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Spray Adhesive Saves Lives When Surgical Sutures Fail In Experimental Combat Use

Medical history is being made by the U.S. Army in Vietnam with the first applications to humans of an aerosol plastic spray that adheres to internal organ tissues as a hemorrhage-stopping measure when surgical sutures fail.

In use *only* by the Surgical Research Team of the Walter Reed Army Institute of Research (WRAIR), Washington, DC, under strict Army and Federal Drug Administration (FDA) supervision, the n-butyl cyanoacrylate monomer spray is credited since mid-1966 with saving at least 20 lives at the Army's 3d Surgical Hospital at Dong Tam.

WRAIR scientists who have been involved in development of the adhesive consider its application "potentially dangerous" and stress that it "should be used only in an emergency situation as a 'life-or-death' sur-

(Continued on page 4)

Sentinel Materiel Support Command Created

Establishment of a U.S. Army Sentinel Materiel Support Command, headed by Brig Gen Mahlon E. Gates is progressing although the Army General Order to prescribe its operations had not been issued as the *Army Research and Development Newsmagazine* went to press.

Brig Gen Mahlon E. Gates

The new command is part of the organization for deployment of the Sentinel System, a Chinese-oriented defense against intercontinental ballistic missiles.

General Gates returned from Vietnam to begin duty Jan. 2 at HQ U.S. Army Materiel Command, Washington, D.C. AMC Special Orders No. 2, dated Jan. 2, assigned him as director of the Sentinel Materiel Support Planning Task Force. Temporary headquarters are in the Nassif Building on Columbia Pike near Bailey's Crossroads, about four miles from the Pentagon.

The Sentinel Materiel Support Command (SENMSC) will be one of the major subordinate commands of the U.S. Army Materiel Command, and General Gates will report to AMC CG General Frank S. Besson Jr. When fully organized and staffed, the SENMSC will conform substantially to the standard AMC commodity command complex.

As of Jan. 24, General Gates' staff consisted of two officers. Lt Col James F. Prewett was assigned as director for Maintenance Engineer-

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Radiation Belt Discoverer to Address National JSHS

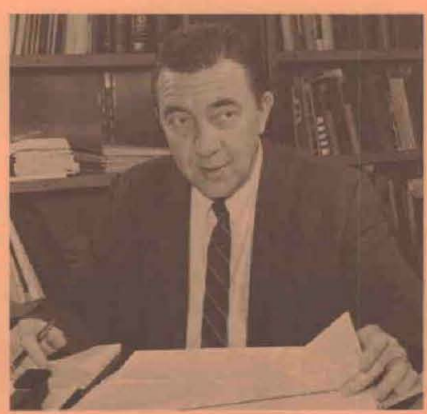
World-renowned discoverer of high-intensity radiation belts in the upper atmosphere, Dr. James A. Van Allen, has accepted an invitation to give the science keynote address at the Sixth National Junior Science and Humanities Symposium, May 15–18.

Dr. Van Allen is head of the Department of Physics and Astronomy at the University of Iowa, which will be host to some 175 of the nation's most gifted high school science students and many of their teachers.

Following Dr. Van Allen's address at the opening session May 16, Brig Gen Thurston T. Paul, representative of the Office of the Chief of Research and Development as director of Plans and Programs, will give one of the major addresses at a luncheon.

Sponsored by the Army Chief of Research and Development with support of academic and industrial or-

(Continued on page 3)



Dr. James A. Van Allen

Featured in This Issue . . .

New HDL X-Ray Facility Simulates Nuclear Effects

Full operational capability of a powerful (6.5 megavolt) Super Flash X-Ray System to simulate *gamma* pulses from a nuclear weapon blast for the testing of electronic instrumentation, constructed at a cost of about $450,000, has been announced by the Harry Diamond Laboratories.

The new facility is described as "the missing link" to complement the Diamond Ordnance Radiation Facility (DORF), constructed at a cost of about $1 million and dedicated Oct. 17, 1961. DORF, located at Forest Glen, Md., simulates *neutron* radiation from an atomic blast.

Both DORF and the new facility generate a pulse flash of extremely high intensity. When demonstrated to the public at its dedication, DORF pulsed for 13-thousandths of a second from the energy level of an

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Army R&D Newsmagazine

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Apstein Heads TARC; 6 New Members Appointed

Assistant Secretary of the Army (R&D) Dr. Russell D. O'Neal presented Certificates of Achievement as The Army Research Council (TARC) held its annual reorganization meeting, Jan. 22–23, with a new chairman and six new members out of a total of 10.

Dr. Maurice Apstein, associate technical director, Harry Diamond Laboratories, Washington D.C., took over as chairman from Dr. Gilford G. Quarles, Corps of Engineers chief scientific adviser, who terminated continuous service as a TARC member since its creation in January 1964. Dr. Apstein has served since 1965.

Five TARC members normally are appointed each year for 2-year terms. Resignation of Dr. Robert E. Weigle, who transferred this past month from Watervliet (N.Y.) Arsenal to a new position with the National Bureau of Standards, created an additional vacancy. The chairmanship changes annually.

New members are Dr. John P. Hallowes Jr., director of the Physical Sciences Laboratory, Redstone (Ala.) Arsenal; Willard R. Benson, chief of the Engineering Sciences Laboratory, Feltman Research Laboratories, Picatinny Arsenal, Dover, N.J.; Dr. Thomas E. Sullivan, Physical and Engineering Sciences Division, U.S. Army Research Office (USARO); and

Dr. Kay F. Sterrett, acting chief, Research Division, Cold Regions Research and Engineering Laboratory (CRREL), Hanover, N.H.; Col Donald L. Howie, recently appointed chief of the Life Sciences Division, USARO; and Dr. Leon T. Katchmar, deputy technical director, Human Engineering Laboratories (HEL), Aberdeen (Md.) Proving Ground.

Holdover members are Dr. Peter D. Lenn, Office of the Director of Research and Laboratories, U.S. Army Materiel Command; Dr. Hoyt Lemons, Environmental Sciences Division, USARO; Dr. E. Kenneth Karcher Jr., Behavioral Sciences Division, USARO; and Col William D. Tigertt, director of Walter Reed Army Institute of Research, only remaining original member of TARC.

In addition to Dr. Weigle, the retiring members of TARC are Tyron E. Huber, who recently retired from the Army after serving on TARC since its inception and as chief of the USARO Life Sciences Division since January 1961; Dr. John D. Weisz, director, Human Engineering Laboratories, APG; Dr. Andrew Assur, chief scientist, CRREL; and Dr. Ernest Petrick, chief scientist and technical director of laboratories, U.S. Army Tank-Automotive Command, Warren, Mich.

In presenting to them Certificates of Achievement, Dr. O'Neal commended the work of Dr. Quarles and the 10 members who served with him as well as Lt Col Daniel J. Walsh, who retired as executive secretary and has been succeeded by Lt Col Sylvester L. Wilhelmi, USARO Research Plans Office.

Former ASA (R&D) Willis M. Hawkins established TARC as a scientific group to aid the ASA (R&D) and the Chief of Research and Development, Department of the Army, in formulating plans, policy and programs for Army basic research and priority areas of exploratory development.

Members of TARC also represent the Army in their scientific disciplines on the five Joint Discussion Forums established to assist the Di-

(Continued on page 26)

TARC MEMBERS posed with ASA (R&D) Dr. Russell D. O'Neal (left) during recent annual reorganization meeting at the U.S. Army Research Office are (from left) Dr. Hoyt Lemons, Willard R. Benson, Col William D. Tigertt, Dr. Leon T. Katchmar, Dr. Kay F. Sterrett, Col Donald Howie, Peter D. Lenn, Dr. John P. Hallowes Jr., Dr. E. Kenneth Karcher Jr., Dr. Maurice Apstein. Dr. Thomas E. Sullivan was not present at the organizational meeting.

Materiel Command Creates Sentinel Support Command

(*Continued from page 1*)

ing and Lt Col John P. Downing as director for Management Systems and Data Automation. The task was that of simultaneously planning, organizing and recruiting for operations of the command on an expedited basis.

The SENMSC function was described broadly as "to provide logistical support to the tactical equipment comprising the Sentinel System."

This will involve providing repair parts support, depot-level maintenance, and national maintenance point services to the Sentinel System sites, including rapid movement of parts to these sites.

Tables of distribution had not been drawn as of late January, but the estimate was that the staff build-up within FY 69 would reach about 300 personnel. Ultimate size of the SENMSC also was indefinite and rough estimates of requirements ranged from 1,500 to 2,500 personnel.

GENERAL GATES went to Vietnam in March 1966 as chief of the Plans and Operations Division, Military Assistance Command. Seven months later he became CG of the U.S. Army Support Command at Cam Ranh Bay, and in May 1967 returned to MACV as director of construction until he was reassigned to HQ AMC.

Graduated in 1942 from the United States Military Academy with a commission in the Corps of Engineers, General Gates has distinguished himself in progressively responsible engineering assignments.

In 1963, he returned to the Pentagon in Washington, D.C., for his third tour. After serving as chief of the Engineer Branch, Personnel Directorate, Office of Personnel Operations, he was assigned to the Army General Staff as chief, Classification and Standards Division, ODCSPER

After attending the 47th session of the Advanced Management Program at Harvard University, he served on the Army Board to Review Officers' Schools (Haines Board) until assigned to Vietnam. He completed the Engineer Officers Advanced Course in 1953, the Command and General Staff College course in 1957 and the Army War College in 1962.

LT COL PREWETT's qualifications for his new assignment as director of Maintenance Engineering for the SENMSC include a BS degree in industrial engineering from the University of Tennessee, an MBA degree from the University of Chicago, and completion of the Command and General Staff College Training. An Ordnance officer, his most recent assignment was director for ammunition, HQ 2d Logistical Command, Ryukyu Islands.

Lt Col James F. Prewett

Lt Col John P. Downing

LT COL DOWNING served until recently as special assistant to the director of the U.S. Army Management Systems Support Agency, Office of the Army Assistant Vice Chief of Staff, Washington, D.C. His educational background for his new job as director for Management Systems and Data Automation of the SENMSC includes graduation (Signal Corps) from the U.S. Military Academy, an MS degree in industrial engineering from Stanford University, and graduation from the Command and General Staff College.

Radiation Belt Discoverer to Address National JSHS

(*Continued from page 1*)

ganizations throughout the nation, the JSHS Program each year involves more than 5,000 outstanding students in 23 regional science fairs in the United States. The program was initiated in 1958 by the U.S. Army Research Office, Durham, N.C.

About 150 students will be representative of the best of those who compete in the regional JSH Symposia. Each of the regional JSHS directors, a representative of the board of education in each state where a regional meeting is held, and a teacher from each region also are invited to the National JSHS.

In addition, some 25 students and about 15 teachers selected as outstanding participants in the Youth Science Congress Program sponsored by the Office of Education, U.S. Department of Health, Education and Welfare, will attend the Iowa City Symposium.

Sessions, however, will shift to HQ U.S. Army Weapons Command at Rock Island (Ill.) Arsenal, the ultramodern industrial equipment manufacturing complex and laboratories of John Deere and Co. at Moline, Ill., and equally modern laboratories of Collins Radio Co. in Cedar Rapids, Iowa. All of these organizations are supporting the National JSHS.

Arrangements for the symposium are being coordinated between the U.S. Army Research Office at Durham, acting on behalf of the Chief of Research and Development, and the University of Iowa, where Dr. T. R. Porter, associate professor and head of the Science Center, is in charge.

Iowa Governor Harold E. Hughes has been invited to make one of the major addresses, but his participation was tentative as the *Army R&D Newsmagazine* went to press. As at each of the previous National JSH Symposia, many of the nation's foremost educators, representatives of the Department of the Army and industrial leaders will be speakers.

In 1967, for example, the keynote speaker was Dr. Margaret Mead, internationally known anthropologist. In 1966, leading roles as speakers were taken by Dr. Henry Morganau of Yale University and Dean Harry L. Levy of New York City College The main speaker in 1965 was the late Dr. Robert Oppenheimer, and in 1964 Nobel Prize physicist Dr. Polykarp Kusch was the keynoter.

The program this year calls for a number of presentations by academic leaders and scientists of similar professional stature, but commitments were not firm at press time.

Graduate students of the University of Iowa will give briefings on research facilities at the institution and escort symposium participants on a number of tours. Three sessions in major disciplinary areas are slated on the opening day in the university's Students Union Building, where activities are centered.

Spray Adhesive Saves Lives in Experimental Use

(*Continued from page 1*)

gical procedure." The cyanoacrylate monomers have not been approved for clinical use and are being used by the research team in Vietnam under "an investigational drug protocol."

The tissue adhesive material has been prepared by the Army Medical Biomechanical Research Laboratory with support of other WRAIR personnel and packaged by the Barr-Stahlfort Co. Freon, which will not combine with the cyanoacrylate, is used to provide pressure. The package is sterile and disposable.

Noting the experimental successes at the Dong Tam hospital, other Army surgical hospitals in Vietnam have requested authority to use this "last resort" surgical development.

Lt Col Teruo (Terry) Matsumoto, 39-year-old Japanese general surgeon, was assigned to WRAIR in July 1966 as chief of the Department of Experimental Surgery and Col Robert M. Hardaway III assigned him as project officer for the tissue adhesive development. Then director of the Division of Surgery, Col Hardaway was reassigned in June 1967 as CO of the 97th Army General Hospital, Frankfort, Germany, and has been succeeded by Col Harold F. Hamit.

Medical leaders at WRAIR report that Lt Col Matsumoto, after investigating ongoing developments, "plunged into the project with characteristic diligence and enthusiasm." He has maintained a file of informal direct-from-the-field progress reports from surgeons working with the WRAIR research team and is planning to go to Vietnam to brief surgeons at some of the hospitals.

Commissioned a captain in the U.S. Army Medical Corps in 1961, based on his certified intent to become a U.S. citizen, he was naturalized Dec. 18, 1964. He has MD and PhD degrees from Kyushu University, Japan, interned at Cook County Hospital, Chicago, Ill., in 1956 as a U.S.—Japan postgraduate medical exchange student, and finished surgical residency at the Maumee Valley Hospital, Toledo, Ohio.

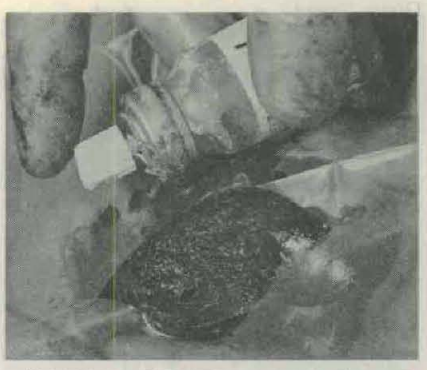
Lt Col Matsumoto was chief of Surgical Service at the U.S. Army Hospital, Camp Zama, Japan, and attended the Medical Officers Career Course of the Medical Field Service School at the Brooke Army Medical Center, Fort Sam Houston, Tex., before reporting to WRAIR

A Diplomate of the American Board of Surgery since 1963 and a Fellow in the American College of Angiology and of the American College of Surgeons since 1966, he is the author or primary coauthor of 85 papers on general surgery and tissue adhesive subjects.

He was awarded the prestigious Sir Henry Wellcome Award in 1967 for an essay on "Tissue Adhesives in Fatal Hemorrhage from Solid Organs." Presented at the 74th Annual Meeting of the Association of Military Surgeons of the United States in Washington, D.C., Nov. 19–22, 1967, it was published in the December edition of *Military Medicine*, official journal of the association.

Nearly 300 members and guests gave him an ovation for a presentation on the aerosol spray tissue adhesive Dec. 29 at the annual meeting of the American Association for the Advancement of Science (AAAS) in New York City.

Col Peter M. Margetis, WRAIR director of the Medical Biomechanical Research Laboratory was chairman of the session on "Physiological Adhesives in Medicine and Dentistry." Col Surindar N. Bhaskar, U.S. Army Dental Corps, also a PhD in Army Institute of Dental Research, presented a paper on "Clinical Use of Alpha Cyanoacrylates in Dentistry" which was placed among the "top 10" of 1967 by the American Dental Association. The fourth WRAMC participant in the adhesives session was Dr. Fred Leonard, chemist and long-time assistant in developing cyanoacrylate combinations, who discussed "Alpha



DAMAGED ORGAN, exposed through sterile acetate opening, is ready for application of surgical spray adhesive.

Noted Army Medic Receives Top Dermatology Award

One of the U.S. Army Medical Service's world-renowned researchers and teachers, Dr. Marion B. Sulzberger, recently became the fourth recipient of the American Academy of Dermatology's Gold Medal Award since it was founded 30 years ago.

The award is the highest bestowed in the specialty of dermatology, academy president Dr. Clarence Livingood stated in making the presentation before some 2,000 members at the annual meeting in Chicago, Ill.

Since Sept. 1, 1964, Dr. Sulzberger has served as technical director of research and chief of dermatologic research, U.S. Army Medical Research Unit, Letterman General Hospital, San Francisco, Calif. He also has continued to serve as technical adviser to the commanding general, U.S. Army Medical Service R&D Command, Washington, D.C.

Dr. Sulzberger moved to his present assignment when the U.S. Army dermatology research program was transferred from Walter Reed Army Institute of Research, Washington.

Dr. Marion B. Sulzberger

The transfer was in line with the objective of establishing clinical research facilities at the Army's major "teaching hospitals." Letterman became the first Army General Hospital to expand clinical research facilities in a planned construction program.

In February 1962, Dr. Sulzberger became principal adviser to The Surgeon General and the Army Chief of Research and Development on all scientific and technical matters related to medical R&D. He continued until he moved to Letterman.

The list of honors he has received is exceptionally long, impressive and representative of the professional esteem he won as a featured lecturer at leading medical institutions in England, Germany, Switzerland, Japan and the United States.

He is the author of numerous medical textbooks and more than 300 scientific articles and monographs. As a physician at Bellevue Hospital in New York City, he achieved Professor Emeritus status.

Founder and past president of the Society of Investigative Dermatology, he is also a past president of the American Dermatological Association, has served as chairman of numerous international groups in dermatology, and has been honored with many top achievement awards.

Cyanoacrylate Polymers and Tissue Adhesion." Dr. Leonard is scientific chief of the Army Medical Biomechanical Research Laboratory.

WRAIR Department of Experimental Surgery researchers have been investigating cyanoacrylate monomers for several years. Methyl cyanoacrylate has been used since 1960 by many investigators as a tissue adhesive for nonsuture closure of wounds. The methyl monomer is histotoxic and higher homologues (closer matching in molecular structure) of the n-alkyl alpha cyanoacrylate were found to become less toxic as carbon atoms were added to the alkyl radical.

Assistance in developing the spray adhesive now being used in Vietnam came from Lt Col John Kovaric, deputy to Col Hamit, Col Margetis, Dr. K. C. Pani, pathologist and Dr. Leonard. Lt Col Charles A. Heisterkamp III returned from Vietnam in December after six months as the Surgical Research Team leader.

Only authorized surgeons listed with the Army and FDA are allowed to administer the adhesive and very few are on the list at this writing.

Strange but true, the first surgical adhesive was developed by the Eastman Kodak Co. approximately 10 years ago. Called Eastman 910, the highly toxic material is the basis for the many adhesive spinoffs that have developed. Eastman has the patent.

Some rather "primitive" adhesives in surgery—particularly brain surgery—date back to 1953. Only in recent years, however, has application of new monomers been made to the moist solid internal organs such as the liver, kidney, spleen and pancreas.

The first adhesive agent to receive extensive tests for strengthening the walls of arteries was a mixture of a proprietary *latex* and *marine varnish*. Tests were made at Duke University, Durham, N.C., by Dr. Barnes Woodhall, former dean of the Medical School and now associate University Provost for Medical Affairs and professor of neurosurgery, and Dr. James Golden, now a neurosurgeon at Palo Alto (Calif.) Medical Center.

This first effort to meet a need for adhesive materials in surgery is described in the book "Aneurysms and Arteriovenus Anomolies of the Brain," by Drs. J. Lawrence Pool and D. Gordon Potts of Columbia University. The book was published in 1965 by Harper and Row, New York.

The Army-developed tissue adhesive has shown such promise in the surgical experiments in Vietnam that the developmental effort has increased at WRAIR, with an eye to the future when a perfect tissue adhesive can be used with ease.

From the death, desolation and holocaustal devastation that engulfed him as a 16-year-old science student survivor of the world's first atomic bombing of a city, Lt Col Teruo Matsumoto emerged with a passion to save life as a physician.

Today he is a member of the U.S. Army Medical Corps and chief of the Department of Experimental Surgery, Walter Reed Army Institute of Research, Washington, D.C. He is also project officer for the WRAIR-developed aerosol tissue adhesive spray which is helping to save lives of U.S. soldiers wounded in Vietnam.

When Hiroshima was bombed, he was in a classroom at a school in Hiroshima. There was a blinding flash and the 2-story structure, less than half a mile from ground zero *in the attack, partially collapsed. When he regained consciousness, he was seriously wounded but managed to climb out of the ruins.*

From other survivors he learned that the Allies had dropped bomb-warning leaflets over the city, but instructions were to turn over the leaflets to Japanese military authority without comment to others. Hiroshima was a military complex but had never before been attacked.

Lt Col Matsumoto carries a few scars of the bombing but has experienced no health problems. He summarizes his experience this way:

"I am the father of two children and am living my second life *as a general surgeon. Whenever I face a sick patient I cannot help but think of the aging faces and voices in Hiroshima. . . . I could do nothing then but walk by. Now, in a similar situation, I could save human lives."*

Lt Col Teruo Matsumoto

Pride in 'Old Reliable' Survives Computer Era

One of the fascinating forerunners of modern high-speed automatic computers is a 1913 Swiss-made, hand-powered, manually operated desk calculator still in active though limited use at the U.S. Army Research Office (USARO), Arlington, Va.

Martin H (Marty) Weik Jr., deputy chief of the Scientific and Technical Information (S&TI) Division "exercises" it for some "convenient computations." Recognized as one of the Army's top automatic data processing authorities, Weik acquired the great-great-grandfather of present-day digital computers from his late father some 13 years ago.

The almost antique brass-finished calculator is still in perfect working condition. It has made the rounds of a Greenwich Village (N.Y.) realty firm's cluttered storeroom, 10 years in a New York City apartment, and a farm at May's Landing, N.J., to which Weik Sr. retired in 1954.

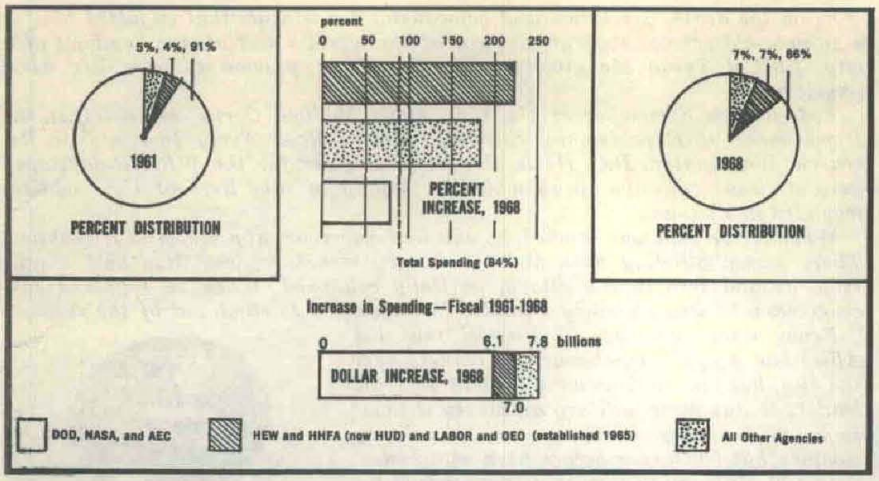
Martin H. Weik Jr., S&TI Division deputy chief, demonstrates 1913-vintage, hand-powered, manually operated desk calculator to Sharon Hunnicutt.

An "integral" part of his life for many years with the New York realtors, the machine was a gift from the firm after it was retired when more modern electric desk "computers" replaced the hand-powered units in the 1920s.

The 2-foot-long "Madas" model, marked "U.S. Pat. Dec. 16th 1913," was made by H. W. Egli Calculating Machines, Zurich, Switzerland. Three registers on the 7-inch slanted face produce solutions to problems of addition, subtraction, multiplication and division with the simple flip of a lever.

Marty Weik, who has an MS degree in electrical engineering from Columbia University, joined the U.S.-ARO S&TI staff (with his machine) in January 1964. Previously, he was for 11 years an electronics engineer for data processing with the computer laboratory, Ballistics Research Laboratories, Aberdeen Proving Ground.

"When electric power fails," Weik commented (mindful of massive power failures in some parts of the U.S. in recent years), "I'll be the only one in USARO—perhaps the entire Army—who can sit here and operate a machine to add and subtract and multiply and . . ."



Federal Spending for R&D—Fiscal 1961 and 1969 (Chart by Battelle)

$17.2 Billion Federal R&D Budget Forecast in 1968

Federal Government R&D expenditures of $17.2 billion predicted for Calendar Year 1968 will be 65 percent of the $26.5 billion total R&D forecast for the United States. Industry is expected to account for $8.3 billion, academic institutions for $865 million and nonprofit research organizations for $265 million.

That is the opinion of Battelle Memorial Institute economists Ralph L. Craig and Leonard L. Lederman, who point out in the BMI annual R&D forecast that federal expenditures will rise about 2.2 percent over 1967 estimates as compared to a national R&D rise of approximately 3.3 percent.

Significantly, for the first time since reliable figures for total R&D expenditures became available, it is estimated that the increase in federal spending on research in the social sciences will be greater than the increase in the physical sciences.

The change is due in part to a sharply reduced rate of growth of military space and atomic energy research programs, but is also due in large measure to a national concern with education, health, urban, employment and welfare problems.

In terms of percentage increase, colleges and universities are expected to show the largest gain in 1968. R&D funds from this sector will be increased by $70 million (an 8.8 percent gain), reflecting in part funds received from foundations and state and local governments.

Investment in research and development by industry is expected to rise by $380 million (an increase of 4.8 percent).

R&D expenditures in the United States for 1965 to 1975 are expected to grow at about the same rate as the Gross National Product (GNP). This would differ from the pattern in the 1955–65 decade when R&D spending grew at an annual rate of 14 percent, while the annual GNP growth rate was 5.5 percent.

The rate of growth of federal spending for R&D associated with social problems has been higher than for military / space / atomic energy R&D since 1961, the Battelle economists observe.

The 1968 Fiscal Year budget for certain agencies shows, for example, that R&D expenditures are 220 percent higher than those for comparable programs for fiscal 1961. Involved are programs administered by the Department of Health, Education and Welfare (HEW); the Department of Housing and Urban Development (HUD), established in 1965 as the successor to the Housing and Home Finance Agency; the Department of Labor; and the Office of Economic Opportunity (OEO), established in 1965.

During the same period, R&D spending by the Department of Defense (DoD), the National Aeronautics and Space Administration (NASA) and the Atomic Energy Commission (AEC) increased 73 percent, largely as a result of a substantial rise in spending on the space program.

Federal budgets for the 1961 and 1968 Fiscal Years provide another illustration of a change in the pattern of federal support of R&D. Ninety-one percent of federal R&D expenditures in 1961 were made by the DoD, NASA and the AEC

R&D programs now in the agencies with strong social orientation—HEW, HUD, Labor and OEO—accounted for only 4 percent of federal research funding. Other departments (Agriculture, Commerce, Interior) and the National Science Foundation, had a 5 percent share of federal R&D funds.

Estimated expenditures for FY 68 show that DoD, NASA and the AEC are expected to account for 86 percent of total federal R&D funding. The share of federal funds going to HEW, HUD, Labor and OEO is expected to total 7 percent. Other agencies will account for the remaining 7 percent.

This means that since 1961 there has been a reduction of about 5 percent in the proportion of federal R&D funds allocated to defense, space and atomic energy programs. (See figure.) However, DoD, NASA and the AEC received $6.1 billion of the $7.8 billion increase in federal R&D expenditures between fiscal 1961 and 1968. All other agencies received $1.7 billion. This reflects the continued importance of DoD, NASA and the AEC as the major funding agencies despite their lower growth rates in recent years.

The Battelle economists say the U.S. is beginning to experience a change in the kind of disciplines supported by federal money. The defense, space and atomic energy programs provide support mainly to the physical and engineering sciences. The major social programs are providing support to many of the behavioral and life sciences.

Since 1965, the federal share of the national total R&D expenditures has decreased slightly. Industry's share has increased slightly for the past four years, but the Battelle researchers do not foresee a return to the industry dominance of research funding common before the 1940s.

Although the U.S. Government is the dominant *source* of research funds, industry continues to *perform* more than 69 percent of all research.

Data for the Battelle forecast for the calendar year are drawn from various sources, including the fiscal year figures of the U.S. Bureau of the Budget, National Science Foundation, and analyses conducted by the Socio-Economics Research Group at Battelle-Columbus and Battelle's Washington offices.

Estimates for industry expenditures are derived in part from an analysis of corporate cash flow, which is considered an indicator of industry's future support of R&D. The supply of industry R&D funds is a function of retained earnings and depreciation.

The forecast for the 1968 calendar year takes into account revisions made recently by the National Science Foundation of data on source of funds and performances of R&D.

Powerful New HDL X-Ray Facility Simulates Nuclear Effects

(*Continued from page 1*)

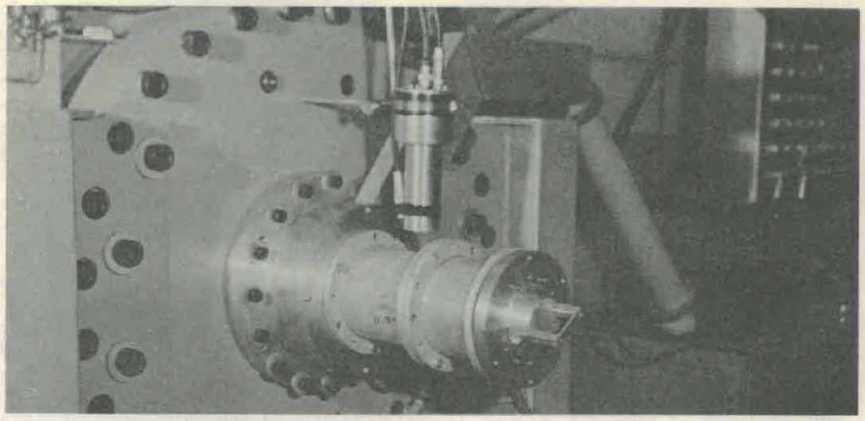
ordinary radio to a level equal to the electrical power used by the entire city of Washington in that period.

The new Super Flash X-Ray System is described by HDL scientists as "one of the most powerful of its kind in the world at this time and the most powerful within an Army installation." They emphasized, however, that a larger, more powerful machine is desirable for some experiments, involving radiation over larger volumes of material at higher intensity than is now available.

Because of its extremely narrow pulse width, stated Frank Wiminnetz, chief of the HDL Nuclear Vulnerability Branch in charge of operations, the system is a useful tool for examining physical phenomena which are of very short duration. Pulse intensity is much higher than in high-voltage X-ray machines available at all except about five similar systems used by the Air Force and industry, he said.

The combination of the DORF and Super Flash X-Ray System enables HDL researchers to expose electronic equipment to a simulation (although not a duplication) of the total effects of radiation from a nuclear weapon explosion. This quasi-nuclear environment, it was explained, saves large sums of money in reducing the number of underground nuclear tests that might otherwise be required.

Wiminnetz said HDL now has the capability of performing its "homework" laboratory testing of electronic components, circuits and materials thoroughly enough to increase greatly the possibility of success in the final underground nuclear tests.



FRONT view of Harry Diamond Lab's 6.5-megavolt Super Flash X-Ray System, showing electron beam drift tube and scintillator-photo diode pulse monitor.

The new facility at HDL permits scheduling of experiments at intervals of about 20 minutes and currently is being used extensively by HDL scientists. The facility, however, is available to all Army laboratories and to other service laboratories and their contractors on a cost-reimbursable basis.

Industrial organizations, it was emphasized, must have a U.S. Government contract and the request for use of the facility must go through the Army or service agency concerned for approval.

Constructed by the Ion Physics Corp. of Boston, Mass., the new facility required almost two years to complete, involving considerable research and design engineering.

About half of the $450,000 total cost was for the X-ray machine, with $100,000 going to additional instrumentation. Roughly $50,000 was needed for research and design engineering, and the remainder for renovating and providing radiation shielding in a building vacated by the National Bureau of Standards.

Wiminnetz is qualified for his responsibility for operation of the system by continuous work in this field for more than a decade. He was part of the National Bureau of Standards staff that was transferred to the Harry Diamond Ordnance Fuze Laboratories (now HDL) when they were established in 1953.

Heywood Succeeds Cantwell On Reserve Policy Board

Appointment of Maj Gen Edwin W. Heywood, ARNGUS, to a 3-year term as a member of the Reserve Forces Policy Board was announced Jan. 8 by Secretary of Defense Robert S. McNamara. He succeeds Maj Gen James F. Cantwell, ARNGUS, whose term has expired.

The Reserve Forces Policy Board, acting through the Assistant Secretary of Defense (Manpower), serves as the principal policy adviser to the Secretary of Defense on matters pertaining to the reserve components.

The Board is composed of 21 members, a majority of whom are officers of general and flag rank from each Reserve component of the Armed Forces. Chairman of the Board is John Slezak, a former Under Secretary of the Army, who is assisted by Maj Gen Ralph A. Palladino, USAR, as military executive.

R&D CAPABILITIES of the Harry Diamond Laboratories (HDL) to fulfill Army needs in Vietnam were surveyed during a recent visit by Dr. William G. McMillan, chief science adviser to General Westmoreland, who will give the keynote address at 1968 Army Science Conference, June 18–21. Accompanying him are Col Leslie G. Callahan Jr., HDL commanding officer, and Billy M. Horton, technical director of the U.S. Army Materiel Command laboratory in Washington, D.C. The apparatus being discussed is a new high-vacuum system for "sputtering" tantalum thin-film, micro-miniature resistors which are compatible with silicon-integrated circuits. HDL pioneered much of this work.

SATCOM Tests Tactical Satellite Communications in Jungle

One of the paradoxes of modern military communications is that a combat commander may find it easier to talk with someone thousands of miles away than to converse with troops operating nearby on the other side of a mountain or in a dense jungle.

That explains why Project EASTT (Experimental Army Satellite Tactical Terminals) has been conducted over a period of about two months recently between the U.S. Army Tropic Test Center in the Panama Canal Zone and HQ U.S. Army Satellite Communications (SATCOM) Agency, Fort Monmouth, N.J.

The purpose of this test activity was to prove the feasibility of tactical satellite communications to overcome the handicap of a canopy of jungle vegetation or a similarly difficult environment.

Test operations each day began with the familiar code call:

"EASTT 3, EASTT 3,
this is EASTT 1—over."
"EASTT 1, EASTT 1,
this is EASTT 3—over."

EASTT 1 was located deep in the steaming jungle of the Army Tropic Test enter and EASTT 3 at HQ SATCOM. The daily conversation was by way of Air Force Satellite LES–5, a part of the U.S. Armed Forces experimental global tactical satellite communications system.

The SATCOM Agency is concerned with the Army's mission, as assigned by the Department of Defense, in demonstrating the feasibility of such a system. The SATCOM project manager for satellite communications is responsible for providing the ground terminals and conducting the communications testing for all DoD satellite communications projects.

EASTT 4, ¾-ton truck satellite communications terminal. Members of the test team are adjusting the special collapsible bifilar helix antenna, with the operations van half hidden by foliage of the jungle in background.

One result of Army R&D has been the Project EASTT terminals, the first step in the design of a satellite communications terminal for combat forces. Equipments were fabricated as an Army in-house effort (SATCOM Agency design, Electronics Command shops), using modified existing electronic equipment and vehicles.

Five terminals were built—EASTT 1 and EASTT 2, jeep mounted; EASTT 3 and EASTT 4, ¾-ton truck installations; EASTT 5, 26-foot van terminal. SATCOM Agency engineers also designed and assembled two special mobile test vans for the technical evaluation of the EASTT terminals and system.

EASTT 1 and EASTT 2, the jeep terminals, can be driven to a site in any type of terrain. In less than 20 minutes, the 2-man crew can erect the antenna, locate the satellite and be ready to handle simultaneous voice and teletype traffic in a tactical satellite communications network.

Installed in the vehicle are the terminal equipments: receiver, transmitter, control panel, antenna diplexer, teletype-writer and associated items. The trailer carries the antennas—a cross-polarized yagi and a collapsible bifilar helix—and the power supply.

The next larger terminals, ¾-ton vehicle installations (EASTT 3 and EASTT 4), can be driven into any type of terrain and, within half an hour, a 3-man crew can have them ready for operation.

Except for increased power output (one kilowatt power amplifier) and the addition of a frequency division multiplex-demultiplex and test equipment for operational checks, the ¾-ton equipment is similar to the jeep installation: receiver, transmitter, control panel, antenna diplexer and teletypewriter. The trailer carries the collapsible bifilar helix antenna and the power supply.

The terminal installed in the 26-foot standard Army cargo van, EASTT 5, can be driven wherever the other terminals can go and its 5-man crew can have it operational within an hour. Designed as the Project EASTT base terminal, it is more fully instrumented and is capable of higher performance than the other EASTT terminals.

EASTT 5 houses a maintenance shop, test facility and special purpose experimental gear as well as the satellite communications terminal. A trailer carries the stowable quad helix antenna.

(Additional pictures on back cover.)

EASTT 1 jeep installation satellite communications terminal in jungle operations of the U.S. Army Test Center, Canal Zone. At the right is the collapsible cross-polarized yagi antenna locked on the LES–5 satellite.

Since Air Force launched the LES–5 July 1, 1967, as an all-solid-state UHF repeater satellite, the SATCOM Agency has been conducting exhaustive tests of the small, mobile EASTT terminals to evaluate the concept of tactical satellite communications as a modern and dependable tool for the combat soldier.

The first test phase was conducted with the terminals located at various points in the Fort Monmouth area. Involving all five terminals and the specially designed test vans, this series confirmed the theoretical predictions of the SATCOM Agency's design engineers and indicated the technical approach for improvement and advanced development. The second phase was then started to determine EASTT terminal capabilities under varying environmental conditions.

A most difficult environmental condition for all communications is, of course, the tropical jungle. SATCOM Agency leaders have long believed tactical satellite communications may present the answer to this problem. To prove this concept, the Agency airlifted by C–133 aircraft an EASTT network—EASTT 1, EASTT 4 and Test Van No. 2, plus operating and test teams, to the Army tropic Test Center at Fort Clayton.

There, on the old Las Cruces Trail with its memories of the pirate Morgan, the vehicles were driven into the deep jungle and located about a mile apart on patches of ground cleared by machete. Then,

pointed through the thick canopy of vegetation, the antennas were locked on the 4½- by 5-foot satellite orbiting 21,000 miles overhead to begin the tactical satellite communications jungle test program.

As had been expected from past performance, the terminals proved to be dependable communications equipment even under the adverse environment of the dense tropical jungle, usually thought impenetrable for most types of tactical communications. Located a mile apart and separated by the crest of a hill and a narrow, over-grown, twisting junge path, the Canal Zone terminals communicated with each other via satellite and with the SATCOM Agency 2,500 miles away.

Test teams ran voice and teletype tests, made measurements, checked voice levels, evaluated signals, plotted curves and drew graphs. They analyzed their findings, studied their charts and evaluated terminal performance, system concepts and operating requirements. Finally, it became conclusively apparent that the terminals operated with complete success through the worst conditions the tropical jungle could offer.

The gratifying technical test results led to communications demonstrations from EASTT-in-the-jungle to Washington via LES–5 and the EASTT terminals at Fort Monmouth. Telephone calls were made from the Las Cruces Trail to General Frank S. Besson Jr., commanding general of the Army Materiel Command; to Lt Gen Austin W. Betts, Army Chief of Research and Development; and to Maj Gen Leland G. Cagwin, commanding general of the Army Test and Evaluation Command.

The jungle test program has served two major objectives: first, to prove the feasibility of tactical satellite communications in a jungle environment and then to prove that such communications could be "secure," a military necessity. To confirm the feasibility of jungle communications, extensive studies were made of transmission fading due to foliage.

Continuous up-link and down-link experiments between the two tropic terminals and between the Canal Zone and the Fort Monmouth terminals revealed that, while the tropic terminals evidence some signal attenuation due to foliage, no significant effect impaired voice or teletype communications.

Based on scientific measurements, these findings satisfied the Army that the R&D effort was a success—that small satellite communications terminals can provide a military tactical field force with clear, dependable, instantaneous, secure communications over mountains, in driving rain, in dank fog, in steaming heat, and, most important of all, through dense jungle foliage.

"We know now," a SATCOM Agency spokesman said, "that our EASTT terminals can go deep into the jungle; that we can set up on a patch of ground cleared by one soldier with a machete; that we can fire up our generators, assemble our antennas, turn on our electronics and communicate with any terminal anywhere that can see the satellite with us."

Success of the tests at the U.S. Army Tropic Test Center has advanced the concept of tactical satellite communications for jungle operations and points the way toward field use. Testing for actual field use, the next step in the evaluation of the EASTT terminals, is well into the planning stage and another series of technical tests is programed.

For this next step, the EASTT terminals will be moved into locations of intense man-made interference where there are planes, trucks, power equipment, electrical and electronic gear and anything else that can be found in a busy military area. Exhaustive experiments will be conducted in the continuing effort to develop reliable satellite communications for the U.S. Armed Forces.

THE JOINT SATELLITE STUDIES GROUP of the International Scientific Radio Union met at Fort Monmouth, N.J., in a session where the host was Team No. 6, Division C, Institute for Exploratory Research, U.S. Army Electronics Command (ECOM). The group was formed to make a concentrated study in the northeastern United States on the structure of the ionosphere through which long-distance radio signals travel. Simultaneous study of satellite signals at the various stations of the group yields information on irregularities in the ionospheric structure. Shown (l. to r., seated) are Dr. Jules Aarons, Air Force Cambridge Research Laboratories (AFCRL), Bedford, Mass.; Dr. Bernard J. Flaherty, University of Illinois; John A. Klobnchar, AFCRL; Haim Soicher, ECOM; (standing) Prof. K. C. Yeh, University of Illinois; Dr. Paul R. Arendt, ECOM; and Dr. George H. Millman, General Electric Co.

AVCOM Calls Upon Industry For Aircraft Maintenance

Greater dependence upon commercial aircraft maintenance plants, involving contracts for an estimated 8.5 million man-hours of labor in FY 69, has been announced by the U.S. Army Aviation Materiel Command.

Director of Procurement and Production Col Clifton O. Dufy at HQ AVCOM, St. Louis, Mo., anticipates that urgent requirements for commercial maintenance of Army aircraft will increase to about 12.5 million man-hours during FY 70.

Due largely to the war in Vietnam, government-owned and operated repair facilities which have been performing most of the overhaul of aircraft required by AVCOM are now operating at peak capacity.

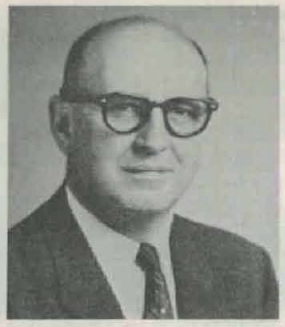
Fourteen Army aircraft systems, rotary and fixed-wing, are included in the expanded commercial overhaul program, involving 174 classifications of engines, transmissions, rotor blades and related equipment.

Copies of a letter setting forth AVCOM aircraft maintenance requirements have been disseminated to many known potentially interested concerns. The letter states in part: ". . . In order to obtain this capability from commercial enterprises, this Command must proceed immediately with preliminary action to determine and identify overhaul sources interested. . . .'

Firms interested in such contracts may contact Leonard Richman, AVCOM Chief of Industrial Assistance Office, P. O. Box 209, St. Louis, Mo.

ECOM Sets Up Tactical Communications Office

Brig Gen P. A. Feyereisen



Donald G. Fink

Theodore A. Pfeiffer Jr.

Action to assure compatibility in development and interoperation of combat-type communications systems is assigned to a new Tactical Communications Systems Office at HQ U.S. Army Electronics Command, Fort Monmouth, N.J.

ECOM CG Maj Gen William B. Latta announced selection of Brig Gen Paul A. Feyereisen as deputy CG for the new organization, in addition to his responsibility as United States program and project manager for the Mallard Project.

In the latter position, General Feyereisen serves under the Army Materiel Command to carry out the U.S. portion of the project and is directly under the Army Chief of Staff to direct international aspects. The goal is establishment of a tactical communications system, in the 1975 time frame, to serve armies, navies and air forces of U.S., Australia, Canada, United Kingdom.

In his new role as deputy CG for the Tactical Communications Systems Office, General Feyereisen is charged with assuring "coherence and integrity" of tactical communication system engineering assigned to ECOM.

Army Materiel Command CG General Frank S. Besson Jr. approved the new ECOM element and authority to establish it was granted by the Department of the Army.

A staff of 33 military and civilian personnel is planned, headed by Theodore A. Pfeiffer Jr. as acting technical director. He has been serving as associate director in charge of technical programs and analysis in the ECOM R&D Directorate.

Plans for the office were developed by a 5-man panel headed by Donald G. Fink, general manager of the Institute of Electrical and Electronics Engineers and chairman of the ECOM Electronics Advisory Group.

The office will work closely with the Army Combat Developments Command, and particularly its Communications-Electronics Agency at Fort Monmouth, to determine the communication needs of the men in the field. The drive for greater compatibility extends to better interfaces between tactical and strategic systems, including global communications networks.

The tactical communications study team was established by Willis Hawkins, former Assistant Secretary of the Army for Research and Development, and its work continued under Dr. Russell D. O'Neal.

U.S. Army Standardization Group (U.K.) Adopts Symbolic Badge

The U.S. Army Standardization Group (United Kingdom), stationed in London, has adopted a badge symbolic of its mission.

Heraldically, it is described as "a griffin rampant or with two heads, dexter an eagle, sinister a lion, holding in its dexter talon a sword, blade proper hilt or, and in its sinister talon a sheaf of arrows proper."

The griffin, a beast half lion and half eagle, represents the conjoining of U.S. and U.K. military effort—the eagle representing the U.S. and the lion the U.K. The eagle grasps the sword of the British Army and the lion the arrows of the U.S. coat of arms—representing standardization and interchange of equipment and techniques.

The design is also an international effort. It was conceived by Maj J. M. Massaro, executive for administrative services of the Standardization Group and drawn by Dan Escott, a British citizen and former artist at the U.S. Army Institute of Heraldry. Members of the group wear civilian clothes in London and the emblem will serve as a lapel pin for unit identification.

Brehm Named Deputy ASD For Land Forces Programs

"Acting" was dropped from the title of William K. Brehm when he was sworn in Jan. 5 as Deputy Assistant Secretary of Defense (Land Forces Programs), Office of the Assistant Secretary of Defense (Systems Analysis).

Brehm had served in an acting capacity since October 1967, when the new office was established as an outgrowth of the Land Forces Division, ODASD (General Purpose Programs), ODASD (Systems Analysis). He had served since October 1964 as director of the Land Forces Division.

The office he heads was created because of the increasing size and complexity of the programs and problems falling within the scope of his responsibility, the Department of Defense announced.

Responsible for analysis of all DoD Land Forces Programs, including combat and support forces, force structure, deployments, readiness, weapons, materiel and manpower requirements, he also is charged with developing improved management systems for use in DoD planning and analysis of these programs and requirements.

Dr. Alain Enthoven, Assistant Secretary of Defense (Systems Analysis), has three other deputies. Russell Murray II is Principal Deputy Assistant Secretary and also DAS (General Purpose Programs). Dr. Ivan Selin is DAS (Strategic Programs) and Robert C. K. Valtz is DAS (Regional and Resource Analysis).

Dr. Enthoven has headed the OASD (Systems Analysis) since it was created in September 1965. Graduated from the University of Michigan in 1950 with honors and a degree in mathematics, he continued his studies there to earn a PhD in 1952. He held progressively responsible positions in industry before assuming his present duties.

Lotz Succeeds Meyer as STRATCOM CG

Change-of-command ceremonies Jan. 31 made Maj Gen Walter E. Lotz Jr. the successor of retiring Maj Gen Richard J. Meyer as CG of the U.S. Army Strategic Communications Command, Fort Huachuca, Ariz.

General Lotz had served since Sept. 1, 1966 as Chief of Communications-Electronics, Department of the Army, and since October 1967 as Assistant Chief of Staff for Communications and Electronics in a redesignation of this General Staff position.

STRATCOM is the agency responsible for the Army's global communications network, now operational at installations in some 30 nations.

Prior to assignment as Chief of Communications-Electronics, General Lotz served a year in Vietnam as assistant chief of staff, Communications-Electronics, U.S. Military Assistance Command. That tour followed two years as Director of Army Research, Office of the Chief of R&D, HQ Department of the Army.

Most of his assignments during a 29-year Army career have been as a Signal Corps officer, including a 3-year tour at Fort Huachuca (1959–62), first as chief, Electronic Warfare Department, then as director of the Systems Development Directorate, and finally as deputy commander. His next assignment was deputy CG, Army Electronics Command, Fort Monmouth, N.J.

General Lotz has a doctoral degree in physics from the University of Virginia (1953) and an MS degree from the University of Illinois.

Maj Gen Walter E. Lotz

Ship Design May Be Aided By Result of Army Study

Thermographic phosphors, presently used in nondestructive testing of weldments, may also provide a simple method for observing water flow around ship hulls which could influence future marine craft design.

That is the conclusion drawn from a preliminary report of an "in-house" research study made by the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va., on the feasibility of using thermographic phosphors in detecting hydraulic flows.

Philip Morrill, an engineer in the Marine and Bridge Division who conducted the preliminary study, said the thermographic phosphor would permit the water flow under and outside of a ship's hull to be determined simply inside the hull. Results would show areas rather than point-to-point as is common.

Thermographic phosphor, he said, could be used in the ship's piping system to locate points where the flow of liquid may be blocked by foreign bodies, or used in a pipeline to permit correction of design at points of turbulence and to increase the efficiency of the whole line.

Eastman Kodak Co. originated the technique and licensed the U.S. Radium Corp., Morristown, N.J., to manufacture and market temperature-sensitive phosphor. The common form of this phosphor is a bright yellow, fine-grained powder which fluoresces orange in ultraviolet light.

A coating of the phosphor will glow with bright and darker spots where minute temperature differentials exist on the same body, so that the heat pattern is visible and may be recorded by photography.

The phosphor may be applied as a spray from a pressurized can in a fast-drying vehicle, and a portable ultraviolet light allows the total elapsed time for the test to be a matter of minutes. Low cost permits large areas to be economically tested.

Morrill said a stripping film may be applied, where desirable, so that the surface is returned to its original appearance, or the phosphor may be left in place for future use. Such use enables locating of "hot spots" and potential trouble on electronic assemblies and components.

Brig Gen Clement Named CDC Director of Doctrine

Combat Developments Command Director of Doctrine is the title that Brig Gen Wallace L. Clement assumed Feb. 1 when Brig Gen Roy L. Atteberry left for an assignment in Germany.

General Atteberry is assigned as chief of staff, HQ Communications Zone, U.S. Army, Europe.

Until he moved to the Pentagon as the first director of the new Office of Personnel Studies and Research, Office Deputy Chief of Staff for Personnel, Department of the Army, Mar. 15, 1966, General Clement was commander of the U.S. Army Research Office and Assistant Director of Army Research, Arlington, Va.

General Atteberry deployed the 1st Infantry Division Artillery to Vietnam and commanded the unit until March 1966. He served several months as chief of the Surface Plans and Operations Division, HQ Military Assistance Command, Vietnam, prior to assignment to HQ CDC.

In 1961, he attended the British Imperial Defence College in London before assignment to HQ SHAPE in Paris, where he served until June 1964, when he became commander of the 1st Infantry Division Artillery.

Graduated from the United States Military Academy in 1941, he served in World War II in the Aleutian Islands and Marshall Islands campaigns before assignment to Europe in April 1944. He participated in the invasion campaign and served in Europe until the end of operations.

Brig Gen Wallace L. Clement

Brig Gen Roy L. Atteberry

Major RDT&E, Procurement Contracts Total $470 Million

Army research, development, test, evaluation and procurement contracts of over $1 million from Dec. 12 to Jan. 11 totaled $470,243,220.

General Motors Corp. was awarded contracts totaling $42,457,364 for assemblies for 81mm cartridge projectiles, metal parts for 105mm projectiles, engines for OH-6A helicopters, and joint design and engineering test team effort for the Main Battle Tank 1970s.

A $37,492,815 modification to a previous contract awarded to Day and Zimmerman, Inc., is for loading, assembling and packing medium caliber projectiles and for maintenance and support services at the Lone Star Ammunition Plant, Texarkana, Tex.

General Dynamics Corp. received a $32,428,399 definitization of a contract for Redeye missiles. Contracts totaling $32,341,085 awarded to Thiokol Chemical Corp. are for loading, assembling and packing ordnance items.

Lockheed Aircraft Corp. will be paid $21,400,000 under an option to a previous contract for Cheyenne helicopters and for funding for long-lead-time items. National Presto Industries, Inc., was issued a $20,967,140 contract definitization for 105mm projectile parts.

Three contracts totaling $18,445,049 with Martin Marietta Corp. are for Shillelagh missiles and selected items of Pershing missile equipment. United Aircraft Corp. will supply CH-54A helicopters, a main transmission test stand, and engineering and technical data for $17,400,000.

Four contracts totaling $16,087,285 with the General Electric Co. will procure 20mm air-defense artillery guns for the XM163 weapons system, AN/MPQ-4 radar sets, 7.62mm aircraft machineguns and ancillary equipment, and installation of Nike Hercules modification kits.

Honeywell, Inc., received four contracts totaling $15,051,944 for grenade fuzes, bomb dispensers, and R&D of ammunition. Emerson Electric Co. will provide aircraft armament subsystems, test sets and test stands for XM28 and TATI02A subsystems for $12,250,187.

Planning activities for the Sentinel System antiballistic missile defense and an increased level of preproduction engineering and manufacturing will be furnished under a $12,053,399 contract modification with Western Electric Co.

Five contracts totaling $11,444,948 with the Hughes Aircraft Co. will procure radio system components, the Iroquois Night Fighter and Night Tracker System, and industrial engineering services for the TOW weapon system and the AN/TSQ-51 control and coordination system.

AiResearch Manufacturing Co. received a $10,499,959 contract for MUST (Medical Unit Self-Contained Transportable) components. Atlantic Research Corp. will assemble openers for the Tactical Fighter Dispensing Munitions (TFDM) program, load assemblies for 60mm projectiles, and load Redeye missiles with propellant for a total of $9,630,838.

Grumman Aircraft Engineering Corp. received an $8,609,311 contract for OV-1 Mohawk aircraft and related services. Philco Ford Corp. gained contracts totaling $8,176,478 for engineering services and components for the Chaparral missile system and for 40mm grenade launchers for the AH-1G Huey Cobra copter.

Brads Machine Products Inc. will supply booster metal parts loaded with detonators for $7,324,800 and Chrysler Corp. contracts totaling $7,211,718 are for M60A1E1 turret systems for M60 tanks, repair parts, periscopes and range cards, and for engineering in support of vehicles related to the M48 and M60 tanks.

Amron Corp. will provide 20mm cartridge cases for $7,127,600 and U.S. Time Corp. won a $7,000,000 letter contract for artillery ammunition. Inflatable shelters for medical units for the MUST system will be procured from the Garrett Corp. for $5,635,500.

Contracts totaling $5,585,391 gained by Sperry Rand Corp. are for aircraft compass magnetic radio indicators, electronic control amplifiers

$21.4 Million Gear-Up Ordered for Cheyenne

Award of a $21.4 million procurement contract for the Army's AH-56A Cheyenne helicopter, termed the world's most advanced gunship of its kind, was announced Jan. 8 by the Department of Defense.

The contract, following less than a month after the Cheyenne was demonstrated to the public for the first time, exercises an option of the current contract with the Lockheed-California Co., providing for production planning and engineering and procuring long-lead-time materiel.

Heavily armed but highly maneuverable, as demonstrated in the public showing, the Cheyenne is the first rigid-rotor craft ever designed from its inception as an integrated aerial weapons system. It is designed for a top speed of 250 m.p.h., far greater than any gunship helicopter in service.

The Army contemplates procurement of 375 Cheyennes, at a cost of about $1.5 million each, with the first deliveries for combat expected in approximately two years. The $21.4 million contract provides for gear-up production. The UH-1 gunship now being used in Vietnam costs about $250,000 and a modified version, the Huey-Cobra, costs about $475,000.

Capable of carrying an assortment of guns, bombs and rockets, the Cheyenne will escort troop-carrying helicopters and provide direct fire support in the combat landing zone.

Management of the Cheyenne is a U.S. Army Materiel Command responsibility and Lt Col Emil E. Kluever is project manager.

TWISTER IS THE BASIS of a $1.6 million contract to design and develop a military vehicle. The U.S. Army Automotive-Tank Command (ATAC) chose the Twister as the prototype for a series of experimental vehicles. In tests, the vehicle designed by the Lockheed Missiles and Space Co. demonstrated impressively its capabilities in rice paddies, snow and on cluttered mountain slopes, as well as in the desert, evaluators of test operations reported.

and miscellaneous major caliber items, mines and bomb fuzes. Chamberlain Manufacturing Co. will supply parts for 155mm projectiles for $5,462,500.

Mason and Hangar-Silas Mason Co., Inc., was awarded a $5,356,478 modification for loading, assembling and packing miscellaneous items, medium and major caliber projectiles, and related components.

Goodyear Tire and Rubber Co. was issued a $5,024,956 contract for track shoe assemblies for M48 tanks. Zero Manufacturing Co. will receive $4,598,620 for expandable shelters for MUST units. Contracts totaling $4,425,187 with Harvey Aluminum, will procure parts for 20mm projectiles and 40mm cartridge cases.

McGraw Edison Co. won a $4,233,664 contract for time fuzes for ammunition and Boeing Corp. was issued two contracts totaling $3,853,874, one for technical publications for CH-47A, -B and -C helicopters, and one for identifying and fabricating prototypes of ground support equipment and special tools for the CH-47 Chinook helicopters.

Texas Instruments, Inc., was awarded contracts totaling $3,526,791 for bullet jacket cups for 7.62mm tracers and for infrared detecting sets. Bell Aerospace Corp. will get $3,449,122 for nonpersonal services and supplies for a product improvement program for the UH–1 and AH–1 helicopters and for the repair of UH–1 helicopters.

U.S. Steel Corp. will provide parts for 8-inch projectiles for $3,434,200. Design, development and interim operation of the Integrated Technical Data Systems for the Cheyenne Project will be continued by TRW Inc. for $3,229,000. Union Carbide Corp. will receive $3,057,252 for dry batteries for radio sets.

Bulova Watch Co. will supply fuze parts for $2,656,040 and Atwood Vacuum Machine Co. won a $2,550,010 contract for M12 links for 20mm cartridges. A $2,156,584 contract with Raytheon Co. is for multiplexers and spare parts kits. Pace Corp. will provide ground illuminating signals for $2,093,675, and Stevens Manufacturing Co. will supply ¾-ton trailers for $2,048,863.

Other contracts are:

Allison Steel Manufacturing Co., $1,984,000 for aluminum bridges; ACF Industries, Inc., $1,916,544 for metal parts for point detonating fuzes for 81mm cartridges; Jackes-Evans Manufacturing Co., $1,761,278 for 7.62 cartridges links; Continental Motors Corp., $1,730,661 for engine assemblies for M60 tanks; and

E. I. du Pont de Nemours and Co., $1,724,250 for TNT; Leece Neville Co., $1,718,280 for generator assemblies for personnel carriers; Cleveland Container Corp., $1,702,107 for containers for 81mm mortar ammunition; R. C. Can Co., $1,695,573 for fiber ammunition containers for 81mm mortars; Baldwin Electronics, Inc., $1,693,072 for opener assemblies for the TFDM program; and

Kennedy Van Saun Corp., $1,534,000 for metal parts for 105mm projectiles; Teledyne, Inc., $1,492,310 for links for the 20mm cartridge; Hayes International Co., $1,471,500 for hardware and documentation for general transfer and reference sets for the Metrology Calibration Center; Magnavox Co., $1,400,000 for fuzes for the Redeye missile; and

Fusion Rubbermaid Corp., $1,389,640 for plastic canisters for the TFDM program; Cadillac Gage Co., $1,343,000 for 79 light armored cars; University of Wisconsin U.S. Army Mathematics Research Center, $1,300,000 for services of highly qualified mathematicians to provide the Army advice and assistance in solving of mathematical problems; Neatco Products, Inc., $1,201, 810 for components for artillery proximity fuzes; AVCO Corp., $1,238,400 for metal parts for adapter boosters for 750-pound bombs; Ford Motor Co., $1,237,000 for engineering services for 5-ton trucks; and

Levinson Steel Co., $1,233,500 for reactivation and repair of government-owned facilities at Hays Army Ammunition Plant, Pittsburgh, Pa.; Dirilyte Co. of America, Inc., $1,227,000 for fin blades for 2.75-inch rockets; Woodland Container Co., $1,212,478 for wood packing crates for mine canister kits; and

Nash-Hammond, Inc., $1,205,085 for plastic canisters for the RFDM program; Northrop Carolina, Inc., $1,191,000 for 300,000 pounds of riot control agent CS–1; Clevite Corp., $1,189,065 for dry batteries; LaPointe Industries, Inc., $1,169,274 for AS–1729/VRC base-mounted antennas; Alsco, Inc., $1,158,429 for 2.75-inch rocket launchers; FTS Corp., $1,143,140 for fin blades for 2.75-inch rockets; Kaiser Jeep Corp., $1,089,898 for M606 utility trucks; and Action Manufacturing Co., $1,022,900 for rocket fuzes.

SCIENTIFIC CALENDAR

Meeting of the American Association of Pathologists and Bacteriologists, Chicago, Ill., Mar. 1–3.

Technology for Manned Planetary Missions Meeting, sponsored by AIAA, New Orleans, La., Mar. 4–6.

19th Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy, sponsored by the American Chemical Society and the Spectroscopy Society of Pittsburgh, Pittsburgh, Pa., Mar. 4–8.

Meeting of the American Society for Testing Materials, Atlanta, Ga., Mar. 6–8.

1968 American Congress on Surveying and Mapping—American Society of Photogrammetry Annual Joint Convention, Washington, D.C., Mar. 10–15.

International Convention of the Institute of Electrical and Electronics Engineers, N.Y.C., Mar. 16–21.

International Meeting of the Anesthesia Research Society, San Francisco, Calif., Mar. 17–21.

Meeting of the American Radium Society, Miami Beach, Fla., Mar. 18–21.

IEEE International Convention and Exhibition, N.Y.C., Mar. 18–21.

3d Symposium on Microwave Power, sponsored by the International Microwave Power Institute, Boston, Mass., Mar. 21–23.

2d International Conference on Vacuum Ultra-Violet and X-Ray Spectroscopy of Laboratory and Astrophysical Plasmas, College Park, Md., Mar. 24–28.

Symposium on Communication by Chemical Signals, sponsored by OCRD, Worcester, Mass., Mar. 25–27.

Meeting of the American Chemical Society, San Francisco, Calif., Mar. 31–Apr. 5.

Symposium on the Accurate Characterization of the High Pressure Environment, sponsored by the International Union of Pure and Applied Chemistry, Gaithersburg, Md., Mar. 1968.

MERDC Assigns New Chief of Quality Assurance

New chief of the Quality Assurance Office at the U.S. Army Mobility Equipment Research and Development Center (MERDC), Fort Belvoir, Va., is Bonnie L. Williams, a civil engineer with 25 years of federal service.

He succeeded Cyrus A. Martin, reliability engineer of MERDC, who served as acting chief since June 1967 following reassignment of Mervyn Lilley to the MERDC Department of Transportation.

Bonnie L. Williams

Since 1962, Williams has served as technical adviser to the Support Equipment Branch, Mobilization Division, Directorate of Major Items at HQ Army Materiel Command.

His primary functions are to supervise the MERDC's quality assurance activities and coordinate them with Army and Department of Defense agencies involved in development, application, maintenance and supply of military equipment.

Williams received a BS degree from Virgniia Polytechnic Institute in 1933 and has taken several advanced courses at George Washington University. He has completed courses at the Army Industrial College and the Army Supply Management School, Fort Lee, Va.

USAETL R&D Advancing Global High-Speed Mapping Goals

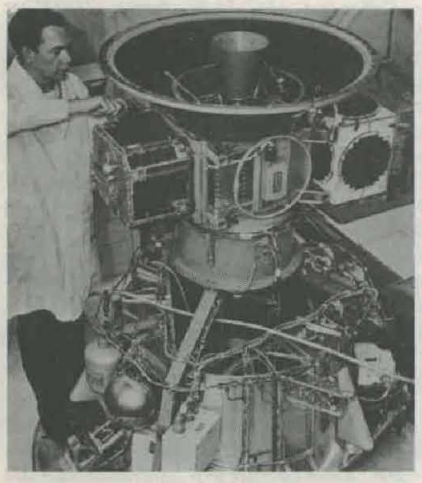
By Gilbert H. Lorenz

Providing new techniques, equipment and systems for supplying the military commander current and adequate terrain data when and where needed is an important research and development responsibility of the Corps of Engineers. Preparation and maintenance of up-to-date mapping data throughout the world so that the Department of Defense and the Army can respond effectively in a timely manner is a tremendous task.

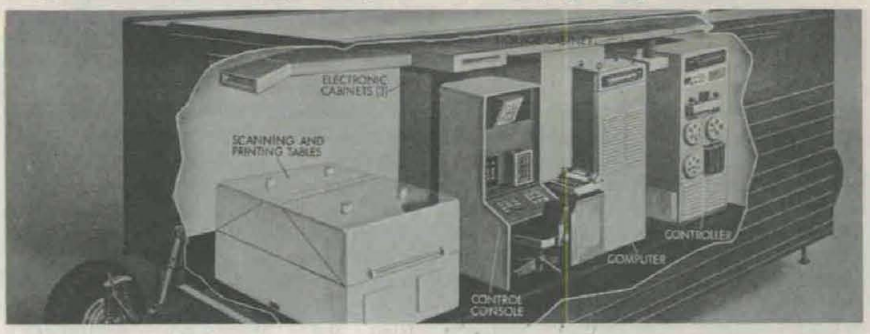
Compiling maps in the normal process is complex and time-consuming. Territorial and cultural changes require periodic revision. The R&D program must address the two primary objectives of accelerating the mapping process and of responding quickly to demands for terrain information in its most accessible form.

Among specific objectives are improving the knowledge of geodesy so that accurate 3-dimensional position information is available and accelerating survey operations for both map control and field artillery fire control. Capabilities are needed for rapid new mapping and map revision in both the field and base plant, as well as rapid reproduction and distribution of maps and substitutes.

A full R&D program must include development of equipment and techniques which can be used in both base plant and field installations; exploratory investigations for advancing the state-of-the-art; and basic research to formulate new principles. That portion of the program applicable to the field army is performed for the Army Materiel Command (AMC); the remainder supports requirements of base plant facilities, such as the Army Map Service.



SATELLITE is being mounted on Burner II, the payload injection stage.



AUTOMATIC PHOTOMAPPER—Module of Rapid Combat Mapping System.

To carry out this program, the Chief of Engineers maintains the U.S. Army Engineer Topographic Laboratories (USAETL, formerly U.S. Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency), at Fort Belvoir, Va. USAETL has two major subdivisions—the Research Institute for Geodetic Sciences, and Mapping and Geographic Sciences Laboratory.

The Research Institute is responsible for basic research and certain individually oriented exploratory developments in the geodetic sciences. Areas of study include: photogrammetry, involving microimagery, metrology, calibration techniques, and geometric and statistical mathematics; geodesy in all its forms, with emphasis on modern astronomic and satellite applications; and electronic techniques concentrating on exploitation of modern instrumentation in support of atmospheric refraction studies, micromeasurements and satellite telemetry.

The Mapping and Geographic Sciences Laboratory conducts feasibility studies, and is charged with design, development and testing of systems, equipment and techniques in the fields of surveying, photogrammetry, cartography, mapping and geographic sciences.

The current research program in geodesy is directed toward filling gaps in knowledge regarding global geodetic parameters. Under development is a theory of a world geodetic system, with the origin at the center of mass of the earth, which will provide an optimum base for further applications in geodesy.

Studies are being conducted in the following areas: exploiting celestial and satellite geodesy to develop more accurate and reliable World Geodetic System parameters; developing a technique for combining satellite and surface gravity data to provide the best gravity field for a Coalescent World Geodetic System.

The Sequential Collation of Range (SECOR) System for obtaining geodetic position data, by electronically measuring the distances between a transponder in a satellite and several ground stations, has been operational for three years.

Improved transponders, operational at altitudes up to 2,000 nautical miles, and the launching of satellites containing these transponders in new booster environments require further research and development.

Theoretical studies and tests with SECOR, as well as with the Doppler Satellite System, are being performed to define the next generation satellite system for tactical positioning use as well as geodetic applications.

Investigations of new techniques for ground survey are aimed at developing equipment which will enable faster artillery surveys under all weather conditions. Laser velocimeters, gyros, accelerometers, Kalman filtering, and computer simulations are being studied, with the ultimate objective of developing equipment using inertial techniques.

Electronic distance and angle measuring equipment is being developed for all-weather capabilities. Electronic ranging equipment employing phase comparison techniques is being developed to provide fast and accurate surveys under all conditions. This Long-Range Survey System is secure from enemy detection or jamming.

A lightweight gyro azimuth theodolite has been developed for the azimuth orientation of conventional artillery and of short-range missiles. The device uses a pendulous precision gyroscope with electrical damping to determine azimuth to one minute at mid-latitudes in about 10 minutes.

Analytical photogrammetry is being exploited for establishing geodetic control networks by means of the mathematical relations existing between successive camera stations, recorded parameters of camera systems and surveyed ground points.

The work involves the development of sophisticated programs using both small and large computers, to establish secondary control points between existing ground control points. Various approaches to the problem of automatically selecting, marking and measuring points on the photo imagery are being explored.

Since one of the slowest procedures has been the compilation of a line map from aerial photographs, emphasis has been placed on automating this operation. The Universal Automatic Compilation Equipment (UNAMACE) was developed as the result of exploratory investigations in information theory, automatic recognition and discrimination, optical and electronic image correlation, and attempts to automate existing stereoplotting equipment.

Inputs to this computer-controlled, electronic scanning and correlating equipment are stereoscopic photographs, together with the program tapes furnishing the required camera correction data, the orientation data for the specific photographs, and the proper operating program.

UNAMACE automatically produces simultaneously an elevation chart, digitized elevation data, and an orthophoto. The latter is a corrected photograph in which all features are in geometrically correct position and is equivalent to the planimetric portion of a map manuscript.

The elevation chart is produced in the form of bands of different line densities. These bands presently must then be manually converted to the usual contour form by drawing the average boundary between them. Spot-by-spot elevations are also stored digitally on magnetic tape for later cartographic use.

A pair of photographs can be compiled on the UNAMACE in one hour as compared to one or two days with conventional stereo-plotting instruments. While this equipment is in use at Army Map Service, additional research and development are being accomplished to optimize its computer programs and to enable use of additional inputs, such as color photography and radar presentations.

The orthophoto, either with or without superimposed contour lines, can be used directly as a map substitute when quick mapping response is required. When certain key detail has been intensified on the orthophotomap, and it is color printed in a special way known as a Pictomap, its suitability as a substitute is enhanced.

Research and development effort is now being concentrated on cartographic automation—the automatic extraction of complete line map information, or that portion required for intensifying an orthophoto into a suitable map substitute.

The current approach is to line follow and identify detail on the orthophoto, and digitize this information so it may later be processed through an automatic data plotter. Such equipment is under development.

For long-range automation, the application of pattern recognition and adaptive learning devices is being investigated. The Natural Image Computer is a promising development which will process the entire field of view by means of logic masks and produce binary outputs.

To provide a mapping capability in a forward area, immediately responsive to the needs of the Army commander, the Rapid Combat Mapping System (RACOMS) is being developed for the Army Materiel Command. The objective is the production of four 15-minute quadrangle maps at a scale of 1/50,000 within 48 hours after receipt of photography.

Grouped by functions in a module concept, the equipment will be housed in expansible shelters on detachable running gear to provide air and ground mobility. Two major developmental items will be included, the Automatic Photomapper and the Electrostatic Printer.

The Automatic Photomapper is a rugged, mobile version of the UNAMACE. The Electrostatic Printer will print 5-color maps at the rate of 2,000 sheets per hour from either 70x100mm chips or full-size transparencies. It will print both maps and photomaps at a greater rate than conventional presses.

The RACOMS will produce mosaics, revised maps or orthophotomaps, as the particular situation demands. A joint systems demonstration test is being planned by the U.S. Air Force and U.S. Army for early FY 69.

Another important development is all-weather mapping. A milestone, resulting from many years of exploratory effort in radar mapping, occurred last year when a 6,000-square-mile area in Panama and Colombia was flown in a 20-day period, utilizing an AN/APQ-97 radar system developed for the Army Electronics Command.

Conventional photographic coverage of this area has been impossible because of the continuous heavy cloud cover. A 1/250,000 scale map is being produced from this radar coverage. This project is only the start of an accelerated program to develop adequate mapping radar sensors and ground data reduction equipment.

Initially, radar mapping will only be suitable to fill gaps in the photographic coverage because of its inferior resolution and accuracy. Eventually, when techniques and equipment are satisfactorily developed, the quick mapping response which will be possible will dictate the use of radar as a primary mapping sensor.

Topographic maps furnish only a portion of the terrain intelligence required by field commanders and CONUS planners. More detailed data are required concerning natural and cultural environment and industrial and economic resources.

Therefore, an important element of this research and development program is Military Geographic Intelligence. Its purpose is the determination of optimum collection systems and the development of processing, storage, retrieval and display systems to provide this additional terrain information.

Through such an effort, surface configuration, cross-country movement, water resources, lines of communications and construction resources, can be evaluated more effectively. A digital data bank appears to be the only adequate means of storing and retrieving the vast amount of information needed. Since techniques and equipment are in many cases similar to those used in mapping, this effort complements the mapping R&D program.

This comprehensive Army Corps of Engineers program, recognizing requirements of all levels of command, is directed to producing up-to-date terrain data and graphics suitable for planning and operations with a minimum of delay. Effectiveness of our military operations depends on the adequacy and timely accuracy of the commander's knowledge of the terrain of the battlefield.

Gilbert G. Lorenz, director of the Mapping and Geographic Sciences Laboratory, U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Va., graduated from the Massachusetts Institute of Technology in 1934 with a BS degree in civil engineering. Since 1936, he has been working with the Corps of Engineers in research and development of equipment and techniques for mapping. During World War II while serving as a major, he headed the Corps of Engineers Office at Wright Field, Dayton, Ohio, in aerial mapping research and development.

Col R. H. Offley

Lt Col L. M. Hand

Lt Col D. K. Locke

Lt Col H. E. Maes

Robert F. Chaillet

3 Vietnam Returnees Among 5 Assigned to OCRD

Former OCRD Deputy Director of Developments Col Robert H. Offley Jr. has returned for a third tour of duty in the Pentagon, following a year in Vietnam, to head the list of OCRD personnel assignments.

Newcomers include Lt Col Lee M. Hand, Lt Col Donald K. Locke, Lt Col Henry E. Maes and Robert F. Chaillet. This list constitutes the smallest turnover of personnel in several months.

COL OFFLEY's new assignment is Army representative to the Joint Service Office for Advanced Tactical Command, Control and Communications. During the past year he served as deputy chief of staff, II Field Force, Vietnam. In recent years he has served as commanding officer, 56th Artillery Group and the 18th Airborne Corps Artillery, Fort Bragg.

Graduated from the United States Military Academy in 1942, Col Offley has an MS degree in aeronautics and guided missiles from the University of Southern California (1949) and an MA degree in international affairs from George Washington University (1964). In 1965 he completed the Advanced Management Program training at Harvard University. He has attended the Command and General Staff College and the National War College.

LT COL LEE M. HAND has been assigned to the Environmental Sciences Division for duty with the Joint Meteorological Satellite Programs Office, Office of the Director of Defense Research and Engineering. Until recently he was in Vietnam for a year as Assistant S-3, HQ 1st Aviation Brigade.

From 1964 to 1966, he was assigned as operations and training staff officer, Office of the Deputy Chief of Staff for Military Operations (Aviation), U.S. Army Continental Army Command, Fort Monroe, Va.

Assigned to Vietnam in 1963–64, he served as executive officer, 117th Assault Helicopter Co. While stationed at Fort Huachuca, Ariz., in 1963, he was chief, Avionics Branch, Electronics Division, Electronics Research and Development Agency. For a year previously he was a meteorological research officer with ERDA.

Lt Col Hand's educational qualifications include a BS degree in military science from the University of Maryland (1956) and BS and MS degrees in meteorology from the University of Utah (1961–62). He has attended the Command and General Staff College.

LT COL DONALD K. LOCKE has been assigned to the Foreign Development Branch, International Office, following a tour in Vietnam as deputy province senior adviser, Military Advisory Command, III Corps.

He served in 1964–65 as chief of the Research and Analysis Division, Gunnery Department, Artillery and Missile School, Fort Sill, Okla., following two years there as an instructor. He served in Germany (1958–61) as assistant S-3, 3d Infantry Division, Artillery, and as Commander of Battery D, 1st Field Artillery Battalion Rocket/Howitzer), 9th Artillery.

Lt Col Locke received a bachelor's degree in business administration from the University of Oklahoma in 1952, and has attended the Command and General Staff College.

LT COL HENRY E. MAES recently ended a 4-year tour as chief of the Materiel Division, U.S. Army Combat Developments Command Medical Service Agency, Fort Sam Houston, Tex. He is now assigned to the Medical and Biological Sciences Branch of the Life Sciences Division.

In 1961–62, he served with the Military Assistance Command, Vietnam, as adviser to the J-4 of the Joint General Staff of the Republic of Vietnam. That assignment followed a 3-year tour as medical operations officer, HQ 5th Region, U.S. Army Air Defense Command, Fort Sheridan, Ill. From 1956 to 1959, he was an optometrist at Camp Zama, Japan.

Lt Col Maes received a PhD degree from the Illinois College of Optometry in 1949, and has attended Command and General Staff College.

ROBERT F. CHAILLET has succeeded Frank H. Wright as technical information program coordinator in the Programs and Concepts Branch of the Scientific and Technical Information Division.

Employed as a research psychologist with the U.S. Government since 1955, he was until recently chief of the Technical Specifications Office, Systems Research Laboratory, U.S. Army Human Engineering Laboratories, Aberdeen Proving Ground, Md.

He worked in 1961–62 at the U.S. Army Missile Command, Redstone (Ala.) Arsenal and from 1955 to 1961 was with the U.S. Naval Research Laboratory, Washington, D.C.

Chaillet has an AB degree in psychology from the University of Miami (1954), where he continued graduate work in that field. He has authored and coauthored several technical publications, including four Human Engineering Laboratory equipment design standards.

THEMIS Proposals Exceed 400

Academic institutions responding to the call for participation in the second year of Project THEMIS, a Department of Defense program to expand and provide new opportunities for defense-related research, have submitted more than 400 preliminary proposals.

Screening of these proposals is expected to be completed by the end of February. Director of Defense Research and Engineering (DDR&E) Dr. John S. Foster Jr. will request detailed proposals of those selected by Apr. 5. It is expected that proposals selected for support will be announced by the close of this academic year in June.

Fifty THEMIS grants were awarded in the first year. Renewal proposals by those universities are now being evaluated by Army program monitors at field laboratories.

Additional evaluation of proposals will be made by the Director of Army Research, Office of the Chief of Research and Development, Department of the Army, and final approval will be given by the DDR&E.

Army Engineer Heads Dams Unit

Wendell E. Johnson was recently elected 1968 chairman of the United States Committee on Large Dams, of the International Commission on Large Dams.

As chief of the Engineering Division, Directorate of Civil Works, Office of the Army Chief of Engineers, he supervises the engineering of water resource projects in the nationwide civil works program of the Army Engineers. He is chairman of the U.S. Section, Columbia River Treaty Permanent Engineering Board, a Fellow of the American Society of Civil Engineers and a member of the National Society of Professional Engineers.

Joint Line Islands Experiment Completes First Phase

The first phase of a long-term investigation in tropical meteorological research has been completed in the Line Islands Experiment (LIE), some 1,300 miles south of Honolulu, Hawaii, by nearly 100 scientists and military weathermen.

Assembled as a joint civilian-military task force, they conducted the first intensive effort to explore the "equatorial trough zone," a missing link to understanding global behavior of the atmosphere.

The LIE was a cooperative undertaking by university scientists, government agencies and private organizations. Sponsored by the National Science Foundation, it was managed by the National Center for Atmosphere Research (NCAR), Boulder, Colo., as overall coordinating agency.

Army meteorological observers from the U.S. Army Electronics Command Meteorological Supply Activity, Fort Huachuca, Ariz., a field activity of the Army's Atmospheric Sciences Laboratory, Fort Monmouth, N. J., assisted in establishing and operating base camps and weather observing stations on Palmyra, Fanning and Christmas Islands.

The Meteorological Support Activity (MSA), commanded by Lt Col Horace Linhares, is the U.S. Army agency responsible for providing meteorological support to research, development, test and evaluation (RDT&E) activities thoughout the Continental U.S., Alaska and Panama.

Subordinate teams since 1951 have provided meteorological services for Army RDT&E activities except for the Army Missile Program. Support sites have ranged throughout North America, including Greenland and Canada, and extending to Hawaii and now the Line Islands.

Observers from the Meteorological Support Company at Fort Huachuca and the Meteorological Team at Yuma operated major surface weather observation sites, one on each island, and a double-theodolite, low-level pilot balloon site on Christmas Island. Army equipment and funding were supplied by the MSA.

Project officer for Army support was M/Sgt Frank Harrison. M/Sgt Felix Barreras and S/Sgt James Nichols, Fort Huachuca, were noncoms in charge on Palmyra and Fanning Islands, respectively.

Twenty-four hourly surface weather observations were taken daily on each island for a total of 3,864 separate observations. Five hundred double theodolite observations were obtained from balloon ascents to 7,000 feet in support of a boundary layer study designed by Dr. Mariano Estoque, University of Miami.

Army observers serviced and maintained automatic weather stations and other special meteorological equipment provided by the NCAR and the University of Hawaii.

Elements of the U.S. Army Electronics Command and the Department of Defense supplied valuable support services for the experiment. The Navy provided supplies and airlift to and from the Islands from Honolulu, and made weather reconnaissance flights from Honolulu and Guam over the Line Islands equipped with sky cameras and weather radar.

The Air Force made high-altitude weather reconnaissance flights over the area and the USAF Air Weather Service 6th Weather Squadron Mobile, Tinker AF Base, Okla., furnished personnel and weather equipment to operate three Rawinsonde (upper air) observing teams.

The Air National Guard from California, Arizona and Utah provided weekly airlift in and out of the islands, carrying thousands of pounds of food, equipment and general cargo plus scientists and support personnel.

Other airlift assistance was provided by the Hawaii Air National Guard, and the U.S. Coast Guard, Barbers Point, Hawaii.

The project solicited and received assistance from the National Aeronautics and Space Administration, Environmenteal Science Services Administration (ESSA), and Atomic Energy Commission.

The Coast and Geodetic Survey of ESSA provided support with one of its research ships, the *Surveyor*, which contributed valuable meteorological and oceanographic observations near the Line Islands and ocean tracks across the equator.

Logistics and planning for the experiment were accomplished by the NCAR Facilities Laboratory under direction of William S. Lanterman Jr. (Capt USN, Ret.) and Jack D. Tefft. Field project management initially began at NCAR in Boulder and later was continued from the AEC-Damon Tract compound, Honolulu, where the AEC provided operating space and also furnished heavy equipment, trucks, loaders and generators.

The main base for island operations was established on Palmyra. The Fanning Island site has been leased by the Research Corp. of the University of Hawaii and the Christmas Island base was set up in a recently abandoned U.S. Air Force compound, now under jurisdiction of the British Ministry of Defence.

Conventional meteorological equipment was installed for surface observations on windward, lagoon and leeward areas of all islands. Rawinsonde launch sites and balloon inflation shelters were constructed, as were shelters for observers and recording equipment. A weather radar site and satellite picture receiver site were also established on Palmyra.

Complete color photo records were made of sky and cloud conditions with 16mm time-lapse, hourly 35mm and still cameras. The photos will be correlated with pictures received from reconnaissance aircraft and from operational ESSA and Nimbus satellites, especially the new Applications Technology Satellite. ATS 1, which was stabilized in a synchronous orbit in a stationary position 22.300 miles above the equator at 152° west longitude, over the Line Islands.

The advent of the ATS–1 satellite in conjunction with the Line Islands Experiment provided an opportunity without previous parallel to measure time sequences of cloud development, motion and decay and to establish associations between cloud systems and tropical meteorological parameters.

Dr. Edward J. Zipser, NCAR, scientific coordinator for the experiment, said the major goal was to obtain needed data from the region known as the equatorial trough zone.

The combination of surface-based, airborne, seaborne and satellite observations enables scientists to begin an attack on the meteorological problems of tropical convection, cloud systems, synoptic scale disturbances, and the effects of islands on local weather.

Scientists from at least seven universities and from NCAR, ESSA, and the Woods Hole Oceanographic Institution are using collected data. The University of Hawaii is analyzing and archiving much of the conventional observational data obtained during the experiment. NCAR is organizing the photographic material from satellites, aircraft and ground observing stations.

The National Science Foundation director, in an invitation to the Secretary of Defense, stated:

"By participating in the Line Islands Experiment, the DoD could make a major contribution to the success of an important undertaking in the atmospheric sciences" and "would contribute to ongoing military research and development programs and gain knowledge which will be of great value to military services in large-scale land, sea or air operations in any tropical area."

Automatic Point Transfer Instrument Speeds Map Production

An addition to the series of dramatic new tools to speed production of maps from aerial photographs at the U.S. Army Engineer Topographic Laboratories, Fort Belvoir, Va., has been developed under contract.

The experimental "Automatic Point Transfer Instrument" (APTI) identifies, marks, measures, and records the coordinates of points on aerial negatives and transparent positives despite possible differences in format, size, tilt, focal length, scale and image distortion.

Topo Labs leaders claim that the instrument will shorten substantially the time required to provide the photo measurements necessary as one step in the preparation of a finished map. The APTI is a member of a family of sophisticated photogrammetric equipment developed, or being developed, by the Topographic Laboratories.

Development of the UNAMACE (Universal Automatic Map Compilation Equipment) was announced in the November 1967 edition of the *Army R&D Newsmagazine*. UNAMACE produces ground elevation information (contours) and completely corrected photographs (orthophotomaps) from a wide variety of photographic inputs of any scale or tilt and from any type of camera system.

The APTI marks control points necessary for input to the UNAMACE. It consists of a control console, three precision comparator tables, associated electronic cabinets, and read-out and read-in equipment.

The control console contains three operator point-location displays, a stereo viewer, a monitor display system, a control for manual and automatic referencing and for registration of conjugate images for marking and measuring.

Three input photos, which may be taken by different cameras, are mounted on the three precision comparator tables. Pertinent parameters of each photographic input are preset on the control console. The system views conjugate areas of the photographic inputs, then measures and marks individual conjugate points to micron accuracy.

An electronic correlator adjusts table drives to maintain complete registration as the system is driven to different coordinate locations on the photos. An automatic computer eliminates image shape distortions from one photographic input to the others.

The digital portion of the equipment can read out the coordinates and point identification data of a desired point on punched cards and hard copy. It can also position the tables to predetermined coordinates from punched card inputs.

Engineering tests of the instrument will conducted by the Topo Labs. Because of the APTI's high-precision sensitivity to environment, tests will take place in a "clean room," in which temperature, humidity and dust particles are controlled.

The instrument was developed by the Link Group of General Precision Systems, Inc., at a cost under $2 million.

MERDC Barbed Tape Provides 'Instant Obstacle'

An "instant obstacle" under development at the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va., can be emplaced more quickly and easily than the barbed wire now used in Vietnam to deter attacking troops.

Illustrations below show the new experimental barbed tape that can form an obstacle 75 feet long and 2½ feet high. The steel tape has inch-long, razor-sharp barbs. It is packaged in a doughnut-shaped polyurethane container 33½ inches in diameter and 4 inches wide.

For emplacement, one end of the tape is staked to the ground. The tape then pays out from the container as the man holding the 40-pound unit backs away.

At approximately the same cost as the triple standard concertina barbed-wire fences, the experimental obstacle has proved in extensive tests to be five times more effective, at only a fraction of the weight, volume and emplacement effort.

University Using AFRRI Ion Accelerator in Cancer Research

Experiments using neutrons for cancer research are being made by the University of Pennsylvania School of Medicine scientists with the positive ion accelerator at the Armed Forces Radiobiology Research Institute (AFRRI), Bethesda, Md.

The Catholic University of America also signed an agreement recently to use the AFRRI nuclear reactor, electron linear accelerator and X-ray machines for basic research in biology and medicine. In turn, AFRRI scientists will have the use of research facilities at the university.

Dr. James T. Brennan, professor of Research Radiology at Pennsylvania University and the first AFRRI director, heads the team of investigators. They are exposing cultures of leukemia cells to the varying doses of neutrons to determine what kind of

DR. JAMES T. BRENNEN (Col, MC, USA, Ret.). Picture taken during duty as AFRRI director.

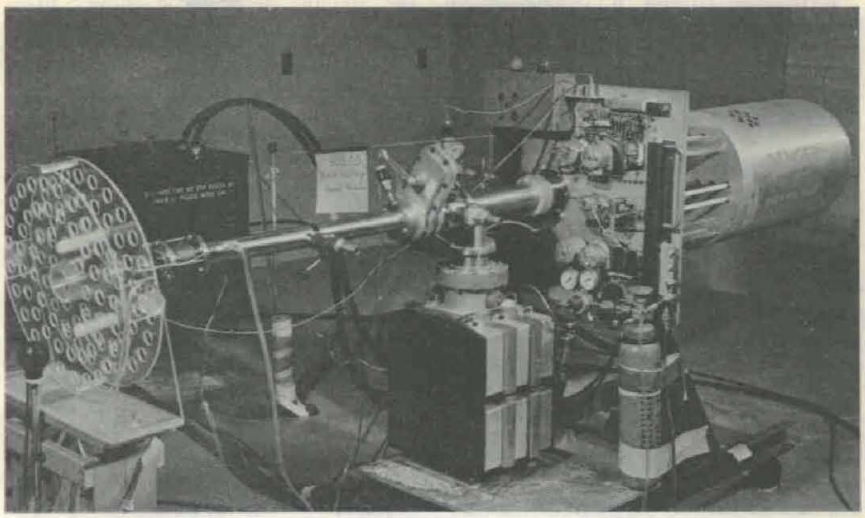
neutron generator might be best suited for cancer therapy.

Based on certain physical characteristics of neutrons, as compared to gamma (X-rays), Dr. Brennan and his associates believe it may be possible to employ neutrons in therapeutic doses to destroy different types of cancer cells in a tumor.

AFRRI's neutron generator is one of a number of such sources, located at various laboratories, that the team from the university will evaluate. About five irradiations will be made at AFRRI by Feb. 28 under terms of a renegotiable agreement.

A tri-service element of the Defense Atomic Support Agency since 1964, AFRRI conducts a research program aimed at better understanding the biological effects of ionizing radiation. Programs range from subcellular studies through organs and systems effects to the behavioral response of the total organism.

(For further information on AFRRI organization, mission, capabilities and accomplishments, see page 16, December 1966 issue of the *Army R&D Newsmagazine*.)



AFRRI POSITIVE ION ACCELERATOR. Deuterium ions are accelerated by an electrical potential in the section of the machine to the right. They are sent down the drift tube (left) where they strike a tritium-implanted target. The reaction creates a field of single-energy neutrons. The plastic wheel (far left) at the end of the drift tube is an exposure array to hold animals.

Former ARPA Head to Chair Defense Science Board

Effective Mar. 1, the Defense Science Board chairmanship will pass from Dr. Frederick Seitz, president of the National Academy of Sciences, to Dr. Robert L. Sproull, vice president for Academic Affairs at Cornell University and former director, Advanced Research Projects Agency.

Department of Defense announcement of selection of Dr. Sproull was made Jan. 9, along with information that Thomas L. Phillips, president of the Raytheon Co., has succeeded Patrick E. Haggerty, chairman of the Board of Texas Instruments, Inc., as DSB vice chairman.

Dr. Seitz and Mr. Haggerty will continue to serve as DSB members. Newly appointed members-at-large are Dr. John L. McLucas, president of the MITRE Corp., Dr. Ithiel de Sola Pool, chairman of the Department of Political Science at Massachusetts Institute of Technology; and Dr. Albert D. Wheelon, vice president of Hughes Aircraft Co.

Chartered as the senior technical advisory body in the Department of Defense, the DSB advises the Secretary of Defense through Director of Defense Research and Engineering. The DSB consists of members-at-large appointed from civilian life and ex-officio members representing major federal agencies.

After receiving a PhD degree from Cornell University in 1943, Dr. Sproull was employed by the RCA Laboratories until he became assistant professor of physics at Cornell in 1945. Advanced to full professor, he served successively as director of the Laboratory of Atomic and Solid-State Physics and director of the Materials Science Center. He is a member of Phi Beta Kappa, Sigma Xi and the American Physical Society.

Dr. Robert L. Sproull

THOMAS PHILLIPS joined the Raytheon Co. in 1948 and distinguished himself in the design of servomechanisms, special radar circuits, and systems, earning promotion to manager of the Systems Department in 1953.

Elevated to executive vice president in 1961, after serving as vice president and division general manager, he became president in 1964. He has been a member of the DSB since 1963 and is a member of the Institute of Electrical and Electronics Engineers, American Institute of Aeronautics, and the American Ordnance Association.

Jungle Acoustics Studies Aid Design of Detection Devices

Extensive studies of acoustics in the Panama Canal Zone are yielding data to aid in the design and testing of devices used to improve capability of detecting the enemy in jungle environments.

Investigations conducted over a period of more than two years at the U.S. Army Tropic Test Center, Fort Clayton, C.Z., are the only research of this type conducted since a pioneering study was made in 1944, according to Dr. Delaney A. Dobbins, who has coauthored two reports with Charles M. Kindick, an electronics technician.

The newest studies of sound transmission and localization in tropical vegetation have been conducted under the U.S. Army In-House Laboratory Independent Research (ILIR) Program, as were seven earlier research tasks at the Tropic Test Center on visual capabilities of soldiers in the jungle.

Dr. Dobbins recently moved to Arlington, Va., to accept a position as a research psychologist in the Behavioral Sciences Division, U.S. Army Research Office, Office of the Chief of Research and Development.

One of the questions he considered in the studies at the Army Tropic Test Center was: How can the developer of a device to detect, by auditory or any other means, unfriendly forces in a jungle setting proceed without knowledge of normal, unaided human capabilities? Data collection forms the basis of value analysis for all types of detection gadgetry.

Previous TTC studies in jungle visibility showed that in the dense vegetation environment, with perfect visibility typically restricted to 30–40 feet, the soldier can usually hear human activities at greater distances. The jungle effectively reverses the relative human dependence on these two senses. A jungle listener must be able not only to detect man-made sounds but must be capable of localizing their direction.

The first study attempted to determine (1) how sounds in audible range are affected as they travel through jungle foliage and (2) what is the resulting effect on auditory response.

Research in the first phase included repeated transmission of pure tones ranging from 63 cycles per second (Hz) to 8,000 Hz through dense semideciduous jungle.

Sound pressure levels (SPL) were measured at varying distances from the source simultaneously with measurements of natural jungle sounds. The transmissions, made by an audio generator through loud speakers, provided measurements which revealed the amount of acoustic energy present at the ear of a human as he moved farther from a sound source.

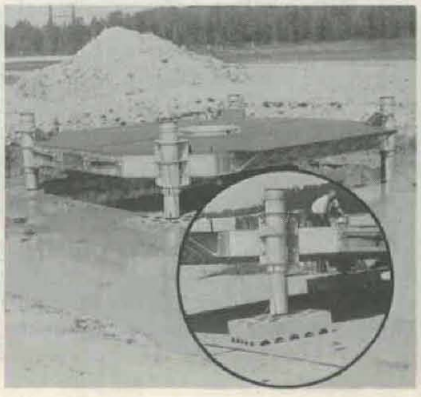
Human listeners were later placed on the same site at the same distance from the sound source. These 50 enlisted men from Infantry forces signalled to researchers by an electrical device when tones became audible. A correlation between physical and sensory events thus was possible.

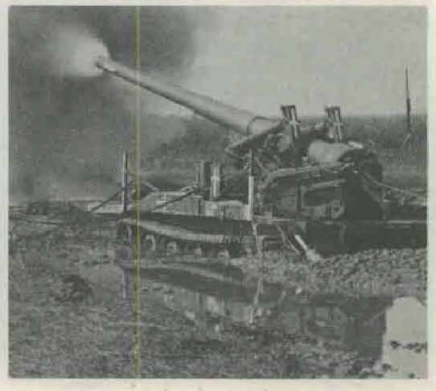
Transmissions were made under various conditions of day and night, with and without intervening vegetation, and on different sites. Micrometeorological data were gathered.

Major conclusions of the report on "Transmission and Audibility of Sounds in the Jungle" include:

- The jungle serves as a low-pass filter for audible frequencies because lower frequency sounds bend around the vegetation and penetrate long distances through the jungle. High-frequency sounds are back-scattered by vegetation and rapidly lose strength and audibility.
- The 63-Hz tone appeared to penetrate jungle vegetation better than physical laws would predict. Studies over open terrain indicated that this effect was caused by some unknown factor in the tropical environment and not by resonance from vegetation.
- Despite different thermal patterns under the jungle canopy during day and night, researchers could find no measurable difference in the horizontal physical transmission of sound over short distances.
- There is a high correlation between sheer loss of acoustic signals through vegetation and the audibility of sounds, that is, there were no major discrepancies between the human data and the physical data. Scientists noted that there was less variability in the measured SPLs than in the human hearing. This finding allows some "synthetic" prediction of audibility of sounds by knowing the frequency of the signal, the distance of listener from source, and the masking effects on hearing by natural jungle noises.
- Although sound transmissions were not affected by varying day-night heat patterns, difference between natural jungle sounds during those periods caused significant difference in human responses. Sounds below 1,000 Hz are more easily heard at night. Daytime sounds above 1,000

TECOM Simulates Vietnam Terrain for Testing





FAR FROM THE MEKONG DELTA, Vietnam, rice paddies and other off-road areas are simulated at test sites of the U.S. Army Test and Evaluation Command (TECOM). At left, CH47 Chinook drops M102 howitzer and ammunition to firing platform developed for marginal terrain. Below (left) is a platform submerged in inundated testing grounds at Jefferson Proving Ground, Ind. (Insert shows leg anchor.) The platform is now used in Vietnam. Shown below is a M107 self-propelled gun as it retains a "toe hold" in a swampy firing position during tests at Aberdeen Proving Ground, Md. The long-range artillery piece is being used in Vietnam after extensive TECOM testing.

Hz are better received.

• The jungle's filtering effect and natural jungle sound spectrum shift the point of maximum hearing down the frequency scale as the listener is moved away from the sound source. In a silent environment, human hearing is at its normal maximum at 4,000 Hz, but in the jungle maximum sensitivity shifts to 1,000 Hz at only 25 feet from the sound source and further down to 63 Hz at 400 feet.

In the "Localization of Sounds in the Jungle" report, Dr. Dobbins and Mr. Kindick used 15 sounds transmitted by recording tape through loud speakers in positions unknown to listeners. Thirty-two soldiers received the sounds from eight directions determined by their head positions.

Sounds included six pure tones ranging from 65–6,000 Hz; six continuous noises such as patrols, vehicles and voices; and three impact noises such as mortar fire, smaller weapons and machete chopping.

Angular error in degrees of localization of the various sounds was computed between the listener's judgment of the sound direction and its known true position. Major results included:

• Sound localization was poorer than in open terrain and errors were from one-third to three times higher than those in open-air studies. Mean errors of 25, 20 and 15 degrees were found for pure tones, continuous noises and impact sounds respectively.

• Lower frequency pure tones were better localized than high frequencies.

• Ten percent of all localizing responses in the jungle were reversals (greater than 90° from true sound direction). Reversal errors to pure tones were approximately double those for continuous noises, and triple for impact sounds. Most reversals occurred when the sounds came to the median plane of the head, front or back, because the listener is then deprived of both cues to sound localizing, arrival time and intensity.

• Distance had no effect on the mean localizing error between 200–500 feet from the source when reversal errors are not included. Reversal errors increased significantly because of greater sound reflection and decreased audibility caused by the jungle vegetation when distance from the source is increased.

• In general, sounds were best localized when the sound passed through the right-left axis of the head; next best when the sound came from the listener's front; and worst when sounds came from behind.

The acoustic studies filled in some of the basic information gaps and provided secondary usage by Department of Defense agencies involved in design of personnel detection devices.

Mooers' Law for Information Systems Explained

By Calvin N. Mooers,
Rockford Research Institute

We are all aware that some retrieval systems, although technically rather poor, nevertheless receive intensive use; while other systems, sometimes technically very much better, receive little customer use. Why?

I should like to explain this situation by a principle, or law, of behavior which I believe governs the use of retrieval systems. We have all heard of Parkinson's Law governing some of the more preposterous features of the exponential growth in size of government activities. In analogy, we might call my principle Mooers' Law for retrieval systems.

We have all seen reports describing retrieval systems which can perform more effectively, search more rapidly, operate on larger collections, and so on, than can others. However, as we furnish our customer more and better retrieval system performance, can we be assured that they will make any greater use of the systems? I think the answer is "NO."

It is my considered opinion, from long experience, that our customers will continue to be reluctant to use information systems—however well devised—so long as one feature of our present intellectual and engineering climate prevails. This feature—and its prevalence is all too commonplace in many companies, laboratories and agencies—provides the basis for:

MOOERS' LAW: An information retrieval system will tend not to be used whenever it is more painful and troublesome for a customer to have information than not to have it.

If this law is true—and I believe it is—this is indeed a pessimistic and even a cynical conclusion. In the building and planning of our information handling and retrieving systems, we have tended to believe implicitly, and to assume throughout our writings, that having information easily available was always a good thing, and that all people with access to an information system would want to use the system.

It is now my suggestion that many people may not want information, and they will avoid using a system precisely because it gives information.

Having information is painful and troublesome. We all have experienced this. If you have information, you must first read it (which is not always easy. You must then try to understand it. To do this, you may have to think about it. The information may require that you make decisions about it or other information. The decisions may require action in the way of a troublesome program of work or trips, or painful interviews. Understanding the information may show that your work was wrong, or that your boss was wrong, or that your work was needless.

Having information, you must be careful not to lose it. If nothing else, information piles up on your desk—unread. It is a nuisance to have it come to you. It is uncomfortable to have to do anything about it. Finally, if you do try to use the information properly, you may be accused of puttering instead of working .Then in the end, the incorporation of the information into the work you do often may not be noticed or appreciated. Work saved is seldom recognized. Work done—even in duplication—is well paid and rewarded.

Thus not having and not using information can often lead to less trouble and pain than having and using it. Let me explain this further. In many work situations, the penalties for not being diligent in the finding and use of information are minor, if they exist at all. In fact, such lack of diligence tends often to be rewarded. The man who does not fuss with information is seen at his bench, plainly at work doing the job.

Approval goes to projects where things are happening. One must be courageous, or imprudent, or both to point out from the literature that a current laboratory project which has had an expensive history and full backing of the management was futile from the outset. At a desk, an author of a technical report, by not making a prior literature search, and by omitting citations to earlier work, can prepare his reports so much faster, with the additional advantage that people will think the ideas presented were new and were his own.

Unlike a meeting I attended in England, at engineering meetings in this country it is not considered quite proper for a member of the audience to get up and give out in plain langauge the citation and facts showing lack of content or novelty in a paper.

Where rewards, instead of punishment, go with not using information we can expect that any information retrieval system will be used only with reluctance. On the other hand, there are situations where the diligent finding and use of information is stressed and rewarded, and where failure to find or to use information is severely punished. In such places, we can expect retrieval systems to be actively used and we can expect pressure from the information users themselves for better systems. This has proved to be true in practice. . . .

Kudos

DISTINGUISHED CIVILIAN SERVICE MEDAL (DCSM). Dr. Joseph R. Dolce, chief civilian surgical consultant to Edgewood Arsenal's Biophysics Laboratory, recently received the DCSM.

The highest public service Department of Defense award that can be presented to a private citizen honored his contributions to the assessment of wound ballistics in the Army. He has been a consultant since 1954.

The citation noted that his efforts "resulted in the creation of a single, predictable and uniform method of

CHIEF CIVILIAN surgical consultant to Edgewood Arsenal, Md., Dr. Joseph R. Dolce, receives the Distinguished Civilian Service Medal, the Army's highest public service award, from Edgewood CO, Col Paul R. Cerar.

wound ballistic assessment which has greatly facilitated evaluation of the wounding potential of a specific fragment."

Dr. Dolce is a surgeon for the Good Samaritan and St. Mary's Hospitals at West Palm Beach, Fla., and conducts a private surgical practice. Currently a special consultant on chemical, biological and radiological warfare to the Army Materiel Command, he served from 1963 to 1965 as an R&D consultant to The Army Surgeon General. He is a colonel in the Army Reserve and is the surgeon for the 3220th Army Garrison Reserve Unit.

MERITORIOUS CIVILIAN SERVICE AWARD. Two employes of the U.S. Army Missile Command, Redstone Arsenal, Ala., received Meritorious Civilian Service Awards in recent recognition of R&D contributions to the missile program.

They are Charles W. Hussey, technical director of the Future Missile Systems Division, and Allan Platt, deputy director of the Dragon Project Office.

Based on accomplishments of more than 17 years service at Redstone Arsenal, the award to Hussey noted his significant roles in the development of a number of Army weapons systems, from the 400-mile-range Pershing to the XM–3 helicopter subsystem. He was specifically cited for "a continuing history of exceptional leadership and extraordinary management capability."

Platt was cited for "dynamic technical leadership contributing to the successful development, production and fielding of a superior system," the Dragon antitank weapon system. His single integrated engineering concept is being considered as a model for weapon systems acquisition by the Department of the Army.

Walter W. Flynn, acting chief, Program Management Division, Development Directorate, Army Materiel Command, also received the Meritorious Civilian Service Award.

He was commended for his "unusual professional competence, unique ability to create organizational and procedural models, broad knowledge and experience in all phases of research and development management, and unusual competence and dignity as spokesman and arbitrator before Congressional committees."

The citation noted that "his initiative and cheerful participation in the most complex and controversial policy matters have been an inspiration to all his associates. His confidence under extreme pressure and firm leadership qualities generate complete loyalty and respect from all levels of management in the government and in the industrial community."

LEGION OF MERIT (LOM). Lt Gen Harry W. O. Kinnard, CG of the

MERITORIOUS CIVILIAN Service Award is presented to Walter W. Flynn, acting chief, Program Management Division, Development Directorate, Army Materiel Command, by Maj Gen R. H. Free, director, Development.

Army Combat Developments Command (USACDC), presented the Legion of Merit to five members of the headquarters staff at recent ceremonies.

Col Charles W. Calvert, Materiel Directorate, was honored for representing the USACDC on the Material Requirements Review Committee, the Source Selection Advisory Council and the Army Materiel Command Technical Committee. He also was cited as a member of the steering group concerned with the materiel portion of the Department of the Army Life Cycle Management Model, and for his significant contributions to combat developments in the Vehicle Rapid Fire Weapons System Study.

Col Robert A. Guenther, Combat Operations Division, Doctrine Directorate, was honored for meritorious service as commanding officer of the 1st Basic Combat Training Brigade at the Army Training Center at Fort Gordon, Ga., and as project officer for the 13th National Conference of Civilian Aides.

Lt Col Frank W. Nadeau Jr., also

★ ★ ★

EXCEPTIONAL CIVILIAN SERVICE AWARD. Dr. Joseph Sperrazza, associate technical director of the U.S. Army Ballistic Research Laboratories (USABRL), Aberdeen Proving Ground, Md., since 1962, recently received the Army's highest award for civilian employes. Dr. Sperrazza has been responsible for monitoring and coordinating major projects in weapons technology and effectiveness and in wound ballistics.

Assigned to Aberdeen Proving Ground since 1941, he has made contributions in wound ballistics, penetration mechanics, small arms and air blast. He also has been responsible for monitoring USABRL programs involving international activities in these areas of scientific effort.

of the Doctrine Directorate, was cited for service in Vietnam with the 1st Cavalry Division (Airmobile) as operations officer of the 11th General Support Aviation Company, and as commander of the 228th Aviation Battalion (Assault Support Helicopter).

Lt Col Anthony F. Daskevich, Doctrine Directorate, was commended for work with the Army project, "Combat Operations Loss and Expenditure Data-Vietnam."

Lt Col William M. Wright, Materiel Directorate, received the LOM for work in developing materiel requirement documents for the Surface-to-Air Weapons Family Cost Effectiveness Study; Interim Command, Control and Coordination System; and the Simulator Evaluator, Air System.

At HQ Army Materiel Command, Washington, D.C., Col William A. Sussmann of the Directorate of Development received the LOM with second OLC upon his retirement. He was cited for distinguishing himself by exceptionally meritorious service while serving in successive positions of great responsibility.

Assigned to the AMC since 1963, Col Sussmann served as chief, Technical Service Division; chief, Program Management Division; and executive officer, Development Directorate.

BRONZE STAR MEDAL (BSM). Lt Col Roy M. Jones, Directorate of Doctrine, USACDC, received the 4th and 5th OLC and the "V" Device to the BSM for service in Vietnam with HQ and HQ Company, 2d Brigade, 1st Infantry Division.

He earned the 5th OLC and "V" Device for action Apr. 23, 1967, while participating in Operation Manhattan as a civil affairs officer with the 2d Brigade. During a search mission, his vehicle was destroyed by a mine which severely wounded him and killed two other passengers. Refusing to be evacuated, he aided the driver, then boarded a helicopter and directed a search for 45 minutes.

Maj Hollis E. Bivens, a student in the Military Medicine and Allied Science Course at Walter Reed Army Institute of Research (WRAIR), received the BSM for meritorious service in connection with ground operations against a hostile force in South Vietnam. The award honored him for service with the 45th Surgical Hospital from September 1966 to July 1967.

Sp/5 Morris J. Meridith of the 91st Engineer Combat Battalion, Fort Belvoir, Va., was awarded the BSM with "V" Device for his valor as a medic at Nui Ba Den, Vietnam, where he exposed himself to enemy fire to treat the wounded.

STERNBERG MEDAL. The Sternberg Medal, awarded biannually to the graduate with the highest academic standing in the Global Medicine Course at WRAIR, was presented to Capt John W. Cutting, a doctor specializing in preventive medicine, for the course which ended Dec. 22.

NEW DEPUTY CO of the U.S. Army Strategic Communications Command, Brig Gen Gordon B. Cauble, receives the 2d OLC to the LOM from STRATCOM CG Maj Gen Richard J. Meyer for his services as deputy assistant chief of staff, MACV, and as special assistant to the deputy commander.

ARMY COMMENDATION MEDAL (ACM). Col Winnifred E. Seady, chief of the Occupational Therapy Section, Walter Reed General Hospital (WRGH), received the ACM for service as chief of the Occupational Therapy Section of the Army Medical Specialist Corps (AMSC) and assistant chief of the AMSC in the Office of the Surgeon General.

Lt Col John C. Alford earned a second OLC to the ACM for his work as a research and development coordinator at the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. He worked in the Intrusion Detection and Sensor Laboratory following service in the Plans and Programs Division of the Office of the Comptroller/Director of Programs. He is now assigned to Vietnam.

Lt Col Leland A. Buker, assigned to the Medical Corps Branch of the Officer Personnel Division, Medical Service Corps, received the ACM for meritorious service as Inspector General, 819th Hospital Center in France from July 1966 to March 1967.

Lt Col Carl E. Linton, MSC, was awarded the 2d OLC to the ACM for service while assigned to HQ Eighth U.S. Army in Korea, July 1966 to August 1967, as chief of the Program and Budget Division, Surgeon's Office. He is now assigned as chief of the Data Management Consultant Office in the Army Surgeon General's Directorate of Professional Service.

Lt Col Leon H. Mackechnie, USACDC, received the 2d OLC to the ACM for his service as chief, Troop Test Branch, Field Evaluation Division. He was cited for his "expert knowledge and skill in the planning and coordination of the field evaluation, tactical reconnaissance and surveillance."

Maj Earl P. Hatfield, Supply Control Branch, Walter Reed Army Medical Center Logistics Division, was awarded the ACM for his service as chief of Supply and Service for the 225th Station Hospital, Munich, Germany.

Maj Teddy E. Swift, former executive officer for the U.S. Army Medical Biomechanical Research Laboratory, was presented the ACM upon his retirement after 22 years Army service.

Capt Donald E. S. Merritt, chief of the Flight Test Division of the Aviation Materiel Command's Hughes Plant Activity, Culver City, Calif., received the ACM for exceptionally meritorious performance of duty while assigned to the 1st Infantry Division in Vietnam. He was also awarded the 12th and 13th OLCs to the Air Medal.

CERTIFICATE OF ACHIEVEMENT. Maj Henry J. Fink Jr. received a Certificate of Achievement for "exceptionally meritorious performance of duties in two assignments at the U.S. Army Mobility Equipment R&D Center. Now assigned to Hawaii, he was cited for his work as Plans and Programs Officer for the Engineering Laboratory and as executive officer for the center.

JOINT STAFF PLANNER in the Plans and Policy Directorate, Office of the Joint Chiefs of Staff, Washington, D.C., Col Mitchel Goldenthal is presented the OLC to the LOM by General Frank S. Besson Jr., CG of the U.S. Army Materiel Command. He was honored for his work as CO of the U.S. Army Satellite Communications Agency, Oct. 1965 to Nov. 1967.

Microorganism Effects on Missiles Exposed to Tropical Environments

By Oscar H. Calderon

Isolation of microorganisms from substrates and surfaces of missiles and related equipment could indicate the microbial contamination that occurs during manfacturing and assembling, handling and shipping, or exposure and storage of missiles.

Exposing missiles to tropical environmental conditions subjects them to what is believed to be a most deteriorative and corrosive environment. Fungi have been suspected to be one of the most important biological groups that participate in these degrading processes.

The physical phenomenon of diffusophoresis has been utilized to explain the development of an organic layer on all surfaces exposed to tropical atmospheric conditions. This surface condensation could then be a suitable medium for spore germination as well as a nutrient for microbial growth.

The possible influence of microorganisms and metabolic waste products secreted by these microorganisms was partially examined and reported by personnel in and associated with the White Sands Missile Range Microbiological Laboratory.

Missiles were subjected to tropical environmental conditions to determine their ability to withstand adverse conditions over extended time periods. Following exposure for a period of one to five years, 11 missiles were shipped to White Sands (N. Mex.) Missile Range (WSMR) for evaluation.

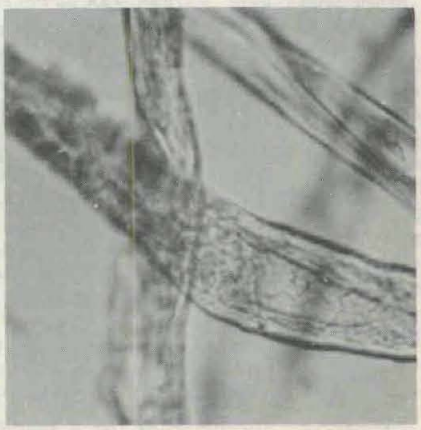
As the missiles were received at WSMR, they were visually inspected and sampled for deposition of microbial contaminants and colonization of missile substrates. Samples of microbial growth and corrosion also were obtained after the missile was completely dismantled. Microorganisms were removed mechanically and culturally to obtain quantitative as well as qualitative data.

Oscar H. Calderon
Chief, Microbiology Laboratory
Environmental Division
White Sands Missile Range, N. Mex.

Determinations of susceptibility of field-exposed missiles and associated material lack many of the refinements and experimental design of laboratory investigations. Randomization and replication of samples on individual units of one missile are utilized.

Substrates examined are designated in broad categories, e.g., plastics, gaskets, surfaces, and paints because of their great complexities as well as various formulations employed.

Bacteria and fungi were found on or in these various substrates, increasing in number with the time of exposure from one to five years. Generally, those materials containing some organic constituents were colonized and



FUNGUS MYCELIUM invading cotton fibers is shown in this WSMR illustration of material exposure to tropical environmental conditions.

WSMR Lab Claims Unique Research Role

NOTE: This short article on research performed in the Microbiology Laboratory at White Sands (N. Mex.) Missile Range is related to the longer scientific report by Oscar H. Calderon.

With a roaring geyser of flame and smoke, another missile surges from its launcher and rises rapidly and majestically into the air. That's the dramatic part of missilery—the part the public appreciates and acclaims.

Not nearly so well known to the multitudes are the work, worry and effort that culminate in a successful launch, encompassing many diverse fields—some relatively unknown and unsung. Microbiology is possibly the least recognized among these.

The Microbiology Laboratory at White Sands Missile Range is one of a kind within the Department of the Army in that it concentrates solely on determining the effects of microorganisms on the degradation of missile systems and components.

The problems that are introduced by the presence of microorganisms involve either their physical presence or occupying space, what they use for food or energy, and what metabolic wastes they excrete.

As an example of how adversely these organisms may affect Army materiel, they have been known to produce living bridges across electrical circuits, causing malfunctioning. They feed upon a great variety of substances: leather, cellulose, canvas, and in some cases silicon rubber, fuels, paints, propellants and polyvinyl chloride.

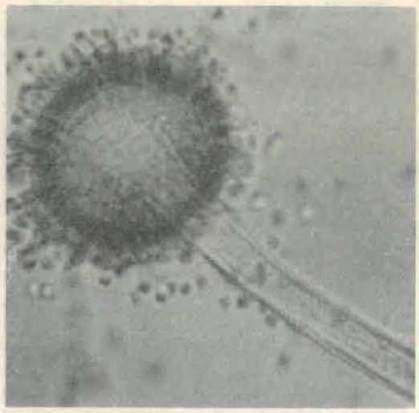
Certain types of microorganisms derive energy from chemical reactions. This is obtained through the oxidation-reduction reactions of inorganic compounds, involving nitrogen, sulfur, iron, manganese and hydrogen, usually resulting in corrosion products. Excretions from microorganisms also cause corrosion.

Two primary ways in which missiles can be effected by microorganisms are in the guidance package and in both interior and exterior paints, although other materials can also be affected.

Rapidity of microorganism degradation of any material is dependent upon temperature, humidity and environment. Under laboratory conditions, optimums of temperature and humidity can be established and testing, to some extent, can be conducted. However, for a thorough analysis and classification of microorganism degradation in a missile system, the test item must be subjected to environmental conditions as well.

Missiles and missile components from many corners of the world are received at the WSMR Microbiology Lab. During the past four years, more than 250 species of microorganisms known to be degrading components or material have been isolated from missile systems.

Missile design engineers have established U.S. Government quality assurance specifications which all missiles and components must meet before they are acceptable. Engineers, project managers, and contractors have, through continuing research, become increasingly cognizant of the problem in waging the battle against microorganism corrosion.



ASPERGILLUS SPORES developing upon conidiophore fungal structure.

maintained relatively high populations of microorganisms.

Pullularia pullulans was the only microbe found on OD color paint and was the primary organism associated with other paints and plastics.

In no instance was the critical number of bacteria or fungi determined for a specific substrate. Data were collected to determine what organisms were associated with this equipment. The most prevalent microorganisms found on or in every missile examined were *Fusarium* spp., *Pullularia* sp., and bacteria.

Sixteen genera of fungi were found less frequently than the above three groups and were considered associate microbes. These included representatives of the genera *Aspergillus, Nigrospora, Alternaria, Curvularia, Myrothecium, Penicillium, Hormodendrum, Spicaria, Cladosporium, Epicoccum, Phoma, Pyrenochaeta, Stemphylium, Chaetomium, Helminthosporium,* and *Trichoderma.* Of the 19 major groups of organisms included above, at least 13 of these groups possess pigmented or dark-colored reproductive structures.

Dominant and associated organisms collectively comprised the entire population on five missiles. The remaining six missiles possessed 24 additional genera of organisms that were designated as incidental forms. A total of 79 fungal species representing 42 genera and six distinct bacterial groups were isolated from 11 missiles.

Many of the more prevalent microbes found on missiles were also observed in investigations involving decomposition of plant parts buried in tropical soils and air-spora of the tropical environment. The percent of microorganisms isolated from missiles, air and soil is summarized in Table 1.

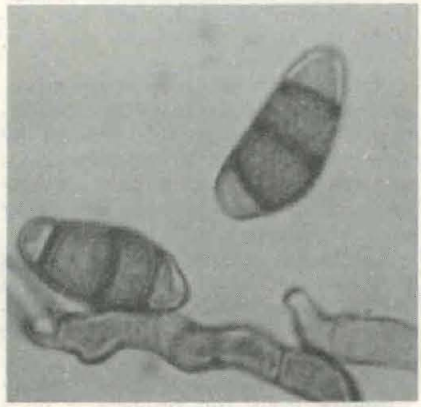
The dominant, associate, and a few of the incidental microorganisms were compared. Ten genera of fungi and bacteria were found on missiles, in air and soil. *Fusarium* spp. and bacteria were the dominant organisms in the three studies.

The percent occurrences of certain genera of organisms on missiles, in air and soil were about the same, e.g., *Penicillium* spp., *Streptomyces* spp., and *Monilia* sp. Higher percentages of fungi were found on missiles than in air or soil in four cases, e.g., *Aspergillus* spp., *Nigrospora* sp., *Curvularia* spp., and *Verticillium* spp. Occasionally, lower percentages of fungi were in air (*Trichoderma* spp.) than on missiles or in soil or lower percent in soil (*Hormodendrum* sp.) than on missiles or in air.

Representatives of fungi were isolated from missiles but were not found in air or soil. These fungi *Pullularia pullulans, Cladosporium* sp., *Epicoccum* sp., *Stemphylium* sp., *Pestalotia* sp., and *Septonema* sp. could have been associated with the tropical environment, but were not included within the parameters of the soil and air investigations. Otherwise; these organisms could have been deposited on the surface during manufacture, assembling, shipping, or handling of the missiles.

Three genera were represented by isolates found only on missiles and in air. *Spicaria* sp., *Cephalosporium* sp., and *Rhinotrichum* sp. could be very late colonizers of soil substrates and would have not been observed in the soil studies. It has been mentioned in the literature that some organisms have the capacity to live and reproduce in an aerial environment. Certain organisms have been observed to grow and reproduce on leaf surfaces.

Missiles and soils were common substrates for eight genera of fungi: *Alternaria* sp., *Myrothecium* sp., *Pyrenochaeta* sp., *Chaetomium* spp., *Helminthosporium* sp., *Sphaeronema* sp., *Stachybotrys* sp., and *Mucor* sp. may have not been prevalent during the six month air sampling period as most of these organisms occurred only incidentally (1–10 percent) in the soil.



CURVULARIA SPORES removed from missile by WSMR Microbiology Lab.

Accumulation of pigmented or dark-spored forms on the missiles is of interest. These same forms were not as detrimentally affected by sunlight as the nonpigmented spores. This observation was also noted during the aerial spora study.

Many relationships exist between the activities of microorganisms occurring on missiles, in air, and in soil. Quantitative data will enhance the further development and evaluation of this information. This could be instrumental in increasing the capacity for microbiological testing by U.S. Army personnel.

TABLE 1. Percent Microorganisms Isolated From Missiles, Soil, Air.

MICRO-ORGANISMS	MISSILES	AIR	SOIL
Fusarium	100	81	85
Pullularia	100	0	0
Aspergillus	73	16	19
Nigrospora	73	2	2
Alternaria	64	0	10
Curvularia	64	11	3
Myrothecium	64	0	11
Penicillium	64	41	67
Hormodendrum	55	35	8
Spicaria	55	12	0
Cladosporium	45	0	0
Epicoccum	45	0	0
Phoma	45	0	25
Pyrenochaeta	45	0	2
Stemphylium	45	0	0
Chaetomium	36	0	1
Helminthosporium	36	0	1
Trichoderma	36	9	49
Pestalotia	18	0	0
Septonema	18	0	0
Sphaeronema	18	0	1
Stachybotrys	18	0	11
Streptomyces	18	20	24
Verticillium	18	1	1
Cephalosporium	1	32	0
Monilia	1	0.5	4
Gliocladium	0	41	3
Oidium	0	31	0
Rhinotrichum	1	6	0
Hyalopus	1	0	24
Masoniella	0	0	13
Pythium	0	0	10
Xylaria	0	0	10
Cunninghamella	0	0	9
Saksenaea	0	0	4
Mucor	1	0	3
Volutella	0	0	2
Ophiostoma	0	0	1
Bacteria	100	100	100

Acknowledgements

This is one of three papers coauthored by O. H. Calderon, White Sands Missile Range, Robert S. Hutton, Tropical Test Center, Canal Zone, and E. E. Staffeldt, New Mexico State University. More importantly, this is the result of the cooperative efforts between U. S. Army Laboratories.

Apstein Heads TARC; 6 New Members Appointed

(*Continued from page 2*)

rector of Defense Research and Engineering. The forums serve as a means of promoting understanding and integrated effort among the three Military Departments, in coordination with the Department of Defense.

Director of Army Research Brig Gen Charles D. Y. Ostrom Jr. is charged by TARC charter with coordinating its activities. General Ostrom and Dr. K. C. Emerson, Special Assistant for Research to the ASA (R&D), represent the Army on the Defense Committee on Research.

Spring meetings of the Joint Discussion Forums will find TARC represented in the major disciplinary areas as follows: *Physical and Mathematical Sciences*, Drs. Lenn and Hallowes; *Engineering Sciences*, Dr. Sullivan and Willard Benson; *Environmental Sciences*, Drs. Lemons and Sterrett; *Life Sciences*, Col Howie and Col Tigertt; *Social and Psychological Sciences*, Drs. Karcher and Katchmar.

In reporting on TARC progress during his tenure as chairman, Dr. Quarles said the major effort was devoted to a review and discussion of in-house laboratory problems and to the experimental Technology or Research Quantitative Utility Evaluation (TORQUE) Program, approved for a feasibility study by the Director of Defense Research and Engineering.

TARC published in May 1967 a 2-volume classified report, totaling 856 pages, as the major input for an updated Army Research Plan. Volume 1 (122 pages), titled "U.S. Army Research and Exploratory Development Program," provides guidelines for the distribution of research resources. This report portrays the ongoing program by 6.21 budget element and 6.11 budget subelement.

Volume 2 (734 pages) presents the "Detailed Scientific and Technical Program" in summaries of the technical objectives and project level work.

Biographical information on TARC's new chairman and members follows:

DR. APSTEIN has served with the Harry Diamond Laboratories since 1953, following 18 years of R&D experience with industry. During preparation of the Bell Report, which had a profound impact on research and development in the U.S. Government, he served as a staff assistant on the President's Science Advisory Committee.

Among numerous honors accorded Dr. Apstein was the Department of Commerce Medal, recognizing him "for outstanding contributions to technology in the fields of aviation ordnance and national and international standardization of weapons."

Under a Secretary of the Army Research and Study (SARS) Fellowship, he studied during 1961 the proper balance between in-house and contracted effort in government laboratories. This is an important area of TARC consideration.

Dr. Apstein is chairman of the Harry Diamond Laboratories staff Development Committee and is an adjunct professor at the American University School of Public Administration.

He received a BS degree in engineering from the College of the City of New York, an MEA degree from George Washington University and a PhD degree from American University. He is a Fellow of the Institute of Electrical and Electronics Engineers (IEEE) and the Washington Academy of Sciences, and a member of the Washington Philosophical Society and the American Ordnance Association.

DR. HALLOWES entered federal service with the U.S. Navy Mine Countermeasure Station, Fla., in 1948 two years after graduating from the Georgia Institute of Technology with a BS degree in electrical engineering. During the interim he was employed in the Research Department of Curtiss-Wright Corp.

In 1951 he was assigned to the Guidance Control Laboratory of the Army Missile Command at Redstone (Ala.) Arsenal, transferring to the Physical Science Laboratory in 1954 and rising to director in 1960.

He received a master's degree in physics in 1948 and PhD in physics in 1964 from Vanderbilt University, and graduated from the National War College in 1966. Numerous professional societies of which he is a member include the American Physical Science Society, the IEEE, the Joint Services Technical Advisory Committee and the American Ordnance Association. He is a registered engineer in the State of Alabama.

WILLARD BENSON has been chief of the Feltman Engineering Sciences Laboratory since 1960 and for a year was detailed as deputy director of Feltman Research Laboratories. His employment record shows broad experience in mechanical, ordnance and research engineering since 1949.

Employed at Picatinny Arsenal in 1952, he served as ordnance engineer for two years. After a year as research engineer for Monroe Calculating Machines Co., he returned to Picatinny in 1955 to serve progressively as chief, Engineering Research Section; chief, Advanced Concepts

DoD Issues New Instruction for Certain Contracts

Policies governing selected contracts which are estimated in the Five-Year Defense Program to require total cumulative financing for research, development, test and evaluation in excess of $25 million, or cumulative production investment in excess of $100 million, are delineated in a new DoD Instruction 7000.2.

Titled "Performance Measurement for Selected Acquisitions," the instruction is *not applicable to firm, fixed-price contracts.*

Subcontracts under pertinent programs will be selected for application of the instruction's criteria by agreement between prime contractors and the contracting military department or defense agency, depending upon criticality.

Specifically provided, however, is that coverage of certain critical subcontracts may be directed by the Department of Defense subject to the changes article of the contracts.

The instruction aims to provide an adequate basis for responsible decision-making by both contractor management and DoD components.

Contractors would provide data through internal management control systems that would (1) indicate work progress, (2) properly relate cost, schedule and technical performance, (3) are valid, timely and auditable, and (4) supply DoD managers with a practicable level of summarization.

DoD Instruction 7000.2, signed by Assistant Secretary of Defense (Comptroller) Robert N. Anthony and effective immediately, is the latest in a series of publications which his office has developed in connection with the Selected Acquisitions Information and Management System (SAIMS), one of DoD's Resource Management Systems.

The new instruction is based on an approach initially taken by the Department of the Air Force and has been under development in the Office of the Secretary of Defense since 1965. It is the product of more than two years' effort in DoD staff coordination and in discussions with representatives of the Council of Defense and Space Industries Association.

and Forecast Section; assistant chief, Nuclear and Advanced Systems Laboratory; and chief, Research and Effects Branch, Ordnance Special Weapons.

He has an ME degree from Stevens Institute of Technology, an MS in applied mechanics from the University of Virginia, an MS in statistics from Stanford University (under a SARS Fellowship) and has continued studies in applied mechanics at Stevens Institute.

He is a member of the American Ordnance Association, Operations Research Society of America, New York Academy of Sciences, and the Scientific Research Society of America. Awarded the Army Meritorious Civilian Service Award in 1965, he is listed in *American Men of Science Who's Who in the East* and *Who's Who in Atoms.*

DR. SULLIVAN was a full professor at Rockhurst College, Kansas City, Mo., until he became chief of the USARO Materials Sciences and Technology Branch in 1966. Following five years of executive experience with industrial oil refineries, he became an independent oil and gas operator and producer in 1945.

In 1948, on a part-time basis, he helped initiate a pre-engineering curriculum for Rockhurst, became increasingly active, was appointed chairman of the Natural Sciences and Mathematics Division, and in 1960 was named head of the Chemistry Department. He started an Engineering Science Degree Program in 1963 and was the first head of the Engineering Science Department at Rockhurst.

Dr. Sullivan earned a doctor of science (ScD) degree in chemical engineering from MIT in 1940 and received a BS degree in chemical engineering from the University of Texas in 1937. His career in private industry included design engineer, process design, sales, engineering, purchasing, construction and preliminary operation of refinery installations.

He is a registered engineer in the State of Texas, a Fellow of the American Institute of Chemists and a member of the American Institute of Chemical Engineers and is active in other professional organizations.

DR. STERRETT joined CRREL in August 1967 as a physical chemist after five years with the Northrop Corp., where he headed the Space Physics, Chemistry and Geology Lab and the Physical Chemistry Lab. He was an extension staff member in engineering of the University of California at Los Angeles during 1965–1966.

Dr. Sterrett received a BS degree (summa cum laude) in chemistry in 1953 and PhD in physical chemistry in 1957 from the University of Pittsburgh. Through a Netherlands Government Fellowship, he studied at the University of Leiden in 1957–58.

He is the author of some 25 reports and articles in the field of physics and related disciplines. Elected a Fellow of the American Association for the Advancement of Science in 1966, he is a member of the American Chemical Society, American Physical Society, Society of Sigma Xi, and the Faraday Society of London, England.

COL HOWIE, former deputy commanding officer of the Army Medical Service R&D Command, served successively over a 6-year period as chief of the Medical Research Branch, chief of the Plans, Programs and Funds Division and as deputy CO. His career includes a tour as deputy director, Directorate of Medicine at Walter Reed Army Institute of Research (WRAIR); CO of the 46th Surgical Hospital, Landstuhl, Germany; chief of medicine at Fort Riley, Kans.; and service with the 1st Cavalry Division (Infantry) in Korea (1950–51).

Col Howie completed premedical training at the University of Iowa and the University of Pennsylvania, receiving an MD degree from Iowa.

From 1952 to 1955, he was in residency training at WRAIR and Brooke General Hospital and has attended the Harvard Postgraduate School of Business Administration. He has been awarded the "A" prefix for outstanding professionalism in internal medicine.

DR. KATCHMAR has conducted research in the fields of individual reaction to stress-producing situations for about 10 years. Selected as a military consultant to the Electronics Industries Association Subcommittee on Human Factors, he also served as an ordnance consultant to the former Operations Research Office of Johns Hopkins University, predecessor to the Research Analysis Corp.

Since 1954 he has served at the Human Engineering Laboratories as chief, Systems Research Laboratory; chief, Experimental Psychology Branch; and as a research psychologist. He was a research psychologist in the summer of 1954 at Walter Reed General Hospital, a research associate at the University of Maryland in 1953–54, and a psychology instructor at the University of Maryland Extension School, 1957–59.

Dr. Katchmar has an AB degree from Bucknell University and PhD degree from the University of Maryland. He is a member of the Eastern Psychological Association, the Maryland Psychological Association, Sigma Xi and the National Academy of Sciences—National Research Council Night-Vision Committee.

Since 1951 he has authored 15 technical publications on stress reaction, human engineering of equipment, and psychological and physiological studies of blast effects.

Becker Succeeds Ewell as Deputy CG of CDC

Brig Gen William A. Becker assumed duties Feb. 12 as deputy CG of the U.S. Army Combat Developments Command, Fort Belvoir, Va., taking over from Maj Gen Julian J. Ewell, reassigned to Vietnam.

Since June 1967, General Becker has served as a deputy to Dr. Jay Tol Thomas, Army Materiel Command Deputy for Research and Laboratories.

Prior to the AMC assignment, General Becker was assistant commander of the 1st Cavalry Division (Airmobile). He was artillery commander during the test period of the 11th Air Assault Division at Fort Benning, Ga., and accompanied the unit to Vietnam when it was renamed.

Other assignments have included executive officer, 2d Infantry Division Artillery at Fort Benning, and commander of the Combat Developments Command Artillery Agency and the 1st Field Artillery Missile Brigade, Fort Sill, Okla.

A 1941 graduate of Texas A&M College, he has attended the Command and General Staff College, the Army War College, the Army Strategic Intelligence School and the Army Language School.

Brig Gen William A. Becker

SATCOM Tests Tactical Satellite Communications in Jungle

See feature article on page 8

PROJECT EASTT test team on location at the U.S. Army Tropic Test Center in the Canal Zone includes (from left, seated) 1st Lt Ronald L. Selfors, Lt Col Donald W. Wiethuechter, WO Tommy H. Wolfe; (first row, standing), Sp/5 Philip F. Bracken, S/Sgt Werner K. Pfeuffer, Albert J. Talerico, S/Sgt Roland L. Brower, S/Sgt Harold Herrin; last row, Sp/5 Laurence H. Laitenen, SFC Curtis J. Livingston, Sp/5 Alvin B. Freeman and PFC Ralph Caso.

CHIEF OF R&D Lt Gen A. W. Betts, in Washington, D.C., converses with EASTT 1 jeep terminal located in the Canal Zone via LES-5 satellite.

TEST VAN No. 2 designed by Army SATCOM Agency, Fort Monmouth, N.J.

EASTT ¾-ton terminal, test van No. 2, and jeep terminal at Canal Zone.

EASTT 4 antenna is locked on LES-5 satellite orbiting at 21,000 miles.

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