academic, professional, industrial and Government support.

The Army has for a number of years participated by appointing judges to select about 20 NSF-I winners and 15 alternates, rewarding them with summer jobs in or one-week all-expense paid visits to Army in-house laboratories.

USAR R&D members are authorized to present U.S. Army Certificates of Achievement, signed by Watson Davis, director of Science Service, and by the Chief of Research and Development, Lt Gen William W. Dick, Jr., for outstanding exhibits at local and regional levels.

Army R&D Reservists also participate by judging exhibits, planning, lecturing, demonstrating, counseling and other activities related to an approved science fair.

Numerous members of USAR R&D Units have written enthusiastically about their participation in the fairs and how much they enjoy working with these outstanding high school science students, encouraging their imaginative scientific interests and seeing the results.

Many of the Reservists have to drive 25 to 100 miles in order to judge a fair and some have had to take a day of annual leave from their civilian jobs, but letters to General Dick indicates that none regretted it.

The nearly 1,300 members of the U.S. Army Reserve R&D Units across the country are trained scientists, engineers, technicians and scientific managers, many of them in highly responsible positions with industry and institutions of learning.

The prime requirement for presentation of an Army Certificate of Achievement is application of interest to the Army. Other criteria are: creative ability, scientific thought, thoroughness, skill, clarity and dramatic value. The number of awards presented at local and regional levels will depend upon the size of the fair, the number of exhibits, and the decision of Army judges.

Although Army judges are encouraged to confer with other judges or scientific advisers on exhibits, the Army judge is the final authority as to whether an exhibit is sufficiently Army-related and is deserving of an Army award. To emphasize the official participation of the U.S. Army, R&D Reservists always appear in uniform.

Exhibits may be in the fields of guided missiles and rockets, biological and medical research, electronics, mathematics, computers, transportation devices, foods research and other basic research areas.

The Army plan further provides that the certificates may be furnished to directors of local level high school science fairs for presentation on behalf of the Army in areas where USAR R&D Units are not readily available for assistance.

When science fair directors reply to Science Service about participation in the NSF-I, indicating also their desire to participate in the Army Certificate of Achievement awards, the information is forwarded to the Chief of Research and Development.

Reservists in R&D Units nearest to the fair up to 100 miles away are notified and they then contact fair officials to volunteer assistance.

Increasing interest of the Department of the Army in the participation by R&D Reservists in local science fairs is evidenced by the fact that all U.S. Army Corps Commanding Generals received a letter this year from Maj Gen J. C. Lambert, U.S. Army Adjutant General, by order of the Secretary of the Army.

The letter, encouraging cooperation of the Army Corps, stated: "Wherever possible, Army commanders are encouraged to organize tours of installations, to sponsor science youth activities and to provide speakers, films and invitations to appropriate scheduled events. Every attempt should be made by USAR R&D Units and individuals who participate in this program to arrange for some additional locally organized Army award to accompany the award of U.S. Army Certificates of Achievement."

The letter, which explained the procedures of USAR R&D Unit participation, also stated: "Department of the Army policy to encourage youth in science is well known, and it is desired that youth science activities be supported on the local and regional level. USAR R&D Units possess capabilities and personnel particularly suited to such a program."

Commanding Officers of all U.S. Army Reserve Research and Development Units also received a copy of the Adjutant General's letter in addition to the annual encouragement from General Dick, the Chief of Research and Development.

Last year, Army R&D Reservists participated in about 100 local and regional fairs. Early reports to Lt Col William B. Murray, OCRD Assistant for Reserve Affairs, indicate participation in 1965 will equal or surpass that mark.

More members in each individual

DURING NATIONAL ENGINEERS WEEK (Feb. 21-27), the U.S. Army Satellite Communications Agency (SATCOM), Ft. Monmouth, N.J., and the Monmouth Society of Professional Engineers sponsored a tour of the facility for local high school students interested in engineering. Col Eugene B. Datres, director, Ground System Department, SATCOM, demonstrates information display equipment to Bill Fitzgerald and Pam Mansfield. Looking on is Calvin M. Riggs, Monmouth County chairman of National Engineers Week. The students also toured the U.S. Army Electronics Command and Laboratories and the Signal School at Monmouth.

Reserve Unit also are participating. Initially, only one or two members served as judges, advisers or coordinators. This year four, five, six and even seven members have volunteered assistance in many Units.

Through close cooperation with local U.S. Army installations and Army Corps Commanders, more R&D Reservists have reported visits to installations are being arranged for winners at local and regional fairs.

A new Unit in Baltimore, Md., activated less than a year ago, the 2394th USAR R&D Unit, commanded by Lt Col Charles R. Gamper, reported that Army winners and runners-up in the Baltimore City Science Fair will be taken on a tour to a Defense installation in the Baltimore area. The 2394th also arranged for a $25 U.S. Savings Bond to be presented to the Army winner at both junior and senior levels.

The Baltimore City Science Fair, sponsored by Johns Hopkins University and Baltimore civic clubs, will be held the last weekend in March. Five members of the 2394th USAR R&D Unit will participate.

Col Armand D. deRosset, commanding officer of the 50008th USAR R&D Unit in Chicago, Ill., reported that he is arranging, through the cooperation of the 45th Artillery Brigade for the top 10 Army winners in the Chicago Public Schools Science Fair to visit a local Army installation. Six members of the Unit will participate as judges in the Chicago fair and the Northwestern Indiana Science Fair.

For the previous three years, the 5008th Unit arranged through the 45th Artillery Brigade for the top two winners to make the "Operation Understanding" Army Air Defense Tour. The trip took the winners last year to the U.S. Army Air Defense Center, Fort Bliss, Tex.; White Sands (N. Mex.) Missile Range; and the Army Air Defense Command, Colorado Springs, Colo.

Five members of the 4015th USAR R&D Unit in Austin, Tex., commanded by Lt Col Roger Q. Spencer, Jr., will judge the Austin Area Science Fair this year. The top boy and girl winner will visit the Army Air Defense Command in Colorado Springs. Last year, winners visited Fort Bliss, Tex., and White Sands, N. Mex.

Similar plans by USAR R&D Units are expected to be arranged in other localities this year to help further the interest of high school students in science and their understanding of the Army's role in national defense and scientific activities.

Reserve R&D Unit Develops ADP Project for CRD

Members of the 6163rd USAR R&D Unit, Phoenix, Ariz., are using civilian job skills to execute an important assignment for the Chief of Research and Development as a part of Reserve duty training.

Col James W. Elmore is commanding officer. Seven members with Automatic Data Processing (ADP) capability, comprising an ADP section under direction of Lt Col Lewis P. Elbinger, are designing a system which will provide up-to-date, automated files of the 1,300 Army R&D Reservists and their specific scientific and technical capabilities.

The system will make more precise the task of assigning mobilization designations to R&D Reservists, by identifying the jobs to be filled at mobilization time, supplying the qualifications of individual Reservists, and facilitating the rapid placing of the right man in the right job.

The automated system is expected to increase the number of USAR R&D Unit members with mob des assignments. Lt Gen William W. Dick, Jr., Chief of Research and Development, has been concerned with the relatively few (12.5 percent) R&D Reservists with mobilization designations. He would like to see this figure increased to at least 80 percent for more effective utilization of these scientific and technical personnel.

Another group in the 6163rd Unit, also under the direction of Col Elmore, is providing technical support for the ADP section by categorizing technical military positions into 30 main classifications, which will then be subdivided more specifically.

Maj Richard A. Shimmons has responsibility for developing the computer programs to implement the automated phase of the project. This work includes building a file for both the resources and requirements, and writing both a matrix dimension option computer program and a matrix element option computer program.

Once the Reserve Unit members have designed the system, it will be the responsibility of the Department of the Army to update and maintain the data bank.

The original concept of the automated mob des system was developed by 1st Lt Thomas F. Duggan, an employee of International Business Machines Corp. in New York City, where he is a member of the 1332nd USAR R&D Unit.

Lt Duggan prepared the basic study while on a 2-week active duty assignment with the Office of the Chief of Research and Development last year. He is continuing to act as a consultant to the 6163rd Unit in Phoenix under auspices of OCRD.

Missile Command Honors 7 for Invention Patents

Seven inventors of the U.S. Army Missile Command's Research and Development Directorate received patent awards in recent ceremonies at Redstone Arsenal, Ala.

Col Thomas W. Cooke, commander of the Army Missile Support Command, presented the patent awards. The inventions were submitted to the U.S. Patent Office through the Army Missile Patent Center at the Arsenal.

Thomas M. Moore, Future Missiles System, shared an invention award with Herman F. Beduerftig, Marshall Space Flight Center, for a jet vest which can give the wearer flight capability through jet thrust.

Charles E. Riley and Billy B. White, Inertial Guidance and Control Laboratory, received a patent for a multi-interval switch actuator.

Coinventors James V. Johnston, Inertial Guidance Laboratory, and Keith H. Clark, Marshall Space Flight Center, patented a pendulous North-seeking gyroscopic assembly. Johnston also received a patent on an electron gyroscope.

An award for a method and device for determining impurities in inert gases went to Dr. Bernard Steverding, Physical Science Laboratory, and Leonard N. Werner, National Aeronautics and Space Administration.

Charles H. Martens, Propulsion Laboratory, was awarded a patent for an invention that provides improvement in the working and shaping of metals in a low-temperature environment.

Stanley C. Wilkins, Army Missile Support Command Transportation Division, received a patent for a semi-trailer that can be used to transport, load and unload forklifts.

3-Year Study Yields Electronic Radiography Test Technique

By Otto R. Gericke
AMRA, Watertown, Mass.

A 3-year research study conducted by the Department of Welding Engineering of the Ohio State University, Columbus, Ohio, under the sponsorship of the U.S. Army Materials Research Agency, has resulted in the development of a new technique for radiographing materials.

The developed test apparatus consists basically of a closed-circuit television system equipped with a special vidicon pick-up tube that is sensitive to X-radiation. The tube takes the place of the photographic film or fluorescent screen normally used in radiography and offers various advantages.

If, for example, a vidicon tube with a sensing area of ⅜ by ½-inch is used in combination with a 17-inch television picture tube, the system provides an electronic image enlargement of approximately 30 diameters.

As a result, a wire of only one mil diameter appears as a line of about 1/32-inch in width and is thus easily distinguishable. The optimum resolution provided by the system is 0.5 mil.

A further advantage of electronic radiography is that test objects can be X-rayed while in motion. Small flaws, that may be overlooked on a stationary presentation, can often be detected by in-motion testing which may even convey an impression similar to a 3-dimensional view.

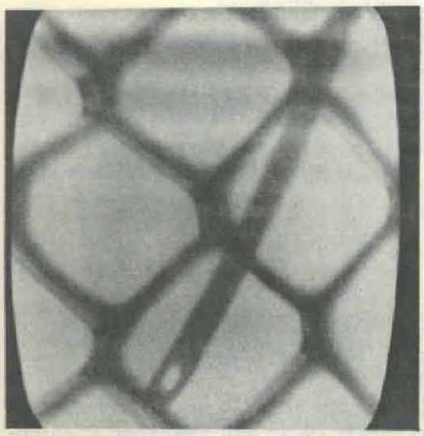


Figure 1. Television X-ray image of a honeycomb structure, with eye of needle indicating a defect.

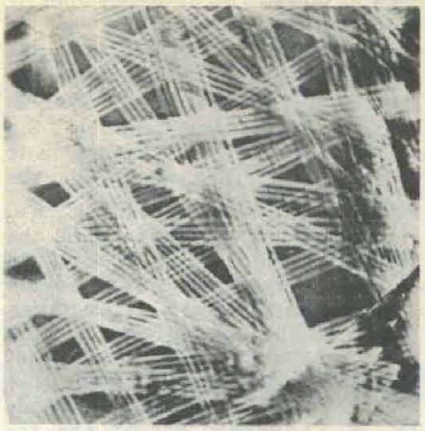


Figure 2. Television X-ray image of fiberglass-reinforced plastic used in missile motor cases.

The radiography of items which incorporate concealed moving components (for example, sealed clock work) and the examination of component behavior under the action of vibrational forces are other important areas of application for electronic radiography.

The observation of living specimens is an example for applications in the fields of biology and medical sciences. It must be noted, however, that the X-ray intensity required to excite the vidicon tube is very high and the resulting radiation dose is eventually lethal.

To inspect thicker sections of materials that absorb a larger percentage of the incident X-radiation, an intensity integrating technique has to be used. To this end, the television equipment is modified to provide either intermittent or slowed-down scanning of the image.

In normal television operation, the exposure time is only 1/30-second per frame. If electrical charges liberated by photoelectric action in the selenium layer of the X-ray sensitive vidicon tube are permitted to accumulate over a longer period of time before read-out is effected by the scanning electron beam, higher sensitivities can be attained.

A significant feature of the electronic X-ray imaging technique is that documentation of test results can be greatly facilitated because the image information is available in the form of video signals. Signals of this type can be recorded on magnetic tape; thus, cost and storage space for permanent records can be considerably reduced.

For normal operation of 30-frames per second, video tape recorders, like those that are now common in television studios, have to be used. When slow-scan operation is practicable, because items do not have to be inspected in motion, an ordinary audio-frequency magnetic recorder can be used to record images. To reconstruct recorded slow-scan images for direct viewing, a cathode-ray tube with a long-persistence screen is required.

To demonstrate the resolution capabilities of the electronic X-ray system, the photographed television image of a honeycomb structure is shown in Figure 1, with the eye of a needle used to identify a defect. The television image shown in Figure 2 shows individual strands of glass fibers that have been used for reinforcement in a plastic rocket-motor case.

At the present stage, basic electronic X-ray imaging equipment is available from commercial sources, while systems for intermittent and slow-scan operation are still in the development stage.

MC Scientist Reviews Germfree Research Progress

(Continued from page 10)

stitute of Research has two subtasks —"The role of bacteria in shock" and "The responses of germfree animals." These administratively assigned brief designations, while broad, do not describe the full scope of the activities involved. The problems under investigation are in several broad areas of military medicine and include studies on shock, burns, radiation injury, infection and immunity, wound healing, growth and metabolism and nutrition.

Comprehensive anatomical, biochemical, physiological and immunological studies comparing germfree, defined-flora and conventional animals are underway. Such studies are being performed on unperturbed normal animals and on animals subjected to selected chemical, physical or viable stressors or these combinations.

Nondestructive Testing of Materials Using Neutrons

By Arnold W. Schultz and William Z. Leavitt
U.S. Army Materials Research Agency, Watertown, Mass.

To supplement to X-ray radiography as a nondestructive testing technique, the radiographic examination of materials using neutrons is being studied at the U.S. Army Materials Research Agency (AMRA), Watertown, Mass.

The potential usefulness of neutrons in testing lies in the fact that they are absorbed in materials through interaction with nuclei, whereas X-rays are absorbed primarily through interaction with atomic electrons.

Unlike X-ray absorption, nuclear absorption of neutrons varies in a random manner with an increase in the atomic number of materials, especially for lower energy neutrons.

Since the mechanisms for neutron and X-ray transport in materials are similar, the degree to which these radiations form images can be compared on the basis of a material's nuclear and atomic cross sections.

As examples of these effects, hydrogen absorbs low-energy neutrons to a much greater degree than X-rays. Hence plastics and rubber, which contain high percentages of hydrogen, are essentially opaque to these neutrons, while these materials are comparatively transparent to X-rays.

Metals like lead and uranium, on the other hand, absorb high-energy X-rays and low-energy neutrons to a similar degree, but are much more transparent to high-energy neutrons than they are to these X-rays.

Materials having similar atomic numbers such as manganese and iron, or indium and cadmium are essentially radiographically indistinguishable using X-rays, but are quite distinguishable using low energy neutrons.

Extending these ideas to problems of concern to the Army, low energy neutrons obtained from the AMRA research nuclear reactor have been used to radiographically examine several-inch-thick sections of uranium and lead on an experimental basis.

To mention only a few applications, these neutrons have been used to detect flaws in adhesive bonds between materials, to examine rubber gaskets for failure when they are located within an assembly, such as within a thick valve, and to determine structural failure in reactor fuel elements, which are radioactive themselves, thus preventing their examination using X-rays.

To extend neutron radiography into becoming a practical tool for eventual application in the field, studies are being continued with emphasis on the use of portable and relatively inexpensive accelerators to serve as sources of neutrons.

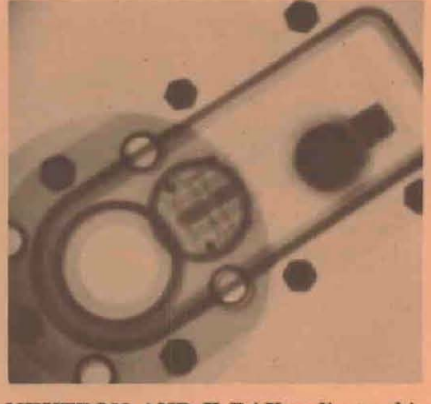
From these accelerators, it appears possible to obtain sufficient quantities of either low- or high-energy neutrons, thereby permitting a large range of materials and thicknesses to be examined such as to make this type of radiography an important addition to the constantly growing family of sophisticated tools available to military inspectors.

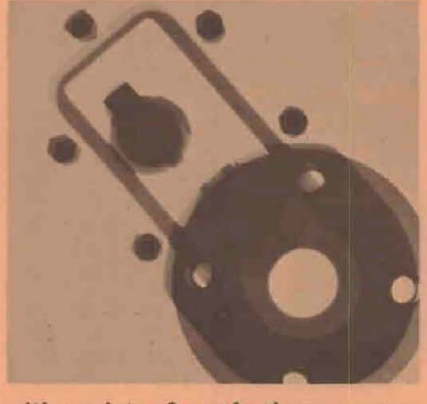
Results of these studies at AMRA and parallel work in progress at U.S. Atomic Energy Commission national laboratories and at Naval laboratories were presented at the 24th National Convention of the Society for Nondestructive Testing, Philadelphia.

Emphasis at the meeting was placed on results of studies using low-energy neutrons obtained from reactors. However, there were indications that work is being oriented toward the use of low-cost neutron generators as they become available.

ARNOLD W. SCHULTZ started his Government career in 1954 upon receiving a B.S. degree in engineering physics from the University of Maine. He joined AMRA after two years with the U.S. Naval Underwater Ordnance Station at Newport, R.I., and Key West, Fla. During the past eight years, he obtained an M.S. degree from Northeastern University and is completing requirements for a Ph. D. in physics. Interested primarily in nuclear and solid-state physics, he is concentrating on the interaction and transport of radiation in materials.

DR. WILLIAM Z. LEAVITT, physical chemist, received both S.B. and Sc. D. degrees from the Massachusetts Institute of Technology (MIT). As a research chemist at MIT's Lincoln Laboratories, he authored several articles in the fields of physical and nuclear chemistry. After three years with the MIT group, he joined AMRA in 1955. There he has been interested principally in nuclear spectroscopy.





NEUTRON AND X-RAY radiographic positive prints of an aluminum vacuum valve are shown above. The rubber O-rings and gaskets are clearly visible in the neutron radiograph on the left, whereas only the grooves in which the gaskets are seated are visible in the X-ray radiograph on the right. Other components are about equally visible in both radiographs.

HDL Team Develops Special Purpose Computer Utilizing Principles of Fluid Dynamics Controls

Fluid dynamics principles that control energy sources without the use of moving parts have been applied to a special purpose pneumatic analog computer at the U.S. Army Materiel Command's Harry Diamond Laboratories (HDL), Washington, D.C.

Based on concepts developed in 1959 by an HDL team headed by Billy M. Horton (now HDL technical director), the computing components, both active and passive, have no moving mechanical parts.

The active components are beam deflection type proportional fluid amplifiers; the passive components — capillary tubes and tanks are analogous to electrical resistances and capacitances.

By placing the components in well-known computational circuits, the operations of integration, summing and scaling are obtained. The integrators that use a bookstrap circuit with positive feedback have a time constant of 10 seconds and a rate of .4 sections^{-1}. The supply fluid is air at 5 p.s.i.g.

The computer, which has been used to solve a second-order linear differential equation with constant coefficients, consists of only two integrators and one summing amplifier that operate on differential signals so that either positive or negative computation is possible.

A switching arrangement is used to set the initial conditions at the integrator tanks while the feedback loop is open. To start the problem, a switch is closed manually to connect the feedback loop. After this the solution proceeds with only the fluid moving. The results check the theoretical solution within 10 percent.

Not intended to produce a fluid analog computer to compete with electronic analog computers, the current experiments are another in a series of research efforts aimed at adapting fluid dynamic principles to a wide application of control systems.

Since March 1960, when details on "Fluid Amplification" were announced at a press conference conducted at HDL (then the Army Diamond Ordnance Fuze Laboratories), the principles have been successfully applied to various fluid-activated systems. (See February 1961 *Newsmagazine*, p. 22, for feature on Fluid Amplification Principles Arousing Wide Response.)

In November 1961, the *Newsmagazine* reported on research initiated at the Diamond Ordnance Fuze Laboratories and, when jointly pursued with the Walter Reed Army Institute of Research, resulted in producing an experimental artificial heart pump that was controlled by a fluid amplifier block.

Kenneth E. Woodward, a mechanical engineer, was credited with development of the heart pump which later was used in a demonstration in which a heart transplant was performed successfully on a dog during a 57-minute experiment at a Cleveland Clinic. (See April 1962 *Newsmagazine*, p. 18, for details.)

Other features included development of a pure fluid valve that is being perfected for use in directing high pressure gases in missile systems. (See March 1963 *Newsmagazine*, p. 24.)

The principles were employed by research engineers to power a missile control system with no moving parts. Successful firing of a test instrumentation missile with a fluid flow control system was reported in November 1964.

HARRY DIAMOND LABORATORIES staff member Judy Lipnick displays a graph showing solution of a differential equation solved by the pneumatic analog computer (background) being developed at the Labs.

ONE OF A TEAM of scientists and engineers working on development of analog computer operated by fluid amplification, Gary Roffman explains simple arrangement of parts on back side of experimental model to Bernadetter Penczak, clerical employee of the Harry Diamond Laboratories.

DoD Instruction Outlines Cost Reduction Verification

Procedures for verifying cost reduction achievements claimed by participants in the Defense Contractor Cost Reduction Program are described in Instruction 7720.12 issued by the Department of Defense.

An enlargement of "Guidelines Defining an Effective Contractor Cost Reduction Program," distributed to major Defense contractors last May, the Instruction also describes the functions of DoD cost reduction monitors who have the responsibility of evaluating contractor programs.

The Instruction explains how a monitor will conduct a qualitative review of a contractor's program, how a validation report will be processed to a central data bank, and how the information will be used.

The objective of the Defense Contractor Cost Reduction Program is to encourage individual contractors to intensify their efforts to achieve meaningful reductions in cost while performing Defense contracts.

Contractors having an annual volume of Defense sales in excess of $5 million, exclusive of firm fixed-price contracts, who have accepted DoD's invitation to report their accomplishments, are considered participants in the program. They submit reports at intervals of six months, based on their own fiscal years.

Evaluations of these reports will be considered by source selection boards or contracting officers in making future awards and in determining profit and fee. The Defense Contractor Cost Reduction Program was established by DoD and industry in response to President Johnson's request of December 1963 for "an affirmative program of cost reduction in performance of DoD contracts.