RESEARCH AND DEVELOPMENT ARMY

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ABCA Armies Streamline Standardization Program Operations

PRINCIPALS AT Fourth Joint Commanders meeting, Nov. 8. (Seated, l. to r.) General Kenneth B. Hobson, Air Force Logistics Command; Rear Adm R. L. Shifley, Vice Chief of Naval Material, representing Vice Adm I. J. Galantin; General Frank S. Besson, Jr., CG Army Materiel Command. (Standing, l. to r.) Maj Gen Paul R. Tyler, USMC Quartermaster-General; General James Ferguson, Air Force Systems Command. (See story, p. 3.)

Sweeping reduction in the number of committees and working groups and establishment of an expanded secretariat streamlined the reorganization of the ABCA Army Standardization Program, effective Dec. 1.

Following review of the proposed reorganization by a Quadripartite Special Working Party appointed by the Washington Standardization Officers (WSO), the Quadripartite Armies—American, British, Canadian and Australian—agreed to:

- Reduction of ABCA committees from 10 to 3 and working groups from 71 to 22;
- Expansion of the staff of the Primary Standardization Office (PSO) by adding two action officers and two clerks to serve as a single secretariat for the committees.
- General administrative simplification.

Review of the ABCA organization and functions by the WSO was directed in April 1965 at Teal IX conference of high-level officials of the ABCA armies in Australia.

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Services Study Methods Of Predicting for R&D

Tri-Service evaluation of technological forecasting techniques and requirements is being accomplished in a 3-month series of "futurists" seminars expected to extend into March. Objective: Development of a mutually acceptable guide to methodology.

Interservice discussions by research planners early in 1966 led to formation of a steering committee and a working group of civilian representatives of the Army, Navy and Air Force. The working group held its first meeting Nov. 14 to lay the groundwork for the seminars.

In addition to studying and grading current Department of Defense methods of forecasting, the group will survey the academic community, industry, other Government agencies and foreign sources. Its aim is to uncover additional methods that may be mutually useful.

The charter for the project states in part:

"In recognition of the need to

(Continued on page 8)

Featured in This Issue . . .

AFIP Honors 2 Civilians With Awards for Merit

Two doctors of the Armed Forces Institute of Pathology (AFIP) recently received the highest and next highest civilian honors that can be awarded by the U.S. Army.

Dr. William C. Manion, chief of the Cardiovascular Branch, received the Decoration for Exceptional Civilian Service. Dr. Kenneth M. Earle, chief of the Neuropathology Branch, was awarded the Decoration for Meritorious Civilian Service.

Both awards were made by Maj Gen Joe M. Blumberg, AFIP director, who recently returned from an ex-

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Dr. Emerson Appointed Assistant for Research

Dr. K. C. Emerson, an internationally known biologist who ended 27

(Continued on page 9)

Army Deputy Chief of R&D Maj Gen W. C. Gribble congratulates Dr. K. C. Emerson at Army Scientific Advisory Panel Meeting, Fort Bliss, Tex., following reading of Army Chief of Staff General Harold K. Johnson's Letter of Appreciation when Col Emerson retired to end 27 years service.

Army R&D Newsmagazine

Vol. 7, No. 11 December 1966

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Assistant Editor.....Read Wynn

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

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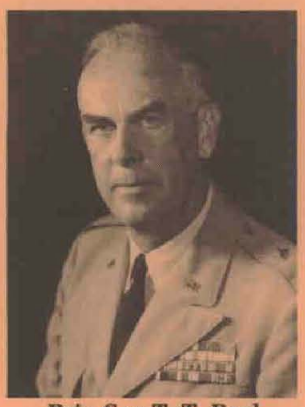
Impact of Helicopters on Army R&D Effort

By Brig Gen Thurston T. Paul

(Based on a presentation before the St. Louis Section of the American Institute of Aeronautics and Astronautics)

My story today begins at a time and place probably lost forever from the record, when an Army helicopter descended from Korean skies to lift a wounded American from a mountain ridge and carry him to medical help and safety. Little did the pilot of that helicopter realize the chain of events that was being set in motion.

Today the cry "Zap Charlie!" is heard all over Viet Nam, a catch-phrase of helicopter fighter pilots in our latest application of the "whirly-bird" to combat. Gun ships spray the Viet Cong with suppressive fire while troops, vehicles and weapons are disgorged from other "choppers" in the newest maneuver against an elusive enemy in the jungles, the highlands and the swamps of South Viet Nam.



Brig Gen T. T. Paul

Helicopters have changed our way of life in the Army, and the impact of those ungainly, noisy, preposterous, but very useful devices, has had widespread effect on the Army's research and development program. My purpose is to convey an idea of the breath of its effect—how the product of Mr. Sikorsky's engineering effort has shaped the course of combat.

Experience with those first-generation helicopters of the Korean War era brought rapid advances in the state-of-the-art, in keeping with the old adage that knowledge begets more knowledge. The U.S. Army fleet has grown to thousands of choppers, varying in size from a 2-man observation helicopter to a large flying crane capable of lifting some several tons. A fully airmobile combat division, the 1st Air Cavalry, is engaged in combat operations in Viet Nam. It is equipped with more than 400 helicopters, its principal mode of transportation and a far cry from its horses of 30 years ago.

Let's set a typical combat scene. Yesterday a patrol in a quiet spot in the Viet Nam jungle contacted a North Viet Nam unit preparing to ambush one of our 1st Cavalry battalions along a Viet Cong supply route. As rifle fire crackled in the trees, a radioman reported the action and its location.

In quick response, alert helicopters were started at the base camp and alert troops loaded. Reinforcements joined the fray in minutes, landing astride the routes the enemy would use to reinforce or withdraw its unit. "Gun ships," helicopters mounting machineguns, grenade launchers and rockets, which had laid suppressive fires on the helicopters landing sites before the troop transports arrived, then turned their fire power to attacks on the enemy.

The battle was carried to that quiet spot in the jungle in less than a quarter of an hour—by helicopter. This is Warfare 1966!

For light observation purposes in Viet Nam we are using either the OH–13, helicopter or the OH–23, which is quite similar. Both are 2-place aircraft of the mid-1950 vintage. Scheduled to replace them shortly is the OH–6A, a Hughes aircraft of 4-place capacity and greatly improved speed, range, reliability and reduced maintenance.

The largest single item in the Army aircraft inventory is the Iroquois UH–1D utility helicopter, known popularly as the "Huey." With its ability to carry 11 fully equipped soldiers, the Huey-D is the workhorse of today's airmobile Army.

Flying with the Huey-Ds are earlier model Huey-Bs, now armed with machineguns, rockets and 40mm grenade launchers. These gun ships, as they are called, provide accompanying suppressive fire support for the troop-carrying aircraft as they come in for touchdown.

To provide a vehicle capable of lifting larger loads, whether it be a full infantry platoon or a howitzer and its crew, the Army has the CH–47 twin-turbine Chinooks—the means whereby the infantryman never lacks for close artillery support. In Viet Nam, 105mm howitzer batteries have been relocated dozens of times during a day, as the Chinooks kept moving the guns where they were needed most.

(Continued on page 22)

COSATI Achievements Reviewed as Knox Takes New Position

Upon his departure Nov. 1 as chairman of the Committee on Scientific and Technical Information (COSATI), Federal Council for Science and Technology, William T. Knox could view with some satisfaction the achievements during a 2-year tenure.

Mr. Knox resigned to become a vice president of McGraw-Hill Co. in New York City, but will act as a consultant to the Office of Science and Technology. In his new position he will have responsibility for advising and assisting management in advancing McGraw-Hill's interests in information systems and services.

Although he joined the staff of Presidential Science Adviser Dr. Donald F. Hornig in September 1964 as technical assistant for scientific and technical information, Mr. Knox did not become COSATI chairman until March 1965.

Dr. Hornig announced appointment of Col Andrew A. Aines on Nov. 16 as acting chairman of COSATI. Col Aines has served as executive secretary of COSATI since June 1964, following 19 months duty as the first director of Army Technical Information and chief of the Scientific and Technical Information Division, U.S. Army Research Office.

COSATI was established in 1962 by the Federal Council for Science and Technology. Its mission is to "contribute to the development of an articulated but decentralized Federal information system designed to provide an important tool for improving research and development, both in and out of Government."

Shortly after Mr. Knox became chairman, a number of panels were established to make in-depth studies of various problem areas of the Government scientific and technical information field.

Effective Nov. 1, 1966, Dr Lee G. Burchinal succeeded John Sherrod as chairman of the Panel on Education and Training. Dr. Burchinal is director of the Division of Research and Dissemination, Bureau of Research, U.S. Office of Education, Department of Health, Education and Welfare.

Author of more than 100 publications, Dr. Burchinal has held research management positions in a number of Federal Government agencies. He received a PhD degree in sociology from Ohio State University in 1956.

The Panel on Information Sciences Technology has issued four reports, one of which is an "Inventory of Projects in Information Sciences and Technology Sponsored by the Government." Dr. Ruth Davis, Office of the Director of Defense Research and Engineering, is chairman of the panel.

The report identifies with a short description some 1,300 projects. The committee found "not as much overlap among agencies as might be anticipated." The panel's other reports discussed the principal technical problems of supporting a national information system.

COSATI has approved extension of the panel inventory work for three years and authorized the panel to undertake additional interagency projects as well as improve the method of disseminating research results.

The Panel on Operational Techniques and Systems is now under the chairmanship of Ed Stiles, National Security Agency, who replaced Armen G. Abdian. Studies on operational problems of ongoing systems including recommendations for changes, have been distributed among several subpanels and task groups.

The Subpanel on Descriptive Cataloging has prepared "Revised Standards for Descriptive Cataloging of Scientific and Technical Reports." This replaces the 1962 edition and is available from the Department of Commerce Clearinghouse for Federal Scientific and Technical Information for $1.00.

The subpanel is preparing a "Standard Corporate Author List" of

(*Continued on page 4*)

Joint Commanders Push Standardization

Complexities involved in achieving objectives of the Defense Standardization Program stimulated discussion at the fourth Joint Commanders' Meeting Nov. 8 in the Pentagon, Washington, D.C.

General Frank S. Besson, Jr., CG of the Army Materiel Command (AMC), took his turn in rotation as host to the flag and general officers who manage the major U.S. military development and logistics agencies. The quarterly series of meetings designed to further interservice cooperation was initiated early this year.

Air Force General James Ferguson, former Air Force Deputy Chief of Staff (R&D), attended for the first time as the new CG of the Air Force Systems Command (AFSC), replacing General Bernard A. Schriever who retired Aug. 31.

Other principals are General Kenneth B. Hobson, CG, Air Force Logistics Command (AFLC) and Vice Adm I. J. Galantin, Chief of the Naval Material Command (NMC). Maj Gen Paul R. Tyler, USMC Quartermaster-General, is the Marine Corps Commandant's representative.

Rear Adm R. L. Shifley, vice chief of Navy Material, attended the November meeting for Admiral Galantin, who was out of the country.

Recommendations for a joint plan to advance the DoD standardization program were presented to the Joint Commanders by panel members Lt Col David A. Cook of AFSC, James A. Brockelsby of AMC and William J. McKay of NMC.

Existing JTCGs reporting at the meeting included those working on Aerial Delivery, Tactical Air Control and Munitions Effectiveness.

The Joint Commanders discussions included Interservice Depot Maintenance and the DoD Resources Management System. The JTCGs on Chemical-Biological and Nonnuclear Ordnance did not report.

Other joint panels on management problems are concerned with Military Interdepartmental Procurement Requests, Basic Principles of Joint Logistics, Plant Cognizance, DoD Aeronautical Depot Maintenance Study, and Military / Civilian Manpower Substitutability.

Panels also are studying an Automatic Data Processing Systems, Selected Acquisition Information and Management System (SAIMS), RDT&E Facilities and Capabilities. Proposed is a panel through which the Joint Commanders could make inputs to the work of the Logistics Management Institute.

Panels do not require full-time commitment of personnel and are "de-

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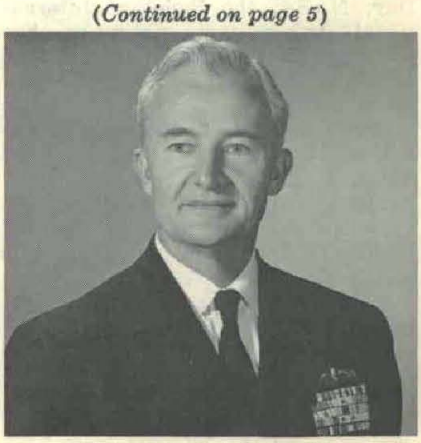

Vice Adm I.J. Galantin
Chief, Naval Material Command

COSATI Reviewed as Knox Takes New Position

(*Continued from page 3*)

organizations which originate reports. Another project is a list of "Standard Data Elements for Magnetic Tape Formats" for use in interchange between agencies.

The Subpanel on Classification and Indexing has prepared for COSATI approval "Conventions for Thesauri Compilation," a set of guidelines for assembling thesauri. The subpanel will review the COSATI "Subject Category List" of principal scientific and technical subject fields used for dissemination and announcement of material.

A Subpanel on Microfiche (now Subpanel on Micromedia) published "Federal Standards for Microfiche" (See *Army R&D Newsmagazine*, November 1965) and recently completed a supplement covering security markings. Following publication of the original "Standards," various manufacturers have developed microfiche readers and printers.

The group is continuing to examine micromedia systems, with an eye to the possible need for new standards.

A Standardization Subpanel's task is to determine precisely how COSATI should proceed in the field of standardization. Working on identification of existing standards which apply to COSATI's aims and goals, it will identify gaps and make recommendations for the development of such standards by another panel.

An Ad Hoc Working Group on the Establishment of Government-wide Standard for Scientific and Technical Report Formats is concerned with the physical format of the report, as opposed to content. Twelve Federal Departments are represented in the working group, which expects to finish its task in May.

Under the direction of Melvin S. Day, NASA, the Panel of International Information Activities has published "Guidelines for Public Domestic Use of Federally Owned Machine-Stored Indexes," one for use in this country and one for dissemination of magnetic tapes in other countries.

The activity of this panel reflects the increased international flow of technical information and data. It is concerned with:

- Establishing policies and programs for acquisition of foreign material and for dissemination of U.S. federally produced material to foreign countries.
- Improving techniques for acquisition, translation and dissemination of foreign material.
- Recommending improvements in the governmental organizationl to increase efficiency of exchange of information.
- Recommending policies regarding the role of nongovernmental organizations and their support in international information exchange.

The Task Group on National Systems for Scientific and Technical Information, a panel-level team established in 1965, has prepared "Recommendations for National Document Handling System in Science and Technology." The report provides for an integrated informational network to be built on ongoing information activities in and out of the Government.

The task group has contracted for three new studies. A report on an "Abstracting and Indexing Study" is being prepared by the Systems Development Corp. for issuance early in 1967. Hopefully, it will help in the formulation of a realistic policy on abstracting and indexing services in and out of Government.

Information communication among the Nation's scientists and engineers will be studied by the American Institutes of Research, Silver Spring, Md. The study will explore the behavior of technical people using oral/informal communications. Its purpose is to obtain a clear description and definition of the role of informal communications techniques.

The study will also pave the way for later measuring of various aspects of the national effort in informal technical communication. The $50,000 contract was awarded by the Army Research Office-Durham (ARO–D), N.C.

In a study of the nationwide systems for handling of scientific and technical data, a preliminary census of activities in the collection, reduction, analysis and dissemination of data will be made by Science Communication, Inc., Washington, D.C.

The study will include scientific data, technical specifications, manufacturers' catalogs, technical operations and maintenance, instruction and training data on the national level in industry, the professions and Government. It will not cover the use of technical data in colleges and universities.

The $286,000 study, which will appear in 1968, is supported by the Advanced Research Projects Agency of the Department of Defense, as is the study on informal communication.

A Task Group on Technical Reports was formed in August to look into the improvement of quality of Federal Government technical reports. Dr. Sidney Passman, Arms Control and Disarmament Agency, heads the panel.

A new Panel on Management of Information Activities is being formed under the chairmanship of Walter M. Carlson, Director of Technical Information, Office of the Defense Director of Research and Engineering. Robert R. Hays, Scientific and Technical Information Coordinator, Naval Research Office, is executive secretary.

COSATI is also planning a possible Task Group on Information Analysis Centers.

New COSATI representatives are W. M. Bastian, United States Information Service; R. A. Spencer, U.S. Patent Office; and Dr. J. D. Wilkes, Agency for International Development.

New observers in COSATI include: Dr. S. R. Galler, Smithsonian Institution, and Gilbert Donohue, Department of Housing and Urban Development. Other observers are from the Bureau of the Budget, Library of Congress, Agency for International Development, U.S. Patent Office, U.S. Information Agency, U.S. Post Office Department and the Central Intelligence Agency.

HEL Designs New Grip To Aid Helicopter Pilots

NEW GRIP for helicopter pilots has been developed by the Human Engineering Laboratories (HEL), Aberdeen (Md.) Proving Ground. More than 60 pilots were interviewed to spell out precise requirements for an aircraft control grip that will simplify pilot's job in the increasingly complex Army helicopters being developed. Bernard M. Corona of the HEL Aviation Branch measured hands of various sizes to find a suitable design that would fit both large and small. The illustrated grip will be adopted as standard on the OH–6A and AH–56A.

Joint Commanders Push Standardization

(*Continued from page 3*)

signed to perform studies in order to develop material logistic principles, and to identify preferred concepts, policies and system design characteristics that could be employed uniformly by the Services."

Included are studies concerning interservicing, integrated management and contract support.

Panels are organized to carry out directed decisions of the Commanders that require joint effort.

Joint Commanders' task groups have been established to handle such long-range problems as Interservice Depot Maintenance and DoD Supply Management Review Program. Task groups require full-time personnel.

The Joint Commanders held a special meeting Aug. 15 to consider the Standardization Program and the delegation of authority to Standardization Assignees.

Initial discussion involved a plan that would insure assignment of standardization authority, including engineering and technical aspects. The goal is "optimum balance between objectives of the standardization program and Service responsibilities for overall operational effectiveness and materiel readiness of weapon systems and equipments."

In discussing the charter for the Joint AMC/NMC/AFLC/AFSC Panel for the Defense Standardization Program, the Joint Commanders pointed out that "considerable realignment of military service policies" will be essential if an optimum degree of standardization is to be achieved during the design and development of systems and equipment.

The Standardization Panel, one of 11 established by the Joint Commanders to cover mutual management problems, is charged with determining the adequacy of current criteria used in designating Standardization Assignees.

Recommendations for realignment of standardization assignee designations will address *all* Supply Classes designed for integrated management by the Defense Supply Agency (DSA) or one of the military services. The Defense Standardization program was established by DoD Directive issued in April 1965.

The Standardization Panel will establish a permanent Joint Technical Coordinating Group (JTCG) for the Defense Standardization Program after assigned spadework has been accomplished. A JTCG is currently in the ad hoc stage.

Supporting the Joint Commanders' Meetings is a Joint Secretariat, composed of personal representatives of each commander, which maintains direct contact with their principal staff members on Joint Commanders' business.

The Secretariat prepares agenda for the Joint Meetings and meets at prescribed intervals to review and evaluate progress of the panels.

Members of the Joint Secretariat are Colonel Joseph Thomas, Army Materiel Command; Capt George L. Bliss, U.S. Naval Material Command; Col B. H. Shiffrin, Air Force Logistics Command; and Col J. R. Cumberpatch, Air Force Systems Command.

The Joint Commanders first meeting was held Mar. 28, 1966, although separate meetings of the Army and Navy commanders with the AFLC and another with the AFSC had been held previously.

The official sanction to the Joint Commanders' Meetings had been given by the Military Departments. The Assistant Secretaries of the Army supervise the activities of the joint commanders in their respective areas of responsibility.

Brig Gen Thurston T. Paul, Director of Plans and Programs, Office of the Chief of Research and Development, has designated the OCRD Research and Analysis Division (Lt Col Gerald E. Ledford, chief, Management Analysis Branch) as point of contact with the AMC member of the Joint Secretariat.

The Joint Agreement states, in part, that the meetings are held "in recognition of the continuing need to resolve interagency problems, to facilitate the exchange of information and accomplish significant joint studies and tasks." It also details two broad objectives:

"Prevent duplication among the Services by joint utilization of personnel, intelligence, facilities, equipment, supplies and services in all cases where military effectiveness and economy of resources will thereby be increased";

And, "Conform to uniform policies and standardize on material and logistic concepts, systems design, forms, terminology and criteria for the procurement, requisition, storage, transportation, distribution, issue and maintenance of weapons systems, supplies and equipment consistent with the specialized needs essential to the effective functioning of each command."

Termed "working groups, not a paper front," the Joint Commanders regard the meetings as a permanent feature in military logistics, serving to minimize the need for the higher authority to become involved in other than outlining broad policy and leaving implementation to the Services.

Agreed also is that the areas for potential coordination among the four commanders are so vast that in one year "we have only scratched the surface."

Some examples cited include common supply procedures, interservice purchases and cross-servicing in repair and maintenance of common materiel items.

With a continuing increase in joint development programs, the Joint Commanders' Meetings are recognized as providing a valuable management tool to enable the Services to cooperate more closely for mutual benefit.

MICOM Assigns Steenburn to Chaparral Management

Lt Col Donald H. Steenburn is the new chief of the Chaparral Management Office at the U.S. Army Missile Command, Redstone Arsenal, Ala.

Upon his recent return from duty in Korea as commander of the 83rd Ordnance Battalion, he completed the 11-week Defense Weapons System Management course at Wright-Patterson Air Force Base, Dayton, Ohio.

Col Steenburn attended the Ordnance Guided Missile School at Redstone in 1953, was Corporal missile project officer at White Sands Missile Range, N. Mex., and missile project officer at Second Army headquarters, Fort Meade, Md., and in Italy.

Lt Col D. H. Steenburn

He served in the Pacific area during World War II, in Japan from 1950 to 1953, in Italy from 1958 to 1961, and later was assigned as operations officer for the Field Command, Defense Atomic Support Agency, Sandia Base, N. Mex.

Backed by a BS degree in mechanical engineering from the University of Vermont, he also is a graduate of the Command and General Staff College and the Armed Forces Staff College. He received the Commendation Medal for service in Italy and the Presidential Unit Citation for duty in New Guinea.

New Electromechanical Hand Lifts Egg Intact

Lifting an egg without breaking should be a routine feat for an amputee using the Army's new electromechanical hand, which automatically adjusts to the force necessary to keep an object from slipping.

Designed primarily for severely handicapped upper-extremity amputees, the hand has a piezoelectric crystal forming the heart of the system, and is hailed by its designers as a breakthrough in automatic proportionate control of prehension.

Developed by the U.S. Army Medical Biomechanical Research Laboratory at Forest Glen, Md., directed by Col Peter M. Margetis, the hand was designed by Lloyd L. Salisbury, chief of the Biomechanical Devices Division, and Albert B. Coleman, chief of the Design Branch.

Below-elbow amputees using mechanically controlled prosthetic devices receive position, force and velocity feedback visually and via biological transducers in the elbow or shoulder. The number of biological transducers is decreased as the level of amputation increases.

In contrast to conventional mechanically controlled devices, the electrical prostheses do not usually incorporate velocity and force feedback. Research in other countries has produced electrically controlled devices which require the amputee to remember the forces used on previous attempts, or visual cueback, to warn him when the object is slipping or being crushed.

With the USAMBRL hand, however, the amputee makes only positioning and grasp decisions. The force is applied by logic within the hand itself.

Upon mechanical activation of a switch by changing harness tension, muscle bulge, or other body motion, the hand lightly grasps an object. If on lifting an object slippage is encountered, the hand grasps harder to overcome the slippage.

Albert Coleman (left) and Lloyd Salisbury demonstrate capabilities of electromechanical hand developed at U.S. Army Medical Biomechanical Research Laboratory, Forest Glen, Md.

Although the slippage signal automatically increases the pinch, an amputee may override the system for grasping vibrating objects such as an electric toothbrush.

Slippage vibrations are detected by the piezoelectric crystal in the thumb. The crystal is part of an inexpensive phonograph cartridge.

A 12-volt planetary-gear-reduced motor, which provides a grasp of 15 pounds, runs the mechanism. The battery can be recharged at night.

The USAMBRL hand will be tested clinically by a testing agency working in cooperation with the Committee on Prosthetics Research and Development, U.S. National Academy of Sciences-National Research Council.

USAMBRL Technical Report No. 6611, coauthorized by Salisbury and Coleman, was published to describe the mechanism and the operating principles of the artificial hand. An article also has been submitted to the *Journal of Medical Electronics and Biological Engineering*.

A patent application has been filed with the U.S. Patent Office.

ABCA Armies Streamline Standardization Program

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Under the reorganization, Working Groups are reduced to "a more manageable number" and materiel items in a particular field are combined to reduce administrative work. Only when a problem reaches complexity will a Working Group recommend a Special Working Party to resolve it.

When the task is completed, the Special Working Party is dissolved to keep working units to a minimum. Under the previous system, numerous ad hoc groups were continued after special tasks were completed.

Committees approved under the reorganization are: Quadripartite Materiel, with 16 Working Groups; Quadripartite Standardization Agreements, with 3 working groups; and the Quadripartite Concepts Committee, with 3 Working Groups, which has not yet been activated by the WSO.

Washington Standardization Officers are Brig Gen Kenneth F. Dawalt, U.S. Army Deputy Chief of Research and Development for International Programs; Brigadier N. G. Wilson-Smith, commander of the Canadian Defense Liaison Staff; Maj Gen R. A. Fyffe, commander of the British Army Staff and Military Attache; and Brigadier W. G. Henderson, commander of the Australian Army Staff and Military Attache.

The Washington Standardization officers are equal in position in the ABCA organization and the chairmanship is rotated semiannually. General Dawalt will become chairman July 1, 1967.

Members of the Primary Standardization Office (PSO), relocated last August from the Pentagon to the Army Research Office, Arlington, Va., are Lt Col Earl L. Keesling, United States; Lt Col Douglas H. McIndoe, Canada; Lt Col Peter P. Steel, Great Britain; and Lt Col John G. Hooton, Australia. Scheduled for reassignment Dec. 31, Col Hooton will be replaced by Lt Col John Burke upon graduation from the U.S. Army command and General Staff College.

With the PSO Secretariat expanded to serve the three ABCA committees, the secretariats for each of the 10 committees were abolished. Members of the PSO Secretariat are Maj Raymond Sunderland, Australia; Sidney Smith, Great Britain; Sergeant Major/Warrant Officer L. B. Fletcher, Canadian Army, chief clerk; and three civilian secretaries.

By the terms of the Basic Standardization Agreement between the four nations in 1964, each nation establishes its own coordinating office for the ABCA Program within its own army.

For the U.S. Army, responsibility is assigned to the International Office, Office of the Chief of Research and Development. Headed by Col William M. Calnan, it coordinates all actions by the ABCA with the International Standardization Office, Assistant Chief of Staff Force for Development; International Development Division, Army Materiel Command; International Division of Combat Developments Command, and other interested agencies.

The present ABCA Army Standardization Program began in 1947 with the Tripartite—American, British and Canadian armies—recognizing the need for cooperation and exchange in research and development and in technical and operational improvements common to their requirements.

Australia was admitted to the program as a full member early in 1963 to form the ABCA Quadripartite. New Zealand became an associate member in 1965, receiving ABCA support through Australia but without representation or vote in the ABCA organization.

Armed Forces Institute of Pathology Honors 2 Civilians

(*Continued from page 1*)

tended staff and consultative tour of Europe and the Far East.

DR. MANION was cited "in recognition of his consultation, education and research in cardiovascular pathology" and for his "outstanding contributions to the literature and the teaching of cardiovascular pathology."

Before joining AFIP in 1953 as assistant chief of the branch he now heads, Dr. Manion was a pathologist at Prince Georges General Hospital, Cheverly, Md. He has a BS degree (1939) from The Catholic University of America, Washington, D.C., and a degree in medicine from Georgetown (D.C.) School of Medicine in 1943.

After interning at Garfield Memorial Hospital, Washington, D.C., Dr. Manion was a lieutenant in the Naval Reserve (Medical Corps) during World War II, serving with the 1st Marine Regiment, Okinawa.

He has served as an instructor in pathology at the University of Maryland and Georgetown University and as assistant and associate professor of medicine in addition to his AFIP duties.

Dr. William C. Manion

Among his numerous professional affiliations are the American Medical Association, Association of Clinical Pathologists, Medical Society of the District of Columbia, Association for the Advancement of Science, American Association of Pathologists and Bacteriologists, Washington Society of Pathologists and the International Academy of Pathology. In 1961 he was chairman of the study section on Cardiovascular Diseases in Animals of the United Nations' World Health Organization.

Dr. Kenneth M. Earle

Dr. Manion has been honored for his exhibits by the American Medical Association and the American Society of Clinical Pathologists and has served in prominent international medical advisory capacities.

Catholic University presented Dr. Manion with its Outstanding Alumni Award in 1963 and he received the Veterans Administration Outstanding Service Award and the AMA Hoektoen Silver Medal in 1964.

DR. EARLE was decorated for contributing "significantly to the field of neuropathology and as an educator, consultant and researcher" with a worldwide reputation gained for his "keen insight and dedication."

He received a BA degree in 1942 from Rice Institute, Houston, Tex., and an MD degree from the University of Texas in 1945. He has a master of science degree (1951) from McGill University, Toronto, Canada.

He was an instructor in pathology at the University of California School of Medicine, Los Angeles, and served his senior residency at Veterans Administration Hospitals at Los Angeles and Long Beach from 1952–1953.

From 1953 to 1962 he was associate professor, then professor, of pathology at the University of Texas, Galveston branch, and was dean of medicine from 1959–1962 before joining AFIP.

Dr. Earle is a Diplomate of the American Board of Pathology in pathologic anatomy and neuropathology and holds medical licenses in Texas and California. He is a member of numerous national and state medical, pathological and neurological organizations, and is author or coauthor of more than 30 technical studies published from 1945 to 1966.

Bjerhammar Heads GIMRADA Research Institute

Internationally known Swedish scientist Dr. Arne Bjerhammar is the new director of the Research Institute for Geodetic Sciences at the Army Engineering Geodesy, Intelligence and Mapping R&D Agency (GIMRADA), Fort Belvoir, Va.

Dr. Bjerhammar is the first to fill the Public Law 313 position created by a major reorganization of GIMRADA last spring.

Associated with GIMRADA for several months in 1963 as a Visiting Scientist, he is well known in this country for his lectures on geodesy and mathematics at Massachusetts Institute of Technology, Cornell, Georgia Tech, Purdue, Michigan State, the University of Michigan, Arizona State and other academic institutions.

Dr. Bjerhammar was graduated from the Royal Institute of Technology, Stockholm, in 1942 and received his technical doctorate in 1948. He served the Stockholm Institute as assistant professor, professor, head of the Division of Geodesy, and dean of the Department of Surveying.

Visiting Scientist at the National Research Council, Ottawa, Canada, in 1957, he is a past president of the Swedish Association of Engineers (1958), and the International Association of Geodesy Study Group for Statistical Methods.

The Research Institute Dr. Bjerhammar heads is one of two distinct elements of GIMRADA, encompassing a program of research in photogrammetry and cartography, geodetic surveying and geophysics, celestial geodesy and physical sciences, and support for mapping and geodesy.

Dr. Arne Bjerhammar

Tri-Service 'Futurists' Study Technical Forecasting Methods

(*Continued from page 1*)

develop advanced methods of technological forecasting . . . it is agreed that representatives of the Headquarters, Air Force Systems Command; Army Office of the Chief of Research and Development; Headquarters, Army Materiel Command; and Headquarters, Naval Material Command will undertake a joint study of methods for forecasting technological progress.

"Technological forecasting occupies a key role in the DoD planning cycle. Decisions, based on forecasting, can be improved by the development of more credible forecasting techniques. . . ."

Army personnel assigned to the working group are Donald B. Keckler, Army Weapons Command, Rock Island, Ill., and Edward Mackiewitz, Army Tank and Automotive Center, Warren, Mich.

Steering committeemen are Marvin Cetron, Headquarters, Naval Material Command; James W. Sterling, Army Research Office, Office of the Chief of Research and Development; Howard Wells, Headquarters, Air Force Systems Command; and Halvor T. Darracott, Army Materiel Command Research and Development Directorate.

The interservice search will be monitored by the Joint Secretariat of the Joint Commanders—top military logistics managers who began quarterly Joint Commanders' Meetings in March 1966. (See feature article, page 3.)

Program planners point out that most research and development forecasting emanates from the "experts" or subject-matter specialists who are on the state-of-the-art frontier, but do not have specific high-level guidelines for making futuristic plans. Each military service forecasts in its own way, such as:

- An Army Materiel Command group under the staff supervision of the Chief of Research and Development is continually assembling input from laboratories and other agencies in the field as the basis for predictions.
- The Navy, also without specific methodology guidance, plans to predicate its R&D forecasts on information furnished by specialists in specific areas on a continuing basis.

The Air Force conducts a periodic "Project Forecast" involving large panels of individuals who have specific expertise in various areas making predictions.

At the orientation meeting of the interservice working group and steering committee, some current methods of forecasting in effect or experimental stage were discussed. They include:

- *Genius.* Intuitive estimate by one or more subject-matter experts.
- *Consensus.* An agreement reached by a panel or poll of experts.
- *Scenario Generation.* A story is prepared, dramatizing the possible future environment with all the predictions that scientific imaginations can conjure to fit into it.
- *Time Series Analysis.* Projection of past performance by simple extrapolation or curve-fitting to provide an analysis upon which a forecast can be made.
- *Biological Growth Analogy.* The process being forecast is compared with the pattern of normal biological growth.
- *Correlation Analysis.* A determination of the relationship of the forecast dependent variable to one or more independent variables.
- *Mathematical Models* and *Econometric Analysis.* The use of a system of equations which attempts to express and explain interrelationships among several variables.

The final methodology guide, according to present plans of the study group, will list all forecasting methods the planners are able to uncover and provide a background discussion of each. Advantages, disadvantages and the areas of applicability of each method will be discussed, enabling subject-matter specialists to choose the method (or methods) most suitable for the subject with available data.

The guide will also offer a commentary on the selection of critical parameters to be forecast, presentation of the data and use of probability estimates.

Office space and secretarial assistance has been made available to the study group by the Army Research Office, Arlington, Va.

WRAIR Reactor Chief Retires, Joins Texas A&M University

Lt Col Dan Hightower, a key figure in installation and operation of the biomedical research nuclear reactor at Walter Reed Army Institute of Research (WRAIR), Washington, D. C., retired Oct. 31 after 20 years and one day in the United States Army Veterinary Corps.

Col Hightower was chief of the Reactor Section at WRAIR and was active in the planning phase for the reactor, which at the time of dedication on Sept. 12, 1962, was acclaimed as the largest of its kind in the world. He is now with the Department of Physiology in the College of Veterinary Medicine at Texas A&M University, his alma mater.

Col Hightower entered the Army in 1946 upon receiving a degree in veterinary medicine and joined the staff at WRAIR in 1961 after receiving an MS degree in applied physics from North Carolina State College.

In addition to various veterinary assignments, Col Hightower served as the Radiation Planning Officer of the Quartermaster Radiation Planning Agency, Washington, D.C.

Christensen Joins DDRE Technical Information Office Staff

Walter C. Christensen has succeeded John F. Stearns as staff assistant to Walter M. Carlson, Director of Technical Information, Office of the Director of Defense Research and Engineering. Stearns resigned to become head of the NASA Scientific and Technical Information Division.

Christensen will assist in providing policy direction to the Defense Documentation Center and in management of scientific information handling in the Department of Defense. Major projects include improvement of local information services, design of large-scale experiments on technical communications and effective adaptation of new techniques for information transfer.

Walter C. Christensen

As a Congressional Fellow last year he conducted a study of the flow of new technology to the small-business community. He holds a baccalaureate degree in mechanical engineering from the Georgia Institute of Technology and is a graduate of the University of Chicago International Institute of Nuclear Science and Engineering.

Currently he is working toward a master's degree at George Washington University, Washington, D.C. He is a director of the District of Columbia Society of Professional Engineers and chairman of the Society's Engineers in Government branch.

New Glider Delivers Cargo from 30,000 Feet in Tests

Preproduction testing of the new precision-drop glider (PDG) system for tactical assault and resupply operations is being conducted at the U.S. Army Test Station, Yuma, Ariz.

Working with the Advanced Research Project Agency (ARPA) of the Department of Defense and the Army, Ryan Aeronautical Co. designed and developed the PDG through some 600 tests with various configurations and payload capacities during the past four years.

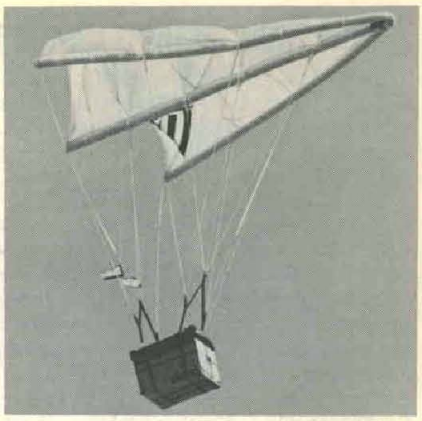
The present Army glider system is for precision delivery of 500-pound high-priority cargo. The Army Aviation Materiel Laboratories (AVLABS), Fort Eustis, Va., has awarded Ryan a $1.1 million contract to design, develop, build and service test a quantity of PDGs.

Air-launched from rotary or fixed-wing aircraft at altitudes to 30,000 feet and at air speeds up to 150 knots, the PDG system has a glide distance three times its altitude at launch.

A drogue chute in the PDG opens seconds after launch and deploys the "flex wing" which becomes a delta wing with the inflation of the non-rigid keel and outboard members. The on-board receiver and electronic package in a control platform is turned on automatically by the drogue chute's static line.

The PDG homes on signals transmitted from a portable ground unit and decends in a gliding pattern to its predetermined landing site. Its configuration and cargo weight are designed to minimize dragging caused by high winds on the ground after touchdown.

Engineers conducting the tests at Yuma point out that the PDG enables the launching aircraft to escape ground fire normally associated with aerial delivery because of the altitude and distance from predetermined landing sites at which it is released.



Ryan photo

Precision Drop Glider

Dr. Emerson Appointed Assistant for Research

(*Continued from page 1*)

years service recently in the U.S. Army, retiring as a colonel, was appointed Assistant for Research to Assistant Secretary of the Army (R&D) Russell D. O'Neal, Nov. 1.

In the Philippines, he participated in the defense of Bataan in 1941-42. After surviving the "Bataan Death March," he spent several years as a prisoner of war in the Philippines, Formosa and Japan.

During a tour in Germany, he served in the famed 2nd Armored Division. In Korea, he was assigned to the United Nations Command and the Military Armistice Commission. He served six years in the U.S. as an instructor, three each with the U.S. Army Command and General Staff College and with an ROTC unit. For seven years he was an R&D specialist in research.

Dr. Emerson has been active in biology since 1939, except for his term as a prisoner of war, and has published more than 90 scientific books and articles in the U.S., Canada, United Kingdom and Australia. He also has written a number of books and articles on military subjects.

In recognition of his contributions to entomology, fellow workers have named one genus and 15 species of insects in his honor—in Mozambique, Columbia, Germany, Portugal, Brazil, United Kingdom and the United States.

For several years Dr. Emerson has been a research associate of the Smithsonian Institution, a collaborator with the U.S. Department of Agriculture, and adviser to many graduate students at some of the leading U.S. and foreign universities.

Societies in which he is a member include the American Society of Parasitologists, American Society of Tropical Medicine and Hygiene, Wildlife Disease Association, Entomological Society of America, Biological Society of Washington, Entomological Society of Washington, American Institute of Biological Sciences, American Association for the Advancement of Science and Sigma Xi.

Antennas in Rotors Give Aircraft 'Night Vision'

Installation of radar antenna arrays in helicopter rotor blades promises to be a revolutionary development that may give the aircraft "night vision" and provide the fast scan rate necessary for accurate radar mapping.

Solution to the problem of antenna-mounting in helicopters was announced recently by the Department of Defense. Developmental work was accomplished by the long-range Joint Army-Navy Instrumentation Research (JANAIR) Program.

Flight tests in the UH–1B helicopter with two 15-foot antennas in each of the two rotor blades have demonstrated that "almost pictorial ground mapping" is possible. Aided by the photographs or charts, pilots report they can readily identify variations in terrain, airport runways, clusters of trees, buildings or oil tanks on the radar screen.

The radar system operates without a computer, mechanical components or a servo system; the receiver and sweep generator are transistorized. Elimination of space-consuming complicated mechanisms increases reliability and maintainability of the system, enhancing its ruggedness for combat environments.

The JANAIR Program, in existence for several years, seeks to improve and simplify cockpit instrumentation display systems in fixed wing aircraft and helicopters. The Office of Naval Research administers the radar development program.

Contractor for the helicopter system development is Bell Helicopter Co. Texas Instruments provided special radar equipment.

Former DDDRE Payne Heads Special DoD Missile Study

Initiation of a 9-month technical study of future ballistic missiles, including their possible performance characteristics, as well as missile base concepts, has been announced by the Department of Defense.

Pressed into service to head the study is former Deputy Director of Defense Research and Engineering (Strategic Weapons) Fred A. Payne. He is on leave of absence from Marquardt Corp., Van Nuys, Calif., where he is vice president for Corporation Development.

For achievements as DDDRE from 1961 until he joined Marquardt Corp. in 1965, he was awarded the Distinguished Public Service Medal.

The study is being conducted under contract with the Institute for Defense Analyses, Washington, D.C.

2-Star Rank Makes Blumberg Top Defense Pathologist

Promotion to major general rank Nov. 10 made Armed Forces Institute of Pathology (AFIP) Director Joe M. Blumberg, MC, the highest-ranking pathologist in the U.S. Armed Forces.

The general returned to Washington, D.C., Nov. 18 after an 8-week staff and consultative tour of military installations in Europe and the Far East. He participated in three international pathological congresses in Singapore, Tokyo and Kyoto, Japan.

The itinerary included Germany Czechoslovakia, Italy, Thailand, Hong Kong, Korea, Okinawa, Guam, the Philippines, Hawaii, Saigon, South Viet Nam, and the *USS Repose*, Navy hospital ship on station off Southeast Asia.

A noted Army medic, General Blumberg became deputy director of AFIP in 1957 and director in 1963, administering the central laboratory of pathology for the Department of Defense. AFIP serves the Army, Navy, Air Force, Veterans Administration and the U.S. Public Health Service.

General Blumberg received an MD degree from Emory University in his hometown Atlanta, Ga., in 1933 and is certified by the American Board of Pathology in anatomic, clinical and forensic pathology.

Commissioned in the Officers Reserve Corps in 1935, he was chief of the laboratory service at the Station Hospital, Fort Eustis, Va., and at the 115th General Hospital from 1943-1945 in England, France and Germany.

He joined the AFIP in 1945 after attending Oxford University, England, and from 1946-1950 was chief of the Laboratory Service and Histopathology Center at Oliver General Hospital, Augusta, Ga. He also served as an associated professor of pathology at the University of Georgia Medical College, Augusta.

Maj Gen Joe M. Blumberg

After four years at Walter Reed General Hospital, Washington, D.C., he became commanding officer of the 406th Medical General Laboratory and consultant to the Chief Surgeon, Army Forces, Far East.

In addition to World War II and Korea service medals, General Blumberg wears the Army Commendation Medal, the U.S. Air Force Outstanding Unit Award, the United Nations Service Medal and three overseas bars.

McNamara Honors Wilson, 80, for Public Service

Secretary of Defense Robert S. McNamara, his top aides and ranking officials of the Armed Forces joined in honoring Charles E. Wilson, 80-year-old retired president of General Electric Co., when he received the Distinguished Public Service Medal.

Presented at a luncheon in the Pentagon, the award preceded Mr. Wilson's 80th birthday Nov. 18. The award is reserved for civilians who have performed exceptionally meritorious service to the Government and who do not derive their principal livelihood from Federal employment. Signed by Secretary McNamara, the citation for the award reads:

To Charles E. Wilson for over a quarter of a century of dedicated services to the United States Government and the Department of Defense. During World War II, at the request of President Roosevelt, he served as Executive Chairman of the War Production Board. It was his responsibility to mobilize the Nation's industrial strength to meet American and Allied needs, and thus to insure our victory in World War II.

Later, during the Korean conflict, by request of President Truman, he served as Director of the Office of Defense Mobilization. In that role, he bore the heavy responsibility for the direction, control and coordination of all the vast mobilization activities of the Government.

In 1961, Mr. Wilson participated in the formation of the Logistics Management Institute, and has served since that time as a trustee of the Institute. He has brought to this position all the wisdom and experience and dedication he has displayed throughout his entire career. His tireless energy, his intellectual breadth, and his selfless service to his country have been a contagious source of inspiration to his colleagues.

Long after most of his contemporaries have laid down their shields with honor, Mr. Wilson has continued to contribute to the military strength of the Nation, to its industrial and economic health, and to the freedom and well-being of its citizens. In recognition of these outstanding achievements, I am pleased to award to him the Department of Defense Medal for Distinguished Public Service.

SECRETARY OF DEFENSE Robert S. McNamara congratulates Charles E. Wilson after presenting the 80-year-old retired president of General Electric Co. with the Distinguished Public Service Medal.

Clarke Becomes New DCOE In General Officer Shifts

Maj Gen Frederick J. Clarke, former CG of Fort Belvoir, Va., became Deputy Chief of Engineers (DCOE) in a series of U.S. Army Corps of Engineers general officer reassignments effective Dec. 1.

Maj Gen Robert G. MacDonnell, Deputy COE since 1963, became president of the Mississippi River Commission and division engineer of the Lower Mississippi Valley Division, Vicksburg, Miss.

The new commanding general of Fort Belvoir is Maj Gen Robert F. Seedlock, former director of Military Construction, Office of the Chief of Engineers. He was succeeded by Brig Gen Andrew P. Rollins.

General Clarke served two years as director of Military Construction before going to Fort Belvoir in July 1965. As deputy, he is the second ranking officer in the Corps of Engineers serving immediately under Lt Gen William F. Cassidy, COE.

Conway Gains 4-Star Rank As Strike Command CIC; Headed Research in 1958

Four-star general rank has come to the first Director of Army Research, Theodore J. Conway, who was a brigadier general when he headed the agency upon its activation Nov. 1, 1955.

Subject to confirmation by the U.S. Senate when Congress reconvenes in January, the full general status was conferred effective Nov. 1, following his assignment as Commander-in-Chief, U.S. Strike Command and Commander-in-Chief, Middle East/ Southern Asia and Africa.

General Conway is the third former R&D leader to achieve 4-star rank. The first was General Robert J. Wood (USA, Ret.). Second was General Dwight E. Beach, who became Chief of Research and Development in June 1962 upon retirement of Lt Gen Arthur G. Trudeau. General Beach is Commander-in-Chief, U.S. Army Pacific.

General Conway served three months with the Office of the Chief of Research and Development before he was named Director of Army Research. In his new role he succeeds General Paul D. Adams. Since March 1966, General Conway had served as CG of the Seventh Army in Europe.

The Commander-in-Chief, U.S. Strike Command (STRICOM) is responsible for the conduct of joint training, development of joint doctrine and for providing a general reserve of combat-ready forces to reinforce other unified commands.

General Theodore J. Conway

Established in October 1961 with personnel of the Army and the Air Force, STRICOM has played a key role in developing and providing combat-ready elements to support operations in Viet Nam.

General Conway also is responsible for planning and conducting U.S. defense activities, including the U.S. Military Assistance Program, in the Middle East, Southern Asia and Africa south of the Sahara Desert.

Graduated from the U.S. Military Academy in 1933, General Conway participated in several major amphibious operations during World War II and was G3 of the Fifth Army during operations in France and Italy. After the war, he served in Operations Division of the War Department General Staff until 1948.

In 1959 he was senior Army adviser to the First Republic of Korea Army. Since 1961 he has served as commander, 82nd Airborne Division; chief, Joint U.S. Military Advisory Group, Thailand; deputy CG, Eighth U.S. Army, Korea; and Assistant Chief of Staff for Force Development, HQ, Department of the Army.

Among the General's awards are the Legion of Merit, Bronze Star with two Oak Leaf Clusters, Combat Infantryman Badge, Master Parachutist, French Legion of Honor, French Croix de Guerre with Palm, Czech-Slovak Military Cross, Polish Golden Cross of Merit with Swords, Order of the British Empire and Italian Order of the Crown.

STRATCOM Elevates James to Deputy Commander

Promoted recently to brigadier general rank in his 31st year of military service, Joyce B. James assumed duties Nov. 1 as Deputy CG of the Army Strategic Communications Command (STRATCOM) in Washington, D.C.

General James succeeded Brig Gen Walter B. Bess, who retired from 30 years in the Army after serving as Deputy CG for only three months. Previously, General James was deputy chief of staff, Operations, STRATCOM.

His military career started with the Army Signal Corps at Fort Monmouth, N.J., and during World War II he served in the Asiatic-Pacific Theater. He returned to that theater during the Korean War, taking part in six campaigns.

Other overseas duty includes an assignment in Hawaii as assistant Signal officer, U.S. Army Pacific, and a tour in Ethiopia as commanding officer of a STRATCOM field command now linked with the Command's European-Middle East operations.

He is a graduate of the Command and General Staff College, and served in the Pentagon as chief of the Operations Branch, Plans and Operations Division, in the former Office of the Chief Signal Officer, prior to joining DCA.

Included among his decorations are the Legion of Merit, the Army Commendation Medal and the Philippines and the Republic of Korea Presidental Unit Citations.

Brig Gen Joyce B. James

Deitchman, 43, Heads ARPA Remote Conflict

Counterinsurgency research of the Advanced Research Projects Agency is the new responsibility of Seymour J. Deitchman, 43, who succeeded Maj Gen Charles J. Timmes Nov. 15 as director, Remote Area Conflict.

General Timmes has been assigned to the Office of the Chief of Staff, United States Army.

Just prior to appointment to ARPA, Deitchman was concerned with counterinsurgency studies as a staff member of the Institute for Defense Analyses. From 1964 to February 1966, he was special assistant for counterinsurgency in the Office of the Director of Defense Research and Engineering.

He first joined the Institute for Defense Analyses in 1960 after serving with the National Advisory Committee for Aeronautics, the Cornell Aeronautical Laboratory and the Bell Aircraft Corp.

In his new Department of Defense position, Deitchman is concerned with all phases of counterinsurgency research, including communications, mobility, systems analysis and behavioral studies.

He received a bachelor's degree in mechanical engineering from the College of the City of New York in 1944 and a master's degree in science from the University of Buffalo (N.Y.) in 1953. He is a member of the Operations Research Society of America and the National Research Peoples Fraternity.

NBS Dedicates $120 Million Laboratory Complex at Gaithersburg

Dedication of a $120 million laboratory complex in Gaithersburg, Md., Nov. 15, marked the 65th anniversary of the National Bureau of Standards, U.S. Department of Commerce.

In conjunction with the dedication, about 500 officials representative of the Federal Government and industry attended a Symposium on Technology and World Trade, Nov. 16-17, sponsored by the Secretary of Commerce, Dr. John T. Connor. An open house celebration was held Nov. 19.

Relocation to the rural location with the greatly expanded facilities provided by the laboratory complex substantially enhances capability of the National Bureau of Standards to perform its mission of furnishing technical assistance to Government agencies and academic and industrial organizations.

Early in 1964 the NBS was designated by the Secretary of Commerce to serve as the focal point in the Federal Government for assuring maximum application of the physical and engineering sciences to the advancement of technology in industry and commerce.

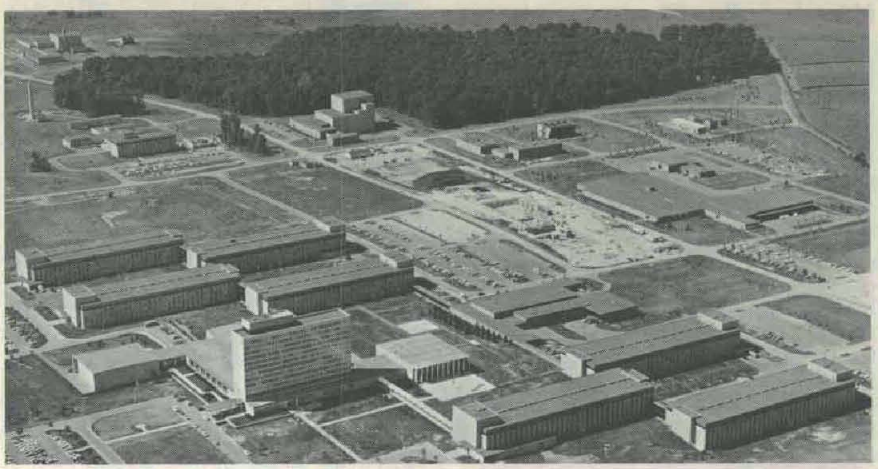
Special Assistant to the Secretary and Deputy Secretary of Defense John M. Steadman headed a list of DoD dignitaries participating in the dedication ceremonies.

Others included Director of the Advanced Projects Agency Dr. Charles Herzfeld, Defense Director of Technical Information Walter M. Carlson and Dr. Edward M. Glass, Assistant Director (Laboratory Management), Office of the Deputy Director (Research and Technology), Director of Defense Research and Engineering.

Engineering Mechanics Building. Among important new facilities at Gaithersburg is the Engineering Mechanics Building, a multilevel structure designed for the Bureau's work on force standardization and research on structural elements.

Housed within the building are the most modern compression- and tension-testing machines in the Nation. Included is a 12-million-pound universal tester slated for operation early in 1967, and a one-million-pound dead-weight force-calibrating machine, each the largest of its type in the United States.

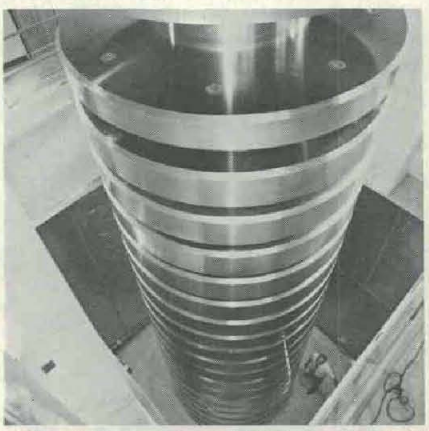
Current programs include development and maintenance of standards of force, specialized standards for vibration-measuring devices, and calibration services for control of working standards for Government agencies and industry.



AERIAL VIEW OF NBS shows 15 major buildings constructed on 565-acre site. Five additional buildings will be erected for specialized use. Dominating the central core of laboratories is the 11-story Administration Building. At its left is the 750-seat auditorium; at the right is the 126,000-volume library. Clustered about the Administration Building and connected to it by all-weather passageways are seven general-purpose laboratories. In the far background at extreme left is nuclear reactor. Between the central complex and reactor is the Radiation Physics Building. To the right of this building is the "stair step" Engineering Mechanics Building. In the right background are the Supply and Plant Building (front) and the Service Building to the rear. (Behind the Service Building is the electric company's substation.)

Allied activities include a laboratory for comparison of mass standards, ranging from 50 to 60,000 pounds, and a scale laboratory for research in problems of weighing large highway transport trucks.

Research is conducted on the performance of structures, using strain-measuring equipment, at both room and elevated temperatures. The standardization and research programs support improvements in design and construction of structures, the operation of high-performance aircraft, and development of missiles and space vehicles.



ONE MILLION POUND deadweight machine at NBS. The weights, each 50,000 pounds are 10 feet in diameter. Calibration accuracy with this machine is of vital importance to the Nation's space program.

Reactor Building. A 10-megawatt nuclear reactor will provide the Bureau and other scientific laboratories in the Washington area with an extensive central facility for fundamental research.

The intense thermal neutron beams will constitute a powerful tool in the analysis of the structure of solids and liquids by neutron diffraction. This technique can be applied to investigate various aspects of crystal structure, such as the location of hydrogen atoms, magnetic crystal properties, intermolecular force constants, and chemical bond strength.

A particularly important use of the reactor will be in the study and measurement of such nuclear processes as fission and neutron capture. Inadequate understanding of the fission process and lack of information on neutron yields still limit the design of breeder reactors.

The high flux from the reactor will also be used to generate radioisotopes for a wide variety of purposes, such as activation analysis and tracer production, as well as for radioactivity standards distribution.

Studies of the effects of radiation on materials will be carried out by in-pile irradiation of bulk matter. Information obtained is expected to be of great value in solid-state and chemical physics and for application to radiation processing and altering the properties of structural materials.

Basically, the NBS reactor consists of an enriched uranium core, moderated and cooled by heavy water and contained in a large aluminum vessel. Thermal and biological shields surround the core vessel and attenuate the radiation (which reaches a level of 10^{14} neutrons/cm^2/sec) to biological and instrument tolerance level. Thirteen beam tubes, or ports, run outward from the core.

Radiation Physics Building. This facility is designed to meet the Nation's needs in electron-beam, X-ray and neutron technology, through development of radiation standards and measurement methods and by obtaining basic data on the interaction of radiation with matter.

First occupied in October 1965, this building has a 4-wing design with about 71,000 square feet of working space. More than 65 percent of the structure is underground, to provide inexpensive natural shielding by the earth.

Above ground, the north wing consists of the main structure with three floors of general laboratory space and offices, where investigations involving low-level or no radiation are conducted. To avoid radiation interference with research activities in this wing, it is removed as far as possible from high-radiation areas.

The remaining wings of the new facility house the high-energy particle accelerators and X-ray machines of the Radiation Physics Division. The Bureau's powerful new linear accelerator (Linac) is located entirely underground in a wing projecting from the rest of the building.

Electron beam energy of the Linac can be varied from 10 to 150 MeV at power outputs greater than 80 kw.—about 200,000 times that previously available at NBS in the same energy frame.

This high-intensity radiation will enable NBS to enter new areas of nuclear and atomic physics. Results will aid in establishing new standards, measuring techniques, and shielding requirements for industrial uses of radiation in such applications as the sterilization of pharmaceuticals, preservation of foods, and polymerization of plastics. The 10 billion rad/hr dose from the Linac will make it possible to set standards of dosimetry for radiation uses in this range.

Among the other particle accelerators are two Van de Graff machines. The first, a 4-MeV electron accelerator, can produce a continuous or pulsed electron beam with energies in the range of 0.8 to 4 MeV to fill a gap betwen the energy ranges from the other NBS machines.

The second is a 2-MeV positive-ion accelerator used to measure neutron cross sections, to study nuclear structure with neutrons, and to calibrate neutron spectrometers and other neutron-measuring instruments.

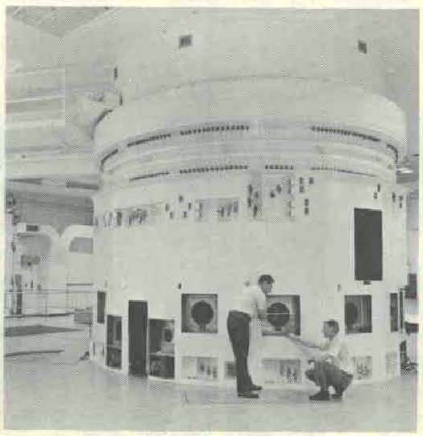
The other machines include a 0.5-MeV constant potential accelerator, which produces a stable, very-low to very-high-current electron beam, and an electron dynamitron that can provide electron beams at high currents with energies ranging from 0.25 to 1.5 MeV.

These four accelerators provide radiation beams of widely varied energy and intensity. Such beams can be used to study the physics of the interaction of radiation with matter; also, the variety of secondary radiations thus produced. A 180-MeV synchrotron will be moved from the old NBS site in Washington to Gaithersburg.

Studies of this kind are of value to the nuclear physicist investigating neutron production by electrons; to the radiation chemist who is interested in reaction rates; to the atomic physicist working with atomic spectra; and to those who produce or make use of radiation to process foods and materials.

X-ray standards and calibrations are available over a range of 50 to 250 kv. Gamma-ray calibration ranges, using cesium 137 and cobalt 60, provide for dose rates from a few milliroentgens per hour to several thousand roentgens per hour.

General Purpose Laboratories. Nearly 70 percent of the total space for technical program use at the new NBS site is in seven General Purpose Laboratory (GPL) buildings erected and equipped at a cost of $38,000,000. Presently these buildings will accommodate about 1,500 scientists and engineers and their staffs who were formerly distributed among 48 buildings at the Washington site.



NBS 10-megawatt reactor.

By definition, a GPL is adaptable to most scientific purposes, permitting areas to be converted from one use to another, say from chemistry to electronics, with relative ease.

The GPLs are arranged around a central core of administration and common use areas: the administration building, library, auditorium, cafeteria and shops. Radiating out from this core are all-weather passageways that lead to four GPLs to the south, Metrology, Physics, Chemistry and Materials, and to three GPLs to the north, Polymer, Instrumentation, and Building Research.

Special-Purpose Laboratories. Construction is underway on four special-purpose research laboratories: Concreting Materials, Individual, Sound and Hazards. A Fluid Mechanics Laboratory and a Gate House are planned for the near future.

The *Concrete Materials Building* will provide equipment for batching, bending and storing of aggregates to be used in structural concrete programs, in standard samples of aggregates and sands, and in standard soil samples for the interstate highway programs.

The *Industrial Building* will provide specialized laboratories and furnaces for work on glasses, ceramics, crystals and metals. Approximately half the space will be used for laboratories and specialized equipment related to textile and paper technology, including several paper mills of various sizes and purposes.

The *Sound Laboratory*, dedicated to acoustical research, will perform an extensive and diverse array of sound measurements, using large anechoic and reverberation chambers. Calibrating microphones and vibration transducers will be used for measurement of small seismic disturbances.

The *Hazards Laboratory* will shelter activities in which there is a relatively high probability of dangerous accidents. Work will be done on high-pressure, long-chain polymers and the distillation of volatiles.

Lt Col C. F. Baish

Lt Col F. D. Conant, Jr.

Lt Col J. A. Davis

Lt Col L. L. deCorrevont

9 Officers Report for OCRD Staff Assignments

New staff officers assigned to the Office of the Chief of Research and Development include seven lieutenant colonels and two majors.

LT COL BAISH (Charles F.), assigned as chief of the High Altitude Systems Branch, Air Defense and Missiles Division, is a 1950 graduate of the U.S. Military Academy (USMA). In 1954 he completed the Battery Officers Course, Fort Sill, Okla., and two years later received an MS degree in mechanical engineering from the University of Southern California.

From 1956-59 Col Baish was on the faculty of the Army Artillery and Missile School, Fort Sill, and stayed to complete the Advanced Officers Course in 1960. For the next four years he served as an assistant professor of mathematics at the USMA.

After completing the Command and General Staff College (CGSC) course in 1965, the Washington, D.C., native served as commanding officer of the 7th Battalion, 2nd Artillery, Eighth U.S. Army, Korea.

LT COL CONANT (Frank D., Jr.), chief of the Nuclear Branch, Nuclear, Chemical-Biological Division, served until recently as commander of the 72nd Armor Battalion, 2nd Infantry Division, Korea.

Prior to the Korean assignment he studied a year at the Air War College, Maxwell Air Force Base. From 1960 to 1964 he was chief, Weapons Branch III, Research and Development Field Command, Defense Atomic Support Agency, Sandia Base, N. Mex.

Before studying a year (1959) at the Command and General Staff College, Fort Leavenworth, Kans., he was an instructor in the Special Weapons, Oberammergau, Germany.

A 1946 graduate of the U.S. Military Academy, he holds an MS degree in nuclear physics from the University of California (1953) and an MS in international relations from George Washington University (1965). He has received the Joint Service Commendation Medal.

LT COL DAVIS (Joseph A.) is a staff officer in the Human Factors and Operations Research Division, Army Research Office (ARO). His previous assignment was executive, Senior Artillery Group, U.S. Army Europe, following two years as Commander, 512th Artillery Group in Germany.

In 1962-63 he was with the Operations Office, Battle Staff Team, Office of the Joint Chiefs of Staff, Washington, D.C. Following duty in Viet Nam (1959-60), he was stationed at Ent (Colo.) Air Force Base. He also has served at Fort Bliss, Tex., as commander of a Missile Battalion and as an instructor at Fort Sill, Okla.

Col Davis joined the Army in 1945 and in 1950 received a BS degree from Southern Methodist University. He completed the Guided Missile Staff Officer Course in 1952 and the CGSC course and Advanced Artillery Officer Course in 1955. He holds the Bronze Star and Commendation Medal with cluster.

LT COL deCORREVONT (Leon L.) is a staff officer in the Research Plans Office, ARO. Graduated from the USMA in 1949, he returned in 1954 to serve three years as an assistant professor in the Department of Physics and Chemistry.

Before serving with the 2nd Battalion, 32nd Artillery in Fort Sill, Okla., and Viet Nam from July 1964 to September 1966, he was stationed in Heidelberg, Germany, with the Central Army Group (NATO). He was assigned to the Department of Gunnery, Fort Sill from 1958 to 1960.

Among his medals are the Legion of Merit, Bronze Star, Air Medal, and Korean Service Medal with four Bronze Stars.

LT COL HANSEN (Marcus W.), staff officer in the Mid-Range Plans Branch, Plans Division, is fresh from a tour of duty with the 101st Airborne Div. and J3, MACV, Viet Nam.

Other assignments have included assistant professor of military science, University of Puerto Rico; operations officer at the Presidio, San Francisco; and staff officer, Operations Section, G–3, Eighth U.S. Army.

Col Hansen received a BS degree in civil engineering from Virginia Military Institute in 1950 and has

Lt Col M. W. Hansen

Lt Col W. H. Travis

Lt Col W. H. Young

Maj W. B. Burdeshaw

Maj P. P. Winkel, Jr.

completed the Advanced Infantry Course and Parachutist School at Fort Benning, Ga., and the Command and General Staff College, Fort Leavenworth, Kans.

He holds the Silver Star, Bronze Star with V device and four clusters, Air Medal with two Oak-Leaf clusters, Legion of Merit and the Purple Heart with two clusters.

LT COL TRAVIS (William H.) is chief of the Operations Research Branch, Human Factors and Operations Division, ARO. He recently completed the Defense Systems Analysis Course at the Institute for Defense Analysis, Washington, D.C.

From 1963-65 he was with the Army Materiel Command Field Office, Sandia Base, Albuquerque, N. Mex. He was with the Joint U.S. Military Air Group, Athens, Greece (1961-63) and the Nuclear Engineering Division, Picatinny Arsenal, Dover, N.J. (1959-61).

Graduated from the U.S. Military Academy in 1948, he has attended the Infantry School, Ordnance School, Guided Missile School, and the Command and General Staff College.

Among his decorations are the Distinguished Flying Cross with two Oak Leaf Clusters, the Air Medal with 10 Oak Leaf Clusters, two Korean Presidential Unit Citations, and the Bravery Gold Medal of Greece.

LT COL YOUNG (William H.) is chief of the Policy Branch, Review and Analysis Division. His previous assignment was with the Military Advisory Command, Viet Nam, as an adviser in the Kien Phong Sector and a member of the Deputy Ambassador Study Group.

From 1959 to 1962 he was research and development coordinator in the Combat Materiel Division of OCRD. Other assignments have included instructor at the Armor School, Fort Knox, Ky., and duty in Okinawa.

A 1964 graduate of the U.S. Military Academy, Col Young attended the Army War College, Carlisle Barracks, Pa., prior to recent assignment in Southeast Asia. He has an MSE degree from the University of Michigan (1959) and attended the CGSC in 1955.

He holds the Bronze Star with cluster and Combat Infantryman's Badge.

MAJ BURDESHAW (William B.), a 1953 graduate of the U.S. Military Academy, is assigned to the Air Defense and Missiles Division. He recently finished duty as sector adviser in the Tuyen Duc Province of Viet Nam after completing the Command and General Staff College course at Fort Leavenworth, Kans.

From 1961-64 he was an instructor at the Air Defense School, Fort Bliss, Tex., following a tour of duty at Fort Sill, Okla. Other assignments include tours in Athens, Greece; Augsburg, Germany; and Fort Campbell, Ky.

Maj Burdeshaw has an MS degree in electrical engineering from Georgia Institute of Technology (1961).

Among his decorations are the Combat Infantryman's Badge, Purple Heart, Air Medal with Oak Leaf Cluster, Bronze Star Medal (with valor) and Oak Leaf Cluster, and Gallantry Cross with Silver Star (Viet Nam).

MAJ WINKEL (Paul P., Jr.), an officer with extensive helicopter experience, has joined ARO's Operations Research Advisory Group as a military adviser. His previous assignment was with the 1st Cavalry Division (Airborne), Viet Nam.

A 1956 graduate of the U.S. Military Academy with a degree in military science, he has done graduate work at the University of Maryland and George Washington University and has attended several military schools.

In 1964-1965, he served with the 11th Assault Division during the revolt in the Dominican Republic. He has also served in Korea.

Maj Winkel holds the Distinguished Flying Cross, the Bronze Star, Air Medal with valor with Oak Leaf Cluster, Air Medal with 15 OLCs and the Army Commendation Medal.

MICOM Wins Top Awards for Improving Management

Methods improvement activities of the U.S. Army Missile Command won two of five first-place awards in the annual competition sponsored by the Industrial Management Society.

The awards were presented last month at the Society's 30th Anniversary Industrial Engineering and Management Clinic in Chicago, Ill. Representing the Missile Command at the ceremony was Col E. J. McGinnis, director of Procurement and Production.

The Missile Command achieved recognition for production of two films that won top honors and another film that shared a second-place award.

"Value of the LAW," a 16-minute film, depicts Value Engineering techniques used during R&D work on the LAW lightweight assault weapon. "Double '0' 16" is a 20-minute film showing advances in the state-of-the-art in automating input, storage, retrieval and display of technical data.

The second-place film is "Trademark of a Craftsman," reporting on the Zero Defects program.

"On-Time Delivery," a film produced by the Missile Command for Anniston Army Depot, also received a first-place award. All of the films, in color and sound, were produced by the Pictorial Division in the Assistant for Communications Office, Support Operations Directorate. RCA Co. provided services under contract.

Missile Command personnel who assisted with production of "Value of the LAW" include Arthur E. Harvey and Raymond G. Weber, Procurement and Production Directorate; Orris H. Cox and Gustus Grace, Arsenal Support Operations Directorate; and Raymond W. Turner, TOW Project Office.

Kenneth E. Joy and William T. Anderson, Quality and Reliability Management Office, worked on "Trademark of a Craftsman."

Assisting with "Double '0' 16" were Gilbert Penny, James H. Peacock, Frank L. Craven, John W. Ecklin and Roland L. Guard, all of the Procurement and Production Directorate, and Howard Gates, Arsenal Support Operations Directorate.

Medaris Visits R&D Activities

MAJ GEN John B. Medaris (USA, Ret.), CG of the former Army Ballistic Missile Agency, Redstone Arsenal, Ala., which launched the first U.S. satellite (Explorer I), Feb. 1, 1958, examines a new 40mm proximity fuze at Harry Diamond Laboratories (HDL), Washington, D.C. Evan D. Fisher, HDL, explains the mechanism. General Medaris recently visited Army agencies in the Washington area, including the U.S. Army Research Office, Arlington, Va. He commanded the U.S. Army Ordnance Missile Command at Redstone Arsenal at the time of his retirement.

Armed Forces Radiobiology Research Institute Ups Capability

Created five years ago to respond to Army, Navy and Air Force questions concerning effect of ionizing radiations on biological systems, the Armed Forces Radiobiology Research Institute (AFRRI) is developing a research capability perhaps unequalled in the Free World.

The AFRRI's stated mission is: "To conduct scientific research in the field of radiobiology and related matters that are essential to the medical support of the United States Military Services, to national welfare, and to the well-being of mankind."

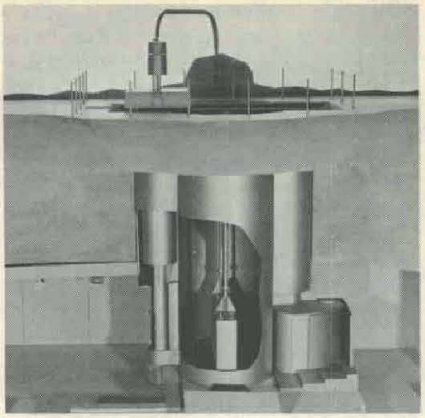
Quite simply, this means that the Institute is interested, ultimately, in the effect of radiation on man. Primary emphasis in AFRRI research is placed on military application. Auxiliary benefits from its programs are seen in the areas of increasing current knowledge in the use of controlled, safe amounts of nuclear energy for medical purposes, as well as in the fields of health physics and radiation protection.

AFRRI programs are developed and conducted by civilian and military investigators in four scientific departments: Behavioral Sciences, Experimental Pathology, Radiation Biology, and Physical Sciences.

The Institute is currently engaged in nine major subtasks, broken down into about 40 work units. Programs range from an evaluation of radiation-induced injury and recovery mechanisms at the cellular and subcellular levels through organ and systems effects to an analysis of total animal response, including behavior.

Although understanding the effects of ionizing radiation on man is the objective of AFRRI research programs, human specimens are not used for experimentation. The closest to an exception to that rule is "Sam," a tissue-equivalent plastic phantom used to simulate man in size and composition. A variety of measuring devices can be implanted easily in Sam's plastic body to tell investigators a great deal about radiation depth dose patterns and mechanisms of energy deposition.

SAM THE PHANTOM MAN, the plastic tissue equivalent of an adult male, is inspected during radiation-measurement test by Lt Col Clarence Duritzky, senior investigator, AFRRI Radiological Physics Division.



AFRRI TRIGA Mark F Reactor

Sam, however, cannot provide all the information needed. For information on living systems, researchers turn to animals * ranging in size from mice to she. AFRRI veterinarians, Air Force Capt Frank Dixon and Army Capt Donald DeYoung, maintain a full history on all animals in residence at the Institute.

Additional animals are maintained at stock farms or purchased from top-ranking suppliers. The animals are cared for by trained handlers, all of whom participate in various training programs which can lead to their certification by the Animal Care Panel as Junior or Senior Animal Technicians.

Results of AFRRI research are given practical interpretation to the military field commander with the help of the Institute's Military Analysis Department. Under the direction of Army Medical Service Corps Col D. H. Behrens, the department acts as a translational link between researcher and the military services. Its functions are to relate the results of AFRRI research to military problems and, conversely, to translate military requirements into a language meaningful to the investigator performing research.

To date the AFRRI research program has been keyed to military requirements. The director is authorized, however, to make AFRRI facilities available to qualified scientific personnel from other organizations for independent research and study as deemed appropriate.

Agencies which have done collaborative work at the Institute include the National Institutes of Health, Walter Reed Army Institute of Research (WRAIR), School of Aerospace Medicine at Fort Sam Houston, Tex., the U.S. Treasury Department, and the U.S. Food and Drug Administration.

AFRRI currently uses a TRIGA Mark F nuclear reactor as its principal source of radiation for experiments. Scheduled for activation in January 1968 is an electron linear acceleration (LINAC) that will have unique capabilities as compared with some 75 linear accelerators installed throughout the U.S. and abroad.

Additional radiation sources available to AFRRI investigators include 250- and 300-KVP X-ray machines and a positive-ion accelerator. A cobalt irradiation facility is also planned as part of the AFRI's developing radiation source complex.

The AFRRI-TRIGA reactor, operated in either a steady-state or pulse mode, produces a mixed field of fission spectrum neutron and gamma radiations. In the steady-state mode it can develop power levels of 100 thermal kilowatts indefinitely or a level of 1,000 kilowatts for periods of ten minutes. A license amendment is presently pending that will authorize 1,000 kilowatt continuous operation.

When pulsed, it can reach a peak power of 1,800,000 kilowatts, with

*** As is required, all aspects of investigative problems involving the use of laboratory animals sponsored by DOD components are conducted according to the principles in the "Guide for Laboratory Animal Facilities and Care" prepared by the National Academy of Sciences—National Research Council.**

TRI-SERVICE staffing of Armed Forces Radiobiology Research Institute is represented by HM1 Ralph Bingham, U.S. Navy, M/Sgt Don Quick, U.S. Air Force, and Maj Douglas A. Hughes, U.S. Army, head of the Reactor Div., Physical Sciences Dept.

Capt J. S. Burkle, USN
AFRRI Director

a pulse half-width of appropriately 10 milliseconds, to produce short-duration high-intensity mixed radiation fields.

The present performance capability of the AFRRI-TRIGA reactor reflects an upgrading of characteristics, accomplished by changing the casing of the fuel elements to stainless steel. Other programs for upgrading the reactor system are constantly in progress so that the reactor may meet continually changing requirements of biological research protocols. The reactor updating is under the guidance of Maj Douglas A. Hughes, U.S. Army Corps of Engineers, head of the Reactor Division.

The AFRRI reactor is licensed and inspected by the United States Atomic Energy Commission and all reactor modifications and improvements require AEC approval. Members of the AFRRI civilian and military staff performing as operators must be licensed by the AEC.

One distinguished feature of the AFRRI-TRIGA reactor is its mobile core, which can be positioned to serve either of two exposure rooms. The larger 20′ x 20′ x 9′ room is for mixed fast-neutron and gamma experiments. The exposure area of the smaller room is separated from the core by a tank of heavy water (D_2O) so that a relatively pure thermal neutron flux is obtained.

A combined closed circuit television and video tape system is used to monitor and record audiovisual data from ongoing experimentation in either exposure room. Other electronic means also are used to obtain behaviorial and physiological data during and immediately after biological specimen irradiation.

These methods provide necessary scientific information for the period of time during which the specimens cannot be directly observed or retrieved from the exposure room either because of radiation safety considerations or because of the time required to open the 12-foot-thick, 48 ton concrete entrance door.

The LINAC to be installed at AFRRI, being built by Varian Associates of California at a cost of about $1.5 million, will be the first LINAC used excusively for radiological research. Its uniqueness stems from its increased beam current (3 amps, during pulse, at 10 MeV) and its long pulse (10 microseconds). Maximum beam energy will be about 50 MeV.

A low-intensity source of 14 MeV neutrons currently in use at the AFRRI is a postive-ion accelerator (PIA). Because of the size of the radiation field and the relatively low dose rates, this machine is used primarily for small specimen studies.

The AFRRI facility is so designed that the large reactor and the LINAC exposure rooms are connected by beam ports, thus permitting simultaneous exposure from more than one source. The advantages and desirability of adding the radiations from a high-intensity neutron accelerator to the multiple-exposure complex are being considered.

In view of the widespread publicity given in September 1962 to dedication of the 50,000-watt reactor for biological research at Walter Reed Army Institute of Research, Washington, D.C., a logical question is:

How do the experimental programs at the Armed Forces Radiobiology Research Institute and at Walter Reed complement and augment each other?

AFRRI Director Capt Joseph S. Burkle, U.S. Navy Medical Corps, answers as follows:

"Athough both the AFRRI and WRAIR research programs are centered on the biological effects of exposure to nuclear radiations, the AFRRI program is concerned with studying the prompt biological effects of a wide range of nuclear radiation doses."

By comparison, the work at WRAIR focuses mainly on low-dose chronic exposures. Specifically, the WRAIR research objective has been defined as ". . . a continuing exploration into life processes in animal tissue when subjected to radiation, and what can be done by way of developing protective measures in addition to therapy after exposure."

Chartered in May 1961, AFRRI became a tri-service element of the Defense Atomic Support Agency (DASA) * in July 1964. Physically located on the grounds of the National Naval Medical Center, Bethesda, Md., it is authorized a staff of 196 civilians and 60 officers and enlisted personnel from the three military services. Each of the Services is represented additionally by a member of its Medical Services on the AFRRI directorate.

Col Louis E. Browning, USA
AFRRI Deputy Director (O&A)

Col James T. Brennan, U.S. Army Medical Corps, credited in the record and by working associates with being the founding father and director of AFRRI during its first five formative years, retired in June 1966. Capt Joseph S. Burkle, succeeded him. Deputy Director (Operations and Administration) Col Louis E. Browning, MC USA, is the Army representative. Deputy Director (Scientific) is Dr. Harold O. Wyckoff, internationally known scientist in radiation research. His deputy is Lt Col H. B. Mitchell, USAF MC.

In conducting its research program to meet military needs, the AFRRI directorate receives guidance from a board of governors, consisting of the DASA Director, as chairman and the Surgeons General of the three services as members. The board meets periodically to review the AFRRI's current and planned scientific program.

That program with its present and anticipated resources—radiation sources, facilities, and trained personnel—is providing constantly more sophisticated methods for a thorough study of the prompt effects of ionizing on biological specimens.

*** The Defense Atomic Support Agency (DASA) is the joint services organization which plans and coordinates the Defense Department's nuclear weapons programs. Its DoD responsibilities include nuclear weapons effects research and underground test programs, monitoring of the nuclear stockpile and maintaining readiness to resume atmospheric testing should it ever become necessary.**

DDC, Tri-Service STI Leaders Review Information Progress

Defense Documentation Center, Army, Navy and Air Force leaders concerned with developing a decentralized, integrated and efficient system of collecting and using scientific and technical information convened Nov. 4 for a review of progress.

Director of Army Technical Information Col Dale L. Vincent opened the meeting at the DDC, Cameron Station, Va., as the host officer and outlined the objectives of briefings given later by representatives of each of the agencies. About 100 persons participated.

DDC Administrator Dr. Robert Stegmaier summarized DDC operations, present capabilities, projected growth to meet the rapidly increasing demands from Government and the outside scientific community, and his views regarding what needs to be done by way of concerted future planning.

Although DDC capabilities for rapid and efficient response have increased tremendously through changes to produce an "organizational entity," with an expanded work force and the most modern automatic data and information processing equipment. Dr. Stegmaier stressed that a great deal remains to be done on system development to achieve objectives.

Required, he stated, is "substantial improvement in the interfaces of effort among the cooperating agencies and the industrial and academic organizations involved in scientific R&D activities."

To establish "better order and authority," Dr. Stegmaier said that coordination and integration of effort among participating organizations depending upon DDC service must be achieved in the framework of a "total scientific and technical information utility complex."

That evaluation of the overall state of progress was supported by Edward K. Grimes, Air Force scientific and technical information program manager, who said:

"My personal opinion is that we are only half effective and that we are at least two to three years away from achieving full-scale operations to meet requirements in a more satisfactory manner."

One of the difficulties as viewed by Grimes is that the STI Program, although backed solidly by each of the agencies concerned, is still not regarded as "a first-line activity—it's an R&D support activity." To achieve the massive effort required, he said, maximum top-level advancement of the program is essential. The level of support is good, he said, but it must be improved.

Another critical requirement he cited is a more effective education program to train users how to take full advantage of the services currently available—"you have to make it easier for the user to use the information than not use it."

Office of Naval Research STI Coordinator Robert Hayes presented a comprehensive report on the evolution of the Navy STI Program, dating back to 1946, and an evaluation of current effectiveness of effort to join with other Federal agencies in coordinated program development.

The review included an explanation of NARDIS (Navy Automated Research and Development Information

Liaison Officers Brief Agencies on DDC Services

To assist user agencies in obtaining the full benefit Defense Documentation Center (DDC) services, liaison officers from the Army, Navy and Air Force are providing unclassified briefings upon request.

The Army liaison officer is Lt Col Raymond L. Farmer and he has been much in demand recently as word spreads that he will give a briefing tailored to the desires of a particular agency—from 30 to 90 minutes. A supporting documentary film (MF 38-5187) is available also, with or without his briefing.

The DDC liaison officer briefings are provided to meet a widely recognized need for more complete information about Defense Documentation Center services, and knowledge of how to use these services.

Despite the fact that the DDC is the successor to the long-established Armed Forces Scientific and Technical Information Agency (ASTIA), many scientists, engineers and technicians in the field are still not fully familiar with the scope of services available, Lt Col Farmer stated.

For example, the DDC provides, without cost to the user, announcements of available documents, full-size or microfiche copies of research and development reports, bibliographies, referral and other services to registered users. DDC services are available to the Military Departments, other Federal agencies and to contractors, subcontractors and grantees engaged in Department of Defense activities.

Agencies interested in arranging for a briefing may contact Lt Col Farmer at the Defense Documentation Center, Defense Supply Agency, Alexandria, Vt., 22314, or by calling Oxford 8-8067. Agencies interested only in the film may borrow it from the same address or from the Army Audio-Visual Support Center which serves their individual areas.

Veteran R&D Officer Commands Edgewood Arsenal

An Army Chemical Corps career officer and a veteran in key assignments in Army research and development is the new commanding officer at Edgewood (Md.) Arsenal. Col William W. Stone, Jr., assumed command Nov. 1 when Col James H. Batte, CO since May 1965, was assigned to the U.S. Army Advisory Group in Korea.

Col Stone had served since September 1965 as Director of Research, Development and Engineering, U.S. Army Munitions Command, Dover N.J., following a 12-month tour as commander of Dugway (Utah) Proving Ground.

Commissioned in the Army Air Corps following graduation from the California Institute of Technology in 1941, he served as a meteorologist until 1943 and later joined the Manhattan Project.

In 1958-59 he was executive to the first Director of Army Research, and Development.

Col Stone holds bachelor's and master's degrees in physics from the California Institute of Technology. His decorations include the Legion of Merit and the Army Commendation Ribbon with four Oak Leaf Clusters.

SWORD OF COMMAND passes from Col James H. Batte (left) to Col William W. Stone who recently took command of Edgewood (Md.) Arsenal.

System), established in January 1964 by the Secretary of the Navy, and Project LEX to provide an operational manual and thesaurus of STI terminology (the latter a tri-Service activity).

An overview of the Army STI Program was presented by Peppino Vlannes, deputy director of Army Scientific and Technical Information. Distributed in support of his presentation was a brochure published in September 1966, "Aspects of the Army Scientific and Technical Information Program."

Highlighting his discussion was an explanation of the Army's newest concept of achieving a more manageable approach to the organization of the STI Program through use of a triaxial "Information Matrix."

Discussed in detail elsewhere on this page in a byline article by Col Vincent, the Information Matrix approach provides for the organization of information-handling effort along the intersecting axes of: 1) resources, disciplines and commodities; 2) operations and procedures; and 3) representations concerned with forms, format, languages and media.

The presentation reported on such Army projects as ATLIS (Army Technical Library Improvement Studies), EDIS (Engineering Data Information System), CIDS (Chemical Information Data System), IDEA (Information and Data Exchange Experimental Activities), and organization of Technical Data Systems in a Multidimensional Context.

Vlannes said that the first of the Army-developed (by Walter Reed Army Institute of Research personnel) Army Chemical Typewriters (ACT) were delivered recently and that an interface with an M-18 computer has been tested successfully. An experimental 5-station network using the ACT-computer interface for the Chemical Information Data System is expected to become operational in 1967.

Each of the presentations was followed by a lively questions and answers session monitored by Martin Weik of the Army STI Division. The questions delved deeply into many of the most difficult problems with which STI leaders are wrestling. One of the final questions was:

"Why can't I go through the Defense Documentation Center to gather information from any other Federal Government agency?"

The answer: "That day will come —but don't ask me when!"

Information Matrix Concept Offered as Management Tool

By Col Dale L. Vincent

Without being too unrealistically fanciful, the arena of information and data handling to meet requirements of scientists, technicians and management may be likened to a *jungle.* With understandable and possibly questionable facetiousness, some who labor in the troubled environment are disposed to apply the term freely.

Certainly no one can be deeply involved without recognizing that literally millions of "panthers"—prehensile problems, that is—lurk deep in the underbrush of controversy and confusion. Some are known, some not.

Similarly, a vast variety of potential solutions are being advanced by predatory exponents. Again, some are good, some not. Obviously, what is needed to work out of the maze, jungle, that is, is a rational assembly of critical factors.

The varying languages used by the inhabitants of our jungle, compounded with the rapid progress of information technology and the lack of definition of parameters of the problems, obscure the approach to effective organization and distribution control of information and data.

Properly defined and identified, the parameters could be fragmented to define, identify and isolate the myriads of ambiguous, undisciplined information-handling problems. Separately identified problems then could be classified and related one to another.

In turn, the information technologist would be provided with an objective approach for evaluation.

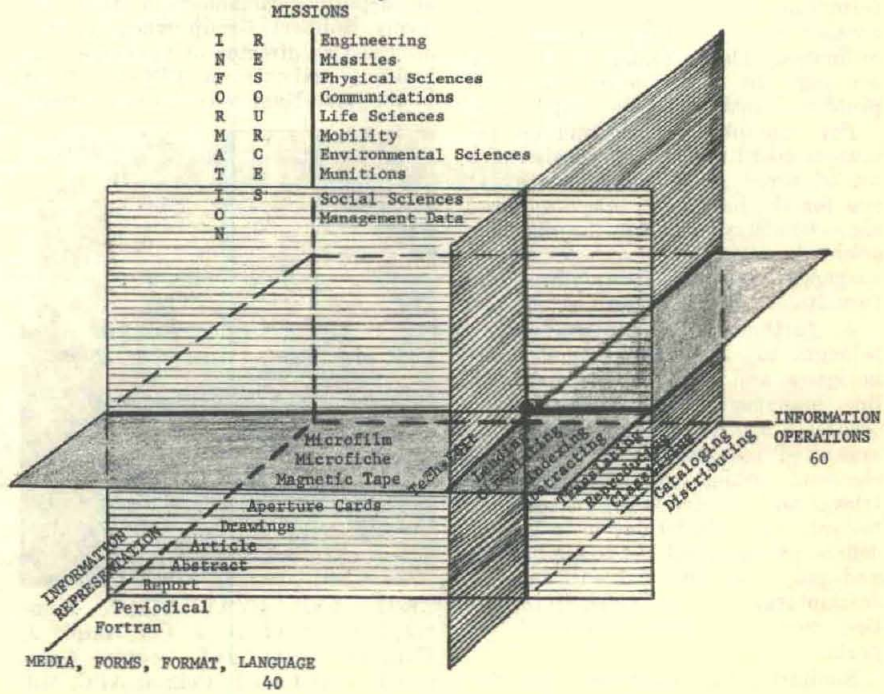
(*Continued on page 20*)

Col Dale L. Vincent has served since Aug. 14, 1964 as director of Army Technical Information and chief, Scientific and Technical Information Division, Army Research Office of the Chief of R&D.

Backed by 27 years military service, he graduated from the University of Wyoming in 1948 with a BS degree in general engineering and received a master's degree in business administration from Stanford University in 1958. His military schooling includes the Army Chemical School, Infantry School, Naval Intelligence School (Russian Language), Command and General Staff College, and the Armed Forces Industrial College.

Figure 1

INFORMATION MATRIX
INTERRELATIONSHIP OF INFORMATION RESOURCES, OPERATIONS, AND REPRESENTATION FOR INFORMATION MANAGEMENT



Information Matrix Offered as Management Tool

(*Continued from page 19*)

More importantly, it would give the line manager a rational and comparative criterion for decision—without being encumbered by the language difficulties associated with information processing.

Review recently of more than 50 Army manual and machine-assisted information systems revealed that each requires specific information-handling *operations* to be performed on specifically identified *information resources* existing in various *representations* (media, formats and languages). A comparatively simple approach to parametric definition and identification displays these requirements in a general coordinate system in 3-dimensional form (Figure 1).

An information handling problem then may be identified at each intersection of the coordinates. For example, store (operation) chemical structures (information) on magnetic tape (medium); retrieve (operation) engineering drawings (information) stored on microfilm (medium); or, more simply, index (operation) mathematics (information) reports on microfiche (medium).

Considering only currently identified information resources (approximately 2,000), information handling operations (about 60) and representations (40), nearly five million specific information handling problems can be identified, classified and interrelated.

Each coordinate axis of the information matrix is divisible into another set of multidimensional coordinates. These assist in further defining the information handling problem identified by the major axis.

For example, the information resources coordinate would consist of a set of three minor coordinate axes: one for the basic scientific discipline, e.g., chemistry; one for the mission-oriented activities, e.g., counterinsurgency; and one for materiel information, e.g., missiles.

A further fragmentation, which belongs to the information technologists and need not concern the line manager or information user, occurs in terms of "hard data" (data organized into specific sets of data elements subject to quantitive retrieval with actual keys) in contrast to "soft data" (information in loosely defined packages subject to qualitative and subjective retrieval with sets of descriptors)—for example, information contained within technical reports.

Similarly, the coordinate axis for information representation is divisible also into a set of multidimensional coordinates, since specific subject information may be expressed in various media, e.g., tapes, cards and films; with several formats, e.g., books, reports, journals and programs; using several languages, e.g., natural and artificial.

A structure for handling information and for improving effectiveness of information-handling activities can be constructed within an organization by applying the information matrix concept in accordance with specific information requirements.

Each information system in an organization can be represented in the information matrix as a point, line, plane or volume. The data and information itself, the operations being performed on the data and information, and the media being used to represent the information, can be identified readily and traced through the coordinates.

Logically, and certainly hopefully, it appears that the information matrix will serve as one of the additional tools in identifying areas of duplication and omission in information and data handling, provide visibility into all pertinent activities, and provide the line manager with cost effectiveness alternatives.

Over a period of time, it is envisioned that a detailed "matrisized" inventory of information and data systems would provide rational guidance for comprehensive and practicable organizational information programs both in and out of the Federal Government.

Polk Assumes Deputy Post at TECOM; Hanchin is CofS

After serving as chief of staff since August 1965, Col John F. Polk is the new deputy to Maj Gen Leland G. Cagwin, CG, U.S. Army Test and Evaluation Command (TECOM), Aberdeen (Md.) Proving Ground.

Former Deputy CG (Brig Gen) John K. Boles, Jr., is assigned to the Defense Communications Agency planning group in Washington, D.C. Col Ralph J. Hanchin who has headed the Management Science and Data Systems Office since TECOM was organized in July 1962, is the new chief of staff.

Col Polk was in Viet Nam in 1963 as deputy commander of the U.S. Army Support Group when he was assigned as director of personnel and training activities at TECOM. Prior to the Viet Nam tour, he was deputy president and later president of the Armor Board at Fort Knox, Ky. Earlier, he served three years as a military attache with the U.S. Embassy in Ireland.

TEST AND EVALUATION Command Chief of Staff Col Ralph J. Hanchin (left) and Deputy Commander Col John F. Polk at APG, Md.

A graduate of the U.S. Military Academy in 1937, Col Polk first served in the Infantry. During World War II, he served with the 1st Cavalry Division in the Pacific and remained with mounted and armored units until 1953, when he joined the G–3 section of U.S. Continental Army Command, Fort Monroe, Va. He was CO, 4th Reconnaissance Battalion in Austria from 1950–53 and spent four years at Fort Riley, Kans., on the staff and faculty of the Army Ground General School.

Col Polk is a graduate of the Command and General Staff College and the Armed Forces Staff College.

COL HANCHIN entered the Army in 1935 after attending the Cleveland (Ohio) School of Architecture, Western Reserve University. He graduated in Field Artillery from the U.S. Military Academy in 1939 and in World War II commanded the 766th Field Artillery Battalion in northern Italy.

He served in China with the U.S. Military Advisory Group from 1947–49 when he was assigned to the Munitions Board in Washington, D.C.

After a tour of duty with the 1st Infantry Division in Europe, he spent four years as professor of military science and tactics at the University of Kansas. He joined USCONARC in 1961 after a year in Viet Nam with Military Assistance Advisory Group.

Contracts Exceed $287 Million for RDTE

U.S. Army contracts totaled $287,129,614 for research, development, testing, evaluation and R&D procurement since reported in the November edition of this publication.

The U.S. Rubber Co. received the largest amount, $52,571,749 for ammunition, explosives and tires. The Ford Motor Co. will get $33,720,544 for ¼-ton trucks and AVCO Corp. will be paid $24,204,760 in four contracts for modification kits and aircraft engines.

Four contract modifications totaling $20,290,928 with the Martin Marietta Corp. will continue research, development and modification of the Pershing weapon system.

Silas Mason Co., Inc., received a $17,644,304 modification for loading, assembling and packing artillery ammunition, and the A. O. Smith Corp. will receive $8,473,009 for metal parts for 750-pound bombs.

Sperry Rand gained a $9,637,599 modification for explosives and operation and maintenance activities at the Louisiana Army Ammunition Plant. Atlas Chemical Industries will provide the Army with TNT and with maintenance activities for $7,107,879.

Continental Motors Corp. received a $6,476,742 third-increment contract for engine assemblies with accessories for ¼-ton trucks. Clark Equipment Co. will supply industrial tractors for $6,303,202.

Two contracts with the Hughes Aircraft Co. totaling $5,667,972 are for research and development of the TOW missile and a modernization program for the AN/TSQ–57 Fire Distribution System for the Marine Corps.

Hercules, Inc., received a $5,392,600 modification for propellants, explosives and operation and maintenance activities. Three modifications totaling $4,674,805 went to the Chrysler Motors Corp. for one-ton power wagons, engine assemblies for ¾-ton trucks, and booster adapters for bombs.

Two contracts totaling $4,361,821 with General Motors Corp. provide for continuation of the ARPA-sponsored supervelocity range program, regulators for trucks, and repair parts for the General Sheridan vehicle.

The Philco Corp. won contracts totaling $4,300,000 for continuation of R&D on the Chaparral air defense missile system, a voice access system and auxiliary items. Cluster bombs and dispenser components will be purchased from Aerojet General Corp. for $4,735,412.

A $4,171,813 contract with the Scoville Manufacturing Co. is for metal parts for the CBU 14A/A canister bomb unit. Similar parts will be purchased from ACF Industries for $4,087,241 and from the Batesville Manufacturing Co. for $4,083,460.

Bell Helicopter Co. will provide main motor hub assemblies for the UH–1 aircraft and gear box assemblies for $4,067,871. United Aircraft Corp. will furnish components for the Flying Crane helicopter for $3,500,000.

Metal parts for 750-pound bombs will be purchased from the American Machine and Foundry Co. for $3,351,841. Magnavox Corp. received a $3,000,000 contract for radio communication sets (AN/ARC–131).

Two contracts totaling $2,916,387 were awarded to the Radio Corp. of America for lightweight radio sets and portable radios. The General Tire and Rubber Co. received a $2,843,740 contract for 7.62mm rifle stock assemblies.

Holston Defense Corp. was awarded a $2,668,390 modification for explosives and operation and maintenance activities at the Holston Army Ammunition Plant.

A propellant research program will be conducted by the Rohm and Haas Co. for $2,500,000. Barber-Green Co. received a $2,465,990 contract for 10 diesel-engine asphalt mixing plants.

Telescopes, telescope equipment and hanger assemblies will be purchased from the American Cytoscope Makers, Inc., under a $2,445,458 modification. Kennedy Van Saun Corp. received a $2,377,120 contract for metal parts for practice projectiles for the M60 tank.

The Koehring Co. received a $2,347,130 contract for diesel-engine crane shovels. Facilities for the production of bomb components will be provided by the American Machine and Foundry Corp. for $2,322,763. The General Electric Co. received a $2,155,320 modification for repair parts for the 7.62mm aircraft guns.

Contracts under $2 million include: Bulova Watch Co., $1,995,752, for rocket fuzes; Maremont Corp., $1,964,098, for gun barrels and inspection equipment; Hamilton Watch Co., $1,798,651, for rocket fuzes.

Union Carbide will receive $1,580,922 for dry batteries for radio sets; the Appalachia Power Co., a $1,522,197 modification for operation of the power plant at the Radford Army Ammunition Plant; and the National Lead Co., $2,942,017 for body assemblies for the CBU 14A/A canister bomb unit. Similar items will be purchased from Honeywell, Inc., for $1,407,356.

Fairchild Camera and Instrument Corp. received a $1,341,000 modification for 2.75-inch rocket fuzes. Norris Thermador Corp. gained a $1,330,947 modification for procurement of new production equipment and reactivation of existing equipment at the Army Ammunition Plant at Riverbank, Calif.

Other modifications included $1,156,464 to Wittronics Manufacturing, Inc. and $1,152,360 to General Time Corp. for 2.75-inch rocket fuzes.

Mohawk Rubber Co. received a $1,106,000 contract for pneumatic tires, and the Goss Co. will furnish equipment to the Electronics Command for $1,000,000.

Picatinny Develops Mine-Field Demolition 'Skids'

Remote-control blasting of enemy mine fields by rockets trailing strings of explosives launched from amphibious demolition "skids" is a new technique developed at Picatinny Arsenal, Dover, N.J.

The fully loaded rowboat-like skids, designated M173, can be towed over land or water and fired by any vehicle containing a 24-volt direct-current power supply.

Constructed of waterproof fiberglass, the skids are 12 feet long and 5 feet wide. When loaded with launcher, rocket and explosives string, a skid weighs 3,000 pounds.

Plastic explosives are coiled in the center section of the skid and attached to an M95 "jato" rocket. When projected across a mine field, the rocket trails an armed explosive charge series that in turn explodes mines planted in its path. The rocket's trajectory is halted by an arresting wire attached to the skid.

Impact of Combat Use of Helicopters on Army R&D Effort

(*Continued from page 2*)

For the very heavy, awkward load, the Army is evaluating the CH–54 Flying Crane, currently capable of lifting 8 to 10 tons, though the Army would like ultimately to have a 20-ton-lift capability.

All of these aircraft are products of an R&D program geared to specific requirements from the Army in the field. The newer models are vast improvements over their 1950-era predecessors. In their future replacements, we are striving for the same or an even higher degree of operational improvement.

With official recognition that there is a useful place for the helicopter on the Army's rolls, there has been an ever-widening scope of requirements levied on Army R&D. Experiments and studies showed that the troop-carrying helicopter could give the Army tremendous tactical mobility, which the helicopter of 1952, with its limited load, range and high maintenance requirement could never do.

In concert with industry, the Army began an accelerated effort to develop new aircraft capable of carrying a full squad or more, lifting a 105mm howitzer, and being maintained in the field by a mechanic with the tools in his tool box.

As part of this effort to develop a second-generation family, the Army has been actively looking for better vehicles than the pure helicopter. This is the basis for the Army's participation in the so-called V/STOL programs—Vertical and Short Takeoff and Landing aircraft. In concert with our sister Services, we have explored a number of new approaches —the Lockheed augmented jet-ejector Hummingbird program, the tri-Service Hawker-Siddeley vectored-thrust P.1127 program, and the GE/Ryan Fan-in-Wing. Other programs have included the Curtis X–19 tilting prop, the Bell tilt-ducted-fan X–22, and the LTV tilt-wing XC–132, all of which are different approaches to V–STOL technology.

These are novel solutions to the problem of short runways, but the Army believes that they are not yet within the state-of-the-art to the extent that they can live in the raw unrefined environment of the Army in the field. A discouraging factor is the very high cost predicted for such aircraft. Consequently, the Army is not currently planning to go into full development of any of these concepts.

Present indications are that the Army's requirement for substantially improved second-generation capability probably can be met best by a compound or composite-type winged helicopter. Several arrangements are under consideration. One would unload or feather the rotor after take-off and use a jet engine for forward thrust. Another would stow the rotor during forward flight and use conventional propellors for thrust. Other concepts would apply a jet principle to the rotor blades or would tilt the rotors for vertical or forward flight.

The demand for better power plants for helicopters has resulted in far more efficient engines. The bigger, more powerful turbine engine of today's and tomorrow's Army aircraft is an exceedingly complex item. It has become increasingly apparent (particularly as a result of Viet Nam experience) that it is essential to develop concurrently with any aircraft a system of maintenance and reliability-testing equipment which can be used by the Army under the most basic field conditions.

The Army's present "off-the-shelf" turbine engine test stand is a useful item, but within limits. Certainly it saves thousands of manhours and money in engine checkout, but it is not capable of handling all of the types of engines in the current and foreseen aircraft inventory. Neither is it air-transportable, for field usage, since each of its two modules weighs some 21 tons.

Consequently, the Army is accelerating development of a new lightweight test stand which will meet the Viet Nam requirement, thereby eliminating the necessity of returning engines to CONUS depots which could have been repaired in the field—if adequate test equipment were available to save time and reduce costs.

The impact of the helicopter on the Army's modern warfare mobility requirements may properly be considered epochal. Its impact on the weapons business has been little less phenomenal. As tests and experience proved that the armed helicopter was a necessity for successful airmobile operations, requirements for new aerial weapons were added to the R&D program.

At first the answer was provided by jerry-rigging onto the airframe a variety of existing weapons systems —.30 caliber or 7.62mm machineguns and 2.75" aerial rockets. But the weakness of lash-ups on airframes not designed as weapon carriers and weapons not designed for aerial use are obvious—the weapons lost effectiveness and the aircraft dropped in performance.

The resulting initial effort was to search for new aerial weapons to fit existing as well as future aircraft. Out of the search came an adaption of the Air Force 20mm Vulcan Gatling gun—a 7.62mm 6-barrel machinegun dubbed the "Minigun." Its rotating six barrels allow a very high cyclic rate of fire, 6,000 rounds per minute. This weapon is now in use in Viet Nam.

Another development was the magazine-fed automatic 40mm grenade launcher, a highly effective antipersonnel weapon in support of heli-

UH–1D, workhorse of today's airmobile Army, stands by to transport troops for an assault. The "Huey" can carry 11 soldiers fully equipped for combat.

TRI-SERVICE V/STOL tilt-ducted-fan X–22A.

copter assault landings. This weapon, too, is now in use in Viet Nam.

The value of the gun ship in Viet Nam has been immeasurable. Experience there, however, has proved beyond question the need for a completely integrated weapons aircraft designed specifically for this mission. The result is the Army's current AAFSS program — the Advanced Aerial Fire Support System.

The Lockheed Corp. began engineering development on this aircraft in November 1965. It is too early yet to say what the final configuration will be, but it will be a compound helicopter with a pusher propeller.

Impact of the military use of the helicopter has been felt in the antitank weapon field as well. Until now the Army's organic means of killing tanks rested with the firepower of its ground-based family of antitank weapons. These ranged from the light one-man portable bazooka to heavy crew-served systems of greater range and lethality, but much less mobility.

With the maturity of the helicopter, the Army is getting a means of placing its heaviest infantry support system of the future—the TOW missile system—on a helicopter, thus making one of its heaviest weapons a highly mobile one. However, the problem of operating sophisticated systems such as this from a helicopter requires different sighting systems, so improved stabilized sights for armed helicopters must be developed.

In this same general area of weaponry, the rapid movement of infantry forces made possible by the helicopter has raised the question of how to provide close artillery support. The Army has a major study effort under way to determine the requirements for aerial artillery, and how such a requirement can be best met.

A part of the artillery problem rests with new and better systems for rapid, accurate position-fixing devices or systems. With the current capability of quickly air-shuttling batteries or even one or two pieces of artillery from one location to another, in poorly mapped areas—where no survey teams are readily available—the requirement for a position-fixing system for prompt fire direction has taken on real meaning.

Have you ever wondered how it feels to be in a helicopter when an enemy is firing up at you, knowing that one hit from a rifle or machine-gun may bring you down in shambles?

A lot of military men had misgivings about the vulnerability of choppers. An agreeable surprise is the remarkably low rate of combat losses to date. In a million and a half sorties in Viet Nam, ground fire has claimed less than 100 aircraft, for a loss rate of less than one per 18,000 sorties. This figure is for helicopters destroyed. Lots more have been damaged, and even brought down, but recovered and repaired to fly again.

Casualties to crew members have been considerably higher, which prompted an accelerated effort to give the crew better protection. New body armor, lighter in weight and more effective than earlier types of flaksuits, has been developed. New materials, such as plastics, and new techniques, such as forming a very hard steel surface backed by a layer of tough steel, capable of stopping a .30 caliber bullet at short range, have been combined. The new vest is very popular in Viet Nam.

One weakness was soon evident in such armor for helicopter crewmen. It did not protect the southern exposure. This need was met in real short order. Copter pilots now have armored seats and shields for the feet and legs, as well as armor for the most vulnerable parts of the helicopter, the hydraulic system and fuel controls.

Because combat infantry units now have the capability of being quickly moved about in widely separated locations throughout the vast battle area, over terrain impossible or difficult to traverse on ground, there have been new direct and indirect impacts on combat support and logistics.

Part of the logistics problem concerns the weight of Army equipment. The growing requirement for much of our own organic equipment to be capable of being moved by Army helicopter has posed more stringent development goals. For example, it is highly desirable that tomorrow's artillery be more readily helicopter transportable—at no loss in weapon effectiveness.

This problem has posed the question, dictated to a great extent by advances in the state-of-the-art: Should we do this by lightening the weapon or by increasing the lift of the aircraft, or both? The weight problem extends to vehicles, to food packaging, to the personal gear of the individual soldier.

The wide ranging capability of the troop-carrying helicopter has in turn generated new systems for resupplying and servicing the aircraft at lo-

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CH–54A "Flying Crane" with pod removed.

Impact of Combat Use of Helicopters on Army R&D

(Continued from page 23)

cations some distance from fixed bases. Under development is a portable maintenance tent for the helicopter. Systems for quick and relatively simple transporting of aircraft fuel to forward areas and for refueling aircraft also are needed.

The inevitable downing of our helicopters, either by mechanical failure or by enemy action, has pointed out a requirement for retrieval of downed aircraft. Coupled with the need for a means of air-lifting heavy, awkward loads into mountainous or jungle areas void of roads, the retrieval requirements helped to bring forth the heavy-lift helicopter. The Sikorsky CH–54 flying crane is one of several responsive aircraft being evaluated by the Army in Viet Nam.

A very real problem which has confronted U.S. Forces in Viet Nam has been the control of dust stirred up in the unimproved landing zones. In addition to the physical discomforture to personnel, and the possible warning to enemy forces, there is the hazard of damage to the aircraft engine from the clouds of dust thrown up by the downwash of the rotors.

Since one beauty of the helicopter rests with its ability to move in and out of unimproved and isolated areas, how do you stabilize the soil or retard dust? Last January the Army started a crash effort to find a solution. In June 1966 we shipped to Viet Nam the first quantity of products of this effort, a cut asphalt, which is expected to help greatly in controlling dust. Large sheets of neoprene also have been used successfully to cover the ground and keep the dust down.

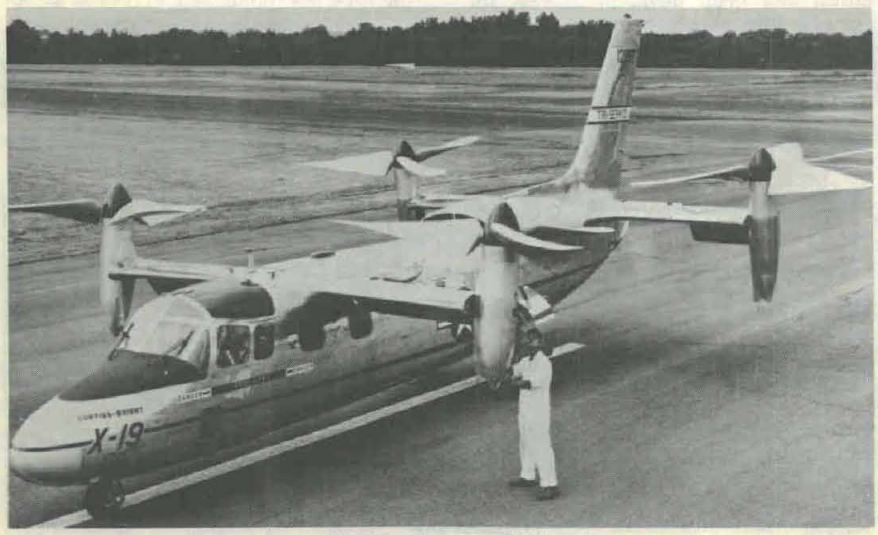
One of the principal areas of U.S. Army R&D impact has been in communications and electronics. With the heavy density of Army aerial vehicles in a combat area, air traffic control problems have been escalating.

The Army's problem is quite different than that of its sister Services, because of the density of our aircraft and because they are down low to the earth where line-of-sight systems—such as radar—are not suitable.

Current navigational systems generally rely on line-of-sight devices, such as radar, or other electronic systems of much more limited range. With the Army of the future expecting to operate large helicopter born forces at low level—where radar-type systems are not adequate, and over wide areas of the battle zone where current methods are frequently outranged—the Army recognizes a major problem of navigation and control.

These are problems Army R&D have licked or are on the way to solving. Scientists and engineers still are striving for a wide range of improvements in the performance, reliability, and operating efficiency of not only our future aerial vehicles, but also of the systems based on the helicopter's capabilities.

Needed greatly is lighter-weight structural material. Engines should have higher thrust-to-weight ratios with reduced specific fuel consumption. Advanced state-of-the-art technology must be applied to enhance the aerodynamic efficiency of the lift system while minimizing drag. Overall handling characteristics and the associated control systems should be improved, thus allowing for simplified operation and reducing the training required.



VTOL tilt-prop X–19.

OH–6A has 4-place capacity.

Integration of improved avionics systems could further enhance the all-weather, day-or-night capability of airmobile forces. Improved sensory equipment for helicopter use and reduced signatures from helicopters and their on-board equipment to enemy detection and counter-measures are still other areas which are seeking solutions.

Equally important, maintenance must be minimal so that the helicopter can literally live in the field, just as the horse lived with the cavalry in days gone by.

The list could go on and on; however, we all know that a "wish list" is not necessarily a project list. Through the full cooperation of the Army scientific community, and our industrial counterparts, areas which show the greatest promise of success are the areas in which efforts must be applied. Expenditure of R&D funds must be judicious, to insure that the next generation of Army aircraft will represent the optimum offered by the state-of-the-art—and then some

Suffice it to say that U.S. Army helicopter development has only scratched the surface. As more experience is gained with helicopters and airmobile operations, it's a safe assumption that the future will see a continuation of the pattern as its effects extended into all aspects of the soldier's life, tactics and equipment.

ERDL Promotes Engineer

William A. Yauss has been named chief of the Electrical Engineering Division at the U.S. Army Engineer Research and Development Laboratories (ERDL), Fort Belvoir, Va. Associated with the Laboratories since 1959, he received his degree in electrical engineering from the University of Cincinnati in 1952.

The division directs all activities related to product engineering of electrical equipment, including development of technical data packages and specifications.

T17 Membrane Gets Workout in S. E. Asia

U.S. Army engineers in Viet Nam have found a valuable construction ally for expedient surfacing of airfields in the T–17 membrane which began arriving in quantity a year ago this month.

Approximately 15 million square feet of neoprene-coated nylon had arrived by Dec. 1, 1966 or was en route to Southeast Asia ports. This is enough surfacing material to cover more than twice every inch of office and corridor space of the Pentagon, the world's largest office building in Washington, D.C.

Engineer units in Viet Nam have gained experience in the use and maintenance of T–17 membrane on airfields, parking aprons, helicopter landing pads and in roadbuilding. Used primarily for temporary airfields, it may require continuous maintenance under heavy C–130 aircraft. However, its performance is adequate if the subgrade is highly compacted before the membrane is installed or if traffic is light.

T–17-covered airfields have been constructed by units of the 937th Engineer Group (Combat), 18th Brigade, the 8th Engineer Battalion of the 1st Air Cavalry Division and others.

Although T–17 membrane normally is not installed where heavy air traffic is expected, it is used for single combat operations or as a temporary field while a permanent one is being repaired. In either case, the surfacing may be subjected to heavy traffic for a short time.

One of the most thorough tests given the membrane was the Viet Nam "golf course airfield" at An Khe, used by a variety of aircraft while the regular airstrip was being resurfaced.

Constructed in two weeks by "B" Company of the 84th Engineer Battalion (Construction) and "C" Company of the 70th Engineer Battalion (Combat), the golf course runway was subjected to 952 sorties in 14 days by C–130s, C–123s, C–47s and CV–2s. The membrane was subject to severe turning and braking stresses.

As reported by the 8th Engineer Battalion of the 1st Air Cavalry Division, 76 tears totaling 670 feet in the membrane were repaired, primarily in the southermost 700 feet of the 3,200-foot airfield where the subgrade was known to be deficient.

Recommendations by the 8th Engineer Battalion commander stated that membrane-covered, medium-lift airstrips "must be checked daily for base failure and once for tears after each C–130 sortie." The commander, Lt Col Charles G. Olentine, reported that 216 C–130 sorties were flown from the golf strip in 12 days, "far exceeding expectations." This was possible, he said, because of "continuous and effective maintenance."

Membrane tears less than six feet long reportedly require a maintenance detail eight minutes to clean, patch and glue. The glued patch is allowed to dry about five minutes before bonding it with the weight of a vehicle. A 6-man crew kept the An Khe golf course membrane repaired and continuously operational.

One engineer observed that patching T–17 membrane is "a sight easier" than patching bituminous (black top) concrete between rains.

T–17-covered airfields constructed by the 937th Group include:

- Phu Nhon airfield, installed south of Pleiku by "C" Company of the 299th Engineer Battalion (Combat). It has a 3,244-foot by 54-foot runway, a parking apron 700 by 180 feet and an aircraft turnaround 100 by 120 feet.
- Camp Holloway, Pleiku, where "A" Company of the 299th Battalion placed 425,000 square feet of T–17 membrane for a maintenance ramp and parking apron, and "C" Company installed 65,000 square feet.
- The 8th Engineer Battalion constructed the Ban Blech airfield (3,200 by 60 feet) and the Oasis (Tuttle) airfield, 3,300 by 60 feet.

T–17 membrane has been used for helicopter landing pads as an antidote for ever-present dust. Helipads have been constructed by units of the 937th Group near Qui Nhon, the 39th Engineer Battalion (45th Engineer Group) at Tay Non and other engineer units.

Viet Nam reports show that the T–17 membrane is an "excellent" expedient for road construction as well as for airfields and helipads. It serves as a ready-made "raincoat" for the soil, controlling dust and creating a nonskid wet-weather surface.

Before quantity shipments of the T–17 membrane were made to Viet Nam for use other than in tests, Army and Air Force units proved it out at various sites in the U.S. during 1965, including Fort Campbell, Ky., and Fort Lee, Va.

200 Soldiers Handle MAW To Aid Anthropometric Study

Anthropometry—the science of measuring the human body and its parts—is being applied to human engineering studies in connection with engineering model production of MAW, medium antitank assault weapon.

At Fort Riley, Kans., 200 soldiers of the 387th Replacement Company representing all parts of the country, in all weights and sizes, last month handled the MAW equipment and simulated firing from all sorts of positions.

Objective: Information that will enable the Army-industry team to develop a weapon that fits the soldier instead of a soldier to fit the weapon.

MAW is the Army's first antitank guided missile light enough to be carried by one man and fired from the shoulder. Being developed by the Army Missile Command, Redstone Arsenal, Ala., and the McDonnell Co., MAW is an armor killer that can go anywhere a soldier can pack a rifle

Radar Expert Heads DoD Tactical Warfare Programs

Sworn into office recently as Deputy Director of Defense Research and Engineering for Tactical Warfare Programs, Charles A. Fowler, 45, is backed for the job by major accomplishments as an industrial radar systems manager.

Director of Defense Research and Engineering Dr. John S. Foster, Jr., administered the oath of office. Affiliated 21 years with Airborne Instruments Laboratory, Long Island, N.Y., Mr. Fowler succeeds Dr. Thomas P. Cheatham, who returned to private business.

Charles A. Fowler

As Deputy DDRE, he will be responsible for supervision and management of research, development, test and evaluation programs and projects relating to tactical warfare. He is credited with significant contributions to industry in air traffic control, air defense, radar techniques and radar systems.

Mr. Fowler's experience includes radar work at the Massachusetts Institute of Technology Radiation Laboratory, Cambridge, and he was head of Airborne Instruments' Radar Systems Department until he entered Federal service. He holds a BS degree in engineering physics from the University of Illinois.

Army Medical Research, Nutrition Lab Work Affects Millions

This is the fifth in a series of articles on U.S. Army Medical Service laboratories research. The first four explained missions of the U.S. Army Institute of Dental Research, Washington, D.C. (June); U.S. Army Medical Unit, Fort Detrick, Md. (September); U.S. Army Medical Research Laboratory, Fort Knox, Ky. (October); U.S. Army Surgical Research Unit, Brooke Army Medical Center, Fort Sam Houston, Tex. (November).

Anyone interested in food could will be interested in the mission of a U.S. Army in-house research facility that has a far-reaching impact on health and happiness (as related to nutrition) of millions of military and civilian personnel.

The mission is that of the U.S. Army Medical Research and Nutrition Laboratory, a Class II installation of the U.S. Army Medical Research and Development Command. The USAMRNL is located at Fitzsimons General Hospital, Denver, Colo. The mission is three-fold:

First, to investigate the adequacy of the soldier's diet, determine the nutrient intake, and assess the health as related to nutritional status of troops in all environments.

- To recommend nutritional measures in support of optimum performance and the prevention of disease and injury under all conditions.
- To extend similar studies, recommendations and training to U.S. civilian groups and to civil and military populations of other countries as appropriate when such action is judged important to national policy and defense by higher authority.

Second, to conduct research on medical and surgical problems of special interest to the Army, including support of approved clinical research, with particular attention to collaborative research in pulmonary disease with Fitzsimons General Hospital.

- To study the physiology of exercise and fatigue in coordination with other laboratories of the U.S. Army Medical Research and Development Command.
- To conduct research on the application of computer techniques in medical research and medicine.

Third, to conduct basic research vital to competence and progress in the aforementioned areas.

The USAMRNL is the result of the combination in September 1958 of the U.S. Army Research and Development Unit, Fitzsimons Army Hospital, with the U.S. Army Medical Nutrition Laboratory. The former was established in 1947 to conduct research in the field of tuberculosis and surgery of the chest. Established in 1944 in Chicago near the Quartermaster Food and Container Institute, the Nutrition Laboratory was moved in 1953 to Fitzsimons General Hospital where metabolic ward facilities and excellent support are provided.

Col James C. Syner
USAMRNL Commanding Officer

USAMRNL work is accomplished by an administrative division and seven professional divisions: Chemistry, Metabolic, Pathology, Microbiology, Physiology, Bioenergetics and Computer. Each division designs and conducts independent research in addition to the many interdivision cooperative projects and services.

CHEMISTRY. The Chemistry Division conducts research in biochemistry, nutrition and clinical medicine. Studies concern lipid and carbohydrate metabolism, vitamin and mineral nutrition, protein and amino acid requirements, and interrelationships. Investigations involve laboratory animals, microorganisms and human volunteers.

USAMRNL staff officer Col Warren C. Morse adjusts the rotor blades of a microfermenter used to grow large volumes of pathogenic microbacteria for producing enzymes and antigens.

Prior to the completion of a series of investigations conducted at USAMRNL, little information was available concerning the adult human requirement for vitamin B_6. These studies were stimulated because of a possible inadequate level of the vitamin in packaged combat rations.

Studies have established, with reasonable accuracy, the adult human requirement for vitamin B_6 and information pertaining to factors that may influence this requirement. Other vitamins, including thiamine and riboflavin, have received attention. Extensive investigations have been made to determine the human requirement for vitamin C and its metabolic function.

Actively interested in the Army extramural program to determine the wholesomeness of foods preserved by radiation, the USAMRNL has assisted in preparing summary reports with other U.S. Army agencies.

Germfree facilities have been established and are being employed to study the role of intestinal flora in various aspects of nutrition.

BIOENERGETICS. Changing needs require that current and newly developed rations (both freshly prepared and as altered by varied storage conditions) be continually evaluated to insure adequate nutrition for soldiers under a variety of duty requirements and environmental situations.

The Bioenergetics Division is responsible for surveys to evaluate adequacy of the Army diet under varied climatic conditions in terms of recommended allowances. Analysis is done on essential nutrients for which recommended dietary allowances have and have not been established.

A special effort is made to evaluate body composition, work performance, and cardiopulmonary measurements in terms of dietary intake, habits and nutritional status.

The soldier in battle or on patrol often is faced with a ration problem. In addition to all the combat gear, he must carry sufficient food to maintain physical efficiency. Current studies seek to determine the minimal food intake necessary to permit a soldier to perform effectively for periods of 3, 7 and 10 days without resupply. The objective is a ration with ade-

quate nutrients and the lightest weight and smallest bulk possible.

MICROBIOLOGY. The USAMRNL Microbiology Division is responsible for coordination with Fitzsimons General Hospital on investigations in tuberculosis, viral and fungus serology, and clinical microbiology. Current efforts are concerned with the metabolic rates of inactivation of biologically active antimicrobial agents and *in vitro* investigation of susceptibility or resistance of mycobacteria to varied antimicrobial drugs.

An analysis was made of results of the collaborative Fitzsimons General Hospital—USAMRNL tuberculosis treatment program during the past three years. Comparison of once-a-day versus twice-a-day treatment revealed the former regimen to be superior as measured by bacteriological conversion, radiological clearing, etc.

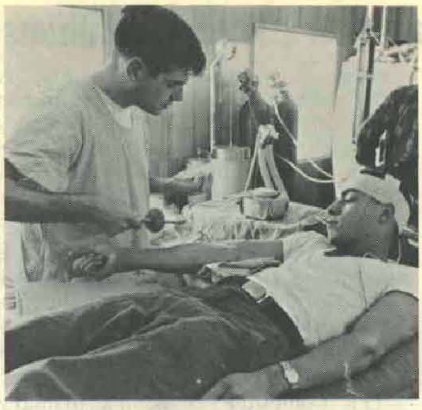
Superiority of any single-dosage regimen was considered to be directly related to the high serum concentrations achieved where all the antituberculosis drugs were given at once.

Results of ancillary studies on serum levels attained following treatment with oral antituberculosis drugs revealed that inclusion with food significantly depressed the concentrations achieved as compared to levels obtained when the drugs were given in the fasting state.

The methodology for the isolation, identification and determination of the pathogenicity of *Staphylococcus aureus* organisms has been extensively studied, resulting in improvements in techniques. A new cultural media, salt-mannitol-plasma agar, has been developed for the isolation and characterization of *Staphylococcus aureus*. Development of better phage techniques for staphylococcal typing is partially completed, but results have opened new avenues requiring exploration.

THE PATHOLOGY DIVISION functions primarily in support of the other research divisions by performing necropsies and requested histopathological examinations of experimental animals, maintaining the animal colony, and furnishing animals to investigators.

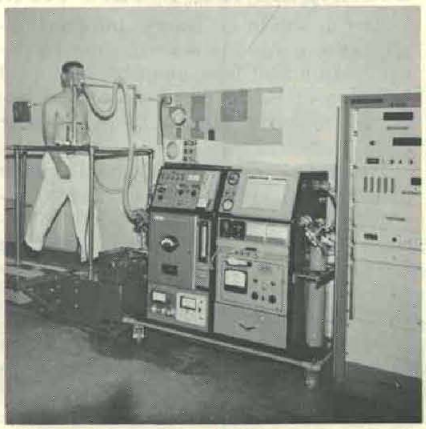
One study has aimed to produce a nontoxic intravenous preparation which will provide a relatively high caloric intake per millimeter of solution for patients unable to assimilate sufficient nourishment. Metabolic and nutritional investigations have strongly supported the value of an intravenous fat emulsion for military medical use.



USAMRNL PHYSICIAN Capt Richard Carson prepares a subject for placement of a brachial artery needle to facilitate blood gas and circulation measurement at the Pikes Peak field laboratory. Changes in CO_2 sensitivity may be related to acclimatization to environmental stresses of high altitude.

Extensive studies have been made on toxicity testing of experimental or commercial fat emulsions combining a number of substances, including glycerol, soybean oil, egg yolk phosphatides, to name a few. All emulsions test have resulted in the development of an intravenous fat pigment and lipoid microgranulomata of the liver and spleen of all test animals.

Isonicotinic acid hydrazide (INH) is one of the drugs of choice in the treatment of tuberculosis in man and animals. Reports by certain investigators credit this chemical with a high order of pulmonary carcinogenicity in mice when administered over a prolonged period.



CONTINUOUS OXYGEN consumption measurement system is applied to a subject walking on a USAMRNL treadmill. The system features continuous monitoring of oxygen, carbon dioxide, heart rate, ventilation, temperature and relative humidity every seven seconds. Data is recorded on strip chart recorder and paper-tape data acquisition system.

The final phase of a study to determine this unfavorable action is in progress. Preliminary reports indicate a significant increase in lung tumor incidence in mice receiving INH by all routes and amounts over an equal number of controls. A dose-incidence relationship was indicated.

THE METABOLIC DIVISION performs laboratory and clinical research studies. Clinical studies utilizing human volunteers are directed toward various metabolic and nutritional problems.

An important part of the research is done in the Metabolic Ward. The Selective Service System and certain religious organizations have cooperated to make available a selected group of 12 men classified as conscientious objectors. As volunteers housed on the Metabolic Ward, they fulfill their military obligation by serving in a civilian capacity as subjects for nutritional and metabolic studies.

The arrangement provides an opportunity to test in humans, in a controlled situation, many theories of the staff of the Metabolic Division and those originating from animal experimentation in other divisions.

Some of the studies conducted to date include the metabolic effects of various nutritional deficiency states; determining the adult human pyridoxine requirements; human digestibility of microcrystalline cellulose; lipid and sterol balance; the effect of gluten loading on normal gastrointestinal absorption.

Current investigation includes the influence of dietary carbohydrate on the control of lipid metabolism, the effect of dietary sodium and potassium on serum electrolyte changes in exercise, and the mechanism of control of body temperature by adrenocortical steroids.

Another current effort is an in-depth study of selected patients admitted to Fitzsimons General Hospital with difficult metabolic problems. The objective is an improved insight into the derangements that occur in metabolic processes, enabling the investigator to study similar processes in normal man which otherwise would remain obscure.

All studies are under supervision of physicians who are competent clinical investigators.

THE PHYSIOLOGY DIVISION performs research in environmental,

(*Continued on page 28*)

Army Medical Research Lab Work Affects Millions

(*Continued from page 17*)

nutritional and performance physiology. Environmental work is directed primarily toward the cardiopulmonary, metabolic, endocrine and cellular responses of humans and animals to high altitude and cold exposure.

The military necessity for physiologic and behavioral studies at high terrestrial altitude became apparent with the Chinese invasion of India several years ago. With the support of the Advanced Research Project Agency and the Army Medical Research and Development Command, the studies were begun in the fall of 1963 at Climax, Colo.

Research has been continued each summer since at the summit of Pikes Peak, Colo. Objectives are:

- To locate and quantitate the performance decrements to be expected in soldiers in military operations at 10,000 to 18,000 feet.
- To measure the extent of and rate of acclimatization.
- To investigate the physiology, biochemistry and pharmacology of the organ systems causing the decrements.
- To ascertain how to minimize the decrements by selection, conditioning, previous environmental exposure, nutrition, drugs or other variables.

Numerous publications and technical presentations at professional symposia have resulted from these studies.

Emphasis in performance physiology is now placed on the high-altitude projects. Human performance is studied primarily from the standpoint of the effect of altitude exposure and caloric deprivation. Training effects, as well as how physical exercise influences basic physiological mechanisms at 14,000 feet, are being investigated. Psychological testing includes assessment of visual and auditory perception and mental performance as affected by variation of altitude and nutrition.

In the area of nutritional physiology, investigation is progressing into the phenomenon of metabolic adjustment to various environmental stresses in animals and humans. A large applied research program has been initiated to study the soldier's physical and mental performance under various nutritional stresses in the laboratory and in the field.

COMPUTER. The RCA Computer Complex presently installed at the Laboratory is the result of years of effort to improve in-house capabilities for processing biomedical information, in line with the great increase in new scientific knowledge.

The Computer Division's primary purpose is to design and develop information systems which could provide total automation for data collection, storage, analysis, retrieval and presentation. Emphasis is on computer systems programing required for a fully automated biomedical information system.

USAMRNL assistance is provided to other agencies in studies of nutritional status of populations, either domestic or foreign, with a view to action for improvement. Laboratory personnel are routinely made available to the Office of International Research, National Institutes of Health, to perform as team members organized for the on-site gathering of information pertaining to the nutritional status of a country or population group.

Gun Part Redesign Wins $1,265

Redesign of the firing stake for the M102 howitzer has won one of the largest Suggestion Awards—$1,265—ever presented to a Rock Island (Ill.) Arsenal employee.

The recipient is production planner Herbert A. Hebeler of the Arsenal's Operations Division. It is estimated that the new aluminum stake for the 105mm, towed, artillery piece will result in a first-year savings of $212,683.

Bengtson Named Director of Missile Command R&D

Former commander of the Army Research Office-Durham, Col Nils M. Bengtson, became the new director of the Research and Development Directorate, Redstone (Ala.) Arsenal, upon his recent return from Viet Nam as commander, 60th Ordnance Group.

Col Bengtson was assigned to Viet Nam in October 1965 after serving three years as commander of the Army Research Office, Durham, N.C.

Graduated from Massachusetts Institute of Technology with an MS degree in 1948, he received a master's degree in business administration from George Washington University, Washington, D.C., in 1962. He is a graduate from the U.S. Army Command and General Staff College (1945) and the Industrial College of the Armed Forces (1962).

The new R&D director was on active duty at Pearl Harbor during the Japanese attack on Dec. 7, 1941. During the final year of World War II, he served in Europe.

From 1952 to 1955 he was the United States representative for Guided Missiles in the United Kingdom, and from 1955 to 1957 served as liaison officer between the Army and the Navy Polaris missile project. He served at Redstone Arsenal in key staff assignments from 1957 to 1961.

Col Bengtson has been decorated with the Legion of Merit, Air Medal, Bronze Star, Commendation Ribbon with Medal Pendant and two Oak Leaf Clusters, Vietnamese Medal of Merit and Vietnamese Service Medal.

Distinguished Medic Retires After 20 Years in Army

Lt Col Kevin G. Barry, internationally known for his contribution to the prevention and treatment by Mannitol infusion of acute renal failure in humans, recently concluded a 20-year Army career.

He retired as chief of the Division of Medicine, Walter Reed Army Institute of Research (WRAIR), to become chief of the Renal Metabolic Service and director of medical Education at the Washington (D.C.) Hospital Center.

Col Barry's studies of acute renal failure led to a concept which emphasized the time factor in the progression to irreversible renal failure. Mannitol infusion administered before total failure has been credited with saving many lives. He standardized dosage and rates of the agent.

Dr. Barry served at Walter Reed General Hospital (WRGH) in the Medical Corps before entering George Washington University in 1946 as a medical student. He completed his internship and residency at WRGH.

Following assignments in Germany and New York, he returned to WRAIR as a research internist and remained until his retirement.

Author of more than 60 publications in medical literature, he holds the Army Commendation Medal for his care of the late General Douglas B. MacArthur when he was a patient at WRGH.

Catholic University Gets Grant

Structural relaxation in liquids research is being conducted at The Catholic University of America, Washington, D.C., under a recent 2-year $73,000 grant from the National Science Foundation.

Part of the University's continuing investigation of ultrasonics and the liquid state, the interdisciplinary study will be directed by Prof. Theodore A. Litovitz of the Physics Department and Profs. George E. McDuffie and Robert Meister of the Electrical Engineering Department.

New Radio-Teletypewriter Family Links Fast-Moving Forces

Fast-moving combat forces will be provided with over-the-horizon, jungle-penetrating communication by a new family of radio-teletypewriter systems being introduced to replace equipment currently in use.

Operating on a frequency range from 2 to 30 megacycles, the radios provide 28,000 different frequencies, simply selected by five controls.

The closely integrated systems—rugged, flexible and highly dependable—can be used for voice and radio-teletypewriter messages up to 1,000 miles with no "skip distance" or blank spots.

Designed for mounting in standard Army vehicles, the tactical sets use as their basic building block a high-frequency single-sideband transmitter-receiver known as the AN/GRC–106. The shelter-mounted AN/GRC–142, one of the first of the radio-teletypewriter configurations, is in the early production phase.

Design and development work was accomplished through the U.S. Army Electronics command (ECOM), Fort Monmouth, N.J., under supervision of the Army Materiel Command Project Management Office for Selected Tactical Radios. Work was directed by Col Roger E. Lawless.

The new systems are compatible with the vehicular-mounted AM systems now in use, with a man-packed high-frequency (AN/PRC–74) set, and with a new man-packed high-frequency radio (AN/PRC–62).

Electronics Command engineers point out that single-sideband high-frequency radios have distinct advantages for use in Army communications. Power consumption is sharply reduced since the energy used in transmitting signals is concentrated in one sideband, instead of being spread across the central carrier wave and the two sidebands characteristic of AM radio operation.

Single-sideband also conserves the limited space available in the high-frequency portion of the radio spectrum, permitting use of more channels without interference.

The high-frequency radios can use simple "whip" antennas and are highly suitable for mobile use. Uninterrupted contact can be maintained in all directions between forces jolting across rough terrain, ECOM scientists report.

As the parent of the single-sideband family, the GRC–106 radio, mounted in quarter-ton and other vehicles, provides voice communications with an output of 400 watts peak envelop power.

Three "simplex" or one-way reversible systems are made by adding to the GRC–106 a teletypewriter (AN/VSC–2) mounted in quarter-ton vehicles, AN/VSC–3 in armored personnel carriers, and AN/GRC–142 in ¾-ton shelters. The shelters can be airlifted.

Another system with a higher message capability is composed of the basic radio and "duplex" teletypewriter equipment (AN/GRC–122). It is mounted in the ¾-ton shelter for simultaneous sending and receiving of printed messages along with voice communication.

The largest member of the family, AN/GRC–108, consists of similar duplex teletypewriter equipment and a radio with an amplifier of two kilowatts peak envelop power.

An engine-driven generator mounted in a trailer provides power for extremely long-distance transmission, whereas the other sets operate from military-type 24-volt vehicular electrical systems.

Equipment and assemblies making up the systems were developed under direction of ECOM's Communication and Automatic Data Processing Laboratory, headed by Col George M. Snead, Jr. Prime work was done by the Engineering Development Technical Area, directed by Ivan F. Dodd.

Various parts of the assembly work are being done by the Army Materiel Command Lexington (Ky.) Bluegrass Army Depot, Tobyhanna (Pa.) Army Depot, and Sacramento (Calif.) Army Depot.

Device Shields Aircraft Engines From Dust

Viet Nam problem: How to eliminate or substantially reduce dust ingestion in vehicle, aircraft and other motors—a $100 million cost item for jet aircraft engines alone last year.

Possible solution: A device known as a clustered particle separator which is being tested on the air intake of a modified M–151 jeep.

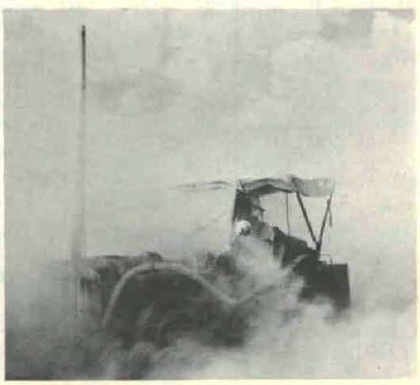
The U.S. Army Tank Automotive Center (ATAC), Warren, Mich., which owns the one-quarter-ton experimental vehicle powered by a 75-horsepower gas turbine engine, is working with the Air Force Office of Aerospace Research on the jointly funded program.

Scientists at the Aerospace Research Laboratories (ARL), Wright-Patterson Air Force Base, Ohio, designed the clustered particle separator, under the direction of Dr. Hans J. P. von Ohain, chief scientist and senior research leader in the ARL energetics laboratory.

The device is designed to remove dust particles and other foreign objects from the air before they can be sucked into the gas-engine engine, thereby preventing erosion of the compressor section of the engine and glass formation on the engine's hot surfaces.

Following a series of preliminary tests at Wright-Patterson, the experimental jeep was flown to the U.S. Army Test Center at Yuma, Ariz., for further tests in October to determine how well the device sifts out dust from the desert.

"We believe and hope we have the answer to the dust problem" stated Lt Col Melvin R. Keller, director of the ARL energetics laboratory. He thinks the separator will restore the life span of aircraft engines in Viet Nam to a level comparable to that of engines used at United States airports.



M–151 ARMY JEEP, fitted with dust-particle separator, is enveloped in dust during recent tests at Yuma, Ariz. The track's caliche dust is so fine that not even a special screen used to strain impurities in the final processing of women's face powder can catch and hold any of the dust. The dust-particle separator stopped 92 percent of it. The verticle snorkel was added to the jeep to cool the engine oil.

USAF photo

Army Orders Armor for UH–1s

Armored seat assemblies for pilots and copilots of Army UH–1 Iroquois helicopters have been ordered by the Army Aviation Materiel Command, St. Louis, Mo., in a $99,239 contract with M. H. Spinks Enterprises, Inc.

Aircraft Post-Crash Fire Retardation Research

By Francis P. McCourt

Studies of accident histories involving helicopters and fixed-wing aircraft of all classes indicate that fatalities are most numerous in accidents involving post-crash fires; also, that the post-crash fire fatality problem in helicopters is significantly more serious than in fixed-wing aircraft.

Evidence available on helicopter accidents followed by fire reveals that once ignition has occurred in the presence of significant quantities of uncontained fuel, chances of survival are greatly reduced, even when crash fire equipment is immediately available. Findings reflect also that 8.2 percent of all accidents result in post-crash fire and that 63 percent of all fatalities occur in these accidents.

Conclusions resulting from accident studies and post-crash fire research conducted to date include:

- Escape time from a cargo or transport-type fixed-wing fuselage is considerably longer than that from a helicopter in the event of fire.
- Improvements in existing ground fire-fighting systems will provide little, if any, improvement in escape time from a crashed helicopter in which the crash forces result in fuel tank burst and post-crash fire.
- More emphasis needs to be placed on "built-in protection" in the aircraft.

Research currently sponsored by the U.S. Army Aviation Materiel Laboratories (USAAVLABS) is in areas which fall under the heading of "built-in protection": (1) improved fuel containment, to prevent the massive failures which release quantities of liquid fuel, and (2) the chemical alteration of the physical state of liquid fuel to prevent atomization of the fuel into a fine mist under impact conditions. Significant progress has been made in both areas.

In the area of fuel containment. the purpose of Army-sponsored research was to determine what materials offer the best protection against impact penetration, possess tear resistance, and prevent the sudden release of fuel during a crash. Eighty material samples were examined and 10 were subjected to detailed comparative tests.

Samples were drop-tower-tested for resistance to penetration and tear-tested under carefully controlled laboratory conditions. The most promising materials developed in these tests were fabricated into full-scale fuel tanks for testing in several types of aircraft under actual crash conditions.

In a controlled crash test of a C–45 impacting at 96 miles an hour, the behavior of polyurethane-bonded, multi-ply nylon tanks was observed. Impacted with a telephone pole, the right-wing fuel tank was compressed to almost 50 percent of its depth. Volume was dramatically rearranged, but the tank did not leak; it even resisted penetration by the jagged wing skin and structural members resulting from the crash.

Tested in a CH–34 helicopter, multi-ply-nylon tanks showed a similar ability to absorb high vertical crash forces in excess of 100 G's without leakage. The tanks even demonstrated the ability to absorb the localized impact produced by tying boulders to the bottom of the fuselage to simulate an extremely rough terrain crash environment.

The only fuel spillage evident in the post-crash scene came from ruptured conventional aluminum tanks.

A tank made of "Crinkle Core," composed of a nylon felt core and a surface of pleated thermoplastic, also worked extremely well. In one C–45 test, a full fuel tank actually was thrown clear of its wing structure. It came to rest, six feet in front of the wing, without any leakage.

Even when positioned between a cargo load and the floor, with large boulders attached to the bottom of the helicopter, the Crinkle Core material successfully retained its entire volume of fuel. This severe environment utilized less than 20 percent of the crash-worthy potential of the tank.

The series of tests proved clearly that materials are available which provide realistic resistance to crash impact, penetration and tearing. These materials can reduce significantly the incidence of post-crash fires in severe but survivable accidents.

The second area of research in the USAAVLABS aircraft fire safety program is aimed at controlling the flammability of hydrocarbon fuels by chemically altering their properties.

To control flammability, the fundamental properties of fuel must be understood. A liquid fuel by itself does not burn. Combustion takes place when the mixture of fuel vapor and air is favorable and when an adequate ignition source is present.

Flammability control of a specific petroleum fuel is related to two properties—its rate of vapor release and its particle size. It is well known that materials of very low or no volatility will burn, often explosively, if in a very finely divided form. Powdered aluminum and other metals will burn rapidly in air. Even a material such as wheat flour dust has exploded when ignited by a static electricity charge.

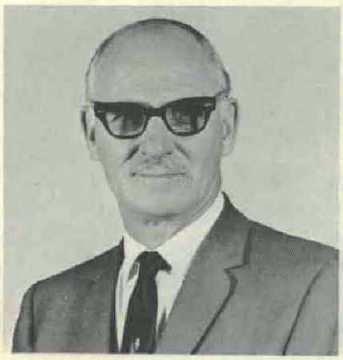
Consequently, attempts to modify fuels chemically have been aimed at controlling particle size. Army research has been concentrated on chemically transforming basic liquid fuels into gels and emulsions.

Gelled and emulsified fuels were tested in comparison with liquid fuels to determine to what extent modified fuels could alter the burning and flame propagation rates of the basic fuel.

Francis P. McCourt, chief of the Safety and Survivability Division, U.S. Army Aviation Materiel Laboratories (AVLABS), Fort Eustis, Va., has been active in all phases of aviation for the past 34 years.

He plans and executes an R&D program in aircraft passive defense and aircrew survivability, which includes aircraft crash injury research, gelled and emulsified fuels, armor systems, and reduction of enemy detection.

McCourt also serves as an adviser to AVLABS for Army Aviation Requirements and directs the AVLABS Crash Injury Program, which he established in 1959. He received the Flight Safety Foundation's Laura Taber Barbour Award for Flight Safety in 1966 and a Department of the Army R&D Achievement Award for aviation crash injury research in 1962. In 1963 he made a presentation on Army progress and objectives in aircraft survivability at the International Flight Safety Symposium in Athens, Greece.



Appointed by the Department of Defense in 1962 to head a special team to study vulnerability and survivability conditions of aircraft being utilized in Viet Nam, McCourt contributed to a number of safety measures, including personnel armor incorporated into Southeast Asia operations.

A retired lieutenant colonel in the Army Reserve, he served on active duty during World War II and the Korean War. He is a rated pilot for both multi-engine fixed-wing aircraft and helicopters, attended St. Agnes School and the Roosevelt Flying School in New York, and is a member of AIAA, AAAA, NDTA, ROA and Aircraft Owners and Pilots Association.

Two-ounce samples of liquid JP–4 fuel and JP–4, gelled by a 2-percent additive, where impacted against a grate target provided with an ignition source. The liquid JP–4 was reduced to a finely atomized mist upon impact with the grate. The fuel burned completely in a matter of seconds, and the flame propagated at the rate of 1.22 feet per second.

When the fuel had been altered, both the burning and propagation rates of the impacted fuel were drastically lowered. Some fuel masses escaped ignition completely. The flame propagation rate was reduced to .11 foot per second, an improvement of more than 90 percent over the liquid JP–4.

Preliminary ballistic tests have shown that the ability of modified fuel to withstand crash impacts also provides a high degree of invulnerability to small-arms fire, including ball, armor-piercing, and incendiary types.

The action of a .50-caliber incendiary round was photographed in stop motion as it penetrated a drum of modified fuel. As the round came to rest on the spall board it was still burning, but no ignition of fuel occurred in either the drum or the fuel spattered on the spall board.

Experimental work has shown that large quantities of jet fuel can be gelled quickly and completely by only a small percentage of additive to the basic fuel. Obvious disadvantages are that pilot initiation of the gel is required and that, once initiated, the gel can not be reconverted easily to liquid fuel. Handling the very large volume of fuel required for the aircraft of today also would involve substantial pumping and plumbing problems.

Emulsified fuels, on the other hand, are more practical for future use, because they can replace liquid fuel in the fuel system up to and including the point of ignition of the fuel. They can be converted easily to liquid fuel.

Hydrocarbon fuels can be converted into a slurry consistency by the use of small amounts of emulsifying agents. Resultant emulsions are a 2-component system. The hydrocarbon fuel, termed the discontinuous phase, is dispersed within the emulsifying agent, the continuous phase.

A fuel emulsion containing only a small amount of continuous-phase material can provide both controlled volatility and resistance to spray and misting, two requirements for a safe fuel. The continuous-phase material can be one of an almost infinite number of materials, can be made from either combustible or noncombustible liquids, and can be stripped off prior to burning or burned in the engine.

As chemists work to understand better the properties of various gels and emulsions, Army-sponsored programs are directed toward the development of systems which can utilize this new safe fuel.

Army-sponsored testing has verified the ability of emulsified jet fuel to pass through jet ejector nozzles. A nozzle from an Army helicopter turbine engine was tested for fuel spray at pressures which varied from 60 to 450 p.s.i. It was found that the pressures required to produce fuel flow and spray patterns equivalent to raw jet fuel could be duplicated with a pressure increase of less than 3 percent for the emulsified fuel.

A completely simulated fuel system was used in tests comparing the ability of the engine system to handle both emulsified and gelled fuels. The fuel control test stand simulated actual engine operating conditions within calibrated parameters.

Reaction of the fuel control to the various types of fuels was determined by recording the visual data and computing the performance. A technician simultaneously adjusted the simulated discharge pressure to the engine control speed setting. Control calibration was obtained on raw JP–4, a 97-percent JP–4 emulsion, and a 2-percent gel.

In one jet engine (the Continental T–72), the rotating slinger atomized the raw liquid JP–4 fuel and distributed the atomized fuel to the combustor. The gel pumping unit delivered the 2-percent gel at a flow rate of about 500 pounds per hour. The same gel was observed after it had passed through the engine fuel pump. The pump speed was adjusted from idle to full throttle.

The gel solution was observed and photographed in the engine primer nozzles, where operation appeared to be identical to normal JP–4 spray. As shown with a split-screen technique and freezing the action, the spray pattern appeared to be comparable for both the gel and the liquid JP–4.

Without any modification to the engine controls, the gelled material was pumped and controlled in the engine fuel system. A sample of a 97-percent emulsion was pumped from the emulsion control unit, through the engine fuel pump, engine fuel controls, primer nozzles and distribution system.

Consistency of the fuel was observed at the side of the container as the jet impinged against it and the complete fuel system was demonstrated by supplying metered fuel to the slinger test stand.

On the basis of the remarkably successful results obtained with these simulated fuel system tests, a Continental T–72 engine was prepared for operation in a test cell. Tests were performed with three different gels and two different emulsions. Comparisons were also made with the performance of the same engine run on liquid JP–4. No significant difference in performance was noted while the engine was being run on the semisolid fuel.

The normal fuel control systems was used without modification for all tests. Continuous engine runs in excess of one hour were made at all engine throttle settings, and cold starts were made on all of the modified fuels.

Only one significant problem was uncovered during these tests with gelled and emulsified fuels. The modified fuels tend to suspend and transport any contaminants present in the fuel system. Developmental work could provide a successful filtering system, probably requiring only slight modifications to present systems.

The limited research work conducted with gelled and emulsified fuels to date has been extremely encouraging. However, the effort devoted to modified fuel technology represents only a small fraction of the work remaining to be accomplished in this area. Both theoretical and practical work is needed before modified fuel systems can be considered for operational use. Extensive work in understanding the rheology of gel and emulsion systems must be completed.

A logical next step in defining the feasibility of fuel emulsion could well be an extensive operational test program. Static testing could be performed on obsolete military aircraft equipped with engines similar to those which have already demonstrated successful test cell engine runs.

Subsequent testing could be performed on obsolete military aircraft Model 220–N available for research programs from the Flight Safety Foundation. Two control engines could be operated on conventional jet fuel while two other engines are run on various emulsions.

Use of a static test bed would precede a flight test program. The later flight experience could provide a big step toward the development of operational criteria.

No one can say if and when modified fuels will be ready for operational use. Of course, before a successful prototype system is put into production, it must be justified on a cost-effectiveness basis. Nevertheless, a major hurdle has been crossed in the study of a fuel which promises to provide an answer to the aircraft fire problem. It promises immediate benefits today and a future which may well see the routine use of this ingenious "safe fuel."

LEGION OF MERIT. For "exceptionally meritorious service" with the U.S. Army Corps of Engineers Nuclear Power Field Office (NPFO), Fort Belvoir, Va., S/Maj Harold L. Allen recently received the Legion of Merit.

Presented at a ceremony marking his retirement after 20 years service in the Army, the award recognized his work from January 1964 to September 1966, as plant supervisor of the U.S. Army Engineers Reactors Group and SM–1 Nuclear Power Plant of the NPFO. The citation also notes his performance in key positions at other Army nuclear power plants, including installations in Greenland and Alaska. It states that:

"He proposed essential system modifications and provided recommendations which resolved difficult plant problems; proposed the concept of a traveling maintenance team which expeditiously served field plants whenever summoned . . . conceived, designed and fabricated devices which enabled mechanics to repair and maintain contaminated plant components expertly and quickly, with reduced personnel radiation exposure, plant downtime and expense."

AVLABS ANNUAL AWARD. William R. Aiken, Jr., was presented recently with the First Annual Director's Award for Technological Achievement consisting of a lapel pin, a plaque and $300 in cash. The aerospace engineer in the Applied Aeronautics Division, U.S. Army Aviation Materiel Laboratories (AVLABS), Fort Eustis, Va., was lauded for his "outstanding technical achievement as leader of the performance group in the Advanced Aerial Fire Support System (AAFSS) evaluation."

Cited also was his "technical competence in providing high-speed rotary-wing performance data for the various rotary-wing AAFSS candidate systems during concept formulation, and for excellence in technical direction of the hot-cycle rotor program."

The committee that selected Aiken consisted of Col Harry L. Bush, commanding officer; Lt Col John W. Elliott, deputy commander; Larry M. Hewin, technical director; Mead H. Mitchell, Jr., deputy technical director; Lt Col Harold L. Baker, assistant technical director; Paul J. Carpenter, director, Systems; Charles D. Roach, director, Research; and Martin C. Malone, special assistant, Value Engineering.

CARLTON AWARD. The Institute of Electrical and Electronics Engineers Barry Carlton Award, a national honor, was presented recently to Raymond L. Robbiani of the Atmospheric Sciences Laboratory, Electronics Command, Fort Monmouth, N.J., for a technical paper titled "High Performance Weather Radar." Robbiani also received the Army Certificate of Commendation.

SPECIAL ACT AND SERVICE CERTIFICATES. At the Nuclear Power Field Office, Fort Belvoir, Va., three engineers earned SASCs for coauthoring a paper titled "The Compact AK Process Nuclear System," published in *Engineering for Power*. The award honored Winfred M. Crim, Jr., George B. Manning and John R. Hoffman.

James K. McNally, also of the NPFO, received the same award for a paper titled "Gamma Induced Sensitivity Loss in the Proportional Counters of a Nuclear Power Plant."

INVENTION AWARDS. Seven employees of Edgewood Arsenal, Md., received invention awards. Jacob I. Miller, Omer O. Owens and Harold Z. Sommers were recognized for work on chemical agents. Hugh R. Carlon

3 Top Awards Honor Stith Retiring After 30 Years

Three top awards were presented to Col Marrion C. Stith, executive officer, Walter Reed Army Medical Center (WRAMC), Washington, D.C., when he retired recently to end 30 years of Army service.

Col Stith received the Legion of Merit and The Surgeon General's Medallion from Surgeon General (Lt Gen) Leonard D. Heaton, and the Walter Reed Medallion from Maj Gen Douglas B. Kendrick, Jr., commanding general of WRAMC.

The Legion of Merit was awarded for outstanding service from 1959 to October 1966. During this period Col Stith served as executive officer, U.S. Army Hospital, Fort Leavenworth, Kans.; executive officer and later chief of Administrative Services, Valley Forge General Hospital, Phoenixville, Pa., and chief of Administrative Services, Walter Reed General Hospital, Washington, D.C.

His previous military awards included the Bronze Star and Army Commendation Medal with two clusters.

Graduated from Western Kentucky College in 1936, he received a master's degree in business administration from George Washington University last June.

The colonel has accepted a position as administrator of the Charles S. Wilson Memorial Hospital, Johnson City, N.Y.

LWL Engineer Cited for R&D on Viet Nam Projects

Chief of Research and Development Lt Gen Austin W. Betts presented the Meritorious Civilian Service Award to John C. Ackerman for supervising U.S. Army Limited War Laboratory quick-reaction projects in response to Viet Nam war requirements.

Ackerman was cited for performance of duty as chief of the LWL Development Engineering Division at Aberdeen Proving Ground, Md., from June 1963 to June 1966. He was responsible for planning and execution of R&D and supervising 34 engineers in four branches.

Projects completed during this period included development of a jungle canopy platform, PRC–64 radio, claymorette counter-ambush weapon, free-drop water container, compact rifle sight, mobility augmentation for the M113 armored personnel carrier, a system for lowering personnel and cargo from hovering helicopters, and small arms protection kits for vehicles.

The division also has developed such items as a balloon communications system, lightweight single-frequency radio repeater, inertial microphone for relatively noise-free communication among helicopter crew members, and a delta reconnaissance vehicle.

Ackerman holds a BS degree from Manhattan (N.Y.) College and has been with the Limited War Laboratory since 1962.

was cited for work on "Low Frequency Switching," Russell I. Wessells for developing a "Ballistically Stabilized White Phosphorous Shell," Melvin J. Carlson for discoveries titled "Apparatus and Method for Pulse Forming," and Abraham Flatau for an "Autorotor Launching System."

STERNBERG MEDAL. As the officer who this year demonstrated the greatest proficiency in preventive medicine, Capt Jerry Gullion, U.S. Army Medical Corps, received the Sternberg Medal. It was presented at the graduation ceremony for students in the Walter Reed Army Institute of Research first Global Medicine course.

The medal honors the memory of Dr. George Miller Sternberg, who served as Surgeon General of the Army from 1893–1902 and founded the U.S. Army Medical School, now WRAIR.

Capt Gullion received a BA degree from Rice University, an MD degree from the University of Texas, and has been in the Army since 1966.

CERTIFICATE OF ACHIEVEMENT. Sp/5 Gene V. Winans, NPFO, Fort Belvoir, Va., received a CA Award for preparing a 3 x 18-foot schematic drawing for use in training the crew and testing the MH–1A Floating Nuclear Power Plant, the first of its kind in the world and now stationed at Fort Belvoir. The citation stated that Specialist Winans "expended much effort during off-duty hours to complete the task and that, through generous devotion of his talent as a draftsman, he effected great monetary savings for the Army while creating a diagram of professional quality."

COMMENDATION MEDAL. Col Frank K. Lawford, new executive officer of the Walter Reed Army Medical Center, received the second Oak Leaf Cluster to the Army Commendation Medal for his work at Brooke General Hospital, San Antonio, Tex., as chief of Administrative Services.

An Oak Leaf Cluster was awarded to Lt Col Paul A. Kelley, Air Defense and Missiles Division, OCRD, at a retirement ceremony. Col Kelley, a member of the OCRD staff since 1962, has worked since February with the Office of the Director of Defense Research and Engineering on temporary duty.

S/Sgt Curtis McClean, senior medical specialist at Walter Reed General Hospital, received the Army Commendation Medal for his work as a section sergeant in the Medical Battalion of the 25th Infantry.

CERTIFICATE FOR OUTSTANDING PERFORMANCE. George A. Ahern, U.S. Army Electronic Proving Ground, Fort Huachuca, Ariz., received a certificate for outstanding performance. Angela P. Beckwith, Golda L. Frey, and Hazel H. Strange, also of USAEPG, also received COPs.

AMC Chief Scientists Air Views on R&D Procedures

Problems of "Inter-Laboratory Technical Cooperation," with respect to improving operational procedures, were discussed by the Chief Scientists of the Army Materiel Command's Commodity Commands during a recent 2-day meeting at Fort Monmouth, N.J.

Dr. Craig M. Crenshaw, AMC Chief Scientist, chaired the meeting at HQ U.S. Army Electronics Command. Representatives of the AMC Deputy for Research and Laboratories, Dr. Jay Tol Thomas, and the AMC Director of Developments, Maj Gen Kenneth H. Bayer, participated.

Consideration was devoted to improving cooperation among co-located AMC laboratories, dispersed command laboratories and AMC-wide labs. The Chief Scientists visited ECOM laboratories to gain specific knowledge of areas of current and potential cooperative programs.

AMC Chief Scientists have been meeting at intervals of six months to a year at the invitation of Dr. Crenshaw and so far have visited three of the commodity command headquarters on a rotational basis.

General Frank S. Besson, Jr., CG of the Materiel Command, has issued a guidance paper titled "The Role of the Chief Scientist of a Commodity Command of AMC," which was the topic of Chief Scientists meeting at Redstone (Ala.) Arsenal in Dec. 1965.

The guidance outlines the role of the Chief Scientists in relations with the commander, as the leading scientific spokesman of the command, in other relations outside the commodity command, and in fostering a climate for scientific advances.

Aerodynamics Expert Joins DoD as Foster's Assistant

Recognized as an expert in aerodynamics and propulsion, Dr. William R. Laidlaw has accepted an appointment as special assistant to Director of Defense Research and Engineering Dr. John S. Foster, Jr.

Dr. Laidlaw was vice president of Research and Engineering, North American Aviation, Inc., Los Angeles, Calif., before being sworn into the newly created Public Law 313 position and has had extensive experience in the aircraft industry. Navy Capt Preston N. Shamer is the other special assistant to Dr. Foster.

A native of Canada, Dr. Laidlaw received a BA degree in science from the University of Toronto in 1950 and master's and doctoral degrees from MIT in 1951 and 1954.

He is a member of the Air Force Scientific Advisory Board, the American Institute of Aeronautics and Astronautics, the American Astronautical Society and the Society of Experimental Test Pilots.

Dr. Laidlaw also has served as a consultant to the President's Science Advisory Committee, the National Aeronautics and Space Administration and the Air Force Aerospace Research Pilot School.

WRAIR Hosts CENTO Meeting To Consider Medical Problems

Walter Reed Army Institute of Research (WRAIR) was host to the fifth Central Treaty Organization (CENTO) Military Medical Conference in Washington, D.C., early in November.

Representatives from Iran, Turkey, Pakistan and the United Kingdom joined with medical leaders of the U.S. Armed Forces in exchanging information on advances in military medicine. The objective is to standardize military medicine in CENTO countries insofar as is feasible.

U.S. Army Surgeon General (Lt Gen) Leonard D. Heaton welcomed the conferees. During their 4-day visit conferees were taken on a tour of WRAIR, the Armed Forces Institute of Pathology and Walter Reed General Hospital to view medical equipment and exhibits.

SCIENTIFIC CALENDAR

Conference on Solid-State Physics, Manchester, England, Jan. 4-7.

Electrical and Electronic Measurement and Test Instrument Conference, sponsored by IEEE, Ottawa, Ontario, Canada, Jan. 9-11.

Meeting of the Society of Automotive Engineers, Detroit, Mich., Jan. 9-13.

Symposium on Reliability, sponsored by IEEE, Washington, D.C., Jan. 10-12.

Meeting of the American Chemical Society, Kansas City, Mo., Jan. 15-19.

Symposium on Atomic, Molecular and Solid-State Physics, Gainesville, Fla., Jan. 16-21.

Conference on Acoustic Noise and Its Control, sponsored by IEEE, London, England, Jan. 23-27.

Meeting of the American Mathematical Society, Houston, Tex., Jan. 24-28.

IEEE Winter Power Meeting, N.Y.C., Jan., 29-Feb. 3.

Conference on Mathematical Theory of Control, sponsored by OAR, AFOSR and University of Southern California, Los Angeles, Calif., Jan. 30-Feb. 1.

International Symposium on the Zodiacal Light and the Interplanetary Medium, sponsored by the NBS, Jan. 30-Feb. 2.

22nd Conference of the Society of the Plastics Industry, Washington, D.C., Jan. 31-Feb. 3.

SIMULATION Pays Off

By Col G. L. Barnhill and J. B. Hayes

"Simulation" means many things to many people. In its historical essence, it is the act of feigning; assuming the appearance of; without reality. In the past, it has carried a bit of stigma, a touch of fakery. In more recent usage, the word stands for a vastly broader area of activity, a modern arm of science, a significant contribution to the advancement of technology.

The Air Corps used the Link Trainer in World War II as an effective tool in training tens of thousands of aircraft pilots. This was rudimentary simulation in its proper modern sense of practical application of time- energy- and cost-saving devices or techniques.

Who can count the numbers of simulations the space age programs have engendered? What would we have known of weightlessness, except by simulation? How could we have guessed the makeup of the surface of the moon, without exhaustive tests in vacuum chambers?

Application of total system simulation techniques to military vehicle design has been on the increase for the past decade. Prior to this period, experimental tests usually were conducted on full-scale prototypes. Little use was made of the methodolgy known as mathematical model analysis.

System simulation, where mathematical models are applied to high-speed electronic computers to describe the behavior of complete systems or some specific subsystem, is an integration of engineering and mathematical talents, analog and digital computers, mechanical devices, and visual aids.

What is the status of system simulation today? Has it paid off *cost-wise?* Has it assisted in improved vehicle design? A few of the many accomplishment of the Army Tank-Automotive Center (ATAC), Warren, Mich., will serve to provide an insight to the application of system simulation techniques.

RIDE EVALUATION activities in the ATAC Systems Simulation Branch involve forecasting the maximum safe speed at which vehicles can travel over the battlefield. A major problem in increasing this "cross-country" speed of vehicles has been the high cost in time and dollars of trying out and evaluating new design ideas. Full-scale models to try out each concept are prohibitively expensive.

System simulation reduces the cost of assessing new designs. In 1963 cross-country performance simulation cost $4,000. Cost of each simulation this year is expected to be approximately $600. The difference is attributable to the development of new computer programs and techniques.

During an important Parametric Design, Cost-Effectiveness study last year, the Lockheed Missile and Space Co. required a high-speed reliable procedure for evaluating cross-country performance of many vehicle designs. Needed in support of a joint United States and Federal Republic of Germany (US/FRG) tank development program was an organization capable of formulating basic hypotheses by statistical methods to derive the required data.

ATAC was handed the task, which involves predicting cross-country speed over various terrains, including those representative of middle Europe, by using electronic computers.

In the vehicle performance studies for the US/FRG program, vehicle traffic was simulated over pastureland, rock-strewn fields, plowed areas, gullies and ditches as speeds up to 60 miles per hour.

In such a simulation program, three elements are brought together—the road, the dynamic characteristics of the vehicle, and the human occupants. Vehicle speed is produced by mathematically moving the road relative to the vehicle. Ride vibrations recorded on magnetic tape and recreated in a motion simulator permit solutions to mathematical equations describing each motion.

Physical evaluation of the ride is accomplished on a mechanical "Ride Simulator." This is a random motion machine capable of providing bounce, pitch, roll and yaw vibrations.

Judgment of a good or bad ride in

As head of the Research and Engineering Directorate, U.S. Army Tank-Automotive Center, Warren, Mich., Col Gervase L. Barnhill is backed by 24 years experience in combat and scientific phases of military service.

A registered professional engineer, he has a BS degree in chemical engineering from the University of Tennessee and an MS degree in metallurgical engineering from Stanford University.

After six years of duty as an officer in World War II, during which he took part in the U.S. Marines invasion of Okinawa, he entered private industry from 1946 to 1950, but was recalled to service in the Korean War.

Col Barnhill has been a logistics adviser to the Turkish Army, director of Field Service for the Army Ballistic Missile Agency, and project manager of the Lance missile system.

Proior to joining the ATAC staff, he was in Germany as chief of Materiel Readiness at HQ USAREUR and later as commander, U.S. Army Advanced Weapons Support Command.

As chief engineer, U.S. Army Tank Automotive Center, Joseph B. Hayes holds one of the highest civilian jobs at the installation which employs 7,000 persons, mostly civilians.

He joined the Detroit Arsenal, site of ATAC in 1948, and has held key positions as comptroller and staff assistant to the commanding general, and deputy director, Research and Engineering Directorate.

An engineering graduate of the University of Detroit, Hayes joined the Government as an ordnance engineer with the old Detroit Ordnance District in 1940. In 1941, he was reassigned to the Lone Star Ordnance Plant in Texarkana, Tex., as an engineer on ammunition production until he entered the Air Corps in 1943.

In 1946, he went to work as a civilian on ammunition and rocket programs at Picatinny Arsenal, Dover, N.J. He also has served as the U.S. delegate to a NATO group composed of vehicle component experts and is currently the U.S. technical project officer on a Military Vehicles Data Exchange Agreement Program with Australia, the United Kingdom, and Canada.

the "old days" was based on measurements using live occupants in vehicles. Ride evaluation now can be accomplished by using the Pradko-Lee "absorbed power measurement," an analytical tool for determining the "power" absorbed by a man exposed to mechanical vibrations.

Human response to mechanical vibration has captured the interest of many researchers. ATAC began work in this area in 1963, searching for a way to simulate man under conditions of vibration. Primary emphasis has been applied to random vibration environments created by air-, sea- and land-vehicles.

Research resulted in the new concept of "absorbed power"—criteria which appeared to correspond to subjective human response to vibrations, based on recognition of the elastic properties of the human anatomy.

For example, if the seat in which you are sitting should begin to vibrate, there would be an energy input. The seat cushion would deflect. Your body would move or be displaced. This elastic movement requires energy, the average value of which is referred to as "absorbed power."

If a steel block replaced you on the cushion, however, the "absorbed power" of the block would be zero, due to its inelastic properties.

Absorbed power describes the "man," his posture, and the seat. Sinusoidal and random vibration now can be forecast without physical experimentation upon humans.

Simulation techniques in the tank-automotive field have produced significant research results. ATAC management initially put "customer money" into this venture with some trepidation. Fortunately, the profits are high and the prospect for greater savings is highly promising.

DYNAMOMETER FIELD SIMULATION. Combat and military vehicles are designed to insure superior performance over the roughest terrain and climate in the world, necessitating highly reliable and durable components. Each major component or system, as well as the entire vehicle, must be developed under real and simulated conditions of expected use.

Literally, researchers must "bring the field into the laboratory." Under the dynamometer field simulation program, components of military vehicles are tested in the laboratory under the operating conditions and duty cycle that will be experienced in service.

Used extensively by ATAC during the last three years for durability testing of engines, power-shift transmissions and power trains, the dynamometer methods consists of three steps:

- Instrumenting an engine and power train in a test vehicle to record duty cycles over standard test courses, such as at Aberdeen Proving Ground, Md.
- Reduction of this field data to establish a typical duty cycle for durability testing of current production and new designs of power trains.
- Setting up the selected engine and power train with required accessories in the laboratory to conduct continuous durability testing under the conditions determined for the typical duty cycle.

Simulated vehicle mileage can be accumulated more rapidly than during regular vehicle testing. Only the items under investigation need be tested. Weather conditions that might hold up actual vehicle testing in the field are not involved.

Comparison of failures recorded during field testing with those obtained on dynamometer simulation tests increases understanding of design requirements for new vehicles.

Many different laboratory machines simulate field use of components or assemblies undergoing test. For example, the Track-Block Test Machine simulates the action a track-block encounters when installed on a tank. Track-blocks are installed on the underside of the machine head, which rotates eccentrically against a road-plate supported by a hydraulic cylinder controlling the load.

The test action compresses and scuffs the track-block during each cycle. In addition, a hydraulic motor skews the road-plate to simulate turning of the vehicle. This simulation quickly eliminates inferior track-block formulations. Only the most promising new designs need be field tested on the vehicle.

As another example, all tests for the fixed fire extinguishing systems which protect the engine compartments of combat vehicles are simulations. It is too risky to start a fire in an assembly containing approximately 300 gallons of fuel, 40 gallons of lubricating oil and battery hydrogen gas, all in the immediate proximity of live ammunition!

Simulation also is used to test the ozone resistance of rubber. ATAC formerly accomplished such tests by atmospheric exposure of tires in selected areas of the United States. The project engineer proposed building an ozone chamber large enough to hold several large tires, thus eliminating the time and cost of shipping them to outside exposure sites.

Believed unique in this country, and perhaps in the world, is the large "walk-in" ozone chamber constructed for ATAC testing. It has controllable ozone environment and temperature conditions, and ozone can be generated up to 500 parts per 100 million. The low temperature capability is 65 below zero Fahrenheit. "Mounted" tires are exposed to ozone while clamped in a fixture to simulate the worst vehicle deflection loads.

SCALE MODELS. The use of physical, or scale, models of ground vehicles to predict the performance of full-scale vehicles is not widely developed at this time, and for a good reason. Construction of a valid scale model of a ground vehicle may equal or exceed the cost of the prototype.

The terrain-vehicle system is so complex that a proper scale model would have to include such controlling parameters as the power-to-weight ratio; the dynamic characteristics of the suspension; the steering characteristics; the soft-soil performance; and the behavior of the traction elements.

Scale models can be useful, however, when a single performance parameter is of interest. For example, a scale model can indicate the soft-soil performance or can be useful in the study of the water operation of a vehicle. Considerable success has been achieved using models for design of the hull and to study vehicle water performance. As a result of some of these tests, a 70 percent increase in water speed has been obtained.

Scientific simulation, already burgeoning, is yet in its infancy. The few notable tank-automotive examples herein described represent but a fraction of the total effort committed in this broad field. Still the infant is already paying his room and board, and returning to his sponsor an incredible saving in time, dollars and human resources.

TECOM Hosts USACDEC Group

The U.S. Army Test and Evaluation Command hosted a conference for representatives of the U.S. Army Combat Development Command Experimentation Center, Nov. 17–18, at Aberdeen Proving Ground, Md.

An 8-man group from the Center, Fort Ord, Calif., was headed by Col Vernon G. Gilbert, deputy commander.

The conference and tour focused on Army materiel currently under test or programed for future testing. Major military materiel discussion items were selected by the infantry, field artillery, armor, aviation, air defense and electronics directorates of USA-TECOM.

The group toured the Proving Ground's Development and Proof Services, where specific weapons and instrumentation systems were demonstrated.

Army Tests Water-Jet Boat for Marshes

Water-jet boats with weed-chopping devices that can maneuver through dense aquatic plant growth and shallow water are being tested by the Army Engineer Research and Development Laboratories (ERDL).

Walker's Lake, a man-made body of water on Virginia's Chickahominy River 10 miles north of Williamsburg, is the main test area being used by the Fort Belvoir, Va., agency. It is the nearest water approaching the growth-choked density of the Mekong Delta region of South Viet Nam.

Two types of boats, with single and double jets, are plying the test area where at least 25 genera of acquatic marsh (paludal) plants thrive. Each boat displaces 3,500 pounds.

The JBX–20 carries a Ford Intercepter gasoline engine of 280 horsepower which operates a single Berkeley 16JA water jet. The welded aluminum hull boat is 23 feet 3 inches long with a beam of 9 feet 9 inches. Empty it will do 25 knots. It can carry 2,000 pounds of 12 troops and their gear in 10 inches of water at 17 knots.

Shallow water navigation is possible with the water-jet principle in both boats. Steering is accomplished by rotation of the jet nozzles. The welded aluminum hull of the JBX–20 can be reversed with a "clamshell" attachment to the jet mechanism. Each jet intake has a weed-cutter.

The Tamco Aqua Jet, propelled by two jets powered by twin Chevy II 110-horsepower gasoline engines, has a fiberglass hull 25 feet 6 inches long with a beam 7 feet 10 inches. It has a 25-knot capability empty, a maximum speed of 15 knots with a 2,000-pound load, can be rotated 360 degrees for steering maneuverability and can be used in 13 inches of water.

ERDL is also testing boats powered by aircraft engines for increased mobility in shallow, weed-infested water. One "airboat" undergoing tests in the Chickahominy site at Accotink Creek near Fort Belvoir is propelled by a 400-horsepower engine with 4-blade propeller.

An air-rudder steers the boat, capable of 40 m.p.h. in open water. It can carry 2,000 pounds at 30 m.p.h. through swamps. (See *Army R&D Newsmagazine*, December 1965–January 1966 edition, page 56.)

Botanists have determined that several species of water plants in Walker's Lake also are prevalent in Southeast Asia and that the general density of growth affords "a challenging test site" for the jetboats.

JBX–20 propelled by Berkeley 16JA water jet.

Army Dentists Developing Spray-on Oral Bandage

Bulky dressings for oral surgery may be superseded by a spray-on chemical adhesive which has been tested successfully in human dentistry by the U.S. Army Institute of Dental Research (USAIDR).

Results of a clinical study of 105 patients support the belief that the adhesive is superior to any other peridontal dressing in use. The study was made by Lt Col Surindar N. Bhaskar, USAIDR Chief of Oral Pathology, and Lt Col Joseph Frisch, who heads the Peridontal Section at Walter Reed General Hospital, Washington, D.C.

Synthesized by the U.S. Army Medical Biomechanical Laboratory, Forest Glen, Md., for dental and medical applications, the clear liquid adhesive (normal alkyl alpha cyancrylate) cements cut tissue together, stops bleeding, reduces postoperative pain, and accelerates healing. If the patient wears a denture, it can be used immediately following surgery.

Other advantages are that the adhesive usually requires only one application and can be applied without special training. Preliminary bacteriologic studies revealed that the material inhibits growth of *staphylococcus aureus* and *eschericia coli*.

Possible further uses include gastrointestinal and vascular anastomoses and for inducing hemostasis in solid friable organs such as the liver and kidney, as well as on donor sites and burns. Research in these areas is being done by Dr. T. Matsumoto, Division of Surgery, Walter Reed Army Institute of Research.

Tests of the spray-on adhesive began a year ago with the objective of supplying the wounded soldier in Viet Nam with a simple means he could apply to stop bleeding until evacuated for professional treatment. Based on the results at Walter Reed General Hosiptal, Col Bhaskar has requested that the adhesive now be field tested in Viet Nam.

All testing must be done with the authorization of the Food and Drug Administration.

The clinical study at the USAIDR consisted of 276 procedures in peridontal surgery, extraction sites and ulcerations, mainly gingivectomies and mucogingival flap procedures.

The adhesive is now being tested for use in the restoration of decayed teeth and relief from toothaches. It also is being used in general surgery on animals at the Walter Reed Army Institute of Research's Department of Experimental Surgery.

The October 1966 edition of *Oral Surgery, Oral Medicine and Oral Pathology*, under the Section of the Federal Dental Services, carries a technical article titled "Application of a New Chemical Adhesive in Peridontic and Oral Surgery." It is coauthored by Lt Cols Bhaskar and Frisch, Col Peter M. Margetis, director, and Dr. Fred Leonard, technical director of the Army Medical Biomechanical Research Laboratory.

USCSC Schedules OR Seminar

Career executives with broad administrative responsibilities, GS–15 (or equivalent) are eligible for nomination to attend an Executive Seminar in Operations Research (OR), Feb. 2–3, at the U.S. Civil Service Commission, Washington, D.C.

The seminar includes presentations on theory and practice of OR, including an introduction to OR, mathematical tools of management, models and model building, how to organize for OR, management application of OR, and OR and the decision maker.

Nominations should be submitted by Jan. 6, 1967 to the Director, The ADP Management Training Center, Office of Career Development, U.S. Civil Service Commission, Washington, D.C. 20415.