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Army Honors 24 Scientists With R&D Achievement Awards

Diversity and depth of scientific and engineering activities at Army in-house laboratories are demonstrated impressively by 14 winners of the Fifth Annual Research and Development Achievement Awards chosen recently. Twenty-four individuals from 11 laboratories are honored by the selections. One award represents an integrated team effort by 10 persons from four installations. Another award is to a team of two. Pictures of the winners and information on their achievements appear on pages 3, 42-44.

The 10-man group achievement in design and development of the Army's XM454 projectile is by far the largest collective effort in the 5-year history of the awards program, initiated by Lt Gen Arthur G. Trudeau when he was Chief of Research and Development.

Other R&D achievements that earned 1965 awards recognition in-

(Continued on page 3)

Project HARP Probes Exceed 400,000 Feet

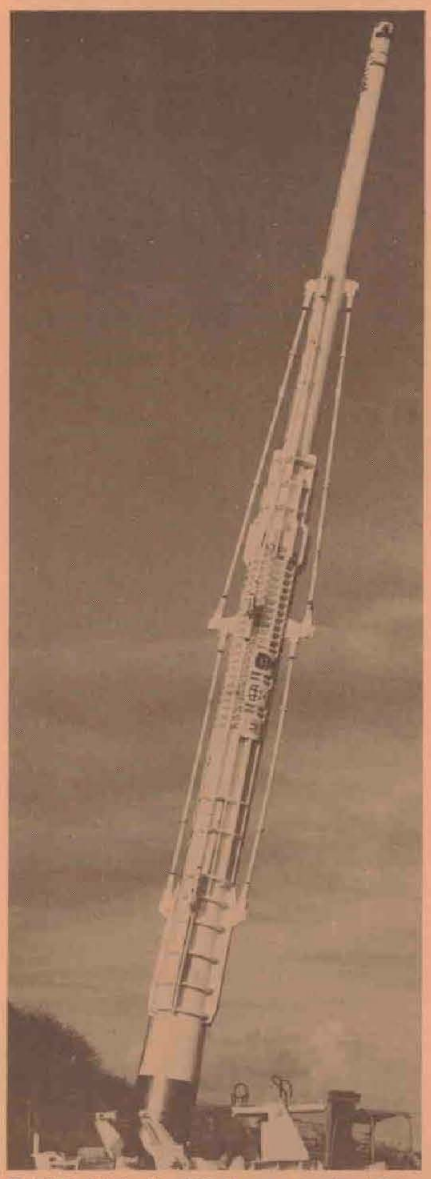
Using the "longest gun in the world"—114 feet long and weighing 200 tons—Project HARP (High Altitude Research Program) recently measured atmospheric conditions beyond 430,000 feet above the Island of Barbados, West Indies Federation.

HARP is a joint Canada-U.S. Army project, seeking to exploit the inherent accuracy and reliability of gun-fired projectiles for research. During the past five years probes with 5-, 7- and 16-inch guns have reached ever deeper into the atmosphere.

Major HARP advances were reported in the *Army R&D Newsmagazine* in November 1964, page 36, when 5-inch gun probes launched from Wallops Island, Va., and 16-inch firings from the Island of Barbados successfully transmitted information at altitudes from 200,000 to 350,000 feet.

Seven-inch gun tests were carried out during January and February this year at Wallops Island, achieving ejection of instrument payloads of 27 and 64 pounds to altitudes of 330,000 and 200,000 feet, respectively.

(Continued on page 4)



HARP 16-inch, 200-ton gun stretches 114 feet skyward following modification and firing of atmospheric probes to 430,000 feet at Barbados.

Army Selects Indiana Girl Top Winner at 16th NSF-I

National Science Fair-International (NSF-1) evidence over the past three years shows that the Army goes for "beauty with brains" in friendly rivalry with the Air Force and the Navy to select the Nation's leading teenage scientific talent.

For the third consecutive year, the Army's NSF-1 choice as a representative for the Japan Student Science Awards is a pretty girl with winning ways—among people as well as in scientific competition.

Barbara Ann Bennett, 18, of Garfield High School, Terre Haute, Ind., will represent the Army at Tokyo, Nov. 1-6, hopefully as effectively in winning the esteem of Japanese students and adults as did Nancy Lee Williamson in 1964 and Rhea L. Keller in 1963. Miss Bennett is one of 20 gifted young science students selected for Superior Awards by a panel of Army judges at the 16th NSF-I in St. Louis, Mo., May 5-8. Twenty-one students were chosen as alternates and recognized with Meritorious Awards.

All Army awards, including five

(Continued on page 2)

Featured in This Issue . . .

Army R&D Newsmagazine

Vol. 6, No. 6 June 1965

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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 the widely dispersed and diffused Army R&D activities; to maintain a closer link from top management through all levels to scientists, engineers and technicians at the bench level; to express views of leaders, as pertinent to their responsibilities, and to keep personnel informed on matters germane to their welfare and pride of service.

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Army Selects Indiana Girl Top Winner at 16th NSF-I

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special awards by the Army Aviation Association of America, were presented by Maj Gen Austin W. Betts, Deputy Chief of Research and Development, Department of the Army. Dr. J. Fred Oesterling, Deputy Scientific Director for Research, U.S. Army Natick (Mass.) Laboratories, was chairman of the panel of Army judges.

Winners of the Superior Awards were given a choice of summer employment at Army in-house laboratories, where they will have the opportunity of working alongside Army researchers, or of making all-expense-paid one-week visits to the laboratories. Pictures of the winners with their displays and information on their choices is carried on pages 2, 22-25.

The Army alternate for the Japan Student Science Fair Awards is Gregory W. Kozlik, 16, a senior at Lane Technical H.S. in Chicago, Ill. His NSF-I display, which he will show at Tokyo in the event Miss Bennett cannot go, is titled "Field Emission Microscopy." Her exhibit is "Mushroom Production by Tissue Culture and Fermentation — Related Nutritional Studies."

An indication of the keen competition and the comparative evaluation of the exhibits and contestants by military judges is the fact that the Air Force and Navy selectees for the Japan Fair also were chosen by the Army for Superior Awards.

The Air Force named as its representative William Andrew Voelkle, 18, of Sam Houston (Tex.) Senior H.S., whose exhibit was titled "Advanced Space Propulsion—The Ion Electrastatic Thrustor." The Navy decided on John Richard Gott, III, 18, of Mayme S. Waggener H.S., Louisville, Ky., who displayed "Pseudo-polyhedrons—A New Class of Geometric Figures."

TRI-SERVICE representatives selected to attend Japan Student Science Awards in Tokyo include (l. to r.) John R. Gott, III, Navy; Barbara Ann Bennett, Army; and William A. Voelkle, Air Force. Standing behind Gott is Gregory W. Kozlik, superior award winner and Army alternate for the Japan Student Science Fair Award.

Barbara Ann Bennett, National Science Fair-International (NSF-I) winner and Army selectee to participate in annual Japan Student Science Awards in November, is congratulated by Maj Gen Austin W. Betts, Deputy Chief of Research and Development. At left is Jack Fenn, Department of the Army project officer.

As its alternate to the Japan Fair, the Air Force selected Robert Stephens, 18, Brookfield (Wis.) East H.S., whose work was on "Force Analysis of the Bermudan Mainsail." The Navy alternate is Dale Jay Walther, 17, East Anchorage (Alaska) H.S., whose research was on "Establishing Plant Immunity as a Tool in the Search for Cancer's Cure."

The Army Aviation Association of America selected five first-place winners, each of whom received a plaque and $100. They are: Ann Marie Bigelow, 17, Galion (Ohio) Senior H.S., for "Development of an Experimental Vibrating-Reed Anemometer"; Joel H. Breger, 17, Northwood H.S., Silver Spring, Md., for "Design and Characteristics of a Miniature Supersonic Wind Tunnel";

Jerry Wood Childers, 18, North Augusta (S.C.) Senior H.S., for "The Channel Wing Aircraft"; James Hallett Oberlin, 17, New Haven (Ind.) H.S., for "Design for a Man-Powered Flying Machine"; and John F. Rollins, 17, Eisenhower H.S., Lawton, Okla., for "Design and Use of a Wind

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Research & Development Awards Honor 24 Army Scientists

(Continued from page 1)

clude materials research productive of transparent aircraft armor weighing only half as much as bullet-proof glass; high-temperature stress studies that discovered a new phenomenon believed of potentially broad application (vaporization expansion wave in superheated liquid metals);

Development of a new precision digital telemetery system; advancement of fluid dynamics theory, wind tunnel technology and numerical analysis; studies of antitank missile systems and electronic countermeasures (ECM vulnerability); development of lightweight ceramic plastic composite armor systems;

Research leading to development of an all-weather detector for guerrilla warfare countermeasure applications; notable advances in burns wound research and treatment; improvements in field assessment of chemical agents and aerobiological problems; and advances in warfare vision research, that is, the ability to maneuver in darkness.

No repeaters are among the 1965 award winners and most of them can be appreciative of their honors as the major recognition they have gained in their careers as Army scientists and engineers. In age, they constitute a balanced blending of young, matured and seasoned scientific talent.

Chief of Research and Development Lt Gen William W. Dick, Jr., who approved selections as submitted by judges, will present awards to Washington, D. C., area winners at a luncheon June 28. Commanders of the major commands or installations concerned will be requested to arrange for presentation of the other awards.

Chaired by Dr. Carl Lamanna, deputy chief of the Life Sciences Division, U.S. Army Research Office, the judges panel included four other Army Research scientists and two representatives from each of the materiel directorates of the Office of the Chief of Research and Developments. They are:

Dr. Robert B. Watson, chief, Physics and Engineering Branch, Physical Sciences Division; Dr. C. Jelleff Carr, chief, Scientific Analysis Branch, Life Sciences Division; Dr. Lynn E. Baker, chief psychologist, U.S. Army, Human Factors and Operations Research Division; Dr. Lester W. Trueblood, chief, Regional Branch, Environmental Sciences Division;

Col George Sammet, Jr., assistant director, and Lt Col James J. Cobb, chief, Nike X and Space Divisions, Missiles and Space Directorate; Lt Col Charles W. Spann, chief, Electronics Branch, Communications and Electronics Division; and Lt Col James L. Quinnelly, chief, Combat Arms Branch, Combat Materiel Division, Directorate of Developments.

The Army R&D Achievement Award consists of a bronze wall plaque and a lapel pin, to give "recognition of technical achievements of scientists and engineers by accepted leaders in their field." Only in-house laboratory personnel, including technicians or subprofessional personnel, are eligible.

Criteria require that a recipient of the award be directly responsible for a significant scientific or engineering achievement that:

- Establishes a scientific basis for subsequent technical improvement of military importance and/or
- Materially improves the Army's technical capability and/or
- Contributes materially to national welfare.

The 1965 Army Research and Development Achievement Award winners and a synopsis of the work recognized by the judges are:

ANTHONY L. ALESI, U.S. Army Natick (Mass.) Laboratories. Responsible for the evaluation, development and synthesis of new and improved materials resistant to penetration by antipersonnel missiles. Made significant contributions to the development of two materials systems of transparent armor that provides effective protection against caliber .30 armor pressing projectiles, with a 50 percent reduction in weight over "bullet-proof" glass.

Based upon the development of these systems, the incorporation of transparent materials into Army aircraft to provide protection against small arms fire is now feasible in some Army aircraft since their weight limitations will not be exceeded by the required armor weight.

DR. FREDERICK D. BENNETT, Ballistic Research Laboratories, Aberdeen Proving Ground, Md. As chief of the Exterior Ballistics Laboratory, contributed personally and through leadership of others to the discovery and analysis of a new phenomenon—the vaporization expansion wave in superheated liquid metals—during research on the electrical properties of exploding wires. This wave may have application to such diverse problems as nuclear reactor explosions and volcanic eruptions.

Produced and studied the macroscopic behavior of matter subjected to extraordinary extremes of physical stress caused by high temperatures, pressures, or electrical resistive properties of the superheated metallic state.

FRANCIS W. BOTSCH, U.S. Army Research Institute of Environmental Medicine, Natick, Mass. Developed a highly portable, laboratory precision, digital telemetery system which is capable of collecting hitherto unobtainable large numbers of physiological measurements from unrestrained test subjects performing military tasks under extreme enviromental conditions.

The flexibility of this system, resulting from the variety of parameters amenable to assessment, materially broadens the spectrum of potential experimental designs and permits sophisticated statistical planning and analysis of results.

DR. PAUL D. FYLNN, Frankford Arsenal, Philadelphia, Pa. Contributed significantly to the advancement of photo-optical instrumentation engineering by designing equipment and developing techniques which created a new and practical research tool.

Information developed through this research tool will be useful in studies of fracture mechanics, armor penetration, and ultimately in the design of new and improved Army weapons. The system also has possible application in other fields such as biomechanics in connection with skeletal failure in the human body under stress.

DR. JOHN H. GIESE, U.S. Army Ballistic Research Laboratories, Aberdeen Proving Ground, Md. While serving as chief of the Computing Laboratory, he contributed significantly to the growth of fluid dynamics theory and the related development of wind-tunnel techniques. His study of the singularities of simple flow models, which he constructed, laid the foundation for a solution of a wide class of problems.

His contribution to numerical analysis, the problem of subsidence, the motion of a rigid body within a liquid-filled cavity, and the problem of constraining impinging jets have an intimate connection with the efficient utilization of electronic computers, soil mechanics, ballistics of special

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Project HARP Probes Exceed 400,000 Feet Altitude

(Continued from page 1)

At the conclusion of the 1964 firings in Barbados, the 140-ton, 16-inch gun, equipped with a 22-foot muzzle extension, showed reliable performance in the exploratory development aspects of the project.

In the early exploratory development stage, the muzzle extension was damaged by the steel fins of a projectile, and later failed under pressure loads during firing.

A search for a longer muzzle extension located a 51-foot section of a Mark 6, 16-inch gun barrel owned by Sandia Corp. at Pocatello, Idaho. Shop facilities were leased at Pocatello, machinists were hired, and the section was smooth-bored.

Work on the new section was completed by the first week in February, 1965. The 30-ton tube was moved by rail to Cape Kennedy, Fla., by ship to Barbados, then towed through the narrow streets of Bridegtown to the gun site seven miles away atop a high plateau.

With the 51-foot extension attached to the original gun, 30 additional tons of stiffness and tie-rods were welded on and a completely new hydraulic system installed. After some difficulty with the hydraulic system, and the repairing of some cracks that developed in the outer hoops of the 40-year-old "surplus" barrel, the gun was successfully fired on Mar. 23.

Resembling in appearance a science fiction space cannon, the 200-ton gun can be elevated to 85° in 7 minutes.

Many successful flights of 250 megacycles telemetry and two of 1,750 megacycles telemetry were made during 1964 using the 5-inch guns at Wallops Island and the 16-inch gun at Barbados.

Telemetry has been used to measure payload compartment temperatures. Tri-methyl-aluminum (TMA) and aluminized balloon releases have been tracked with radar and wind directions and speeds determined.

Upper stratospheric data have been gathered by tracking chaff and aluminized parachutes ejected from the 5-inch guns at Wallops and by TMA trails generated by projectiles from the 16-inch gun at Barbados.

The TMA trails involve chemiluminescent reactions with atomic oxygen above 86 kilometers. Generated by seven pounds of TMA, these trails persist for over 15 minutes and can be seen 150 miles from launch.

Following the addition of the 51-foot section to the 16-inch gun, 14 projectiles were fired during Mar. 23-29. Four projectiles carrying balloons and six carrying TMA were fired, attaining apogees ranging from 259,000 to a record 430,000 feet.

TMA was released from five of the six above cited projectile flights and camera recordings were taken of each flight from at least two of three islands (Barbados, Grenada, St Vincent) manned for this purpose.

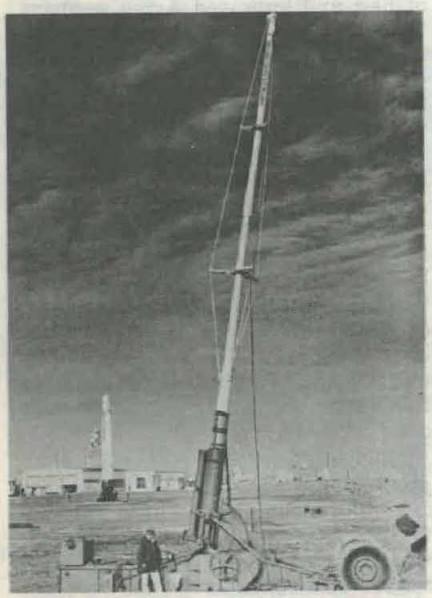
The altitude of 430,000 feet was attained by a 185-pound missile. A similar vehicle fired previously by the unextended gun reached only 335,000 feet.

An experimental projectile and three rockets were fired during the March 1965 schedule. Two of the later firings were the first flights with fiberglass rocket bodies, which are believed to have a greater performance potential than steel bodies.

The third rocket flight with a steel body was successfully launched using solid-propellant end-burning grain.

A report summarizing the latest firings with the modified 16-inch gun at Barbados stated that:

- The 51-foot muzzle extension has made an outstanding improvement in performance extending the capabilities of the gun-boosted probes to altitudes in excess of 400,000 feet.
- Experimental projectiles with balloons and TMA release are substantially operational, with some improvement required for balloon release and/or radar support.
- Experimental rockets are showing increased promise through the use of fiberglass, solid propellant end-burning grains, and reduced acceleration associated with the extended gun.



HARP 7-inch gun is raised for vertical firing of gun probes in high-altitude research at Wallops Island.

HDL Fires Quartz Crystal Units in Gun Environments

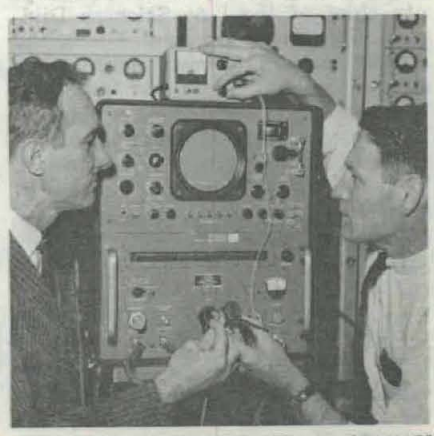
Successful firings of quartz crystal oscillators in gun environments ranging up to 72,000-g. (72,000 times the force of the crystal's weight) have been announced by the U.S. Army Materiel Command's Harry Diamond Laboratories Washington, D.C.

HDL scientists are hopeful that the modified military CR24/U units may, for the first time, lead to crystal stabilization and/or control of electronic circuits used in artillery weapons. In previous tests, quartz crystal oscillators have failed at much lower accelerated pressure.

Four HDL crystals were mounted in a test slug and fired from a 75 mm. smooth-bore howitzer into a styrafoam - sawdust - filled recovery trough at the HDL Test Area. The series resonance of the crystals was checked after successive shots of 14,000, 42,000, 66,000 and 72,000-g. without a single failure.

In addition, a 30-MC crystal oscillator was mounted in the test slug and fired in a 63,000-g. environment. The oscillator experienced a permanent increase in frequency of 700 cycles per second (approximately .0023 percent).

Codevelopers of the crystal units at HDL are Frank Vrataric, a research electronic engineer, and James Richardson, a physicist. They indicated that while the crystals are still in the preliminary development stage, they will be used in immediate applications, such as the U.S. Army's Project HARP (High Altitude Research Program) as well as telemetry systems for fuzing systems, projectile environment studies, etc.



CODEVELOPERS of military CR24/U crystal unit, James Richardson (left) and Frank Vrataric, check controls.

New Appointees to TARC Include Chairman, 6 Members

Rotational realignment of The Army Research Council (TARC), involving Dr. Richard A. Weiss relieving Dr. Ralph G. H. Siu as chairman and six additional changes of members, was effected June 1 by Assistant Secretary of the Army (R&D) Willis M. Hawkins.

TARC is the group of eminent scientists, engineers and administrators originally appointed in January 1964 by Secretary Hawkins to make a penetrating study and analysis of all aspects of Army research—facilities, personnel and funding—for maximum utilization of resources.

In August 1964, after seven months of daily sessions often extending far into the night, TARC issued its first report, a 434-page condensation of an original document of more than 2,000 pages, titled "Army Research Program Covering 6.1 Activities for Fiscal Years 1965-1969." Future reports will cover activities funded under the 6.2 category and others.

TARC's organizational concept provides for 2-year terms except that four of the eight original appointees and the chairman were expected to serve approximately one year. In addition to Dr. Siu, retiring members are Dr. Leonard S. Wilson, Dr. Donald M. Swingle, Dr. S. B. Levin and Dr. C. W. Lampson, all of whom hold positions of top leadership.

Director of Army Research Brig Gen Walter E. Lotz, Jr., will continue to serve as coordinator of TARC, as he has since its inception.

New appointees to TARC, including two to expand membership from 9 to 11, are: Dr. Maurice Apstein, associate technical director, Harry Diamond Laboratories, Washington, D.C.; Dr. W. W. Carter, chief scientist, U.S. Army Missile Command, Redstone Arsenal, Ala.; Dr. Hoyt Lemons, chief, Geophysical Sciences Branch, Environmental Sciences Division, U.S. Army Research Office.

Dr. Helmut E. Weickmann, chief, Atmospheric Physics Branch, Meteorological Division, U.S. Army Electronics Laboratories, Fort Monmouth, N.J.; Dr. John D. Weisz,[1] technical director, U.S. Army Human Engineering Laboratories, Aberdeen Proving Ground, Md.; and Col William Hausman, M.C., deputy director, Division of Neuropsychiatry, Walter Reed Army Institute of Research, Washington, D.C.

TARC's hold-over members under the 2-year term appointments are Col Tyron E. Huber, chief, Life Sciences Division, U.S. Army Research Office; Col William D. Tigertt, director, Walter Reed Army Institute of Research; Dr. Gilford G. Quarles, chief scientific adviser, Office of the Chief of Engineers, Washington, D.C.; and Dr. J. V. R. Kaufman, chief scientist, U.S. Army Munitions Command, Picatinny Arsenal, Dover, N.J.

Dr. R. A. Weiss

Dr. W. W. Carter

Dr. Hoyt Lemons

Dr. H. E. Weickmann

Col W. Hausman

Dr. Maurice Apstein

In a letter notifying Dr. Weiss of his appointment as TARC chairman, ASA (R&D) Willis M. Hawkins stated:

". . . The responsibility of The Army Research Council is to advise the Chief of Research and Development and myself on matters concerning the Army research and exploratory development effort. I place great importance upon the work the Council has done in the past, and anticipate work in the future will be equally important. . . ."

In taking over from Dr. Siu as TARC chairman, Dr. Weiss will carry on for one of his closest friends and long-time associates in Army research careers that have brought them many honors. Dr. Siu, whose "T-Thoughts" column brightened this publication for four years, was honored as one of the Nation's 10 outstanding Federal Government career employees for 1961. Dr. Weiss won the same honor in 1959.

The National Civil Service League selected Dr. Siu as a "recognized international scientist and a forceful leader among men who strive to focus scientific thought and development upon new horizons." He was lauded also as a "key scientist in the radiation preservation-of-foods field . . . and the dynamic impetus behind a recently established Army monograph research and development series—a significant collection of research results being published in book form."

Selected as the Department of the Army choice to attend the National War College 10-month course in 1963, Dr. Weiss has served more than six years as Deputy and Scientific Director of Army Research. Backed by more than 23 years of Federal career service, he became scientific adviser to the director of Research, Office of the Chief of Research and Development in 1955 and two years later was promoted to acting chief scientist.

Dr. Siu is arranging a Chinese dinner at a prominent Washington restaurant to honor retiring members of TARC late this month. His talents as one of the Army's top toastmasters are expected to make that occasion a fitting reward for their hard work.

[1] Photograph of Dr. Weisz was not available for publication at the time the *Newsmagazine* went to press.

Lt Gen Harrell Commands CDC; Beach Succeeds General Howze As CG, 8th U.S. Army in Korea

Lt Gen Ben Harrell, Assistant Chief of Staff for Force Development in the Pentagon since February 1963, recently relieved Lt Gen Dwight E. Beach as commanding general, U.S. Army Combat Developments Command, Fort Belvoir, Va.

The new Assistant Chief of Staff for Force Development is Lt Gen Theodore J. Conway, former Deputy CG, Eighth U.S. Army, Korea, and the first Director of Army Research in 1958.

General Beach will succeed General Hamilton H. Howze, scheduled to retire July 1 as CG of the Eighth U.S. Army, commander of the United States Forces in Korea and Commander-in-Chief, United Nations Command.

Graduated from the U.S. Military Academy in 1933, General Harrell commanded Infantry troops in combat and served as a war operations planner for 38 months during World War II. For 3½ years after the war he served at the Infantry School, Fort Benning, Ga.

In early 1949, at the age of 37, he volunteered for airborne training. After earning the parachutist's badge, he served in four consecutive airborne assignments, including 1950-51 duty as chief of staff, Headquarters, 11th Airborne Division, Fort Campbell, Ky.

In 1952 he was graduated from the National War College and assigned for one year as an operations and training staff officer, Supreme Headquarters Allied Powers, Europe at Marlay, France.

After a year in Berlin as commanding officer, 6th Infantry Regiment, U.S. Army Europe, General Harrell was named chief of staff for the U.S. commander in Berlin.

In 1955 he became executive officer, Office of the Assistant Secretary of the Army (Manpower and Reserve Forces), Washington, D.C., and later served two years as chief, Infantry Branch, Career Management Division, and chief, Infantry Branch, Officer's Assignment Division, Office of The Adjutant General.

An assistant division commander, 7th Infantry Division, and CG of the 7th Infantry Brigade, he served in Korea until August 1959. With the U.S. Continental Army Command, he then served as assistant deputy chief of staff for operations and later as deputy chief of staff for operations.

Assignments followed as CG, 101st Airborne Division, Fort Campbell, Ky., and nearly two years as CG of the U.S. Army Infantry Center and commandant of the Infantry School, Fort Benning, Ga.

Lt Gen Ben Harrell

Lt Gen Dwight E. Beach

Lt Gen Theodore J. Conway

GENERAL BEACH attended the University of Michigan for two years before entering the U.S. Military Academy. Commissioned in the Field Artillery in 1932, he was detailed to the Army Air Corps but was assigned to various horse-drawn Field Artillery units prior to World War II.

Since the war, he has commanded the Artillery of the 11th Airborne Division and the 45th Infantry Division in Korea and served as Artillery officer and chief of staff for plans and combat operations, Eighth U.S. Army, Korea.

Subsequent assignments included director, Office of Special Weapons Development, U.S. Continental Army Command; director of Guided Missiles, Office of the Deputy Chief of Staff for Military Operations, Washington, D.C., commander of the 82nd Airborne Division, Fort Bragg, N.C., from June 1959 to April 1961.

In May 1961 he returned to the Pentagon as the Deputy Chief of Research and Development and in July 1962 advanced to Chief of Research and Development. In July 1963 he became CG of the Combat Developments Command.

General Beach is a graduate of the Field Artillery School, Amphibious Training School, Command and General Staff College, Armed Forces Staff College and the Army War College.

GENERAL CONWAY was appointed the first Director of Army Research in 1958 after having served in the Office of the Chief of Research and Development since 1955. Assigned to the 82nd Airborne Division in June 1960, he served as assistant commander until April 1961, when he became division commander.

In July 1962, he was assigned as chief of the Joint U.S. Military Assistance Advisory Group in Thailand. In April 1963, he became deputy commanding general, Eighth U.S. Army, Korea.

A 1933 graduate of the U.S. Military Academy, General Conway served in African and European campaigns during World War II. His additional post-war assignments included senior Army adviser, First Republic of Korea Army; Korean Military Advisory Group; and plans officer, Operations Division, Supreme Headquarters, Allied Powers, Europe.

Goulding Succeeds Lennartson As Deputy Assistant SecDef (PA)

Phil G. Goulding has been named Deputy Assistant Secretary of Defense for Public Affairs, succeeding Nils A. Lennartson.

A Washington correspondent for the *Cleveland Plain Dealer* for the past 15 years, he has worked on assignments at the White House, State Department, Congress and national politics. He has concentrated on military affairs involving the Pentagon for the past eight years.

A native of San Francisco, the 44-year-old journalist holds a B.S. degree from Hamilton College, Clinton, N.Y. During World War II he served in the U.S. Navy as an officer.

ASA Accepting Wilks Award Nominees

The second annual Samuel S. Wilks Memorial Award for statisticians will be presented at the 11th Conference on Design of Experiments in Army Research, Development and Testing, Oct. 20-22, at Picatinny Arsenal, Dover, N.J.

Nominations for the award will be accepted until June 30 by the American Statistical Association (ASA), sponsor and administrator of the award and funds donated by Philip G. Rust, retired industrialist of Thomasville, Ga.

The Wilks Award memorializes the late Princeton University professor as one of the Nation's great mathematicians who was responsible for exceptional contributions to both theoretical and applied mathematics.

Dr. Frank E. Grubbs, associate director of the U.S. Army Ballistic Research Laboratories, Aberdeen, Proving Ground, Md., received the initial award presented at the 10th Design of Experiments Conference for distinguished achievements in ballistics research and in mathematical statistics.

Consisting of an honorarium, a citation and a gold medal, the award is given annually for outstanding contributions to the advancement of scientific or technical knowledge in Army statistics.

Considerations for selection include ingenious application of such knowledge, or successful activity in the fostering of coordinated scientific efforts which coincidentally benefits the Department of the Army.

Eligibiles for the award include Government statisticians and those from universities and industry who have made significant contributions to the general field of Army theoretical or applied statistical endeavors.

The ASA awards committee this year includes Dr. Frank E. Grubbs, Ballistic Research Laboratories, Aberdeen Proving Ground, Md. (chairman); Dr. Francis G. Dressel, Duke University, and the U.S. Army Research Office, Durham;

Dr. Churchill Eisenhart, National Bureau of Standards; Dr. Alexander M. Mood, U.S. Office of Education; and Maj Gen Leslie E. Simon (USA, Ret.), Winter Park, Fla.

Picatinny Research Physicist Awarded SARS Fellowship

A Secretary of the Army Fellowship to conduct research in detonation physics has been awarded to Joseph Hershkowitz, a research physicist in the Engineering Services Laboratory, Picatinny Arsenal, Dover, N.J.

Studies will be conducted at the University of Brussels, Belgium, and the nearby Center of Research for the Explosives Industry between June 1965 and June 1966.

SA Fellowship are awarded to Army employees to encourage the discovery, development and increased use of the best creative talents among outstanding career employees. The purpose is to provide them with the chance to participate in activities which permit creative thinking and enhancement of their own abilities in fields important to the mission of the Army. Mutual benefits accrue to the employee, his organization, the command and the Department of the Army.

Picatinny Arsenal is a component of the U.S. Army Munitions Command, a major element of the U.S. Army Materiel Command (AMC). Since the establishment of the Materiel Command in August 1962, 15 AMC employees have received SA Fellowships.

Hershkowitz received his bachelor's degree in physics from City College of New York in 1941 and a master's degree in physics through night school study at New York University. Prior to assignment at Picatinny Arsenal in 1956, he was employed by the U.S. Navy.

11th Design of Experiments Meet Slated

A request for submission of papers with a tentative agenda for the Eleventh Conference on the Design of Experiments in Army Research, Development and Testing was issued recently by the U.S. Army Mathematics Steering Committee.

Scheduled Oct. 20-22, at Picatinny Arsenal, Dover, N.J., the conference will be hosted by the U.S. Army Munitions Command.

Papers dealing primarily with experiments in the predesign phase or with unsolved statistical and probabistic problems will be presented at the clinical sessions. Panel members then will discuss the papers with the authors.

The technical sessions enable scientists to discuss achievements in the broad area of statistics with persons in other Army installations.

Presentation time of papers in clinical and technical sessions normally averages 20 and 30 minutes, respectively, exclusive of time devoted to discussion. A few classified sessions are slated.

An additional feature will be a panel discussion on "Selecting the Best Treatment," presided over by Prof. Robert Bechofer of Cornell University.

Information required for proposed papers includes title and short abstract, name of author and sponsoring activity, type of paper (clinical or technical), presentation time, security classifiication, and equipment needed—slide projector, etc.

Authors from Army installations are requested to submit prospective papers for the clinical or technical sessions to reach the Army Research Office, Durham, N.C., by Aug. 27.

Lt Col Elfert Assigned as Chemical R&D Labs CO

The U.S. Army Chemical Research and Development Laboratories (CRDL) at Edgewood Arsenal, Md., are now commanded by Lt Col Bernard G. Elfert, until recently their administrative officer.

Commissioned in 1949, he was in enlisted service in the U.S. and England during World War II. His military career included assignments as chemical supply officer in Korea and Japan during the Korean conflict and instructor at the Chemical School, Fort McClellan, Ala.

Col Elfert has also served as adjutant and commander of Headquarters Company, 1st Chemical Battalion; member of the Army Chemical Center briefing team; CRDL Headquarters Company commander; and chief of the CRDL Technical Information Division.

Among his military awards are the Bronze Star and the Army Commendation Medal. He holds a bachelor's degree from Jacksonville (Ala.) State College and a master's degree from the Johns Hopkins University, Baltimore, Md. He has also attended the University of Florida, Loyola University and the University of Maryland.

Lt Col B. G. Elfert

CRDL's Dr. Wills Receives Exceptional Service Award

Research accomplishments with therapy for toxic phosphorus compounds, used as basic ingredients in military chemical nerve agents, have earned Dr. J. Henry Wills, Chemical R&D Laboratories, the Army Decoration for Exceptional Civilian Service.

The Army's highest civilian employee award was presented to Dr. Wills, chief, Physiology Division, by General Frank S. Besson, Jr., CG, U.S. Army Materiel Command, at a ceremony in Washington, D.C.

Employed at the Chemical R&D Laboratories since 1947, Dr. Wills is the second key staff member at the research facility to receive the Decoration for Exceptional Civilian Service. Dr. Van Sim, deputy director of medical research, won it in 1959.

The citation stated, in part: "Through his personal efforts and outstanding leadership, Dr. Wills, since 1959, was instrumental in initiating and conducting pharmacological studies which have contributed significantly to advanced knowledge of toxicology and therapy in relation to toxic phosphorus compounds, and improving our capability of defense against such agents . . ."

A native of Richmond, Va., Dr. Wills is a 1934 graduate of Virginia Polytechnic Institute. He earned his master's degree in biochemistry at the Medical College of Virginia (1936), and his doctoral degree in physiology at the University of Rochester, N.Y. (1941).

Dr. J. Henry Wills

He has been a Valentine Fellow in biochemistry at the Medical College of Virginia; a Fellow in physiology and pharmacology at the University of Rochester, and a Porter Fellow of the American Physiology Society at Harvard Medical School. He has also served as associate professor of pharmacology at the University of Rochester and the University of Tennessee.

In 1956, he was the U.S. Army nominee for the Fifth Annual Rockefeller Public Service Award, and two years later was awarded a Secretary of the Army's Research and Study Fellowship.

He is a member of various professional societies and fraternities, president and former treasurer of the Edgewood Arsenal Branch of the Scientific Research Society of America, past president of the Maryland Section of the Society of Experimental Biology and Medicine, and former president of the Mental Health Society of Harford County, Md.

In addition, he is a member of the Toxicology Subcommittee of the Food Protection Committee, National Academy of Science-National Research Council; and a lecturer in physiology and pharmacology on the graduate faculty of the University of Maryland.

He has authored more than 50 scientific publications.

C. B. Sawyer Award Established At Frequency Control Meeting

Establishment of an annual $500 award for technical achievement in frequency control was a highlight of the recent 19th Annual Frequency Control Symposium in Atlantic City.

The C. B. Sawyer Award, the first of which will be presented next year, was announced by W. L. Doxey, technical director of the Electronics Laboratories, U.S. Army Electronics Command, Fort Monmouth, N.J. The award honors the late Dr. C. B. Sawyer, of Cleveland, Ohio, a pioneering scientist in electronics.

Sponsored by the Solid State and Frequency Control Division of the Electronics Laboratories, the symposium attracted more than 600 engineers and scientists from the U.S. and seven foreign countries. Presentation of more than 30 papers featured the world's largest annual meeting on frequency control.

Sponsor of the Sawyer Award is the company he founded eight years ago, Sawyer Research Products, Inc., of Cleveland. Dr. Sawyer regularly attended the annual Frequency Control Symposia until his death in March 1964.

Dr. Herzfeld Moves Up to ARPA Director

Deputy Director of the Advanced Research Projects Agency Dr. Charles M. Herzfeld has been selected to move up to director, replacing Dr. Robert L. Sproull.

Dr. Sproull is expected to leave about July 1 to return to Cornell University, where he was director of the Materials Science Center from 1960 until his appointment to the Department of Defense's Advanced Research Projects Agency in 1963.

Dr. Herzfeld, who has been deputy director since 1963, served two years as director of Ballistic Missile Defense at ARPA. A 1945 graduate of Catholic University with a degree in chemical engineering, he received a Ph.D. degree in chemical physics from the University of Chicago in 1951.

Dr. Charles M. Herzfeld

On active military duty, he served for the next two years as a theoretical physicist at the Ballistics Research Laboratory of the Army Ordnance Corps.

Upon return to civilian life Dr. Herzfeld entered Government service at the U.S. Naval Research Laboratory. He served at the National Bureau of Standards as chief of the Heat Division and as associate director prior to coming to ARPA.

During this Government service, Dr. Herzfeld also was a lecturer at the University of Maryland from 1953-1957 and a professor of physics at Maryland from 1957 to 1961.

A Fellow of the American Physical Society and of the Washington Academy of Sciences, he is also a member of the American Ordnance Association, the Philosophical Society of Washington, and Sigma Xi. He has edited the standard scientific work on temperature and has authored many scientific articles.

Dr. Herzfeld was awarded the Arthur S. Flemming award in 1962 as one of the outstanding young scientists in Government.

Army Harry Diamond Laboratories Demonstrate Digital Computer Without Moving Parts Utilizing Principles of Fluid Dynamics

Application of fluid amplification principles to the basic elements of a digital computer geared to binary logic was demonstrated recently at the Army's Harry Diamond Laboratories (HDL) in Washington, D.C.

The principles of fluid dynamics, which control energy sources without the use of moving parts, were earlier applied to a special purpose penumatic analog computer at HDL, as reported in the March 1965 issue of the *Newsmagazine*, p. 36.

A synchronous full-adder was selected as the circuit capable of performing the functions of a digital computer with the exception of a long term memory capability.

The circuit uses the AND/NOT function, where the binary notation tow bits (binary digits) are combined logically to give 1 AND/NOT 0=1 or 1 AND/NOT=0 with a carry of 1 to be added in the next higher significant column at the next synchronizing clock pulse. This is accomplished with two AND/NOT units serving as a half-added. In combination with a delay line, two half-adders accomplish a full addition.

The delay line consists of AND elements and flip-flops that advance the pulse in synchronism with the clock pulse. This same technique can be used for an input or output register.

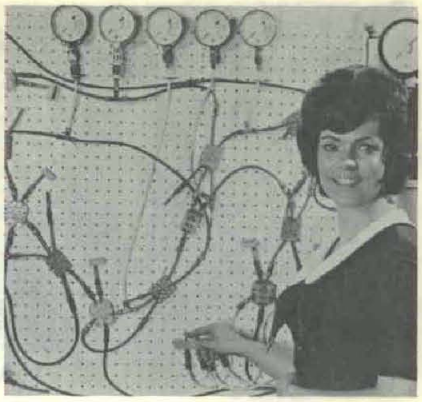
Only the flip-flops have continuously flowing power jets. Remaining elements are passive until they receive flow from a flip flop. This greatly reduces the power requirements, and is possible because of the high gain of the HDL flip-flop. One flip-flop will consistently trigger 16 flip-flops of the same size at the same jet pressure.

The fluid elements in the system, using air, are self-matching. It is not necessary to impedance match the elements when connecting them together in systems. This is accomplished by dynamic bleeds approximately at a right angle to the main flow.

The output of the HDL flip-flop can be completely blocked or unblocked without affecting the flow in the opposite output, i.e., the outputs are decoupled.

When sufficient standardized units become available, any logic desired can be connected into a system. When the desired results are obtained, the circuit can be arranged with standardized templates, photographed, and etched to provide an integrated circuit on a plate.

This previously was done with NOR (Negative-OR) logic, and is now extended to conventional logic, materially reducing the number of elements required (especially the number of active units) as well as the power requirements.



EXPERIMENTAL BINARY COMPUTER, developed at the U.S. Army's Harry Diamond Laboratories, is demonstrated by HDL employee Sandra Dodson. The computer utilizes fluid amplification principles which control energy sources without moving parts.

Although miniaturization of fluid systems is limited by the inter-connections and access into and out of a system, reduction of the number of power jets facilitates the reduction in size, HDL researchers report.

"Coanda Effect" Discoverer Visits Harry Diamond Labs

Dr. Henri Coanda, internationally known as the researcher who discovered the "Coanda Effect," recently visited the Army Material Command's Harry Diamond Laboratories (HDL) in Washington, D. C.

The 78-year-old scientist is the inventor of numerous aircraft instruments and he has completely designed new aircraft. In 1909 he supervised construction of and piloted a jet-powered aircraft which burned on its second flight. His work then was directed to propeller-type aircraft. As recently as 1955-56 he served with the French Ministry of Air as an aeronautical engineering consultant.

In 1955 the *New York Herald Tribune* ran a feature article describing the "Coanda Effect" he had discovered, i.e., the peculiarity of the flow of air or gases to lock on to material adjacent to the flow unless diverted by counter action.

This "lock on" flow characteristic plays an important part in the system of fluid amplification invented by Billy M. Horton, technical director of HDL. Interest in this new control system motivated Dr. Coanda's visit to Washington.

DISTINGUISHED VISITOR Dr. Henri Coanda (second from left), Capt G. B. Riley of the Bureau of Naval Weapons and Billy M. Horton, Harry Diamond Laboratories (HDL) technical director, hear explanation by HDL commanding officer, Lt Col M. S. Hochmuth. The scientist-inventor from France was briefed on the HDL fluid amplification system invented by Horton.

ECOM Engineer Made ACS Fellow

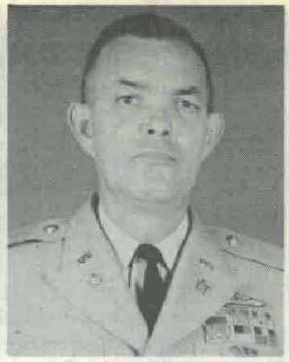
Sam DiVita, supervisory electronic engineer with the U.S. Army Electronics Command, Fort Monmouth, N.J., has been elected a Fellow of the American Ceramic Society (ACS).

Commended by the Department of the Army in 1963 for outstanding work in electronic ceramics, DiVita was selected for his "productive scholarship in ceramic science and notable contributions to the ceramic arts and industry."

A pioneer in ultra-fine-grain ferroelectric ceramics, he has contributed to development of synthetic micas, low-loss microwave insulators, and ceramic substrate materials for thin-film circuits which are helping usher in a new era of smaller and better electronic equipment.

Col F. J. Nemethy

Col R. W. McEvoy



Lt Col H. H. Cooksey

OCRD Summer Personnel Turnover Begins

Col Frank J. Nemethy reported to the Office of the Chief of Research and Development May 1 as chief of the Special Warfare Division, relieving Col Robert W. Garrett, who assumed the position of senior military adviser, U.S. Army R&D Operations Research Advisory Group.

Col Nemethy, who served as senior adviser of the 7th Viet Namese Infantry Division until his present assignment, holds a B.S. degree in education from the University of Georgia (1958) and an M.A. in international affairs from George Washington University in 1961. He is a graduate of the Command and General Staff College and Army War College.

COL ROBERT W. McEVOY reported recently as deputy chief of the Environmental Sciences Division, U.S. Army Research Office, after an assignment as chief of the Inspection Branch, G4 Section, Headquarters EUSA, Korea. Effective June 1, he took command of the U.S. Army Limited War Laboratory at Aberdeen Proving Ground, Md.

From 1959-63 he was commanding officer of the Harry Diamond Laboratories, Washington, D.C., and has served as executive officer of the Feltman R&D Laboratories, Picatinny Arsenal, Dover, N.J. Another major assignment was ordnance representative, U.S. Army Standardization Group-United Kingdom, London, England. He received his bachelor's degree in civil engineering from City College of New York in 1940 and has completed the Ordnance Officer's Advanced Course.

LT COL CHARLES H. SUNDER has been assigned to the Plans Division from the Department of Defense Ad Hoc Working Group on Development Requirements Definition, located in the U.S. Army Research Office. He reported to OCRD in September 1964 and was immediately detailed to the working group. Graduated in 1948 from the U.S. Military Academy, he holds an M.B.A. from American University and is a graduate of the Command and General Staff College.

The assignment of LT COL HOWARD H. COOKSEY, chief, Combat Material Division, as executive to the Chief of Research and Development heads other personnel changes scheduled for June and July.

Col Cooksey will relieve Col David G. Gauvreau, who has been assigned to Army Air Defense Agency, Ft. Bliss, Tex. Previously Col Cooksey served in OCRD from 1954 to 1958, followed by two assignments in Germany. His schooling includes a B.S. degree from Virginia Polytechnical Institute and completion of courses at the Command and General Staff College, Armed Forces Staff College and the National War College.

LT COL REX R. BLEWETT has been selected as the new assistant executive for administration, succeeding the late John Green. Chief of the Foreign Developments Branch, OCRD International Office, until his new assignment June 21, he served from 1958-60 as chief of Reserve Affairs when the office was part of the U.S. Army Research Office Research Support Division. His return to OCRD was preceded by a 3-year tour in Europe and a year at the Army War College.

LT COL WALWORTH F. WILLIAMS, acting assistant executive for administration, will become OCRD assistant executive, about July 1, relieving Lt Col William T. Tucker, who has been assigned to Fort Sill, Okla. Col Williams entered OCRD in February 1964 from an assignment with the student detachment, Headquarters, Third U.S. Army, Fort McPherson, Ga., and served as assistant to Mr. Green until he died.

COL FRANK A. BATES, assigned as defense commander, Headquarters, 5th Regiment, Army Air Defense, Fort Sheridan, Ill., is scheduled to enter OCRD in July, relieving Col John W. Ervin as chief, Nuclear-Chemical-Biological Division.

COL GUY H. DREWRY, JR., ordnance project officer, Nuclear-Chemical-Biological Division, Research and Engineering Directories, U.S. Army Munitions Command, Dover, N.J., is scheduled to be the new deputy chief, Physical Sciences Division, U.S. Army Research Office, filling the spot vacated in May by Col Hubert L. Nolan.

LT COL ROBERT W. SAMUEL, chief of the Chemistry and Materials

DoD Deputy General Counsel Receives Career Service Award

Department of Defense Deputy General Counsel Leonard Niederlehner and nine other Government employees received Career Service Awards of the National Civil Service League at the Annual NCSL awards dinner May 19.

The NCSL is a nonpartisan, nonprofit citizens organization founded in 1881 to promote efficiency in Government. Its Career Service Awards Program is sponsored by business firms, organizations and individuals interested in a quality public service. The Department of Defense (DoD) nominated Niederlehner on the basis of 25 years of superior performance and accomplishments in the Civil Service, stating:

"His career has been characterized by rapid and consistent growth and a record of distinguished achievement in a variety of complex, critical national programs, many of which he initiated and established.

"He is not only an outstanding lawyer by all professional standards but is, by virtue of his dedicated interest in and brilliant understanding of the many facts of Defense policies and programs, a highly competent policy analyst and advisor."

Acting General Counsel of the DoD since Mar. 2, 1964, Niederlehner was graduated in 1937 from the University of Cincinnati College of Law and practiced law in Cincinnati from 1937-40.

In 1960 he received the DoD Distinguished Civilian Service Medal and in 1961 was awarded the Rockefeller Public Service Award.

Leonard Niederlehner

Branch, Physical Sciences Division, has been named to succeed Col Raymond S. Isenson, as chief of the Research Plans Office, U.S. Army Research Office. Col Isenson departed in May to serve in the Office of the Assistant Director for Research, Director of Defense Research and Engineering.

LT COL DONALD P. DOERFLEIN was assigned to the Policy Branch, Review and Analysis Division, after a year as executive assistant J3, Headquarters, Military Assistance Advisory Group, Viet Nam, preceded by tours as instructor in recoilless weapons at the Artillery School and in division operations at the Command and General Staff College. He received his bachelor's degree in education from the University of Omaha in 1964 and is also a graduate of the Command and General Staff College and the Armed Forces Staff College.

LT COL JAMES E. WIRRICK reported to OCRD and was assigned as U.S. Army senior standardization representative to the Australian government, Canberra, Australia. His recent experience has been as an instructor at the John F. Kennedy Special Warfare Center, with the Army Scientific Advisory Panel Secretariat, and the Office, Army Chief of Information. A 1946 graduate of the U.S. Military Academy and 1956 graduate of the Command and General Staff College, he received his M.S. in psychology from the University of Miami in 1962.

MAJ DONALD E. ROSENBLUM, assigned to the Special Warfare Office since entering OCRD in August 1963, has been named to relieve Lt Col Kenneth R. Bull as secretary of the Army Scientific Advisory Panel. Col Bull has been selected to attend the Navy War College.

Recent departures from the U.S. Army Research Office, OCRD, include:

COL THURMOND D. BOAZ, formerly chief of the Special Projects Branch, Life Sciences Division, who has been assigned to the Preventive Medicine Division, Office of The Surgeon General, Washington, D.C.;

COL CHARLES W. COOK, formerly with the Medical and Biological Sciences Branch, Environmental Sciences Division, has been assigned as commanding officer of the U.S. Army R&D Group-Far East in Japan, relieving Col Arvey Sanders, who has returned to Walter Reed Army Institute of Research, Washington, D.C.

AMC, SMC Relocate Certain Staff Elements

Relocation of certain staff elements of the U.S. Army Materiel Command and its subordinate Supply and Maintenance Command to facilitate working relations was announced in May.

Commanding generals of both commands are now located in Building T-7 at Gravelly Point, Va., which has been the Materiel Command Headquarters since the AMC was created in the Army reorganization in 1962.

In explanation of this change, it was stated that the separation of the headquarters of the Supply and Maintenance Command in the Nassif Building at Bailey's Crossroads, Va., and the headquarters of the Materiel Command in Building T-7, about five miles away at Gravelly Point, Va., made it difficult to maintain the essential degree of coordination.

Various elements of the Headquarters of the Supply and Maintenance Command perform staff-type functions for both the SMC and the Materiel Command, it was pointed out, requiring proximity of their offices to AMC working associates.

Consequently, staff elements of the two headquarters were relocated among Building T-7, the Nassif Building and the Naval Weapons Plant in Washington, D.C. Sixty-seven personnel were involved in the move of the Research Division of the AMC Directorate of Research and Development and the AMC Technical Committee Secretariat from Building T-7 to the Nassif Building.

Col Harvey Heads Air Defense at MICOM

Col Clarence C. Harvey, Jr., has been assigned as deputy CG for Air Defense Systems, U.S. Army Missile Command.

Nominated for promotion to brigadier general and confirmed by the U.S. Senate, he will succeed Brig Gen Howard P. Persons, Jr., for the second time when he assumes his new duties. In 1961 he followed General Persons as deputy chief of staff, HQ Seventh Army in Europe.

Col Harvey has been assigned to the Defense Intelligence Agency in the Pentagon since August 1962 and is expected at Redstone in June.

On duty at Redstone Arsenal since August 1963, General Persons has been reassigned as assistant chief of staff for Operations, Training, Plans and Combat Development, Headquarters, U.S. Army Air Defense Command, Ent Air Force Base, Colorado Springs, Colo.

As deputy commanding general, Air Defense Systems, Col Harvey has responsibility for development and management of missile systems designed for defense of Army field units and American cities against the threat of aerial attack.

Graduated from the U.S. Military Academy at West Point in the Class of 1938, he served in various Artillery assignments in the European Theater of Operations during World War II. In 1949 he was graduated from the University of Southern California with an M.S. degree in guided missiles and aeronautics.

He has also completed courses at the U.S. Army Field Artillery School, Fort Sill, Okla.; the Command and General Staff College, Fort Leavenworth, Kans.; and the Army War College, Carlisle Barracks, Pa.

Dr. Killion Designated Chief Scientist for USAEPG

Dr. Lawrence E. Killion has been assigned as chief scientist of the U.S. Army Electronic Proving Ground, Fort Huachuca, Ariz.

As an adviser to the commanding general on technical matters of importance regarding programs of national consequence, he is responsible for providing direction, development, integration and coordination of the varied and highly complex technical programs of the USAEPG.

Dr. Killion was formerly scientific adviser of the Test Directorate at USAEPG, and chief of the Nuclear Quality Assurance Agency with the Albuquerque Operations Office of the Atomic Energy Commission for six years. Before the New Mexico assignment he was with the Defense Atomic Support Agency in Washington, D.C.

A graduate of Baylor University, Waco, Tex., he received his master's degree in physics from Indiana University in 1948 and a doctorate in 1955 at Washington University, St. Louis.

During World War II he served with the Infantry and in 1947 was commissioned in the Air Force. In 1958 he accepted a Civil Service job with the U.S. Atomic Energy Commission.

Dr. L. E. Killion

Lawrence F. Ayers

George Orrell

Dr. John P. Hallowes, Jr.

11 DA Civilians Chosen for Advanced Study Grants

Eleven Department of the Army employees were selected recently for research or study fellowships or to attend military service colleges.

Selected as the Department of the Army civilian choice to attend the 1966 course at the National War College, Washington, D.C., Dr. John P. Hallowes, Jr., is the second R&D scientist in the past three years to win this distinction.

Employed as director of the Physical Sciences Laboratory, R&D Directorate at Redstone (Ala.) Arsenal, Dr. Hallowes was nominated by Maj Gen John G. Zierdt, commanding general, U.S. Army Missile Command.

Dr. Richard A. Weiss, Deputy and Scientific Director of Army Research, was the Department of the Army selectee to attend the National War College in 1964. Currently attending is Merrill T. Kelly, who was assistant chief, Counterintelligence Division, Office Assistant Chief of Staff for Intelligence, when selected.

Qualifications for selection to attend the National War College include an outstanding record in Government career service and a recognized potential for "increasingly important and valuable service to the Department of the Army."

Dr. Hallowes has demonstrated his capabilities since 1948, at which time he was employed at the U.S. Navy Mine Countermeasures Station in Panama City, Fla. In 1951 he transferred to the Army and was assigned to the Guidance and Control Laboratory at Redstone. After six years in the Physical Sciences Laboratory, he became director in 1960.

In 1946-47 he was employed by Curtiss-Wright Corp. in Columbus, Ohio, performing research on guidance electronics for the Atlas missile system. He holds a B.S. degree in electrical engineering from the Georgia Institute of Technology, M.S. degree in physics and a Ph. D. in nuclear physics from Vanderbilt University.

Located at Fort Lesley J. McNair in Washington, the National War College was established in 1946 as a joint educational institution operating under the Joint Chiefs of Staff. The course of study centers around current problems facing Government policy makers. Each class of 132 consists of personnel from the Armed Forces, the State Department and several other civilian agencies.

Department of Army civilian employees selected for fellowships or other service colleges include:

Industrial College of the Armed Forces—James E. Gillis, Jr., chief, Intelligence Division, U.S. Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va.; Dr. Earl D. Heath, chief, Education and Promotion Branch, Safety Division, Office of the Deputy Chief of Staff for Personnel;

Richard L. Milne, chief, Production Planning Division, Procurement and Production Directorate, Headquarters, U.S. Army Weapons Command, Rock Island Arsenal, Ill.; Robert J. Moore, chief, Weapons and Munitions Branch, Supply Management Division, U.S. Army Supply and Maintenance Command, Washington, D.C.; Richard H. Riel, physical sciences adviser, U.S. Army Combat Developments Command Ordnance Agency, Aberdeen Proving Ground, Md.;

U.S. Army War College—John J. Onufrak, acting chief, Studies and Force Analysis Division, U.S. Army Strategy and Tactics Analysis Group, Bethesda, Md.

Career Education Awards by the National Institute of Public Affairs, which enable recipients to attend one of six affiliated universities—Lawrence F. Ayers, Jr., project engineer, Strategic Systems, U.S. Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va., University of Indiana; George Orrell, supervisory general engineer, Engineer Strategic Studies Group, Office of the Chief of Engineers, Washington, D.C., University of Chicago; and Edward A. Schroer, assistant director of instruction, U.S. Army Quatermaster School, Fort Lee, Va., University of Virginia.

Princeton University's Mid-Career Program for Federal Officials—Frank Hinman, Jr., program coordinator and executive assistant to the commanding officer, Sierra Army Depot, Herlong, Calif.

Brig Gen Reichel Named Director of Transportation

Lt Gen Lawrence J. Lincoln, U.S. Army Deputy Chief of Staff for Logistics, has named Brig Gen M. J. Reichel as Director of Transportation.

General Reichel, who will be the Army general staff adviser on transportation, previously served two years commanding the Tobyhanna (Pa.), Army Depot; also one year as CO, U.S. Army Terminal Command, Atlantic, and a year as transportation officer of the United Nations Command U.S. Forces and Eighth U.S. Army, Korea.

Starting his Army career in 1936 as a private, he was commissioned in 1942, serving in the Pacific Theater during World War II with the Corps of Engineers. He transferred to the Transportation Corps in 1950, serving with the Transportation Division, U.S. Army Europe, 1954-57.

In 1958 he was one of several senior officers selected to organize the Logistics Research and Doctrine Division of the Army Logistics Management Center, Fort Lee, Va. After that assignment he commanded the 48th Transportation Group at Fort Eustis, Va.

He is a graduate of the Command and General Staff College and the Industrial College of the Armed Forces. His decorations include the Legion of Merit, Bronze Star with three Oak Leaf Clusters, Philippine Presidential Citation and the Presidential Distinguished Unit Citation.

Brig Gen M. J. Reichel

Hydrogen Generator Advances Fuel Cell Technology

A promising advance in generation of hydrogen for powering fuel batteries, which convert the chemical energy of a fuel and oxidant into electric current, is reported by the U.S. Army Electronics Command, Fort Monmouth, N.J.

The development, carried out for the E-Command's Electronics Laboratories by Engelhard Industries Inc., Newark, N.J., consists of a scaled-down system for simply and efficiently producing the hydrogen from a kerosene-type hydrocarbon fuel and water. The hydrogen can in turn be used in a fuel battery, where it electro-chemically combines with oxygen taken from the air to supply electric power.

Continuing work in the field of fuel batteries-or fuel-cell systems as they are more fully termed—has been receiving major attention in recent years by the military services and industry in this country and abroad. Though still in development stages, fuel-cell systems, which operate silently, have a high potential for providing energy to operate various kinds of electronic equipment for combat.

The new hydrogen generator is a 90-pound "breadboard" (or pilot) model that can be further miniaturized to 35 pounds, according to Stephen J. Bartosh, the engineer in charge of the project for the Power Sources Division of the Army Electronics Laboratories.

Bartosh points out that buying hydrogen outright from large fixed-site plants is costly. Normally it is stored in special pressurized metal cylinders which are heavy and cumbersome to transport. The scaled-down generator, he said, promises a more feasible means for supplying the relatively small quantities which would be used in fuel batteries.

The hydrocarbon fuel that is fed into the reactor is known as BTX-UDEX raffinate. Commercially available at about 25 cents a gallon, it is handled like gasoline and can be transported in ordinary drums and cans.

"Ideally," he explained, "we would like to be able to feed raffinate, or some other hydrocarbon—such as gasoline or kerosene—directly into a fuel cell. Since the state-of-the-art has not yet reached a point, we have taken the course of developing a practical means for field conversion of a liquid hydrocarbon into hydrocarbon we can use in fuel-cell systems."

Essential parts of the hydrogen-producing units include a vaporizer coil, a reactor and a steam-reforming catalyst, a diffusion coil, a startup burner, an operational burner and a hand-operated pump which compresses air in a tank to force the raffinate and water to the reactor.

The process works like this:

The startup flame, which itself burns raffinate, heats the vaporizer coil and reactor. The proper proportion of water and raffinate are then fed into the system. The fuel and water are vaporized and enter the reactor. There the conversion to hydrogen occurs with the aid of the steam-reforming catalyst.

After reaching the required temperature, the startup burner is turned off, and the process becomes self-sustaining by burning the 'off-gases," composed of methane, carbon monoxide, and a measure of hydrogen in the operational burner.

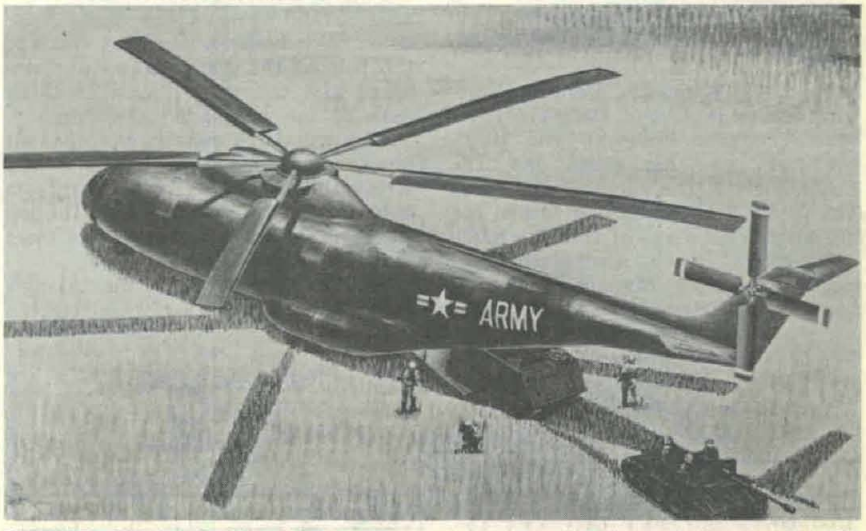
When the operational temperature and the required pressure are reached, the hydrogen, still mixed with the unwanted gases, passes through an alloyed diffusion coil, which is highly selective in permitting passage of that element only. The delivered product is ultra-pure hydrogen.

Produced at the rate of about 10 standard cubic feet an hour, the output is sufficient to supply the fuel for a 500-watt fuel battery. One of the major objectives in the Laboratories' research and development program in the field is a 2-unit portable system, consisting of such a fuel battery and its hydrogen generator, with a combined weight of 70 pounds.

"For the purpose we have in mind —use by troops in the field—we have emphasized low weight, the self-sustaining features, and ease of operation in the reactor's design," Bartosh stated. "Time is, of course, another important item, and here we have the whole process down to approximately 30 minutes—from startup to the rated delivery of the hydrogen."

As for the fuel batteries themselves, they have a basic similarity to dry batteries. A notable exception is that the activant chemicals in ordinary batteries are self-contained; when the energy that is convertible into usable electricity is depleted, they must be thrown away.

In a fuel battery, hydrogen or some other fuel is fed in from an outside source to the anode, (positive pole), and oxygen (air can be used) or some other oxidant is fed to the cathode. This efficient method for converting chemical energy into electricity continues as long as the fuel and oxidant are provided. There is nothing to wear out, since the electro-conversion process takes place within the fuel battery itself without any open flame or moving parts.



DESIGN OF A HEAVY-LIFT rotor system to enable Army helicopters to fly troops and military vehicle-weapons weighting up to 20 tons into forward combat zones is under study at the Lockheed-California Co. The giant aircraft (artist's concept above), minus cargo, is designed to travel 2,200 air-miles nonstop without refueling. Turbine-powered, it would be 111 feet long, have a rotor blade diameter of 100 feet, and be operated by a 3-man crew. The study is one of several being sponsored by the Transportation Research Command, Ft. Eustis, Va., the Army's primary aeronautical research agency.

1,000 Industry Executives Attend Advanced Planning Briefing

Key officials of the Department of Defense (DoD) and the Military Services addressed more than 1,000 executives of major firms at a recent Advanced Planning Briefing for Industry in Washington, D.C.

Sponsored by the DoD and the National Security Industrial Association (NSIA), the sessions were the fifth of a series of briefings since early March to provide a DoD-wide picture of long-range development needs; also, to assist industry in planning for and seeking Defense contracts. Briefings in Los Angeles, New York, Chicago and Dallas attracted almost 4,000 business and industry officials.

Principal speaker for industry at the Washington sessions was Thomas Meloy, chairman of the board of Melpar, Inc., and vice president and trustee of the NSIA. Director of Defense Research and Engineering Dr. Harold Brown outlined major DoD objectives, the programs designed to implement them and changing patterns in Defense spending.

Introductory remarks were made by Joseph A. Califano, Jr., special assistant to the Secretary and the Deputy Secretary of Defense.

Dr. Alain C. Enthoven, Deputy Assistant Secretary of Defense for Systems Analysis (Comptroller), discussed "Five-Year Force Structure and Financial Program." His talk covered the Defense annual planning cycle, the decision process and the essential elements of industry planning.

Fred A. Payne, Jr., Deputy Director for Strategic and Defensive Systems (Defense Research and Engineering) gave his views on "The Technological Challenge of the Next Ten Years," outlining the future for industry in all areas of Defense R&D.

James W. Roach, Assistant Director, Engineering Management (Defense Research and Engineering), spoke on "Management Trends in Defense Development and Production." Current and planned management programs to achieve more effective control of weapons acquistion and support were explained. He covered use of Government facilities, program management, project definition phase, PERT and configuration and change control, small business, DIAC activities, contractor performance evaluation, economic adjustment and contracting trends.

Paul H. Riley, Deputy Assistant Secretary of Defense for Material Requirements (Installations and Logistics), reviewed "The Defense Cost-Reduction Program." This was a discussion of the success and effect of the cost-reduction program and the role of business, industry and labor in continuing cooperative activities.

Daniel M. Luevano, Assistant Secretary of the Army (Installations and Logistics) outlined the "Army's Advanced Planning Requirements."

Detailed presentations followed by General Frank S. Besson, Jr., CG, U.S. Army Materiel Command; Maj Gen John G. Zierdt, CG, U.S. Army Missile Command; Brig Gen Howard F. Schiltz, CG, Army Aviation Materiel Command; Maj Gen Frank W. Moorman, CG, U.S. Army Electronics Command; Maj Gen Roland B. Anderson, CG, U.S. Army Weapons Command.

General Besson reviewed the Army's mission and some of the recent technological advances. He also clarified the role of the Army Material Command and the part played in it by each of the commodity commands.

In addition to hardware and weapons procurement, he reported that the Army this fiscal year will buy from industry approximately $2.5 billion worth of goods and services to meet operational needs.

General Besson said the Army's sizable and continuing requirements are "an ideal market for the small businessman. You do not need large production facilities or an extensive staff of scientists and engineers to do business with the Army. . . . All categories of industry, both large and small, have an important place on the Army-industry team."

To encourage unsolicited proposals, General Besson stated that the Army spent close to $11.5 million exploiting the 1,600 unsolicited proposals submitted during the past 2½ years. He also explained the Army's new Advanced Planning Procurement Information (APPI).

The APPI will include pertinent historical facts about each item and the Army's planned procurements during the next six years—quantities, monthly production rates and anticipated methods of procurement, if that information is available.

General Zierdt, in his presentation on the U.S. Army Missile Command, stated that in FY 66 the Army will spend about $750 million on its missile and rocket programs—more than 50 percent for R&D.

Funding for procurement of current missiles and equipment is decreasing, he said, but pointed to three newer systems which could involve substantial hardware buys: the Redeye shoulder-fired antiaircraft missile, the TOW wire-guided antitank missile and the Lance ballistic missile.

He listed current needs as follows:

- New means of target acquisition and ways of packaging missile defense systems for maximum compactness and mobility.
- An effective antitank weapon for the individual soldier that is a lightweight, easily operated, direct-fire weapon.
- Propellants with very high burning rates and some solutions for the structural and aerodynamic problems caused by the terrific velocities such propellants produce.
- A completely out-of-line-of-sight missile capability and man-portable Laser illuminator and other Laser battlefield applications.
- Multipurpose missiles and lighter weight missile ground support equipment.
- Applications of pure fluid control systems.

In his concluding remarks, General Zierdt pointed out that the Redeye originally began as an unsolicited industry proposal.

General Schlitz discussed activities of the Army Aviation Materiel Command and its parent U.S. Army Mo-

CHART 1

FINANCIAL SUMMARY BY PROGRAM

($ Billions, Fiscal Years)

(Total Obligational Authority)

Major Program	1962 (Orig.)	1964	1965	1966
STRAT. OFF.	7.6	7.3	5.3	4.5
CONT. DEF.	2.2	2.1	1.8	1.8
GEN. PURPOSE	14.5	17.7	18.1	19.0
AIRLIFT/SEALIFT	.9	1.3	1.5	1.6
R&D	3.9	5.3	5.1	5.4
OTHER	15.8	18.1	19.0	19.4
TOTAL OBLIG. AUTH.	44.9	51.9	50.9	51.7
FINANCING	-1.3	-.9	-1.1	-3.2
NEW OBLIG. AUTH.	43.7	50.9	49.7	48.6

CHART 2

FINANCIAL SUMMARY BY BUDGET CATEGORY

($ Billions, Fiscal Years)

(Total Obligational Authority)

Budget Category	1964	1965	1966
MILITARY PERSONNEL	14.2	14.9	15.0
OPER. & MAINT.	11.7	12.5	12.5
PROCUREMENT	15.8	14.0	13.9
RDT&E	7.1	6.6	6.8
CONSTR. & HOUSING	1.7	1.6	2.1
OTHER	1.3	1.3	1.5
TOTAL	51.9	50.9	51.7

bility Command. He cited the experimental 1¼-ton cargo truck as a good example of a substantial program that originated as an unsolicited proposal and will involve an anticipated $50 million of procurement over the next several years. Such unsolicited proposals, he said, are essential to continued success.

In the aviation field, his command hopes to begin in the near future an industry competition for development of an advanced compound helicopter combining the efficiency of the helicopter in vertical flight with the efficiency of a fixed-wing aircraft in forward flight.

General Schiltz reviewed Army needs for continued development of amphibious vehicles; lightweight, precise, power-turbine generator units; practical fuel cells; new sources of energy and propulsion systems for heavy equipment; lightweight materials and engineering and design for bridges; lighter and more sensitive mine detectors, including aerial detection devices; and new materials and methods for mass production of high-quality lenses for night-vision devices.

General Moorman discussed the six major areas of the Army Electronics Command programs—Communications, Combat Surveillance and Target Acquisition, Automatic Data Processing, Avionics or Aircraft Electronics, Image Interpretation and Electronic Components.

Among promising and vital areas of R&D he listed are automatic switching; vehicular-mounted, man-packed, single-sideband and tropospheric scatter radio sets; airborne surveillance; data processing systems for handling tactical information and analysis; microelectronics and fuel cells.

"On the strategic side," he said, "we need better worldwide communications nets. On the tactical level, modern combat concepts of highly mobile, well-dispersed striking forces impose new demands for command control and fast exchange of data and other information."

Referring to needs in battlefield surveillance, General Moorman stressed microelectronics requirements for low weight, small size, high reliability and low-cost mass production. Advanced work in transistors he called a "wide open field."

To encourage the small businessman, he pointed out that the Electronics Command has usually awarded directly to small business 18 percent of its procurement contracts and 10 percent of the R&D money. "The increasing sophistication of systems may affect this proportion to a degree," he said, "and the prime contractor may possibly depend in a greater number of instances on the specialized talents of the small firm."

General Anderson reviewed such current Weapons Command programs as the M60A1 and the General Sheridan tanks, the Combat Engineer Vehicle, Armored Launched Bridge, M109 self-propelled 155 mm. Howitzer, the Mechanized Infantry Combat Vehicle, the XM21 Machinegun-Rocket Launcher and the M5 40 mm. Grenade Launcher.

"In fire control," he commented, "we are exploring more sophisticated systems which will be less complicated to operate and will more nearly approach an all-weather capability. In the vehicular armanent field, we are working for cannon with higher velocity, more rapid rates of fire and improved accuracy."

Additional needs General Anderson stressed are:

- In combat vehicles, better cross-country capability, an engine that efficiently uses more than one fuel, more rugged track and suspension systems, better swimming ability as well as improved armor and better tank-defeating armament.
- In aircraft weaponization, configurations specifically designed for aircraft of very lightweight with reduced or eliminated recoil and a stand-off fire capabiilty so the aircraft need not be over the target to engage the enemy.
- In aircraft fire control, rapid solutions to range computations, automatic tracking and increased night capability.

One of the features of the Washington briefings was a display of 275 exhibits by contractors, illustrating techniques of saving under the Defense Contractor Cost Reduction Program.

Another highlight for industry representatives was the availability of procurement specialists and counselors from the Department of Defense, the Military Services, Defense Supply Agency, Small Business Administration and the Department of Commerce.

Information on potential DoD purchases totaling $175 million and about 500 current "Invitations for Bid" and "Requests for Proposals" were made available to industry and small businessmen.

Sons, Daughters of R&D Officers Win Scholarships

Officers assigned to research and development or related activities were among the proud fathers of 69 Greater Washington Area high school students selected recently for college scholarships under the National Merit Scholarship Program.

Among the scholarship winners, varying from a minimum of $250 to a maximum of $1,500 annually for four years, were: Bruce H. Vincent, son of Col Dale L. Vincent, Army Director of Technical Information; Jay A. Blewett, son of Lt Col Rex R. Blewett, deputy chief, International Office, Office of the Chief of R&D;

Nancy A. Olenchuk, daughter of Lt Col Peter G. Olenchuk, formerly on the Army Research Office staff and now assigned to the Office of the Joint Chiefs of Staff; Michael B. Jones, son of Maj Ernest O. Jones, Walter Reed Army Medical Center;

Daniel C. Bird, Jr., son of Col Daniel C. Bird, Wayne G. Hawley, son of Lt Col Charles C. Hawley, and Richard J. Dunn, III, son of Lt Col Richard J. Dunn, Jr., Hq, Office of Communications-Electronics;

Patrick R. Hayes, son of Col George J. Hayes, Walter Reed AMC; Teresa D. Palmer, daughter of Col Robert S. Palmer, and John R. Randolph, son of Lt Col Jacob A. Randolph, Office of the Deputy Chief of Staff for Logistics; George H. Duckworth, son of Col George H. Duckworth, U.S. Army Combat Developments Command.

Scientific Calendar

Gordon Research Conference on Coal Science, New Hampton, N.H., July 5-10.

Applied Mechanics and Fluids Engineering Joint Conference, sponsored by the American Society of Mechanical Engineers, Washington, D.C., July 6-9.

Meeting of the National Association of Metal Finishers, N.Y.C., July 7-10.

Conference on Colloid, Surface and Macromolecular Chemistry, sponsored by the National Science Foundation, Bethlehem, Pa., July 8-23.

Annual Conference on Nuclear and Space Radiation Effects, sponsored by the Institute of Electrical and Electronics Engineers, Office of Naval Research, National Aeronautics and Space Administration, Atomic Energy Commission, OCRD and the Air Force Office of Scientific Research, Ann Arbor, Mich., July 12-15.

52nd Annual Convention of American Electroplaters Society, N.Y.C., July 12-15.

Regional Technical Conference, sponsored by the Society of Plastic Engineers, Seattle, Wash., July 14-15.

Convention of the International Society of Clinical Laboratory Technologists, Tulsa, Okla., July 22-24.

Positron Annihilation Conference, sponsored by ARO-D, ARPA, National Science Foundation, NASA, Wayne State University and the University of North Carolina, Detroit, Mich., July 27-29.

Reliability and Maintainability Conference, sponsored by the American Society of Mechanical Engineers, American Institute of Aeronautics and Astronautics, Society of Automotive Engineers and the American Society of Technical and Mechanical Engineers, Los Angeles, Calif., July 28-30.

Functions of USARO Physical Sciences Division Outlined

Dr. Ivan R. Hershner has been chief of the Physical Sciences Division since 1959 except for 10 months (1963-64) as scientific director, U.S. Army Research Office (USARO) while Dr. Richard A. Weiss was attending the National War College. Dr. Hershner joined the Office, Chief of Research and Development as a mathematical adviser in 1956. Previously he served as professor and chairman, Department of Mathematics, University of Vermont (1953-56); assistant professor, mathematics, University of Chicago (1947-48). In 1962 he was chief of the Research Division Planning Group for activation of the U.S. Army Materiel Command and has chaired the Mathematics Steering Committee since 1960. He holds B.S., M.A. degrees from the University of Nebraska and M.A., Ph.D. degrees from Harvard University.

Dr. Robert B. Watson, chief, Physics and Engineering Branch since 1960, holds an A.B. from the University of Illinois, M.A. from University of California at Los Angeles, and Ph. D. from Harvard University. He began his career at the Harvard Underwater Sound Laboratory (1941-45) and was assistant professor, then associate professor of physics at the University of Texas (1945-60). During the latter period as a research associate at the Defense Research Laboratory (1945-52). He was a research physicist in the Military Physics Research Laboratory, University of Texas (1952-58). He is a member of many professional societies and his areas of technical specialization include Lasers, acoustical and electromagnetic problems, electromagnetic and acoustic propagation studies.

Lt Col Robert W. Samuel has been chief, Chemistry and Materials Branch since October 1964, after a year in Viet Nam as executive officer, Advanced Research Projects Agency R&D Field Unit, and two years as deputy director for engineering testing, Development and Proof Services, Aberdeen Proving Ground, Md. A 1944 graduate of the U.S. Military Academy and a 1961 graduate of the Command and General Staff College, he received his M.S. degree in mechanical engineering from the University of Michigan in 1957. His decorations include the Silver Star, Legion of Merit with Oak Leaf Cluster, Bronze Star and Distinguished Unit Citation.

Fred Frishman has served as chief, Mathematics Branch, since 1960, after five years as a lecturer in statistics, George Washington University, Washington, D.C., and six years as head of the Mathematics Division, U.S. Naval Propellant Plant, Washington; also statistician, U.S. Navy Bureau of Ordnance 1951-54 and statistician, Naval Inspector of Ordnance, Rochester, N.Y., 1949-51. He has a B.B.A. degree in business statistics from City College of New York and B.A., M.A. from George Washington University where he is studying for a Ph. D. Affiliated with a number of mathematical and statistical professional societies, he is executive secretary of the Army Mathematics Steering Committee. He is a member of the DoD-NASA Liaison Group for Research in Quality Control and Reliability and Joint Services Advisory Group for Research in Mathematics.

Research in the physical and engineering sciences supports the Army Materiel Development Program through creative advances in materials, energy sources and electronic systems to improve Army weapon systems and equipment.

Toward this aim, the U.S. Army Research Office Physical Sciences Division, directed by Dr. Ivan R. Hershner, Jr., is organized into three branches. Physics and Engineering is headed by Dr. Robert B. Watson, Chemistry and Materials by Lt Col Robert W. Samuel, and the Mathematics Branch by Fred Frishman.

The Physical Science Division functions as technical contact at Army General Staff level for the Assistant Secretary of the Army (Research and Development), the Director of Defense Research and Engineering and other staff agencies in matters pertaining to the Army physical sciences program.

The Division also participates in the formulation of plans and programs in assigned areas and supervises the program of the Army Research Office-Durham for the Director of Army Research.

As the Division chief, Dr. Hershner provides the principal advice and assistance on physical sciences research to the Director of Army Research and the Chief and Deputy Chiefs of Research and Development.

Dr. Hershner formulates, coordinates and supervises the execution of policies, plans and programs. He also provides input material to the Annual Army Long-Range Technological Forecast and Army Research Plan.

In addition, he maintains full cognizance of research programs of other military departments, Government agencies and industrial and academic laboratories to determine the impact of these programs on the Army Research and Development Program.

The Physics and Engineering Branch is responsible for staff supervision of research and exploratory development in the fields of physics, electronics, mechanics, aerodynamics and allied areas of engineering.

The Branch provides staff supervision and broad monitorship of related U.S. Army Materiel Command (AMC) programs, reviews appropriate AMC budgets and programs, and gives scientific advice to the Chief of Research and Development, the Army staff and the Office of the Secretary of Defense.

Members of the Branch are responsible for Army staff supervision and monitoring of Joint Service contracts in electronics; also, monitoring the physics, electronics and mechanics research programs of the Army Research Office-Durham (ARO-D) and foreign Army research offices.

Boards, committees and groups to which the Branch furnishes Army membership include the Advisory Group on Electronic Devices, and the DoD Special Group on Optical Masers. It also supplies liaison to the Advisory Group on Air Research and Development (AGARD), North Atlantic Treaty Organization (NATO).

The Branch designates the Army member to five subgroups or working panels of the Tripartite Technical Cooperation Program (TTCP), including the areas of infrared and exterior and interior ballistics.

The high-powered and versatile light source known as the Laser is one of the most important and promising areas of research monitored by the Branch. Research is concerned with more efficient materials for Laser sources and possible applications. Fundamentals of basic theory underlying Laser operations are being investigated and feasibility of systems applications are being examined and reexamined as the state-of-the-art develops.

Coordination of all work in the area of Lasers is accomplished by the Special Group on Optical Masers, established by the Director of Defense and Engineering.

Army in-house research produced a successful Laser range-finder within three years from the first achievement of a working Laser.

Future applications of the Laser currently forseen include optical radars, target illumination for guided missiles equipped with optical homing devices, new surveillance and communications systems, better data processing systems, reliable optical identification and navigational devices, and weapon systems.

U.S. Army Missile Command scientists recently confirmed that certain malignant tumors or cancer in mice can be destroyed by infrared Laser radiation. (See p. 12, May 1964 issue of *Newsmagazine.*)

On Feb. 17, 1965, the Army announced that a single pencil-thin Laser light beam was utilized to relay simultaneously the signals received from all seven of the television channels broadcasted from New York's Empire State Building, providing a needed enlargement of communications capabilities for general and military use.

The ballistic research program also is monitored by the Physics and Engineering Branch. It involves the study of the motion of projectiles as a particular branch of applied mechanics; also, the related fields of physics, chemistry, mathematics and engineering.

Ballistic research seeks to facilitate the development of weapons and missiles which have better initial characteristics, improved flight performance and maximum terminal effectiveness at target arrival. It also provides data as a basis for developing a defense against enemy weapon capability.

Pure fluid systems research, one of the major efforts monitored by the Branch, aims to improve the technique of using a relatively powerful stream of fluid, such as the jet from a missile, to control a relatively weak stream when properly directed and positioned.

Use of this technique promises devices with greatly increased ruggedness, reliability and shelf life because they can provide amplification and control without any moving parts and without the use of electrons. The devices are also simple and inexpensive to manufacture.

The potential applications cover a variety of fields, such as missile attitude and control, power steering of vehicles, control of thrust in missiles and rockets, fuel control systems in vehicles, autopilot and stabilizing devices for aircraft, and computer elements.

A pure fluid controlled computer without any moving parts was recently developed by the Harry Diamond Laboratories, under the U.S. Army Materiel Command. (See p. 36, March 1965 issue of *Newsmagazine.)*

The Chemistry and Materials Branch has primary responsibility for staff supervision of research and assigned exploratory development in chemistry, materials, and energy conversion, and miscellaneous activities related to R&D in these areas.

Responsibilities include staff supervision and broad monitorship of related AMC programs, reviewing budgets and programs of AMC, and providing scientific advice to the Chief of Research and Development, Army staff and the Office of the Secretary of Defense (OSD).

Members of the Branch also monitor the chemistry, materials and energy conversion research program of the Army Research Office-Durham, the foreign offices of the U.S. Army Research Office, and the materials program of the Office of the Chief of Engineers.

Membership is provided to such boards, committees and groups as the AGARD Chemistry and Propulsion Panel and Structures and Materials Panel, the Office of the Secretary of Defense Coordinating Group on Materials, the Interagency Advanced Power Group and the TTCP Working Panels on Organic and Inorganic Materials, Explosives, Propellants and Methods of Test and Evaluation of Materials.

One of the major research areas monitored by the Branch is research on explosives designed to produce a much higher yield for use in artillery shells, bombs, demolition charges and other devices. Significant achievement here will reduce the requirement for tactical nuclear warheads.

To better understand the theory of the explosive process, fundamental studies are being performed in such areas as thermochemistry, molecular bonding and radiation chemistry.

All Army weapons have been and future weapons will be dependent upon this research. Evolved from this research are such innovations as the atomic cannon, recoilless rifle, optimum fragmentation warhead and shaped-charge shells.

In addition to explosives research, the major portion of the U.S. Army supporting research program on propellants is monitored by the Branch. This effort includes liquid and solid-gun propellants and hybrid and solid-rocket propellants.

Objectives include improvements in the stability and physical properties of conventional propellants and their mechanism of reactions. Studies to provide major improvements in propellant energy content have a high priority in the program. Improvements in propellants will lead to better, more effective weapons, increased systems reliability, and new weapon systems.

Another important research area is energy. The major objective is to improve conversion efficiency of basic energy materials to electrical power. Different types of energy conversion approaches for a multitude of applications are being investigated, such as fuel cells, batteries, thermoelectrics, thermionics and thermovoltaic converters.

The need for energy conversion research is becoming increasingly more important because of the dependence of combat effectiveness upon electrical power. Communications, fire-control, surveillance and vehicular operations are some of the major areas wholly or partially dependent upon electrical power.

(Continued on page 18)

Functions of Physical Sciences Division Outlined

(Continued from page 17)

The Branch also is concerned with the important area of research in materials for Army weapons and combat mobility, involving physical properties and special fabrication techniques for metals, plastics, rubber, ceramics and composites.

A constant search is conducted for materials which are lighter but much stronger, will withstand extreme temperatures, absorb great energies delivered by impact, and will shield against radiation with acceptable weight penalties.

The Mathematics Branch has primary responsibility for staff supervision for research and exploratory development programs in the mathematical and informational sciences; also, miscellaneous activities related to research in mathematics.

In addition to review of appropriate budgets and programs of the AMC and participation in necessary justification to the Chief of Research and Development, Army staff and the Office of the Secretary of Defense, the Branch also:

Promotes and maintains contact with national and international mathematical organizations; provides detailed monitorship of the mathematical aspects of the informational sciences program, including staff actions on computer utilization, machine translation of languages, information retrieval and computer oriented problems;

Supervises the Mathematics Research Center, U.S. Army, and monitors the mathematics research program of the Army Research Office-Durham and the foreign Army research offices.

The Branch also provides membership as required on the following boards, committees and groups: Chairman, Army Mathematics Steering Committtee; Interagency Committee on Mechanical Translation Research; Joint Services Advisory Committee for Research in Applied Mathematics and Statistics; Interdepartmental Liaison Group for Research on Statistical Control; Interagency Group for Research in Information Systems.

Under Branch monitorship, the Army Research Office-Durham initiates contracts and grants in the Mathematical Sciences. Researchers at the Mathematics Research Center, Madison, Wis., are selected because of competence in specific areas of mathematics which have Army relevance.

An example of research being conducted in the fundamental area is the unification of theories which apply to diverse phenomena and which superficially seem unrelated. One project resulted in the reduction of tables needed for statistical research and analysis.

Another project is concerned with the rounding out of existing mathematical theories and the application of advanced mathematical concepts to the solution of military problems.

Examples of the applied activities of the Mathematics Research Center are: 1) suggestions leading to the solution of a specific non-linear equation rising frequently in Operations Research; 2) assistance in the solution of many problems in hydrodynamics such as turbulence, currents and the rise and fall of tides; and 3) procedures for solving certain problems occuring in the application of electronic computers to military problems.

The Physical Sciences Division is also responsible for monitorship of basic research in the physical sciences. These projects support the Army's in-house basic research program in the disciplines of physics, chemistry and mathematics.

More than 200 separate investigations are being carried out in the various Army laboratories and facilities. Results of these investigations are disseminated through published papers, reports and conferences.

The in-house basic research program is closely coordinated with the external or contract program. Scientific personnel engaged in research in the in-house basic research program are available for consultation and guidance on Army problems within their field of competence.

In so doing, they enhance the coupling important in translating the advances in scientific knowledge into meaningful military applications.

USACDC Evaluates Field Radar

The U.S. Army Combat Developments Command (USACDC) Evaluation Group-Project Michigan conducted a field radar evaluation in conjunction with Exercise Silver Hand, a joint Army-Air Force maneuver, May 1-15, at Fort Hood, Tex.

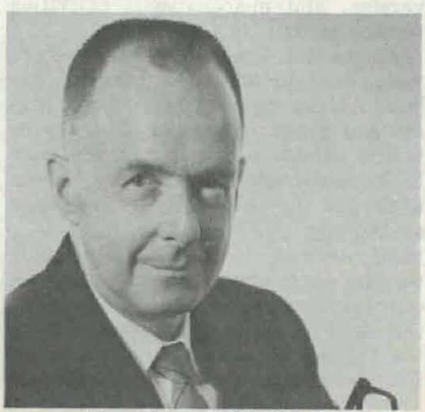
The group evaluated a repetitive area search—moving target indication radar concept of combat surveillance developed by the University of Michigan Institute of Science and Technology. The concept was developed as part of a long-term project for the Army.

Headed by Lt Col William D. Meara, the USACDC Experimentation Command's Project Team 3 of Fort Ord, Calif., provided the nucleus of the evaluation group. Working with them were 80 personnel from the University of Michigan and 35 members of the U.S. Army Electronics Command, Fort Monmouth, N.J.

Research Institute Names General Clark to Key Post

Maj Gen Chester W. Clark, who retired from the Army May 31, is the new vice president of Research Triangle Institute, Durham, N.C., a non-profit corporation conducting research in the physical, biological, medical, mathematical, agricultural, economic and engineering sciences.

General Clark's retirement came a month after leaving his assignment as CG, U.S. Army Japan. There he was presented the Distinguished Service Medal by the U.S. Forces Japan Commander, Lt Gen Maurice A. Preston, for "exceptionally meritorious service in positions of great responsibility from March 1959 to May 1965.



Dr. Chester W. Clark

Backed by 38 years of Army service as a Regular and Reserve officer, General Clark holds B.S., M.S. and Ph.D. degrees and is a former Director of Army Research. (For complete biography, see April 1965 edition, p. 12.)

The Institute is associated on a contract basis with the University of North Carolina, North Carolina State and Duke University. Situated within 30 miles of each other, they form a geographical triangle — hence the designation Research Triangle Institute.

The U.S. Army was one of the first organizations to recognize and use the wealth of research talent available in this unusual academic research complex.

MICOM Consolidates Contract Negotiations

The U.S. Army Missile Command is rapidly completing consolidation of all contract negotiations for Army missile systems and related equipment within the Procurement and Production Directorate.

Col B. A. Saholsky, a veteran Army procurement officer, heads the directorate at Redstone Arsenal, Ala. The Program of centering all contract negotiations for Army missiles is an outgrowth of Army reorganization directed by Defense Secretary Robert S. McNamara.

Increased responsibilities resulting from the consolidation have added more than 420 personnel spaces, primarily to permit the negotiation annually of between $600 and $700 million worth of missile contracts. About half of the personnel spaces went to out-of-state plants under the Procurement and Production Directorate.

Since other organizations of the Missile Command also received heavier workloads as a result of the shift, 96 personnel spaces were added to cover responsibilities in several other offices including General Counsel, Finance and Accounting and Reproduction.

Under the old system, missile requirements calling for contracts were established at the Missile Command, but were then turned over to one of 11 Army Procurement Districts located throughout the industrial centers of the country.

The districts then negotiated the contracts with industry for the Missile Command, and thereafter supervised contract administration at the various contractor plants.

The revised plan calls for contract administration by regional offices of the Defense Contract Administration Service (DCAS), much as they were administered in the past by Army procurement districts. Their duties include expediting production after the contract is awarded, inspection, reviewing work progress, and making pre-award surveys of prospective contractors' plants.

As an exception to the DCAS responsibility, the Missile Command has full cognizance of contract administration as well as execution at five plants involved in missile work. These are in Andover, Mass.; Orlando, Fla.; Salt Lake City, Utah, and two at Redstone Arsenal.

Since the Missile Command had not previously accomplished contracting for its major missile systems' requirements, it was necessary to bring together an experienced team. Qualified missile procurement people have moved in from Birmingham, Boston, Cleveland, Cincinnati, St. Louis, Los Angeles and Philadelphia Procurement Districts.

Brig Gen McGibony Named Deputy Surgeon General

Brig Gen James T. McGibony, MC, succeeded Brig Gen Conn L. Milburn, Jr., MC, effective May 15, as Deputy Surgeon General of the Army, marking his fifth tour of duty in the Office of The Surgeon General.

General Milburn's new assignment is commandant of the Brooke General Hospital, Brooke Army Medical Center, Fort Sam Houston, Tex., where General McGibony served as commandant of the Medical Field Service School until moved to his new duties.

Graduated from Emory University in Atlanta, Ga., in 1935 with an M.D. degree, General McGibony entered the Army that same year and served his internship at the Fort Sam Houston station hospital. He holds a master of Public Health degree from Johns Hopkins University and an MBA degree from George Washington University.

During the early construction of Tripler General Hospital in Hawaii, he was commanding officer and held the same title plus that of post surgeon during erection of DeWitt Army Hospital at Fort Belvoir, Va., 1952-55. He was surgeon of the Okinawa Command and CO during construction of the hospital there (1955-58).

Graduated from the Industrial College of the Armed Forces at Fort Lesley J. McNair, Washington, D.C., in 1959, he is a member of Phi Beta Kappa, the American Medical Association, the Association of Military Surgeons, American Public Health Association, American Hospital Association and the Royal Society of Health.

General McGibony also was the first Army Fellow, American College of Hospital Administrators, and is a Fellow of the American College of Preventive Medicine and the American Association for the Advancement of Science. He is also a member of American College of Physicians.

Brig Gen Conn L. Milburn, Jr.

Brig Gen James T. McGibony

Moot Named Deputy ASD For Logistic Services

Realignment within the Office of the Assistant Secretary of Defense (Installations and Logistics) recently installed Robert C. Moot in the newly created position of Deputy Assistant Secretary of Defense (Logistics Services).

Paul H. Riley, who was Deputy Assistant Secretary of Defense (Supply and Services), became Deputy Assistant Secretary of Defense (Materiel Requirements). He is responsible for management and policy associated with requirements for and production of weapons, major end items of equipment, repair parts and soft goods, supply management systems, and petroleum logistics.

A career Civil Service employee for 18 years, Moot was the first comptroller of the Defense Supply Agency and served from 1961 until he accepted his new duties including: policy formulation and management in telecommunications, transportation and warehousing contract support services, and the Defense cost-reduction program.

His previous Government service has included director for Supply Management Policy in the Office of the Assistant Secretary of Defense (Supply and Logistics) and several years as comptroller of the Bureau of Supplies and Accounts, Navy Department. He served in the U.S. Army during World War II.

6 DoD Civilians Earn Distinguished Service Awards

SECRETARY OF THE ARMY Stephen Ailes (right) and Assistant Secretary of Defense (Manpower) Norman S. Paul (left) congratulate Willard J. Turnbull (second from left), Dr. Elson B. Helwig (center) and Victor Lindner as recipients of the Department of Defense Distinguished Civilian Service Awards in recent ceremonies held at the Pentagon.

The Department of Defense Distinguished Civilian Service Award was presented May 10 to six DoD civilian employees by Assistant Secretary of Defense (Manpower) Norman S. Paul on behalf of Secretary of Defense Robert S. McNamara.

In attendance were the Secretaries of the Military Departments and other high-ranking officials. Recipients and portions of their achievement citations are:

Victor Lindner, deputy director of the Ammunition Engineering Directorate, U.S. Army Materiel Command's Picatinny Arsenal, Dover, N.J., "in recognition of his extraordinary contributions to efforts to increase the total non-nuclear military strength of the United States.

"Mr. Lindner's leadership and technical abilities have resulted in a spectacular increase in the efficiency of anti-tank munitions, munitions for the infantry and artillery, warheads for missiles and rockets and in aircraft and antiaircraft munitions."

His "creative force and exceptional technical abilities have led to improvements which have tremendously strengthened the combat capabilities of the Armed Forces and warrant recognition at the highest level in the Department of Defense."

Willard J. Turnbull, chief, Soils Division, U.S. Army Engineering Waterways Experiment Station, Vicksburg, Miss., "in recognition of his outstanding contributions to the field of soil mechanics and related physical sciences.

"Mr. Turnbull's broad engineering knowledge and exceptional managerial ability greatly advanced the knowledge of soil engineering and the capability of the Department of Defense to successfully support military operations under a wide range of different and difficult conditions.

"The development under Mr. Turnbull's leadership of many new methods and procedures for experimentation, their practical application and heuristic results, reflect great credit upon himself and the Department of Defense."

Dr. Elson B. Helwig, chief, Department of Pathology, Armed Forces Institute of Pathology, Washington, D.C., "in recognition of his dynamic leadership of the Armed Forces Institute of Pathology and his significant contributions to medical knowledge.

"Dr. Helwig's work on the biological effects of Laser radiation, in dermato and gastrointestinal pathology, and his writings and teachings in the field of pathology have played an important part in elevating the Armed Forces Institute of Pathology to a position of worldwide recognition and reflect great credit and distinction on himself and on the Department of Defense."

Jack L. Stempler, senior assistant general counsel, Office of the Secretary of Defense, "in recognition of his outstanding services in providing legal advice to statutory officials of the Office of the Secretary of Defense over the past 17 years on sensitive and critical aspects of national security problems."

Dr. F. Joachim Weyl, deputy chief and chief scientist, Office of Naval Operations, Washington, D.C., "in recognition of 20 years of distinguished service in the Federal Government as a creative scientist and administrator of exceptional talent and far-reaching influence on both national and international sciences."

Dr. John W. Evans, director of the Air Force Sacramento Peak Solar Observatory, Sun Spot, N. Mex., "in recognition of his exceptional contributions to theoretical and experimental research and his scientific leadership of the Sacramento Peak Solar Observatory since its inception in 1952."

Col Emerson Takes Command of USASCC-South

The U.S. Army Strategic Communications Command's new major subordinate command, USASCC-South, at Fort Clayton in the Canal Zone, has been placed under the command of Lt Col Robert J. Emerson.

USASCC-South supervises the operations of seven STRATCOM facilities in Central and South America, including the STARCOM Facility in the Canal Zone, and facilities at La Paz in Bolivia, at Guatemala City Guatemala, and at San Jose, Costa Rica; also, at Managua, Nicaragua; at Tegucigalpa, Honduras, and at Quito, Ecuador.

Formerly the deputy commander of STRATCOM's old Southern Field Office in Panama, Col Emerson succeeds Col J. J. Lluy, who remains in his primary job as the Signal Officer, U.S. Army Southern Command.

A Signal Corps officer with some 20 years of military service, Col Emerson was commanding officer of the 3rd Signal Training Battalion of the Army's Southeastern Signal School at Fort Gordon, Ga., prior to his Panama assignment.

A veteran of World War II, where he saw service in the Pacific during the New Guinea, Leyte and Luzon campaigns, he also took part in the several Korean War campaigns.

His unit, formed last Feb. 1, is one of five key subcommands in STRATCOM's global communications complex extending into more than 30 countries.

Lt Col Robert J. Emerson

M113 Contract Tops $153 Million Total

FMC Corp, received the largest recent aggregation of Army research, development and production contracts totaling $153 million.

FMC's share totaled $44,259,148, including $38,442,675 as the first increment of a $111,445,977 3-year buy of M113 vehicles and spare parts. The Army Tank Automotive Center, Warren, Mich., issued the contract.

Three additional contracts to FMC totaling $5,816,473 call for continuation of engineering services, repair, provisioning and maintenance evaluation for vehicles and weapons; 42 tracked trucks and 14 fork lift attachments and bulldozer blade attachments; and shoe assemblies for the M113 personnel carrier.

The M113 is a rugged vehicle which can be airlifted and can swim inland waterways. Capable of carrying a 12-man squad, the M113 can be adapted for use as a carrier for 81 mm. and 107 mm. mortars, a mobile command post, cargo carrier, flame thrower, or a carrier for Mauler surface-to-air missiles.

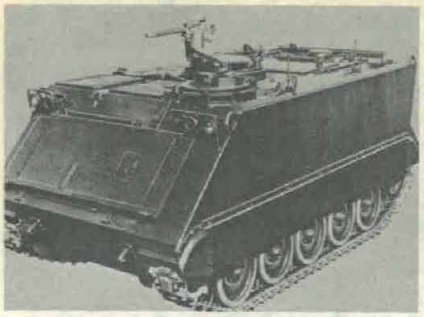
Magnovox Co., Fort Wayne, Ind., was awarded $23,462,116 as the first increment of a $49,853,936 3-year contract for radio receivers of various types. White Motor Co., Lansing, Mich., received a $14,717,430 contract for 2,816 cargo trucks, 2½-ton, for Military Assistance Program-Military Assistance Sales requirements.

Martin-Marietta Corp., Martin Co. Division, Orlando, Fla., was awarded a $11,063,752 contract for research and development work on Project RADA (Random Access Discrete Address), a communication system designed to handle voice, teletype, facsimile, data transmission and reception within an Army combat division.

Remington Arms Co., Inc., Bridgeport, Conn., received a $10,954,110 contract for small arms ammunition. General Time Corp., Westclox Division, LaSalle, Ill., signed a $7,119,962 agreement for ordnance materials.

Hercules Powder Co., Wilmington, Del., was issued a $4,694,250 contract for miscellaneous propellants and explosives. Sperry Rand Corp., Sperry-Utah Co. Division, Salt Lake City, Utah, obtained a $3,234,269 modification to an existing contract for modification kits for the Sergeant missile system, and a $1,170,076 contract for gyro magnetic compass sets with ancillary parts for Army aircraft.

Oshkosh (Wis.) Motor Co. received a $4,310,191 Army contract (Air Force funds) for 75 snow removal units. Ford Motor Co., Dearborn.



M113 Armored Personnel Carrier

Mich., was issued a $2,402,367 contract for 1,687 commercial sedans. Raytheon Co., Lexington, Mass., was awarded a $2,381,784 contract for quality assurance, control and engineering services.

North American Aviation, Inc., Downey, Calif., signed a $2,115,000 contract to develop a mobile medical laboratory unit which will support a field army.

Olin Mathieson Chemical Corp., Winchester Western Division, East Alton, Ill., was issued a $2,005,140 agreement for 5.56 mm. tracer cartridges, Philco Corp. of Philadelphia, Pa., a $2,000,000, modication for classified electronics equipment, and Bell Helicopter Co., Fort Worth, Tex., a $1,570,128 contract for UH-1B and UH-1D Iroquois helicopters.

John R. Hollingsworth Co., Phoenixville, Pa., was issued a $1,485,718 contract for 3,128 generator sets, General Motors Corp. a $1,460,053 contract for 6-cylinder 210 h.p. Diesel engines, and SCM Corp. a $1,399,546 contract for teletypewriter sets (AN/UGC-4 and TT-98/FG) with ancillary items.

Hamilton Watch Co., Lancaster, Pa., was issued a $1,350,300 modification for ordnance items, Pearce and Gresham Co., Decatur, Ala., a $1,332,544 contract for construction of a missile systems calibration facility at Redstone Arsenal, Ala., Emerson Electric Co., St. Louis, Mo., a $1,327,884 fixed-price contract for production of rocket motor inert parts for the Honest John missile system.

Arvin Industries, Inc., Electronic Systems Division, Columbus, Ind., received a $1,291,648 agreement for coder equipment components and Standard Products Co., Cleveland, Ohio, will produce shoe assemblies for the M113 personnel carrier for $1,169,550.

Thompson-Ramo-Wooldridge Space Technology Laboratories, Inc., Redondo Beach, Calif., was awarded a $1,102,000 modification for work on a classified project. Electra Corp., Prestolite Co., Division, Toledo, Ohio, signed a $1,062,185 agreement for 2,564 generators and 8,329 armatures for tactical vehicles.

Specialty Electronics Development Corp. will get $1,046,555 for 288 manual telephone switchboards and 333 telephone signal assemblies, Norris-Thermador Corp., Los Angeles, Calif., $1,044,835 for 105 mm. ordnance items, and Electronic Modules Corp., Timonium, Md., $1,000,000 for classified electronics.

MSTS Sea Lift Offers Drive-on/Drive-off Capability

A Military Sea Transport Service ship which can sail 10,000 miles and swiftly unload tanks, trucks and amphibious vehicles fueled and ready for instant action was launched recently.

Christened the T-LSV-9 Sea Lift, the 21,7000-ton-displacement vessel was described by President Johnson as "one of the greatest ships of its kind ever built" in a congratulatory wire to James G. McCurdy, board chairman of Lockheed Shipbuilding and Construction Co.

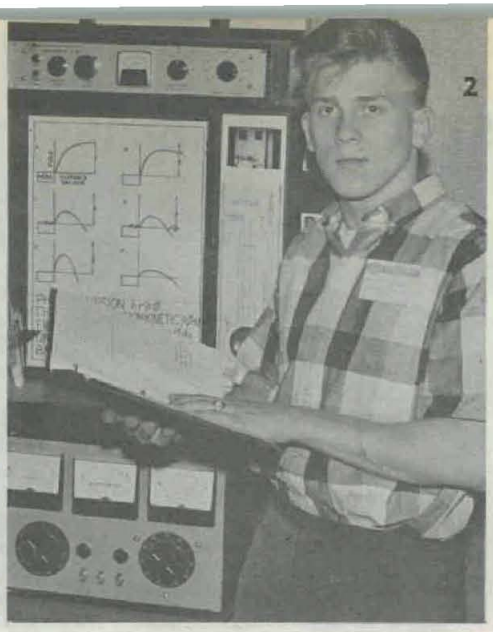
Key feature of the $15.8 million Sea Lift is a drive-on/drive-off capability that employs an integral stern ramp and four dock height side ports. In normal operation, the Sea Lift will dock so the mechanized units can move directly aboard and then, following between-deck driveways, continue under their own power to preassigned parking places.

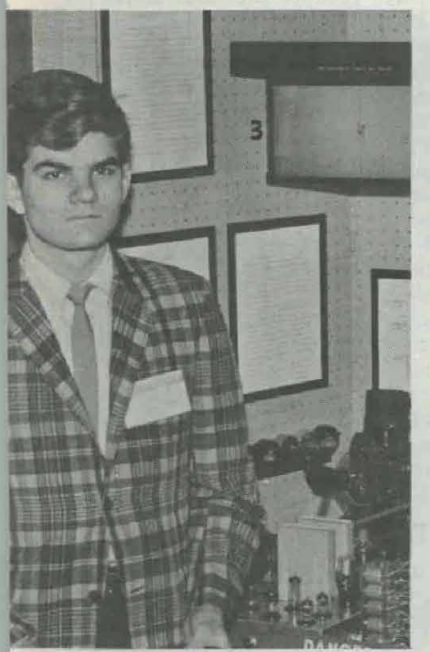
Loaded trailers and semitrailers going aboard will ship out minus tractors to permit more productive use of cargo space. At the arrival port, discharge tractors hook up to trailers and semitrailers for debarkation and self-propelled vehicles drive off unassisted.

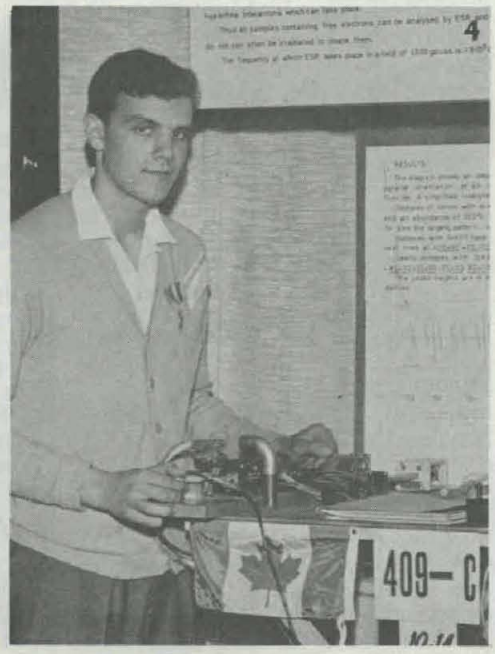
This ship will be capable of discharging cargo from offshore by "marriage" with the Army Beach Discharge Lighter (BDL). The wheeled and tracked vehicles will roll off the transport and onto the BDL, which will take them in for discharge across the beach.

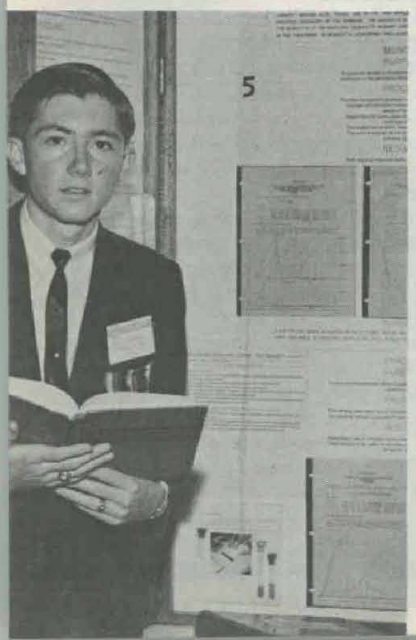
The Sea Lift has a deck area of 99,030 feet—the equivalent of over two acres—is 540 feet long, has an 83-foot beam and depth at the main deck measures 52 feet.

General cargo volume, excluding driveways, will be 946,800 cubic feet. Standard cargo gear is available for circumstances that do not permit external ramp use. Twin screws geared to a steam turbine provide a sustained sea speed of 20 knots at design draft. The keel was laid in May 1964.









Army Selects 20 NSFI W

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Tunnel in Applied Aeronautics."

Each year the NSF-I may be described properly as a "colossal show," a statement supported this year by the 424 students who exhibited their work and also by their teachers who were present to share in the pride of their achievements. The climax was a banquet presided over by Dr. Watson Davis, director of Science Service, the nonprofit organization which conducts the Fair.

Judges who picked 13 NSF-I first award winners from the 424 contestants, each a finalist in regional competition conducted during the past year, had an exceedingly difficult job. The winners were chosen as the best in each of the categories of botany, chemistry and biochemistry, earth and space sciences, medicine and health, physics, mathematics and computers, and zoology.

The many organizations which support Science Service in sponsoring the NSF-I, including the Army, Air Force and Navy, contributed to the success of the 1965 show by making numerous cash and other awards equivalent in many instances to the 13 first-place awards.

Each of the NSF-I first-place winners was given a "Wish Award" for $100 worth of scientific equipment or books of their own choice. Second-place awards of $75 each were made to 15 students and the same number received third-place awards of $50 each. Each of 90 awards for fourth-place winners was good for $25 worth of equipment or scientific books.

Only one of the 20 Superior Award winners selected by the Army judges was among the 13 NSF-I first-place winners. That distinction went to Curtis Bryant, 15, LeMars (Iowa) Community H.S., for his exhibit on "Studying the Solar Atmosphere." Richard Gott, III, the Navy choice for the trip to the Japan Student Science Awards, also was a first-place NSF-I winner.

William A. Voelkle, who has a choice of a visit or summer employment at the U.S. Army Missile Command's Redstone (Ala.) Arsenal, is also the winner of the American Patent Law Association's first award

Fig. (1) Barbara A. Bennett. (2) Gregory W. Kozlik. (3) Alan C. Huber. (4) George S. Beal. (5) John M. Shearman. (6) Francis O. Dudas. (7) David R. Jefferson. (8) Noel Dunivant. (9) Robert I. Smith-Johannsen. (10) Morris Summers. (11) Samuel W. Houston, III. (12) Arthur E. Frankel.

...inners for Visits, Jobs

of a $100 U.S. Savings Bond, a 2-day visit to National Aeronautical and Space Administration research facilities, and a choice of a visit to or summer employment at an Air Force in-house laboratory.

The Army alternate selectee for the Japan Student Science Fair Awards trip to Tokyo, Gregory Kozlik, also was the winner of the American Society for Metals' second-place award of $75 and a plaque. John F. Rollins, an Army alternate for a visit to an Army laboratory, won a $75 second-place award from the U.S. Patent Office.

Three of the Army Superior Award winners, Frederick R. Aronson, George Stuart Beal and Alan Curtis Huber, received Certificates of Merit from the U.S. Atomic Energy Commission and offers of expense-paid visits to the Argonne National Laboratory of the AEC.

Virtually all of the Army Superior and Meritorious Award winners also were recipients of second, third or fourth-place NSF-I awards. Many of them earned additional honors from other organizations supporting the NSF-I.

As the Army representative at the Tokyo Fair, Barbara Ann Bennett can trace her interest in science to her father, who has a master's degree in chemistry. Her mother is deceased. Barbara's research project involved the mass tissue culturing of certain mushrooms and analyzing them for nutritional value in comparison with those grown in soil.

Barbara has many interests in addition to science, including modeling (show model for *Seventeen* magazine), teaching Bible School, staying on the scholastic Honor Roll, serving on the high school Yearbook staff and the Vigo County Youth Jury, and activity in the Pep Club and Sr. Math Club.

Gregory Kozlik is also a young man of varied interests, He is vice president of the Chicago Junior Academy of Sciences and also of the Amateur Rocket Society, a member of the Lane Technical H.S. Math Club and the H.S. track team, and lists weight-lifting, stamp collecting, electronics and astronomy among his hobbies.

For the first time, the U.S. Army reached out to another country to pick a Superior Award winner. George S. Beal, 17, a senior at Aldershot H.S. in Burlington, Ontario, Canada, won recognition for his research on "Electron Spin Resonance and the Xenon Fluorides." His re-

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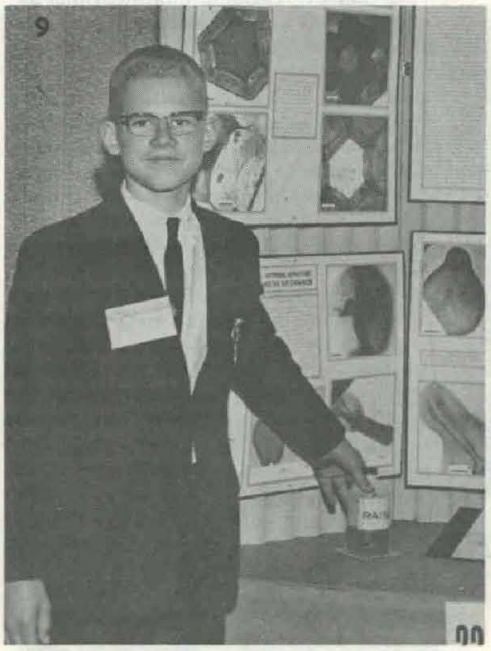
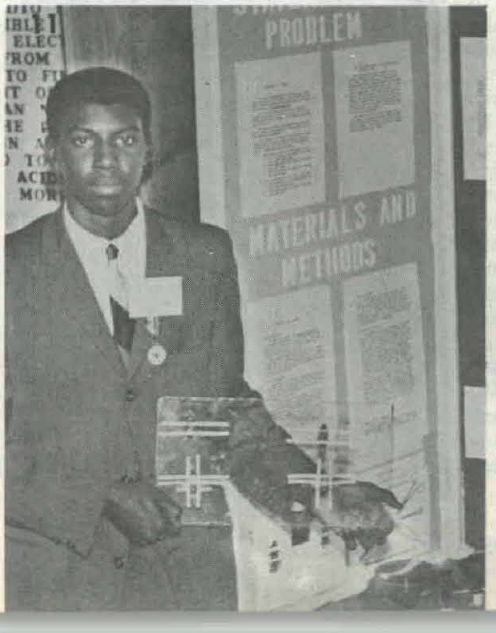
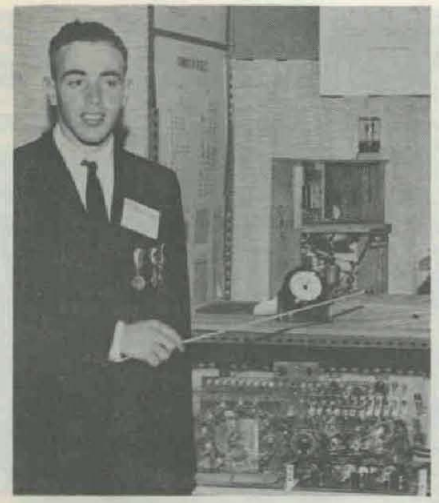




Army Selects 20 Winners at 16th Annual NSF-I

Ida J. Rheuark



Frederick R. Aronson

(Continued from page 23)

ward is a week-long visit to the U.S. Army Electronics Laboratories, Fort Monmouth, N.J.

Two Japanese girls merited and received a lot of attention for their projects at the NSF-I. Toshiko Fujitsu, 18, Seika Girls H.S., Kyoto City, Japan, was one of the 13 NSF-1 first-award winners for her project on "Studies of Insect Galls in Structure and Formation." Mizuyo Shigemoto, 17, Marugame H.S., Kagawa Prefect, was a U.S. Army Meritorious Award winner. Both girls visited the U.S. Army Engineer R&D Laboratories at Fort Belvoir, Va.

In contrast to 1964 Army NSF-I award winners, most of whose parents had professional qualifications as scientists and engineers, including the mother in several instances, the 1965 selectees must have received their stimulous for scientific research in school. Only three Superior Award winners can claim a mother or father with a science or engineering degree. John R. Gott, III, has a dad who is a Ph. D. scientist and Robert I. Smith-Johanssen's father is a chemical engineer.

OTHER SUPERIOR AWARD winners and their research projects are:

Frederick A. *Aronson*, 19, Pascack Valley H.S., Hillsdale, N.J., for "Genetic Changes in Behavior Produced by Low Levels of X-Irradiation in Mice"; Ruth F. *Conner*, 18, Melbourne H.S., Melbourne, Fla., for "Genetic Regulation in Development"; Vernon M. *Cottles*, 17, St. Augustine H.S., New Orleans, La., for "Properties of Gaseous Alkanes as Carrier Gases in Chromatography";

Francis O. *Dudas*, 15, Anaconda Central H.S., Anaconda, Mont., for "Plant Sociological Studies of Forster Creek Area, Montana"; Noel *Dunivant*, Jr., 17, Whiteville (N.C.) H.S., for "Synthesis of Calcite by Hydrothermal Crystallization"; Arthur E. *Frankel*, 17, Stephen F. Austin (Tex.) H.S., for "Sodium Amino Acid Linked Transport";

Arthur W. *Garey*, Jr., 17, Brown H.S., Atlanta, Ga., for "Stannic Chloride as a Solvent System"; Samuel Walker *Houston*, III, 17, Douglas Sr. H.S., Oklahoma City, Okla., for "Effects of Brain Experiments on the Development of the Cockroach"; Alan C. *Huber*, 17, Benjamin Bosse H.S., Evansville, Ind., for "Spark Chamber with System for Photographic Recording of Cosmic Ray Tracks";

David R. *Jefferson*, 16, High Point Sr. H.S., Beltsville, Md., for "Isosceles Trigonometry"; Gregory W. *Kozlik*, 16, Lane Technical H.S., Chicago, Ill., for "Field Emission Microscopy"; Ida J. *Rheuark*, 18, J.E.B. Stuart H.S., Falls Church, Va., for "Developing Useful Products from the Onion Skins"; John McLean *Shearman*, 17, Lovington (N. Mex.) H.S., for "Hormonal Control of Hematapoietic Functions";

Robert I. *Smith-Johannsen*, 17, Queensbury H.S., Glens Falls, N.Y., for "Atmospheric Precipitation"; Morris *Summers*, 15, Terry Parker Sr. H.S., Jacksonville, Fla., for "Polyphenol Oxidase System of a Decapod Crustacean"; and William A. *Voelkle*, 18, Sam Houston Sr. H.S., Houston, Tex., for "Advanced Space Propulsion —The Ion Electrastatic Thrustor."

Twenty-one Meritorious Award were given certificates, namely; William Henry *Blair*, 17, Fayetteville (N.C.) Sr. H.S.; Joseph F. *Celko*, 18, Sylvan Hills H.S., Atlanta, Ga.; Jerry Dale *Cripe*, 16, Auburn (Ind.) H.S.; Virginia L. *Delaney*, 17, Framingham (Mass.) South H.S.; Kenneth Wayne *Emert*, 18, Robert E. Lee H.S., San Antonio, Tex.; Melvin H. *Goodwin*, III, 18, Sunnyslope H.S., Phoenix, Ariz.;

Alfred Arthur *Hagedorn*, III, 16, Cheyenne Mountain H.S., Colorado Springs, Colo.; James Curtis *Heck*, 17, Jonesboro (Ark.) H.S.; Alan Correll *Hull*, 18, Oneonta (Ala.) H.S.; Jay B. *Jordan*, 17, Roswell (N. Mex.) Sr. H.S.; Harry Kyle *Parks*, Jr., 17, Gary (W. Va.) H.S.; William *Rivera*, 17, Immaculate Conception Academy, Mayaguez, Puerto Rico;

JAPANESE high school visitors to U.S. Army Engineer R&D Labs (USAERDL), Fort Belvoir, Va., following participation at 16th National Science Fair-International at St. Louis, Mo., were Miss Toshiko Fujitsu, 18 (second from left) and Miss Mizuyo Shigemoto, 17 (right). Miszuyo Shigemoto was an Army Meritorious Award winner, based on a chemistry exhibit on the nature of precipitate formed by the reaction of lead nitrate and sodium hydroxide in aqueous solutions. Toshiko Fujitsu exhibited an experiment on how parasitic insects inflict so-called plant cancer upon plants. Lt Col John W. Consolvo, USAERDL deputy commander, greeted the visitors, including Mrs. Mieko Komatsu (left), escort-interpreter for the girls.

John F. *Rollins*, 17, Eisenhower H.S., Lawton, Okla.; Frank Raymond *Rudy*, 16, Susquehanna Twp. Sr. H.S., Harrisburg, Pa.; Mary Doris *Ruggere*, 15, Central Catholic H.S.;, Kingston, Pa.; Jack T. *Schaefer*, 17, Davenport (Iowa) West H.S.; Mary M. *Schaefer*, 15, Northern H.S., Flint, Mich.; Sarah Terrell *Smith*, 17, Treutlen H.S., Soperton, Ga.; Leslie Everett *Webb*, III, 18, Falfurrias (Tex.) H.S.; and Gene Harold *Young*, 18, St. Albans (W. Va.) H.S.

U. S. Army laboratories at which the Army winners will visit or work during the summer include:

U.S. Army Natick Laboratories, Natick, Mass.—Barbara Ann Bennett.

U.S. Army Institute of Environmental Medicine — Natick, Mass.—Ruth F. Conner.

Walter Reed Army Institute of Research, Washington, D.C.—John M. Shearman.

U.S. Army Medical Research Laboratory, Fort Knox, Ky.—Fred R. Aronson.

U.S. Army Medical Research and Nutrition Laboratory, Fitzsimons General Hospital, Denver, Colo.—Arthur E. Frankel.

U.S. Army Biological Laboratories, Fort Detrick, Md.—Samuel W. Houston and Francis O. Dudas.

U.S. Army Chemical Research and Development Laboratories, Fort Detrick, Md.—Morris Summers.

Feltman Laboratories, Picatinny Arsenal, Dover, N.J.— Ida J. Rheuark.

U.S. Army Tank and Automotive Center, Warren, Mich.—Vernon M. Cottles.

U.S. Army Cold Regions Research and Engineering Laboratories, Hanover, N.H.—Robert Smith-Johannsen.

U.S. Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va.—Curtis Bryant.

U.S. Army Electronics Laboratories, Fort Monmouth, N.J.—Gregory W. Kozlik, George S. Beal and Alan C. Huber.

Watervliet Arsenal, Watervliet, N.Y.—Arthur W. Garey, John R. Gott and Noel Dunivant.

U.S. Army Missile Command, Redstone, Arsenal, Redstone, Ala.—William A. Volkle.

Frankford Arsenal, Phialdelphia, Pa.—David R. Jefferson.

Curtis Bryant

Ruth F. Conner

John R. Gott, III

DoD Begins Procurement Personnel Career Program

A career development program to improve the quality of Department of Defense civilian and military procurement personnel and increase opportunities for their promotion was announced May 3 by Secretary of Defense Robert S. McNamara.

Recommendations concerning the program were submitted by Military and Civilian Joint Study Groups after approval by the Assistant Secretary of Defense for Manpower and for Installations and Logistics.

Provisions include establishment of a Civilian Procurement Career Management Program, rotation patterns that will use to the maximum those individuals with procurement experience, and coordination of programs of each military department with the Defense agencies so that long-range personnel requirements will be met.

Recommendations include maximum use of personnel with college and graduate education in the procurement field; also, development of a system to assue the entrance of an adequate number of highly qualified civilian personnel at all levels of responsibility, particularly at a trainee level.

Secretary McNamara's memorandum noted that the DoD now spends about $28 billion a year in procuring the equipment and services needed to support the Armed Forces. He requested the Defense officials to initiate the necessary action to assure timely implementation of the procurement program schedule contained in the recommendations.

WSMR Fires 2nd HIBEX

The second successful firing of a high-acceleration experimental missile booster (HIBEX) at White Sands Missile Range, N. Mex., was announced May 6 by the Advanced Research Projects Agency (ARPA).

The HIBEX program is sponsored by ARPA as part of Project Defender, a series of investigations dealing with ballistic missile defense systems, and is directed by personnel at the U.S. Army Missile Command Directorate of Research and Development. Boeing Co. is prime contractor and Hercules Powder Co. is the propulsion subcontractor under contract to the Missile Command.

Several additional development firings of the HIBEX booster vehicle are planned during the current program. HIBEX itself is not a weapon system. It is a program to study the problems associated with the boost phase of a high-acceleration interceptor missile.

Redstone Automates Scientific Information Center

Button pressing to acquire knowledge—be it for the needs of a scientist or advanced student of missilry and space principles—is the method used at the Redstone (Ala.) Scientific Information Center.

The Center's massive accumulation of documents and books related to missiles and space is believed the most complete collection of its kind in the Free World.

Orders, loans, newly acquired books and periodicals are all listed in orderly fashion. Eventually the cataloging will be done by computers.

Withdrawals for loan already are and more than a name is required to draw a book from the library. It takes a social security number. The machine also records such things as name, security clearance and need-to-know, because the Center has a vast amount of classified material.

Fred E. Croxton is director of this automated operation. Readers have access to miles of microfilm by using a reader-printer that flashes the pages on a lighted screen.

A reading room is nestled among the open racks of periodicals in many languages. Full-time Russian, German, Chinese and Romance language translators are available if a summary leads the scientist to a particularly elusive or tantalizing piece. Even this service may soon be computerized.

A direct wire connects with such places as the Library of Congress, Linda Hall in the midwest, John Crerar in Chicago, and the American Institute of Aeronautics and Astronautics and Inter-Library Loan.

Librarians are almost as fond of statistics as are scientists, engineers and accountants. For instance, at RSIC they cite their floor space (three stories high) as 62,500 square feet. More than 305,000 items are on microfilm. The present holdings altogether are about 600,000 reports, 90,000 bound volumes and 10,000 subscriptions.

This literature from the U.S. and worldwide sources includes current and retrospective items. Scientific journals are received from more than 40 different countries. Some of the back-runs of journals date back to 1665, others start in the 1800s.

On the staff are scientists and engineers who perform critical analyses, in-depth research, and state-of-the-art studies of the literature as requested.

Organized in 1962, RSIC also participates in national programs, including the Defense Documentation Center for the Southeast, Department of Defense Scientific and Technical Information Program, Department of the Army Research Task Report, DA Chemical Information and Data Systems, Army Technical Library Improvement Studies, Information and Data Exchange Experimental Activity and others.

The fact that two major Government organizations, the Army and Marshall Space Flight Center, work together in order to cut costs and have at scientists' fingertips a massive store of knowledge has been commended by authorities in Washington.

Albany Girl Repeats Triumph As Engineers' Award Winner

"Lightning," in the form of scientific recognition, struck twice for 16-year-old Linda Kowalski when she won the special award of U.S. Army engineers at Watervliet (N.Y.) Arsenal in the New York State Science Congress, Eastern Section.

It was the second consecutive year that the Albany high school junior has received the award from the Watervliet Society of Engineers. Her project, "The Use of Optical Interferometry in Studying Crystals," which may be applied in distinguishing various minerals, applied principles shown in her 1964 entry.

Linda also received first prize in the senior chemistry division and her project was judged one of the top three in all senior divisions, entitling her to enter the state finals.

The Engineers Society award, a handbook on chemistry and physics, was presented by E. Noah Gould, chairman of the awards committee. Arsenal scientists serving as judges included Frederick J. Schmiedeshoff, research director, Clarke Homan, physicist, and Michael Pascual, mathematician.

E. Noah Gould, chairman of Watervliet Arsenal Society of Engineers awards committee, presents handbook on chemistry and physics to Linda Kowalski for her science fair exhibit.

University Faculty to Work in AMC Labs

Closer contact between major educational institutions and Army laboratories is being encouraged through assignment of faculty members to research laboratories of the U.S. Army Materiel Command (AMC).

Approved by General Frank S. Besson, Jr., CG of the AMC, the program is designed to operate within existing U.S. Civil Service Commission and Army Rules and Regulations on temporary (not to exceed one year) or term (not to exceed four years) appointments as appropriate.

Past experience in a few Army laboratories with fellowships, research associateships, or sabbatical programs has demonstrated the potential of first-hand working relationships between academic and Government scientists.

In personal communications enlisting the support of all laboratory technical directors, AMC chief scientist Dr. Craig M. Crenshaw described the objective as "to help improve the image of Army laboratories in the eyes of the scientific community by constructive actions, not just pious platitudes."

An AMC policy letter on the temporary or sabbatical assignments has received wide distribution throughout the Command. It provides that a limited number of select faculty members, while carrying out research projects within AMC laboratories during sabbatical or other leave, may be designated "AMC Visiting Research or Engineering Professors." Details are being published in AMC Regulation 690-3 for personnel officers.

The contact point within AMC headquarters is Dr. Gordon L. Bushey, assistant chief scientist, who conducted a preliminary survey of the impact and possibilities of the program.

Among points constantly reiterated by Dr. Craneshaw and academic personnel is that the faculty member will just be on leave and will return to his school upon completion of his visiting professorship. Work conducted during the laboratory assignment will be selected jointly by the laboratory technical director and the professor. Results will normally be reported in the open literature.

PIB Conducts System Theory Symposium

Addresses by prominent scientists from the U.S. Military Services, industry and academic institutions throughout the world highlighted the recent Symposium on System Theory conducted by the Polytechnic Institute of Brooklyn in New York City.

Dr. Ernst Weber, president of Polytechnic and chairman of the Advisory Council of the U.S. Army Junior Science and Humanities Program, welcomed the conferees. Dr. Richard A. Weiss, Deputy and Scientific Director of Army Research, made the Army opening address.

Other speakers included Maj Gen D. R. Ostrander, commander, Air Force Office of Aerospace Research; Capt E. J. Hoffman, deputy and assistant chief of Naval Research;

Dr. Donald L. Thomsen, Jr., chairman of the board, Society of Industrial and Applied Mathematics; and Dr. William G. Shepard, vice president of the Institute of Electrical and Electronics Engineers.

Twenty-six papers were presented by scientists from Europe, South America and many parts of the United States. Topics included basic notions of system theory, mathematical representation of systems, dynamic systems (such as finite-state machines), systems with random inputs, optimal systems, large-scale systems and the relation of system theory to science and engineering.

Dr. Emmanuel R. Piore, vice president and chief scientist of International Business Machines Corp., discussed systems and hardware in the featured address at the symposium banquet.

Systems theory, as covered in the symposium program, included concepts fundamental to problems of control, communication, information processing, economic forecasting and other specialized problem areas.

The Symposium on System Theory is the 15th in the series of international symposia conducted by the Microwave Institute of the Polytechnic Institute of Brooklyn under the cosponsorship of the Air Force of Scientific Research, the Army Research Office and the Office of Naval Research.

Cooperating in organization of the symposium were the Institute of Electrical and Electronics Engineers, through its Groups on Automatic Control, Circuit Theory and Information Theory, and the Society for Industrial and Applied Mathematics.

Lt Col Rosenberger Assigned To Medical Research Branch

Lt Col Eugene A. Rosenberg, MC, an internist, has been assigned as chief of the Medical Research Branch, U.S. Army Medical Research and Development Command.

Previously assigned as chief of the Medical Operational Studies at Walter Reed Army Institute of Research, he received an M.D. degree from the University of Illinois School of Medicine in 1949 and an M.S. degree from the University of Rochester School of Medicine in 1962.

He has served as chief of medicine, 14th Field Hospital, Bad Krueznach, Germany, and chief, Medical Branch, Department of Medicine and Surgery, Medical Field Service School, Brooke Army Medical Center, Fort Sam Houston, Tex.

He is a Fellow of the American College of Physicians, a Diplomate of the American Board of Internal Medicine, and a member of the American Medical Association.

Natick Group Maintains Uniformity of Army Uniforms

Assuring that U.S. Army uniforms are truly uniform in quality and appearance is the responsibility of a group of clothing specialists of the U.S. Army Materiel Command's Natick (Mass.) Laboratories.

The program is directed by Capt Bennie S. McFather, a textile technologist and chief of the Uniform Quality Control Office at Natick. In addition to inspecting uniforms and fabrics at the Laboratories, he visits manufacturers and sales outlets across the country.

The roots of the quality control project reach back to the years immediately following World War II, when the lack of uniformity in the appearance of its military personnel became a matter of Army concern.

The cause of the problem was traced to the wearing of uniforms purchased from Post Exchanges and commercial vendors. In 1957 the Army began a Quality Control Program to improve the appearance of military uniforms and accessories disrtibuted from other than Army Issue Points, or purchased from sources other than Army sales stores.

The program is intended to keep the uniform within strict color tolerances, and to insure that fabrics and workmanship meet minimum standards set by military specifications.

Commercial firms which fabricate controlled uniform items and who wish to participate in the program must submit samples of their products for evaluation. The basic material from which the garment is manufactured must also be certified by the Uniform Quality Control Office and, when required, contain a decal certificate number on the back.

The sample is tested for conformance to correct design, pattern and physical requirements of the military specifications. A certificate number is then awarded to each manufacturer for items which meet or exceed the minimum requirements.

Manufacturers are required to incorporate a certificate label in garments produced under the program. The label is designated for all uniform items except hats, caps, and neckties, which only need to show the Uniform Quality Control certificate number under which they are manufactured. Certificate numbers for web belts are placed on the outside of the package from which dispensed.

The Uniform Quality Control Office at Natick will evaluate any certified garments forwarded by an individual or unit to determine if they meet minimum requirements of military specifications. The investigation should be requested if it is suspected that the item is below standards.

This service has been provided for several ROTC units and other military groups before they determined which manufacturer would be awarded a contract for a quantity order.

The U.S. Army's new helicopter turret-mounted 40mm. grenade launcher, developed at a cost of $11 million, was demonstrated to the president of Great Britain's Ordnance Board, Vice Air Marshall D. N. K. Blair-Oliphant (right), when he visited Picatinny Arsenal by Martin B. Chase (left), of the Arsenal's Warheads and Special Projects Lab. Looking on is Wing Commander P. D. Cherry, of the British Embassy in Washington.

Joint Development of the Jet-Flap Helicopter Rotor

One of the Products of the Army R&D Program in Europe

By CHARLES D. ROACH

The U.S. Army Research and Development Group (Europe), in Frankfurt, Germany, operates as a part of the Army Research Office in Washington, D.C. The European Research Office, as it is known in Europe, was established in order to contribute to the overall research and development program of the U.S. Army.

This purpose is accomplished by sponsoring R&D projects of Army interest throughout Western Europe; by establishing technical contacts and liaison with the leading scientific research and development organizations of Western Europe; and by encouraging and developing the free exchange of scientific information between the American and Western European scientific communities in all areas of Army interest.

The office does not solicit research but does receive research proposals. After evaluation, it arranges negotiation of contracts for proposals selected for support. A group of scientists and engineers in the office provides technical representation for the U.S. Government during the course of the contracts.

The European Research Office also serves as a research liaison point between Army laboratories in the United States and the European scientific community. One of its principal purposes is to identify and exploit scientific endeavors in Europe which are advanced beyond the state-of-the-art in the United States.

An example of the cooperation achieved between the European scientific community and the United States is the Jet-Flap Rotor project, supported with the Giravions-Dorand Co. of Paris. This interesting research endeavor has led quite directly to an experimental program.

Sponsorship of this project by the European Research Office has been made possible by the U.S. Army Materiel Command through the U.S. Army Aviation Materiel Laboratories, Fort Eustis, Va.

PROBLEMS IN ROTOR SYSTEM. When the rotor blades of a conventional helicopter are driven by a shaft, the torque driving the rotor reacts on the fuselage and tends to rotate the fuselage in a direction opposite to that of the rotor. This rotation is countered by a tail rotor.

If the rotor could be forced to turn on a frictionless bearing without the necessity of a drive shaft, then there would be no torque reaction on the fuselage and the tail rotor would not be necessary, except to control flight direction during hover.

A tip-driven rotor, several versions of which have been designed and built, satisfies the requirement. By 1954, the first production version of a tip-driven helicopter was flying in France. This little aircraft, the Djinn, was powered by a gas turbine driving a compressor which forced air through the blades and out through a nozzle mounted on the tips of the blades. No tail rotor was installed but directional control was obtained from rather conventional rudders.

The many undesirable features are omitted. Among these are a requirement for transmissions, clutches, drive shafts, reduction gears, and such associated equipment as is required for a shaft-driven rotor. A number of Djinn helicopters are still being used in training by the French Army.

GIRAVIONS-DORAND PROPOSAL. Monsieur Rene Doran, teaming up with a group of engineers highly specialized in helicopter design, formed the Giravions-Dorand Co. to pursue more advanced helicopter concepts. In 1958 this firm proposed to the U.S. Army Research and Development Group (Europe) an investigation of an entirely new helicopter rotor system.

Briefly, Giravions-Dorand proposed a novel method of accomplishing a change in the effective pitch in a tip-driven rotor. When the helicopter pilot desires to gain altitude, he must increase the pitch of the rotor, that is, raise the angle of attack of the rotor blades. In a hovering condition all blades receive an equal increase in pitch, termed "collective pitch."

Figure 1 indicates the relative tangential velocity of the blade through the air under a hovering condition. When the helicopter is traveling horizontally, the forward velocity of the

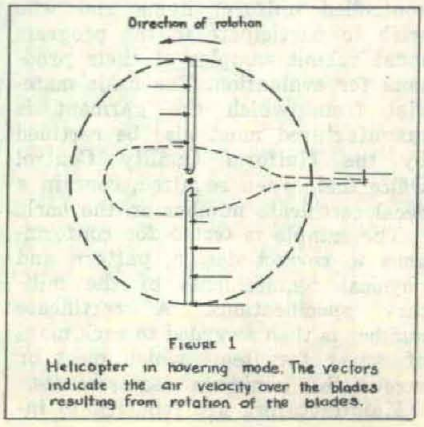


FIGURE 1
Helicopter in hovering mode. The vectors indicate the air velocity over the blades resulting from rotation of the blades.

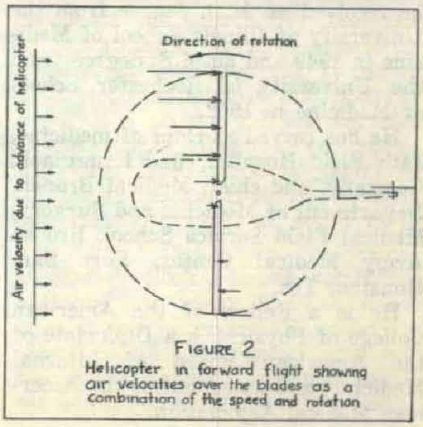


FIGURE 2
Helicopter in forward flight showing air velocities over the blades as a combination of the speed and rotation

Charles D. Roach is aviation liaison officer for the U.S. Army Transportation Research Command (USATRECOM) at U.S. Army R&D Group, Europe. A 1939 graduate of the University of Michigan with a B.S. degree in mechanical engineering and naval architecture, his previous positions have included: marine engineer, Miami Shipbuilding Corp., 1939-41; naval architect, Dooley's Basin and Drydock Co.; director of research, Columbian Bronze Corp., 1943-46; private consultant in engineering, 1946-48; Director of Engineering for Surface Transportation, USATRECOM, Fort Eustis, Va., 1948-60; adviser to commanding officer, Long Range Technological Forecast Office, USATRECOM, 1960-62. From 1957-58 he pursued graduate studies at the Massachusetts Institute of Technology. A recipient of the U.S. Army Meritorious Civilian Service Award, he is a member of a number of professional associations and has published extensively in technical journals.

Charles D. Roach

aircraft must be added to the velocity of rotation of the blade to appreciate the total velocity of air past the blade. Figure 2 shows the blade as it is moving forward with the air vectors over the blade.

The lift, being a function of the square of the air velocity past the blade, will be greater on the side of the advancing blade than on the side of the retreating blade, tending to make the helicopter roll. Increasing the pitch on the retreating blade and decreasing the pitch on the advancing blade counteracts this tendency. Such change in pitch of the blades as they rotate is termed "cyclic pitch."

TIP AND RETREATING BLADE STALL. The helicopter designer is also faced with several more conditions which cause an alteration in the lift pattern. If the advancing blade moves at a velocity approaching sonic speed at the tip, a loss in lift results due to compressibility effects. Further, if the pitch is increased too much on the retreating blade, stall occurs.

The rotor has a limited segment of its rotation where it may actually produce lift efficiently. Ideally, the lift contours should look like Figure 3, but more often they are distorted by these several conditions to look like Figure 4.

COANDA EFFECT AND THE JET-FLAP. Many years ago, Dr. Henri Coanda[1] observed that if a thin jet of air is directed tangentially to a curved surface, the flow clings to the surface and is turned through an angle. This action can be demonstrated by holding the back of a teaspoon adjacent to the flow from a water faucet, as illustrated in Figure 5. Such a curved sheet of air, if located on the upper surface of an airfoil, thus increasing the lift.

If the chord-wise location of such a high-energy stream is located just right, air in the boundary layer which has lost much velocity by viscous drag from the airfoil is re-energized, minimizing the likelihood of boundary layer separation. Of course, if the boundary layer does separate, the circulation pattern is distorted and lift is lost.

Based on knowledge of these physical facts, Giravions-Doran proposed an investigation of the Jet-Flap Helicopter Rotor. In this concept, the flap would consist of a narrow plate along the trailing edge of the blade. The plate would be deformable into a curved surface over which a sheet of high-velocity air would pass, forming a "jet-flap."

If the curvature of the plate were controllable, both in the degree of curve and cyclically in amount, it was presumed, a pitch control could be accomplished that would give the very desirable characteristics needed for helicopters.

In a conventional helicopter pitch control, we find the so-called swash plate. This is a plate set on the drive shaft, movable both angularly and vertically. As this plate is connected to the blades of the helicopter by means of links and cranks, the vertical movement of the swash plate moves all the blades to a new pitch angle. This is the collective pitch control.

The angular movement of the plate increases the pitch in one segment of the blade path and reduces the pitch in another, thus giving cyclic pitch control. Since the blades of the Giravions-Dorand rotor system are fixed in angle of incidence setting and variations of effective pitch are obtained by the deflection of the flap, a method of accurately controlling the flap angle is necessary.

Similiar to the more conventional swash plate, the Giravions-Dorand system also uses a swash plate, but a very light one because the forces are quite minor. The swashplate needs only to move an air valve, expanding a pneumatic bag that deflects the flap. Figure 6 illustrates a cross-section of the flap showing the pneumatic bag.

The blades are set at an initial angle of about eight degrees so that in the event of power failure, the blades are already at the proper angle for a safe autorotative descent. The air necessary for flap control may be supplied by a bleed from the turbine compressor stages or from a separate compressor.

Wind-tunnel tests indicate that the helicopter is controllable by flap deflection alone if there is a lack of propulsion air, providing only that there remains sufficient control air pressure. This safety feature is being investigated and a means of providing a few minutes of control operation seems easily possible.

Propulsion for the blades results from the jet sheet exiting from the trailing edge of the blade. In Figure 7, can be seen the narrow slit above the flap through which the air passes. As this slit comprises about 30 percent of the blade length, special provisions had to be made to preserve the torsional rigidity of the blade.

Fortunately, the turning vanes which are necessary to direct the air

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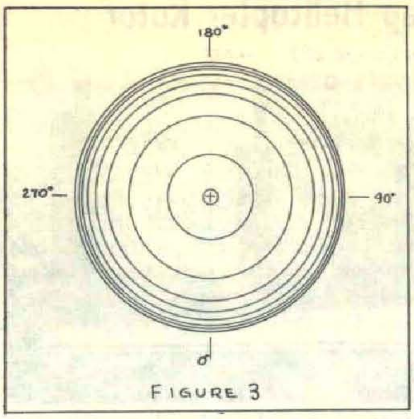

FIGURE 3

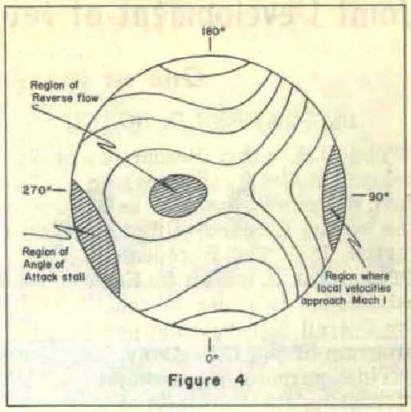

Figure 4

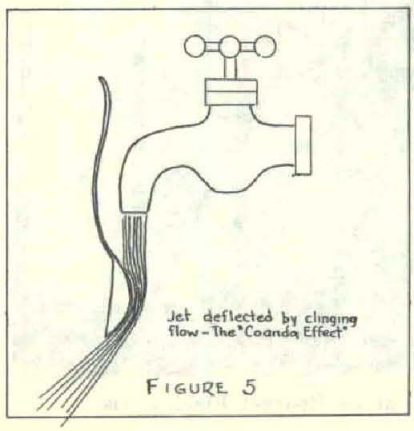

FIGURE 5

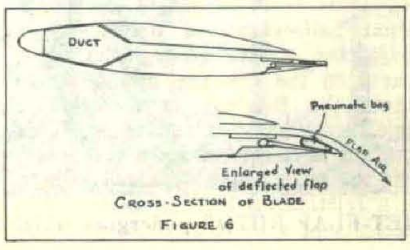

FIGURE 6

[1]Dr. Henri Coanda, fluid dynamicist was born in Hungary and educated in France. He currently serves as a part time consultant to the Huych Corp., Stamford, Conn. (Also see Coanda visits HDL article, page 9.)

Joint Development of Jet-Flap Helicopter Rotor

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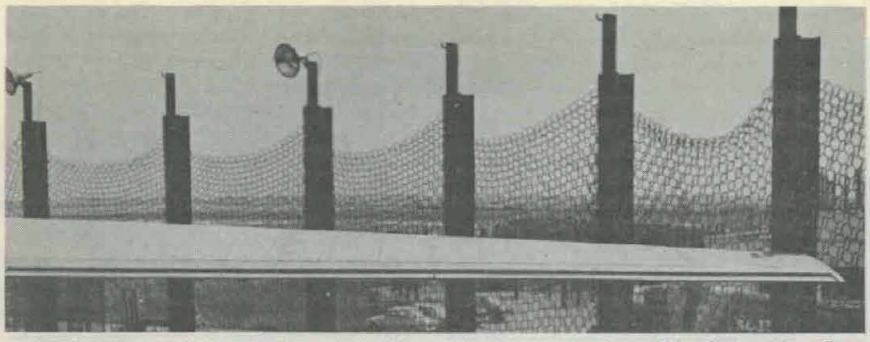


TRAILING EDGE VIEW of jet-flap blade shows the slit above the flap. Protective screen (background) surrounds the whirl test stand.

from the spanwise duct through the slit must be of airfoil shape and are therefore perfectly adequate to form a discontinuous but satisfactory stress distribution in the torsional box of the blade.

THE TEST PROGRAM. With the assistance of the French helicopter manufacturer, Sud-Aviation, and the Office National d'Etudes et de Recherches Aeronautique (ONERA), a theoretical analysis and component tests were made. Eventually, the system was developed to the point where wind-tunnel tests could be performed. These first tests were conducted on a model of about 12 feet in diameter.

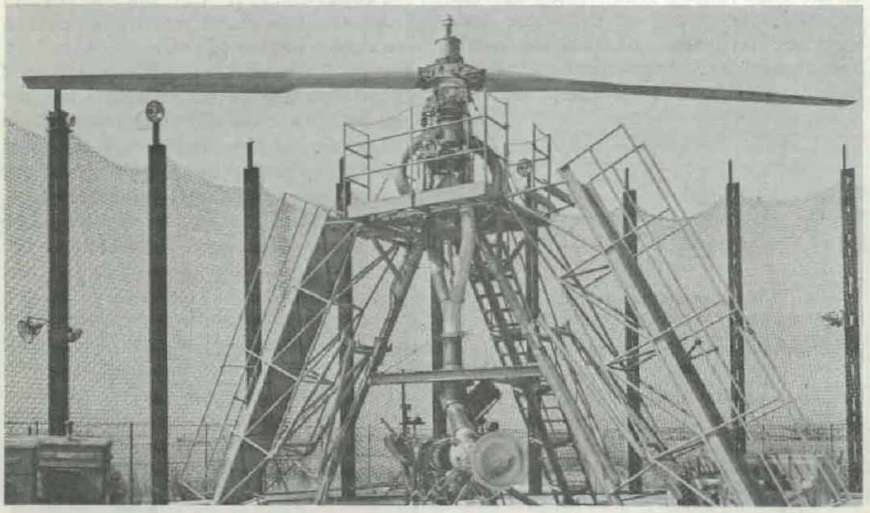
Results encouraged the U.S. Army to decide full-scale tests were desirable. Last August a full-scale rotor 40 feet in diameter (shown in Figure 8), powered by an Allison T-56 engine driving a compressor, was tested on a whirl stand at Le Bourget Field in Paris.

The Jet-Flap rotor is now at the National Aeronautical and Space Administration's 40′ x 80′ wind-tunnel at Moffett Field, Calif., waiting to be tested in a quantitative sense over a long range of flight speeds up to approximately 190 knots.

All the returns are not yet in, so a quantitative evaluation of the project is not possible. However, some speculations are interesting. The Giravions-Dorand system having no gearboxes, transmissions, tail rotor, nor heavily loaded control parts, could lead to a major advance in reduction of maintenance of helicopters.

The ease of control, since only air valves need to be moved, is such as to lend itself to a simple manual system. Almost infinite possibilities appear in variations in cyclic pitch to gain the maximum of blade efficiency for every flight regime.

With careful attention to design and manufacture, weight savings of a high order possibly can be achieved. Still to be determined is the efficiency of such a system. Upon this may rest the success or failure of the concept.



JET-FLAP ROTOR undergoes whirl tests at Le Bourget Field, Paris.

Army Flying Crane Claims 3 World Altitude Records

The U.S. Army is claiming three new world altitude records for its CH-54A Flying Crane after it reached new heights recently in three separate flights over a 12-hour span. Two of the records currently are held by the Soviet Union.

Maj T. J. Clark, Jr., 38, commanding officer of the 478th Flying Crane Co. at Fort Benning, Ga., and CWO Ulysses V. Brown, 37, also of the 478th, were at the controls during steadily increasing climbs that reached 5½ miles above the earth.

The Flying Crane, produced by Sikorsky Aircraft Corp., was credited with the following:

- Reached an altitude of 21,250 feet with a 6,000 kilogram (11,025 pound) load. The existing record is 18,916 feet set by a Russian Mi-6 helicopter Apr. 16, 1959.
- Reached a height of 27,550 feet with a 2,000 kilogram (4,410 pound) load. The present claimed record is 20,898 feet set by a Russian Mi-4 helicopter Mar. 12, 1965.
- Reached a height of 29,300 feet with a 1,000 kilogram (2,205 pound) load. The existing mark is 26,369 feet set by a U.S. Air Force Kaman H-34B Huskie May 25, 1961.

The record claims were filed with the Federation Aeronautique Internationale, the world body that rules on air records.

Fort Belvoir Showing Slated For 'Blueprints of the Future'

A mobile U.S. Army exhibit featuring the Laser will appear at Fort Belvoir, Va., June 17-21, as a highlight of the observance of the U.S. Army Combat Developments Command's (USACDC) third anniversary.

Entitled "Blueprints for the Future," the exhibit tells the story of Army research and development—covering the "idea to item" program in 3-dimensional scenes, animated models, technimated artwork, a color motion picture and with an array of actual hardware. One such action is the Laser.

During a live Laser demonstration, the device will "shoot" a ruby-red beam of light that pierces a sheet of metal, illustrating the control and application of coherent light.

Blueprints for the Future has been touring the country for the past 18 months and has taken the Army R&D story to two million viewers from coast-to-coast. Following its appearance at Fort Belvoir, the exhibit will continue its nationwide tour.

TRECOM Redesignated Army Aviation Materiel Labs

The U.S. Army Aviation Materiel Laboratories (USAAML) is now the official designation for the former U.S. Army Transportation Research Command, Fort Eustis, Va.

Commanded by Col Michael J. Strok, USAAML's mission involves planning, directing and accomplishing research, exploratory and advanced development in all phases of subsonic aeronautics. Included is research flight testing of advanced high performance rotorcraft and vertical takeoff and landing (VTOL) aircraft.

The USAAML were engaged in both aeronautical and surface research until February 1964 when the laboratories became the sole Army aeronautical research center, subordinate to the U.S. Army Aviation Materiel Command (AVCOM). Among notable pre-1964 contributions to the Army were the Ground Effect Machines (GEM), LARC-5 and 15, and Lift-Fan Devices.

Current USAAML research and development projects include the XV-5A VTOL project for the evaluation of the lift-fan propulsion system; the X-10, being used for the investigation of the Dual Tandem-Tilt Propeller principle and possible military application; UH-1B Modified Research Helicopter, providing data for high-speed performance;

The XH-51A Rapid Rotor, providing design criteria; Advanced Aerial Fire Support Systems; and the Precision Drop Glider, which is being used for the development of a new aerial delivery system to permit all-weather cargo delivery.

Col Boyes Manages MAW for MICOM

MAW (Medium Assault Anti-tank Weapon) recently became the tenth project-managed system under control of the U.S. Army Missle Command at Redstone Arsenal, Ala. Simultaneously, Lt Col John H. Boyes was named project manager of the system.

Now in the exploratory development stage, the shoulder-fired missile system is designed to provide the Army with a major boost in firepower for infantry units. Capable of being carried by one man, the simple, rugged weapon requires very little training.

Two concepts of the MAW are now undergoing development. The McDonnell MAW, a command to line-of-sight guided missile is being developed by McDonnell Aircraft Co.; the DC-MAW (Directional-Control Medium Assault Anti-Tank Weapon) is under development by the Missile Command's Directorate of Research and Development.

Other systems under project management at the Missile Command are the Lance, Pershing, Sergeant, TOW, Shillelagh, Hawk, Nike Hercules, Mauler, and Redeye.

MAW project manager, Col Boyes is a graduate of Penn State University with a B.S. degree in education, and Babson Institute of Business Administration with an M.B.A.

Prior to his new assignment, he served at White Sands Missile Range, N. Mex., as chief of the Systems Test Division of the Army Missile Test and Evaluation Directorate. During his career of more than 20 years in the Army, his assignments have included a World War II tour in Europe and duty in Korea. He holds the Army Commendation Medal with Oak Leaf Cluster.

Technical Articles Review Army Aircraft Programs

The Army's Aircraft Systems Development Program, as publicized originally in two feature articles in the *Army Research and Development Newsmagazine*, receives further prominence in *Perspective* and in a technical paper published by the Society of Automotive Engineers.

The first quarter 1965 edition of *Perspective*, published by Cornell Aeronautical Laboratory, Inc., of Cornell University, carries a lead article titled "Upward and Onward: Army Low-Speed Aircraft Aerodynamics Research."

Authored by Richard Ballard, Physical Sciences Division, U.S. Army Research Office, the article is virtually identical to that carried by the August 1964 edition of the Newsmagazine. One of the major subheadings acknowledges "Wide Span of Army Technical Programs Underway," and another page of aircraft pictures is captioned "Army Research Fosters Impressive Offspring."

The Society of Automotive Engineers 6-page publication titled "Army Aircraft Systems Development Program," presented as a technical paper by Col John Dibble, Jr., at the National Aeronautic Meeting in Washington, D.C., Apr. 12-15, is essentially the same as the article he authored for the Newsmagazine in May 1964.

Col Dibble is chief of the Air Mobility Division, Office of the Chief of Research and Development, Department of the Army. His original article for the Newsmagazine was titled "Army Aerial Vehicle Development Spurred by Mobility Goals."

COIN/LARA Experimental Aircraft Flight Scheduled

The first experimental flight of the OV-10A Counterinsurgency (COIN/LARA) aircraft, a mockup of which was recently reviewed by a joint service board, is scheduled this summer.

North American Aviation Corp. is building seven prototypes under an $18 million contract awarded by the U.S. Navy in a Department of Defense program.

The aircraft was designed to perform a variety of missions, including observation and reconnaissance, helicopter escort, limited ground attack, target acquisitions, gun fire, spotting, liaison and utility.

COIN/LARA OV-10A

The review board, which included officers of the Army, Navy, Air Force and Marine Corps, studied the full-scale mockup to determine the contractor's adherence to specifications and suitability for proposed missions.

Military Services also studied the Counterinsurgency plane concept during the original design competition last year. A joint steering committee headed by Dr. Harold Brown, Director of Defense Research and Engineering, included the Assistant Secretaries for Research and Development of the Army, Navy and Air Force.

The Navy was designated the developing agency. Original requirements in the specifications stressed ruggedness, simplicity of operation and moderate cost.

COIN is powered by two turboprop T-76 engines and employs high-lift devices permitting operation from small, unimproved fields.

NLABS Broad Mission—

From Jungle Tropics to Outer Space

Gemini flights and coping with conditions of the jungles of Viet Nam offer a timely measure of the mission diversity of the U.S. Army Materiel Command's Natick Laboratories.

Space foods for astronauts such as Cooper and Young are Natick developments under long-standing and continuous contract to NASA. Contrasting jungles of Viet Nam pose new problems in protecting our military advisers and friendly forces from the deadly ingenuity of guerrilla tactics.

Something had to be done, for instance, to prevent personnel losses and injuries caused by terrain-hidden spikes, fish hooks, needle-pointed bamboo stakes, and other devious casualty-producing devices.

NLABS personnel visited Viet Nam and returned to devise a solution—a slip-in stainless steel innersole with a plastic mesh surface for the combat boot. Urgently needed improvement in protective body armor for Army aircraft personnel in the Far East is also challenging researchers.

These two topical extremes in mission—jungle and outer space—underscore the multi-patterned performance requirements placed on NLABS. They also reflect the Chief of Staff's determination to prepare the Army for Missions Unlimited.

The Army Materiel Command looks primarily to Natick to fulfill the needs of the Army's essential "weapon system"—the combat soldier. He must be provided for and protected in the midst of today's awesome weaponry and strange environments. His food and clothing, his personal and support equipment, must be equal to the man and his every predictable task.

JUNGLE-TROPICAL BOOT developed at Natick has direct-molded sole; eyelets serve as ventilators and water drainage system; steel shank shields wearer from jungle spikes.

The U.S. Army Natick Laboratories staff consists of 1,750 military and civilian personnel organized into seven operating divisions, primarily commodity oriented.

In addition to directing the efforts of these mission activities, the commanding general of the Natick Laboratories provides administrative and logistical support to the Army Cold Regions Research and Engineering Laboratory, Hanover, N.H., and to the Army Research Institute of Environmental Medicine, a tenant at Natick.

Basic research at Natick Laboratories is conducted in biology, chemistry, physics and psychology. Researchers prepare studies on energy, materials, foods and flavors, and investigate biological and human engineering systems.

Development programs of immediate importance to soldiers in the field include rations, clothing, footwear, containers, petroleum handling equipment, materials handling equipment, airdrop equipment, tentage, equipage, and food service equipment.

To outline, even in brief form, all of the great variety of work being done is impossible in the space here available. To select specific areas may result in omissions of significant projects, but it does provide a means of painting a panorama of NLABS activities—a mixture of the simple and the complex, the exotic and the routine, each contributing to improving the lot of the soldier.

One of the world's largest collections of fungi — more than 10,000 isolates — is an important source for studying the role of fungi in deterioration of military supplies in storage. The prime purpose of the collection is to learn how damage may be minimized or eliminated.

Climatic and geographic knowledge is an important tool for battlefield commanders. Cartographers, meteorologists and geographers at Natick collate and analyze global data on terrain features and weather variations.

OUTER SPACE, bite-sized sandwich is a sample of specialized ration components developed by U.S. Army Natick Labs for operational feeding.

Information obtained is used to establish design criteria for the development of clothing, operational rations, specialized equipment, and to aid other agencies in the development of weapons and equipment.

Natick cartographers, for example, design special maps showing world temperatures within an hourly time frame—the type of clothing to wear, conditions for vehicle mobility, ethnic groups and languages, amounts of solar radiation, and expected storage life for supplies such as height and density of timber stands, ridges with slope percentages, and vehicle obstacles.

For the Army this all adds up to increasing its knowledge of and ability to operate in any environment. Getting supplies to an area where they are needed is a continuing logistical problem. Increasing the mobility of supplies and equipment over rough terrain and in depots in theaters of operation is a matter of vital concern to the field army.

To this end, NLABS engineers are designing and developing rough terrain forklift vehicles for easy and rapid handling of supplies and equipment at beachheads and airdrop zones.

Essential to an Army becoming increasingly mobile through the use of light aircraft and helicopters is an effective supply of POL (petroleum, oil, lubricants) in the remote areas. As a matter of priority a lightweight, rugged, air mobile refueling system is in final stages of testing. It will get the real test soon in operations in Southeast Asia.

Development of field shower and

bath units, textile and shoe repair trailers, mobile laundry and dry-cleaning trailers, a portable field bakery using a quick-acting bread mix for baking bun-size loaves, and field heating equipment are also making solid contributions toward providing the American soldier the best that modern technology can furnish.

In modern warfare, it is recognized that psychological weapons are often as effective as bullets. NLABS specialists are developing a PSYWAR field printing plant which can produce a variety of multilingual informational materials; also, a machine for speedy rolling and packaging of field-produced leaflets which can be flown and showered down upon an enemy.

A unique instrument in development is a photocomposing machine that uses a combination of electronic, optical and television techniques. Rapid printing of Chinese ideographs, building each from a few basic strokes, thereby completely eliminates reliance on handset type, as traditionally performed in the printing of Chinese.

Spiritual as well as combat needs for men in the field are served by a portable electronic field organ developed at Natick for chaplains to replace the pedal-pumped instrument.

Materials research and design studies have led not only to improved cold-weather apparel and equipment, but to clothing and accessories adaptable to tropic climatic variables.

Developed for the Army's Special Forces units and counterinsurgency groups are such items as a lightweight load-carrying system consisting of a tubular aluminum frame and nylon pack, a multipurpose net, a plastic canteen, lightweight sleeping gear, lightweight clothing, and a jungle hammock.

U.S. Forces in Viet Nam are giving good reports about a new tropical combat boot. Originally designed for Special Forces troops, it is now being procured for other Army elements and the Marine Corps.

Manufactured by a method whereby a complete full-traction type rubber sole is vulcanized directly to a leather-fabric upper, it has been worn for up to six months in the Viet Nam rice paddies and jungles without needing repair. In fact, it is never repaired; when worn out, a new pair is issued.

Natick's mission responsibilities include the operation of a Uniform Quality Control Office. This activity monitors the quality and appearance of military uniforms sold at Post Exchanges and off-post retail stores. Its success led to an off-shoot activity at Natick which is responsible for maintaining quality control and for designing uniforms and insignia for male and female personnel of the U.S. Post Office Department.

Envisioned for future soldiers is a completely air-conditioned garment for wear in any environment. Called the "Thermalibrium" suit by its developers, the outfit is intended to provide a head-to-foot temperature-controlled system for wear in any climate as well as for required chemical protection.

Related work includes development of improved fibers, weaving techniques, water-and-oil repellent treatments, fire-retardant compounds, and functional finishes, all pointed toward improving military clothing.

In chemicals and plastics, work is in progress on foamed-in-place plastic materials with a potential for use as field shelters, and on plastic materials with a potential for use as field shelters, and on plastics for use as energy absorbers.

Exciting progress in food preservation and processing techniques for military use is being made at Natick. Ionizing energy, obtained from a cobalt-60 source and a linear electron accelerator, is used almost routinely in this research effort.

This new method points the way for the worldwide availability of fresh-like foods at any season with minimum or no refrigeration needed. The method effectively destroys microorganisms which normally cause food spoilage and deterioration.

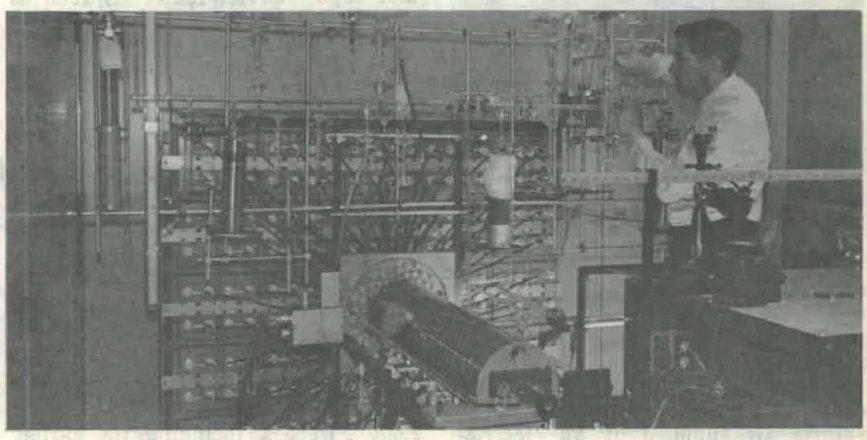
Brig Gen W. W. Vaughan
CG, U.S. Army Natick Laboratories

The Food and Drug Administration has already approved irradiated bacon, wheat flour and white potatoes for human consumption. In the near future, the FDA will be petitioned by the Army to approve irradiated chicken, ham, pork and marine products.

Another current development, barely imagined when the K-ration was the nearest approach to a concentrated meal in a small package, is dehydrated food. Today's dehydrated foods, produced by freeze-drying and other methods, are feather light and rehydrate rapidly under field conditions. Above all, they are extremely palatable, needing only the addition of cold or hot water to restore their original color, flavor and appearance.

The NASA space foods, referred to earlier, include bite-size pieces coated to prevent crumbling. Included are bacon and egg bites, toasted bread cubes, chicken bites, brownies,

(Continued on page 34)



HIGH-VACUUM SYSTEM for flash photolysis is used at U.S. Army Natick Laboratories in studies to provide basic data on photochemical properties of organic dye-like compounds. Selected organic systems undergo a color change when exposed to high intensity light and heat. Among current applications is the development of devices to protect eyes against nuclear explosion flash.

NLABS Broad Mission—From Jungle to Outer Space

(Continued from page 33)

and four freeze-dehydrated foods—beef pot roast, orange juice, applesauce and grapefruit juice.

Packed in flexible pouches, the latter are reconstituted in flight by squirts from a water-pistol type instrument within the space capsule. The eight foods for the Gemini-3 flight were selected from 59 items developed by NLABS food technologists.

Current fast-breaking military concepts rely on airdrop delivery into combat zones of soldiers and their equipment and supplies. Aeronautical and mechanical engineers and parachute design technologists at Natick design better systems, techniques and hardware to enable men and supplies to hit the ground ready for combat.

To overcome the hazards posed by airdropping men and supplies from altitudes of 1,500 feet as is now done, an experimental low-altitude technique for delivery of troops and cargo below 200 feet has been devised.

The new system is expected to operate through a combination of conventional extraction and recovery parachutes, and retro-rockets for reducing the vertical velocity of the load and providing a tolerable ground impact.

Closely identified with the development of food, supplies and equipment is work performed at Natick on a wide variety of containers, packing and packaging techniques, vapor barrier materials, liners and flexible packaging materials.

Such projects may range from the design of a flexible plastic-foil food packet, which a soldier may carry in his pocket, to a unit load container for transport in aircraft, ships and over-the-ground vehicles.

The end result of all this effort is to insure that supplies arrive in condition ready for use when they are needed. NLABS have unique and highly specialized facilities for in-house testing and evaluation of the many items and materials studied in the course of its work.

First of the realistic means of testing is a Solar Furnace, the largest of its kind in the Western Hemisphere. The furnace is used to determine the resistance of materials to high temperature (up to 5,000° F.) to assist in developing equipment to provide thermal protection for the soldier.

The Climatic Chambers furnish a scientific means of assisting testing in the fight of one of man's oldest foes—weather. Soldier-equipment reactions are studied under simulated environments ranging from steaming tropics to windswept arctic wastes.

The NLABS "rain court" provides precipitation which can be varied from a light sprinkling to a torrential downpour. It is used to conduct tests on clothing, tentage and packaging to determine critical variances in seams, stitches, fabric weaves, water-repellent treatments, and vapor barrier materials such as films, foils and treated paper materials. The performance of these materials and end-items is monitored by an electronic "watchman."

While the research and development activities at Natick are important and account for much of its workload, an equally important mission is that of providing support to procurement of items amounting to over $2 billion annually.

Dr. Dale H. Sieling
Scientific Director, Natick Labs

Using data and skills developed in the research and engineering work, NLABS personnel are responsible for the preparation of over 1,600 military specifications and for reviewing and collaborating in the preparation of over 1,000 others.

All of the efforts in standardization and specification field are directed at improving current military items and reducing the number and complexity. This work translates the whole cycle of research, development, test and engineering into a document used to buy the needed item for the user—the combat soldier.

Dedicated and skilled personnel, civilian and military, make up the Natick Laboratories group of scientists, engineers, technologists, technicians and just plain hardworking people needed to make an organization have one goal—to see that the individual soldier has the best support modern science and technology can provide.

AIR-SUPPORTED TENT, developed at U.S. Army Natick Labs, serves as a nose-in type shelter for personnel performing maintenance on Army aircraft. The sectionalized double-wall structure is kept erect by a continuous flow of low-pressure, high-volume air supplied by an electric-powered blower. The tent can be erected in 13 minutes. After the tent is inflated, the blower can be turned off for about 45 minutes without causing the tent to collapse.

$3.5 Million Contract Let for Firebee Target Drones

More than 100 Firebee jet target drones will be built for the U.S. Army and Navy under a $3.5 million contract to Ryan Aeronautical Co.

Carrying production into late 1966, the order increases to about 1,300 the number of advanced BQM-34A (formerly Q-2C) series Firebees produced for the Military Services. More than 2,000 Firebees, including the earlier Q-2A series, have been delivered to the Army, Navy and Air Force.

Re-usability makes the Firebee one of the most economical high-performance targets for air-to-air, ground-to-air, and ship-to-air testing of U.S. missiles and rockets operated by air defense crews.

One Firebee flew 37 missions over a period of three years at the Pacific Missile Range on a wide variety of assignments, including testing and evaluating target systems, augmentation and tracking systems.

Firebees can be launched from the ground or from "mother" planes in the air, can attain altitudes above 60,000 feet and fly by remote control for more than an hour during target missions in testing operations.

Kudos

The Legion of Merit, the Army's second highest peacetime award, was presently recently to Col William W. Stone, commanding officer of Dugway Proving Ground, Utah, for previous service with the Joint Chiefs of Staff, Washington, D.C.

The award, citing his "exceptionally meritorious conduct in the performance of outstanding duties," was presented by Brig Gen James A. Hebbeler, CG, Desert Test Center. Both were key staff members of the U.S. Army Research Office during its first two years of operation.

The award covered the period of August 1962 to August 1964 when Col Stone served as the Army member of the Special Projects Branch, Requirements and Development Division, Plans and Policy Directorate, J5, Organization of the Joint Chiefs of Staff.

COL ROBERT H. YAGER, U.S. Army Veterinary Corps, also received the Legion of Merit for exceptionally meritorious service from July 1957 to April. 30, 1965.

During the period he served first as assistant to the commanding officer, U.S. Army Medical Unit, Fort Detrick, Md., and later as director of the Division of Veterinary Medicine, Walter Reed Army Institute of Research, Washington, D.C.

The presentation, made by Col William D. Tiggert, director of Walter Reed Army Institute of Research, marked Col Yager's retirement from active duty after 26 years. The citation pointed to his "major role in the discovery of valuable medical findings regarding animal diseases transmissable to humans with direct relationship to conservation of the Army's manpower."

COL CHARLES A. HEENE, of the U.S. Army Combat Development Command Experimentation Center, Fort Ord, Calif., also was a recent recipient of the Legion of Merit.

He was cited for distinguishing himself by exceptionally meritorious service while serving as CO of the 3rd Armored Division (Spearhead), United States Forces, Europe from August 1962 to June 1964. Commander of the CDCEC Experimentation Support Group, he is an Armor officer with 25 years active service.

One of the largest cash awards ever given under the Incentive Awards Suggestion Program at the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., recently went to Kenneth D. Robertson.

A young physicist, Robertson received a check for $765 and a Department of the Army Certificate for a suggestion that will save the Government an estimated $22,000 during the first year of implementation.

He proposed that the lensatic compass bowl be modified by reducing the luminous area and, consequently, the amount of tritium activated self-luminous compound. This suggestion substantially reduced the amount of radioactive material which, in turn, reduced the radiological hazard and also decreased the cost per compass.

WRGH Commander Receives Second Star

Maj Gen Henry S. Murphey, commanding general of Walter Reed General Hospital, Washington, D.C., received his second star from Lt Gen Leonard D. Heaton, The Army Surgeon General, in recent promotion ceremonies.

General Heaton also officiated at the promotion of Brig Gen Frederic J. Hughes, director of Professional Services, Offices of The Surgeon General, by pinning on his first star.

General Murphey has commanded Walter Reed Hospital since May 25, 1962 after a tour as commander of Valley Forge General Hospital, Phoenixville, Pa. He received his B.A. degree from Haverford (Pa.) College and an M.D. degree from the University of Pennsylvania.

His professional memberships include the American Academy of Opthamology and Otolaryngology, American College of Surgeons, Association of Military Surgeons, and American Medical Association. He has written several publications on otolaryngological subjects.

Henry S. Murphey, CG, Walter Reed General Hospital gets assistance with pinning of major general insignia by Army Surgeon General Lt Gen Leonard D. Heaton and Mrs. Murphey.

General Murphey holds the Bronze Star Medal, the Army Commendation Medal with Oak Leaf Cluster, and campaign ribbons for the European and Pacific Theaters of Operations.

Weapons Command CG Promoted to Major General

Maj Gen Roland B. Anderson, CG, U.S. Army Weapons Command, received his second star from General Frank S. Besson, Jr., CG, U.S. Army Materiel Command, in a recent ceremony.

Present was General Anderson's immediate predecessor, retired Maj Gen Nelson M. Lynde, Jr. After serving 17 months as deputy, Anderson assumed command Mar. 1, 1964.

General Anderson is responsible for directing and managing the development and production of all of the Army's weapons except missiles.

The Army Weapons Command, headquartered at Rock Island Arsenal, is a major element of the U.S. Army Materiel Command with three subordinate installations: Rock Island Arsenal, Ill.; Springfield Armory, Mass.; Watervliet Arsenal, N.Y.

General Anderson attended the University of Oklahoma for 3½ years before entering the U.S. Military Academy, graduating in 1938. Commissioned a second lieutenant in Artillery, he has served assignments in all areas of the ordnance field, including procurement, industrial management, supply and analysis.

USAPRO Studies Better Integration of Man-Machine Systems

By Dr. J. E. Uhlaner

Activities of the U.S. Army Personnel Research Office (USAPRO) are shaped by a constant objective: to enable the Army to identify the potential fighting force in the civilian manpower pool and to make the best possible use of human resources.

The mission encompasses research in two reaching areas of manpower management. In measurement research, the man is studied as a potential component of the Army's operational systems. In human performance research, the man is studied as a functioning element of those systems.

The human measurement aspect of USAPRO's research mission was presented in the February 1965 issue of the *Army R&D Newsmagazine* in an article by Dr. S. H. King, formerly chief of the Performance Evaluation and Rating Research Group of USAPRO and now a member of the U.S. Army Research Office staff.

The present article describes USAPRO's responsibility on problems of human performances in military systems, and how human factors research approaches these problems.

One approach used by USAPRO is to study each small Army man-machine system. Sometimes this is the only way the problems may be unique to the system as, for example, the Army's image interpretation systems.

In no other set of jobs do individuals use the same viewing techniques, the same skills of identification and estimation, and the same trained conjecture in an attempt to read "ground truth" from aerial reconnaissance photos.

Increased effectiveness in the interpretation process must come from intensive study of these functions in the system in which they occur, to derive principles for families of systems that are to follow.

USAPRO's Support Systems Research Laboratory generates human factors solutions to operating problems within systems such as the image interpretation facility and the command information processing system.

Another approach used by USAPRO is to study behavioral functions —important aspects of military human performance—which are common to a number of small Army man-machine systems. The objective is to gain a better understanding of these functions and to apply the findings across related jobs in various systems. This is the approach taken by the Combat Systems Research Laboratory, dealing with functions underlying performance in communicating and monitoring in a combat environment.

Let's consider an example of intensive study of a particular system.

The human factors scientist has a special way of looking at the image interpretation system. He focuses on the interpreter, true, but he is also concerned with *input*—the raw imagery from which the interpreter extracts intelligence information.

The researcher considers types of imagery (radar, infrared, photos), content (troops, vehicles, missile emplacements), quality of imagery (high resolution, degraded). His objective which he must never lose sight of in his efforts to make an isolated component of the system more effective, is to enhance total *output*. This, of course, is also the chief concern of the military user of the research product.

Experimentation seeks to achieve significant improvement in utilization of a system's individuals, teams, or work force, and may vary methods used by the interpreter, sequence of actions, and equipment.

The investigator brings into play human factors techniques, such as devising objectives measures of the accuracy, completeness and timeliness of the intelligence output. He can then compare output under systematically varied experimental conditions.

USAPRO's Surveillance Systems Research project, started in May 1963, represents a tie-in of human factors research and systems development. The Army has designated the Surveillance Systems Research Laboratory, under construction at USAPRO, as an experimentation center for design concepts for man-machine systems associated with image interpretation. The laboratory incorporates simulation of a computerized Tactical Intelligence Processing and Interpretation Facility (TIPI).

Objective estimates can be made of the efficacy of systems planned or under development by varying the configuration of techniques, concepts and personnel. Designers can use the findings to build into new facilities and future systems computerized functions and controls to supplement the efforts of the human interpreters. Findings are also of immediate utility in image interpretation facilities.

A computer that might be developed for a TIPI-like system is visualized as doing more than perform routine housekeeping chores of computation, storage, and retrieval of data. It can give the interpreter the benefit of almost instantaneous feedback to help him decide how accurate his interpretation is.

Intelligence information produced by an interpreter from an aerial photo of known quality and scale and taken over designated terrain would be fed into a computer. By applying a

Dr. J. E. Uhlaner

Dr. J. E. Uhlaner has been director, Research Laboratories, U.S. Army Personnel Research Office since 1961 and a member of USAPRO since 1947. He has concentrated on development of a research program of human factors utilization problems in man-machine systems, integrating personnel measurement and experimental approaches. Earlier contributions included screening and selection, classification, behavioral evaluation and efforts leading to implementation of the Armed Forces Qualification Test by all the military services.

Presently he serves on a number of committees, including the Engineering and Psychophysiology Panel of the Department of Defense Research and Development Board, the Armed Forces National Research Council Committee on Vision and the Army Human Factors R&D Committee.

Dr. Uhlaner has a B.S. degree from College of the City of New York, an M.S. from University of Iowa, and a Ph.D. from New York University, all in psychology. In 1960 he received the Meritorious Civilian Service Award.

He is a Fellow in four divisions of the American Psychological Association and a member of the Washington Academy of Science, Human Factors Society, Operations Research Society of America and the International Association of Applied Psychology. During WW II he was in the Army Air Corps.

programmed formula to new and stored data, the probability that the item is correct would be calculated.

The formulas developed to yield these "probability indexes" will capitalize on what has been learned—and is being learned—in the USAPRO research laboratory about factors which influence the accuracy and completeness of interpreters' reports.

For example, time does not necessarily work to the advantage of the interpreter examining a piece of imagery. Identifications he makes in the early part of a viewing period are more likely to be accurate than those he makes later.

Evidently, the longer an interpretor looks at a photo, the more likely he is to respond to doubtful cues—cues which are at the threshhold of resolution. Information produced within a brief time is likely to be accurate, even though the possibilities of the photo are by no means exhausted.

Routine practice requires interpretors to record the degree of confidence they feel in each identification—whether they consider it certain, probable or possible. Research has established that they tend to have greater confidence in their correct reports than in those that prove to be wrong.

This finding generated studies now being conducted to find whether—and how — interpreters' judgments about the information they supply can be harnessed and made useful to decision-makers.

Research verification of such results as these led to exeprimentation to establish relationships between accuracy and time, completeness and time, accuracy and completeness. Tradeoffs frequently are involved; any one of the requirements can be emphasized, but often at the expense of the others.

The broader USAPRO research program on surveillance systems includes studies on interpreter techniques in a surveillance facility, influence of displays on image interpreter performance, man-computer functions in an advanced image interpretation processing system, and integration of men, equipment, and procedures in surveillance information processing.

In another system-based effort, USAPRO has undertaken research to enhance the effectiveness of human factors in command information processing systems. To meet the militarv requirements for rapid and continuous updating of vast amounts of data, the Army is developing a network of automated systems.

An ever-increasing load of information pours into the processing center from a variety of sources. The system must screen incoming data, sort it, and store it so that relevant items can be retrieved and displayed when needed.

The picture of events must be assimilated from alpha-numeric and symbolic displays. Combined with information already available, "updates" serve as a basis for tactical decisions. The information must be accurate and it must be supplied in a minimum of "search time."

Such systems can measure up to the demands imposed upon them only if the human element in the system is so integrated that man can be maximally effective in rapidly making the right decisions.

The cornerstone of a research program to support such systems development is more research-based knowledge about the process of human decision making.

Results from USAPRO studies of information processing and assimilation have indicated how the capacity requirements for data storage can be reduced—no small consideration in view of the masses of information processed in such centers.

Findings have also shown how the amount and arrangement of information presented on displays may be modified for quicker and more accurate apprehension—how location of relevant items of information on a display may be aided by coding devices. On-going investigations involve laboratory simulation of subsystems critical to the functioning of command information processing systems.

In contrast to the Support Systems Research Laboratory just described, the Combat Systems Research Laboratory concerns itself with problems that are common to a number of systems. Complex combat and weapons systems have created a relatively new series of monitor jobs requiring alertness and dependability in high degree.

Operators in these systems must detect and identify a variety of visual and auditory signals which are minute, fleeting, occur unpredictably, and are often embedded in distracting sights and sounds. Scientists are studying the performance of monitors so that output can be measured under a variety of signal, task, technique and environmental conditions.

USAPRO has an audition and communications laboratory with basic equipment of original engineering design to perform communications and monitor research under controlled conditions. The laboratory has facilities for simulation of monitoring conditions and signal form and occurrence that make up a specific problem situation.

Many of the laboratory's findings are classified. A typical unclassified finding has provided guidance to better utilization of operators in noise. At medium noise level, multiple transcriber techniques somewhat increased overall accuracy and reduced the number of items incorrectly transcribed by more than 10 percent.

During the past several decades, the Army has had to adjust swiftly to technological change, assimilating to its doctrine and structure the products of new discoveries in science. Human factors research has assumed a substantial supporting role in manpower management's efforts to keep pace with, and particularly to anticipate, changing needs of the service.

This orientation is evidenced in measurement research and in research on human performances in military systems. It is apparent in the posture of the USAPRO laboratories, whose selection and classification objectives

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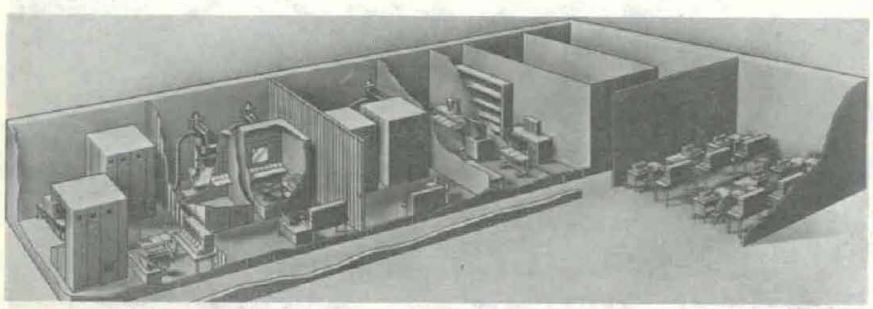


USAPRO SURVEILLANCE Research Laboratory (artist's sketch) shows rear projection viewers (in cutaway booth) by which images are presented to an interpreter in a controlled environment. The "closed" and "open" stations at right are connected to a computer for programmed instructions, presentation of information, and automated data.

USAPRO Studies Integration of Man-Machine Systems

(Continued from page 37)

are attained chiefly through psychological measurement. Here the impact of swiftly evolving concepts in materiel and tactics is sharp and considerable.

High standards of man-for-man effectiveness must be met if the Army is to carry out its worldwide mission. Selection and classification techniques look to new jobs and new human functions required as a part of new weapons systems and new tactical concepts. But selection and classification alone, even when training is added, can by no means do the whole job of making man an effective performer in Army systems.

Maintaining close ties with the material scientist and combat developments experts, USAPRO's two systems laboratories—heavily backed by the Statistical Analysis Research Laboratory with its computer-based competence—concentrate their efforts on functional relationships between men, jobs and machines.

The concept of quality performance of the individual has broadened to include the quantitative measurement of the output of the system of which man is a part. As military experts and hardware developers produce ever more intricate devices, capabilities of an ever higher order may be demanded of the human component. The reverse of the coin is that human capabilities and limitations set their own bounds.

In its 25 years of operation, USAPRO has developed a body of research techniques and methodology related to measurement and quantification of human functioning. These techniques have led to consideration of the more inclusive aspects of human factors research.

Additionally, psychology and the related social sciences have at their disposal many other experimental approaches, all variations of the scientific method, which can be directed toward maximizing productivity of human effort.

Characteristics of personnel, work methods, personnel placement within a facility, man-equipment interactions —all may be experimentally varied to determine by what means a system can be operated at peak effectiveness. Personnel costs and dollar costs have yet to be reconciled by means of a common metric.

This kind of "job engineering" emphasizes systems under development or contemplated for the future, rather than systems now in operation. In fact, a powerful human factor research can make is to delineate the role of the man in future systems, applying studies of psychological and behavioral capabilities and limits in shaping the character of human functions in such future systems.

Five Appointments Announced For Defense Science Board

Appointment of a new vice chairman and four new members to the Defense Science Board, the senior technical advisory board body in the Department of Defense, was announced recently by Secretary of Defense Robert S. McNamara.

Patrick E. Haggarty, president of Texas Instruments, Inc., succeeded Dr. Allen E. Puckett, executive vice president of Hughes Aircraft Co., whose term as vice chairman of the Board expired. Dr. Puckett continues as a member of the Board.

The four new members are: Dr. Robert W. Cairns, director of research, Hercules Powder Co.; Maj Gen James McCormack, USAF (Ret.), vice president of the Massachusetts Institute of Technology; Perry W. Pratt, vice president and chief scientist, United Aircraft Corp.; and Dr. Andrew D. Suttle, Jr., vice president for research and professor of chemistry, Texas A&M University. They succeed four members whose terms also expired last December.

The Defense Science Board is composed of members appointed from civilian life by the Secretary of Defense and of members representing major Federal agencies.

The Board advises the Secretary of Defense, through the Director of Defense Research and Engineering, on scientific and technical matters of interest to the Department of Defense.

Mr. Haggerty, an electronics engineer, is a Fellow of the Institute of Electrical and Electronic Engineers, a member of the National Security Industrial Association, and the Society for Exploration Geophysics.

Rocket Motor System Contract Let

The U.S. Army Missile Command recently awarded a $137,000 contract to the Rohm and Haas Co., for continuation of a program to develop a solid/hybrid rocket motor system. Work under the contract will be performed at the Redstone Arsenal Research Division of the company, and will cover a period of five months.

Army Accepts CV-7A Buffalo Prototypes for Testing

The first of four prototypes of the CV-7A Buffalo transport airplane was accepted recently for testing by the U.S. Army from the DeHavilland plant at Toronto, Canada.

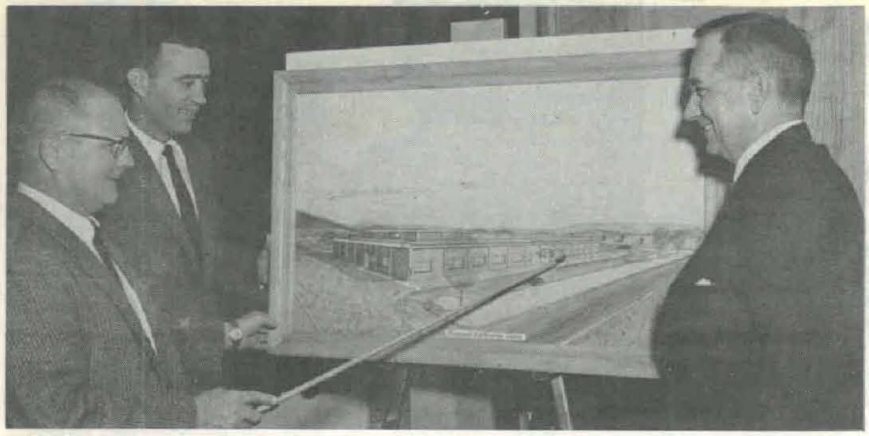
The Buffalo is a STOL (Short Takeoff and Landing) airplane developed from the CV-2B Caribou. It weighs 38,000 pounds, has a speed of 232 knots, and can land in less than 1,000 feet over a 50-foot barrier while carrying nearly four tons of payload.

The CV-7A, which has been flying for about a year, has been certified by the Canadian Department of Transport and the Federal Aviation Agency. It was produced under a cost-sharing arrangement between the Canadian Government, DeHavilland Ltd. and the U.S. Army.

The turbine engines, propellers and electronic equipment are all of U.S. manufacture. The U.S. Army will conduct extensive service, engineering and climatic tests of the four aircraft in the next year.

CV-7A Buffalo, STOL Transport

$1.3 Million Calibration Center Planned for Redstone



Don I. Hervig, chief, U.S. Army Missile Command Calibration Center, explains features of $1.3 million building to his deputy, Lewis D. Ellenberg (right) and David L. Rice of the Operations Office at Redstone Arsenal, Ala.

Ground was broken recently for construction of a $1.3 million U.S. Army Missile Command Calibration Center at Redstone Arsenal, Ala. Maj Gen John G. Zierdt, Missile Command CG, officiated at ceremonies.

The new facility will be more than twice as large as the present Calibration Center, where precision measurements traceable to the National Bureau of Standards, Washington, D.C., are made. Offices and storage rooms will be located around the perimeter of the 150-by-200-foot concrete and masonry building.

The three main laboratories will be situated in the center, separated from the rest of the structure by a continuous hallway, which will act as a buffer zone of dead air space. The building will contain 39,280 square feet of floor space.

Because of the accuracy of measurements made at the Calibration Center—some to within one-millionth of an inch—it has been designed with unique features. The critical areas, where outside vibrations would affect the sensitive instruments, will be built on a 4-foot-thick concrete slab.

The floor of the Microwave Standards Laboratory will be detached from the walls so that outside forces, such as ground tremors, will not throw off delicate operations.

An elaborate air conditioning system will control temperature, humidity and dust in the laboratories, insuring a complete turnover of air every eight minutes. In the Physical Standards Laboratory, where length measurements are made, temperature must be kept at 68° F.

The Electronic and Microwave Standards Laboratories will be inclosed in a "box" of 28-gauge sheet metal to keep out vibrations. All water, electricity and telephone lines running into the building will be filtered to cut out any interference.

As a worker enters the Physical Standards Laboratory, his shoes will be vacuumed free of dust, and dirt will be removed from the soles as he walks on "fly-paper-type" material. Then, he will take an air shower. "Ultra-clean room" conditions will be maintained in some parts of the laboratories and a person entering must change from his street clothes.

The mission of the Center is to provide calibration services in inspecting, testing and adjusting components of missile and rocket weapon systems. The new facility is being erected because of the steady increase in demand for precision measurements and the lack of desired environmental control in Building 4500, where the Center has been located since it was established in 1961, according to Don I. Hervig, chief of the Calibration Center.

The new Center will be built on a site northeast of the Missile Command's Francis J. McMorrow Missile Laboratories. It will provide calibration support to all elements of the Army Missile Command, Missile Command contractors where appropriate, National Aeronautics and Space Administration, and other Army and Department of Defense activities as required.

DDR&E Elevates Fink to Strategic, Defensive Systems Deputy

Daniel J. Fink was elevated May 1 from Assistant Director of Defense Research and Engineering for Defensive Systems to Deputy Director for Strategic and Defense Systems.

Fred A. Payne, Jr., who returned to private industry, had served as deputy director for three years after a year as assistant director. As assistant director since August 1963, Fink was responsible for management of major air, missile and space defense systems development.

Before his Department of Defense appointment, he was vice president of Allied Research Associates, Inc., Concord, Mass., with responsibility for management of technical operations.

Previously he was chief of aircraft dynamics, Bell Aircraft Corp., Buffalo, N.Y., and earlier was with the Cornell Aeronautical Laboratory. He received B.S. and M.S. degrees in aeronautical engineering from the Massachusetts Institute of Technology.

Dr. Harold Brown, Director of Defense Research and Engineering, awarded Payne the Distinguished Public Service Medal prior to his departure. Payne was manager of Advanced Systems Planning for North American Aviation, Inc., before his DoD appointment.

Springfield Armory Holds Youth Science Day

Thirteen scientifically gifted high school seniors from the Springfield (Mass.) system "took over" the U.S. Army Weapons Command's Springfield Armory on Youth Science Day, May 11.

Scheduled annually as part of the Armed Forces Week observance, the event is designed to stimulate interest among top science students of area high schools; also, to acquaint them with operational procedures used by the Armory commanding officer and his staff.

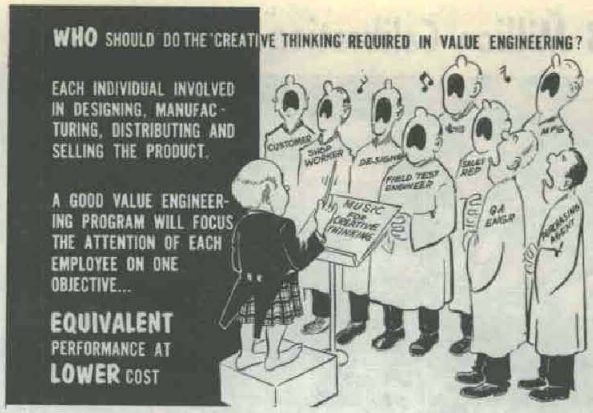
In addition, the students were given the opportunity to solve a professional-type assignment and carry out program-related work.

Students serving as key honorary officials of the day were: Commanding Officer, Peter A. Bloniarz; Deputy CO, James B. Carleton; Chief, Research and Engineering Division, Lawrence R. Swetland; Chief, Installation Facilities Office, Robert J. Wszolek; Chief, Management Science Office, Kenneth G. Condon.

Chief architect and chairman of the Youth Science Day program is Dr. Alexander Hammer, chief of the Support Research Branch, Research Engineering Division.

Value Engineering . . .

"An organized creative approach to lower the cost of a function . . . while achieving equivalent or better performance and reliability."



Cost reduction methodology at Picatinny Arsenal, Dover, N.J., recently saved the U.S. Army and American taxpayers a reported $13.5 million.

By applying the principles of value engineering Picatinny engineers found a way to modify the M-6 warhead of the Honest John rocket so it would function properly with the new motor of the improved Honest John.

It meant that the numerous warheads would not have to be returned to the U.S. from overseas Honest John sites, destroyed and replaced with newly procured warheads designed specifically for the improved missile.

This is only one of many examples of savings through value engineering, one of 24 areas in the Army Cost Reduction Program. During Fiscal Year 1964, value engineering saved the Army over $62 million.

The U.S. Army Materiel Command (AMC), which has responsibility for development and procurement of the Army's hardware, achieved over 99 percent of the Army's value engineering cost reduction. The FY 65 goal has been set at $50 million. Over $44 million was realized during the first half.

The Chief of Research and Development has responsibility for overall staff supervision and coordination of the Army Value Engineering Program. Contributors in addition to AMC are the Army Corps of Engineers and the Office of The Surgeon General. Their individual value engineering programs are still in early stages of development, but are expected to show significant progress by the end of the current fiscal year.

In the past, value engineering was known as value analysis and still is referred to as the "elimination of goldplating." Value engineering, however, is a more fundamental approach than old-fashioned cost-cutting.

VE takes nothing for granted and attacks everything about a product, including the existence of the item itself, subject only to the restriction that the required function or performance must not be changed.

The following example from the Department of Defense Value Engineering Handbook illustrates the distinction:

The cover for an electronic circuit is too expensive because it was designed in a hurry, with the result that it was made largely by hand. Traditional cost-cutting would improve the design and look for better materials and processes to build it.

Value engineering, by contrast, would first define the function of the cover—then look for alternative ways of providing function. Perhaps the cover is supposedly necessary to prevent personnel from being shocked—although there are no dangerous voltages in the circuit.

Thus, use of the value engineering approach eliminates the cover—does not redesign it. The basic function—safety—was met in the circuit design itself and the cover is superfluous. Value engineering leads to cost reduction but is not what many people call cost-cutting.

VE is *not* a trade-off between cost and performance. VE makes required function or performances a constant rather than a variable. In value engineering, required function or performances cannot be reduced, even to reduce cost.

Similarly, value engineering may make use of design techniques as it draws upon all available and scientific disciplines. But to say that VE is nothing more than good design engineering is erroneous.

Value engineering in the defense effort is considered to be somewhat above and beyond the present status of original design practice. It is an adjunct to it—the all-important second look once the pressures of performance, reliability and early delivery have been relieved.

The basic elements of value engineering are the same, whether applied to production, research and development, design or purchasing. The DoD VE Handbook lists seven basic steps: product selection, determination of function, information gathering, development of alternatives, cost analysis of alternatives, testing and verification, proposal submission and followup.

The DoD Handbook also defines value engineering as: *An organized effort directed at analyzing the function of defense hardware with the purpose of achieving the required function at the lowest overall cost.*

In developing alternatives and reviewing for technical feasibility, the value engineer may ask himself these questions: Can the design be simplified? Can a standard part be used instead of a machined part? Will a coarser finish be adequate? Can two or more parts be combined? Is function or quality sacrificed? Is safety or maintainability compromised?

Defense Procurement Circular No. 11 changed Part 17, Section I of the Armed Services Procurement Regulation (ASPR) to incorporate additional value engineering features in Defense contracts.

The Circular encourages prime contractors to establish value engineering programs and to encourage subcontractors also to practice value engineering. Department of Defense policy further states that the Government will be "generous in sharing value engineering savings so long as they are definite cost reduction savings."

Savings resulting from a value engineering program take the form of *initial savings*, achieved at the time a change is first introduced on a procurement quantity and *follow-on savings*, those which accrue in procurement or production of additional quantities of items on which initial savings were reported previously.

Initial net savings of $4,480,000 resulted from a recent value engineering study by the contractor, Aerojet General Corp., on the M449 projectile. Some components were eliminated, others redimensioned, materials were changed and manufacturing and assembly processes were modified, saving $45 per round.

Redesign of a 155 mm. projectile by value engineers at Picatinny Arsenal,

Dover, N.J., produced initial savings of $4,618,900.

A value engineering study by the U.S. Army Tank Automotive Command, Warren, Mich., resulted in substitution of TX100 transmissions in place of TXG90 transmissions for the M113A2 family of armored vehicles, saving $1,462 per unit and $807,000 yearly.

Redesign of the guidance power supply of the Sergeant missile by contractor Sperry Utah, division of Sperry Rand, saved $2,962 per unit and $429,000 yearly.

A value engineering analysis by the U.S. Army Missile Command, Redstone Arsenal, Ala., eliminated the dummy load in the Nike Hercules missile system for field use and saved $11,895 per unit and $197,000 annually.

A somewhat different example of value engineering at White Sands (N. Mex.) Missile Range saved the Government $183,260 through modification of an existing structure as a radar environmental shelter instead of building a new one.

Value engineering got its start in the Army at Watervliet Arsenal, N.Y., in 1956, when the first VE unit was organized to train personnel in VE techniques and to pursue value engineering on a full-time basis.

By mid-1958, all Army arsenals had begun to apply VE techniques. Results at these arsenals gained Army-wide attention. In 1959, an Army instruction appeared which required commanders of installations to report value engineering savings.

Army Regulation 11-26, dated Oct. 23, 1963, provided guidance and established policies and responsibilities for the Army Value Engineering Program. Its objective was stated as: "To reduce the cost of the research, development, test and evaluation (RDTE) and procurement programs without an attendant degradation of functional characteristics of materiel. The pertinent reduction in cost may take the form of savings in monies, materials, facilities or labor."

The AR also specifies that "value engineering will be emphasized and implemented by commanders, technical directors and chiefs of operating agencies concerned with developing and producing materiel."

While assigning staff responsibility for the Army Value Engineering Program, AR 11-26 also stated that within existing resources the commanding general of the U.S. Army Materiel Command, Chief of Engineers, The Surgeon General and the Chief, U.S. Army Security Agency will:

Formulate plans and procedures for developing value engineering programs in their respective commands/agencies to carry out the policies in this regulation and establish procedures for periodic management review of the progress and overall status of their program.

- Designate a program officer as point of contact on VE matters.
- As required, provide for training personnel to perform VE functions.

Training is an important element of a comprehensive value engineering program and requires proper emphasis if value engineering is to reach its full potential.

Since the U.S. Army Materiel Command (AMC) was created in 1962 value engineering at AMC has taken two paths of direction.

First, since some development and a limited amount of production is done in-house, VE training has been conducted for the people of the subordinate commands and installations. VE offices have been established at these locations to provide an in-house program.

The greater portion of AMC's development and production, however, is accomplished under contract. Hence, contractor value engineering programs are expected to yield the large VE savings. Value engineering clauses are included in almost all new contracts with a face value of over $100,000. In addition, in certain contracts, value engineering programs are established as a line item in the basic contract.

Currently AMC has over 500 contractors holding in excess of 900 contracts which include value engineering provisions. Over 800 of these have incentive or sharing clauses and over 60 have full-scale VE features.

The Army Corps of Engineers recently initiated a training program for 1,200 of its key personnel in the principles of value engineering as a part of continuing efforts to reduce costs in the Corps' worldwide construction program.

The courses are designed to assist Corps personnel in administering the value engineering clauses now included in all Corps of Engineers new contracts of $100,000 or more.

The training sessions, to be conducted by Harbridge House, Inc., Boston, Mass., will be held at 10 locations throughout the United States and one site overseas. Each session will include two 20-hour courses.

There will also be two 4-hour briefings for key executives who need to become more familiar with the principles of value engineering but who do not work with it day-to-day.

Defense Secretary Doubles Value Engineering Goals

Two actions designed to attain an annual Department of Defense savings of $500 million through value engineering were effected earlier this year by Secretary of Defense Robert S. McNamara.

Designed to double the annual savings resulting from the elimination of goldplating or unnecessary qualitative features in defense hardware, the actions are as follows:

Each Military Department and the Defense Supply Agency was requested to submit a plan indicating where value engineering personnel can most productively be assigned and what savings will be achieved.

- To evaluate these plans, he established a Value Engineering Evaluation Group composed of the Materiel Secretaries of the Military Departments, the Assistant Secretary of Defense (Deputy Director, Defense Research and Engineering), and the Director, Defense Supply Agency, chaired by the Assistant Secretary of Defense (Installations and Logistics).

Secretary McNamara pointed out that "Total savings attributable to value engineering in Fiscal Year 1964 reached $250 million, far exceeding the goal of $116 million established by the Military Departments and the Defense Supply Agency.

"I believe," McNamara said, "that this amount represents no more than half the level of annual savings which should be possible through the maximum use of value engineering. The actions we have taken should double the level of Fiscal Year 1964 performance and attain a savings rate of $500 million each year by 1967."

Intentional Errors Claimed

The Human Resources Research Office, an element of the George Washington University, Washington, D.C., publishes a bi-weekly information sheet titled *HumRRO Highlights*. The June 1 edition carried this item:

SPECIAL "IF THE SHOE FITS" NOTE. If you find a mistake in this or any other issue of the *HumRRO Highlights*, please consider that it was put there for a purpose. We try to publish something for everyone and some of you always look for mistakes.

Research & Development Awards Honor 24 Army Scientists

(Continued from page 3)

projectiles, and the performance of a shaped charge.

DENNIS D. KASPAREK, U.S. Army Electronics Research and Development Activity, U.S. Army Electronics Command, White Sands, N. Mex. Significant contributions to the development of U.S. Army antitank missile systems through design and development of a system for investigation of electronic countermeasures (ECM) vulnerability.

Design features of the system make it capable of adaption to a variety of other applications other than its basic purpose and improve significantly the Army's technical capability.

MILTON LEVY, U.S. Army Materials Research Agency, Watertown, Mass. As a supervisory physical chemist, developed a lightweight ceramic-plastic composite armor system with outstanding ballistic performance which materially improves the Army's technical capability in the area of armor protection. Contributed to the development of antigalling coating for titanium and an oxidation resistant composite coating system for molybdenum nose cone re-entry vehicles.

Served as consultant or assisted with ARPA Re-entry Vehicle Program, Watervliet Arsenal Mortar Development Program, Picatinny Arsenal Liquid Propellant Rocket Engine Program, and Ballistic Research Laboratory Solid Propellant Rocket Engine Program.

ELSIE McABEE and MITCHEL CHMURA, Picatinny Arsenal, Dover, N.J. Developed a high-rate loading apparatus and test technique which allows for the first time a comprehensive evaluation of the effect of high rate loading on the mechanical properties of plastics. Determined the existence of a correlation between the laboratory data developed with formance of glass reinforced plastic backup in lightweight aircraft armor.

Results indicate that the proper combination of mechanical properties in a plastic would make it a promising candidate for effective armor. Evaluated and reported on the properties of many glass reinforced plastics, thereby achieving for the Army widespread international recognition for the pioneering effort in this field of research.

BENJAMIN D. PILE, U.S. Army Medical Equipment Research and Development Laboratory, Fort Totten, Flushing, N.Y. Conceived the basic design and acted as project engineer in the development of a rugged lightweight portable-battery-operated field X-ray apparatus which significantly improves the capabiilty of the Army Medical Services to provide radiological service in forward and remote areas where conventional electrical power is not available.

FERDINAND A. SCERBO, CARMINE J. SPINELLI and BARTHOLOMEW R. STANG, Picatinny Arsenal, Dover, N.J.; E. N. HEGGE, J. I. BLUHM and F. J. RIZZITANO, U.S. Army Materials Research Agency, Watertown, Mass.; CHARLES CRICKMAN and JOHN CULLINANE, Harry Diamond Laboratories, Washington, D.C.; KALMAN M. SCHULGASSER and D. R. LENTON, Frankford Arsenal, Philadelphia, Pa. As a team they made significant contributions toward improving the Army's capability by several orders of magnitude through design and development of the XM454 Projectile. This development program required many new and radical design features, and technological innovations in order to have a safe, reliable and effective item.

CHANDLER STEWART, U.S. Army Engineer Research and Development Laboratories, Ft. Belvoir, Va. Supervised and personally engaged in applied research related to techniques and equipment for Guerrilla Warfare Countermeasures. Invented and provided the essential design ideas for a low-cost, reliable all-weather concealed passive intrusion detector with radio, or direct alarm indicator which has distinct advantages over systems using radar, infrared, acoustics and seismics. Its immunity to weather, vegetation and animals, along with its complete concealment and long operating life, makes this system unique in comparison with equipment now in use.

The system development was accomplished in the face of overwhelming evidence from other authorities in the field that a system employing the principle proposed by Mr. Stewart could not be competitive with other systems, both in detection characteristics and cost.

HARREL L. WALKER, U.S. Army Surgical Research Unit, Brooke Army Medical Center, Fort Sam Houston, Tex. Made significant personal contributions toward understanding the nature of the burn wound and improving therapy through development of the Pseudomonas burn wound sepsis model.

Subsequent developments using this model revealed that use of a topical chemotherapeutic agent could prevent fatal Pseudomonas burn wound sepsis. Made significant contributions to the research work of investigators and to scientific papers published in *The Annals of Surgery*, of which he is senior author.

DR. RICHARD L. WILBURN, Dugway Proving Ground, Dugway, Utah. Significant contributions to improved testing capability at Dugway Proving Ground in the area of field assessment of chemical agents. Conceived a modification to commercial instrument used to count bacteria colonies which enables it to size and count spots formed by fallout of agents. Conceived a modification to commercial instrument used to count bacteria colonies which enables it to size and count spots formed by fallout of agent or simulant droplets on paper surfaces during testing.

Developed and proved a concept for the field testing of GB munitions using a well-known chemiluminescent reaction, the enchancment of the oxidation of Luminal by the presence of Savin (GB). Also, contributed to the development of instrumentation for the automatic counting of fluorescent particles on various collecting surfaces. Fluorescent particles are of considerable importance as tracers in studies of meteorological and aerobiological problems.

DR. ROBERT S. WISEMAN, U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va. As chief of the Warfare Vision Division, he directs and coordinates research and development projects for passive viewers which amplify ambient light from the night sky, stars and moon and for active sources of light that will provide the soldier with the ability to see in the dark.

Dr. Wiseman has been principally responsible for the high state of image intensification technology leading to the development of an image intensifier tube of sufficient quality for use in various military night-vision systems. His contributions to program planning and execution made the first generation of equipments employing this principle available for immediate military use.

Army Announces 24 Selections For R&D Achievement Awards

(For other winners and achievements that earned awards, see page 44.)

(1) FERDINAND A. SCERBO, Picatinny Arsenal, Dover, N.J. (2) F. J. RIZZITANO, U.S. Army Materials Research Agency, Watertown, Mass. (3) BARTHOLOMEW R. STANG, Picatinny Arsenal, Dover, N.J. (4) D. R. LENTON, Frankford Arsenal, Philadelphia, Pa. (5) E. N. HEGGE, U.S. Army Materials Research Agency, Watertown, Mass. (6) MITCHEL CHMURA, Picatinny Arsenal, Dover, N.J. (7) J. I. BLUHM, U.S. Army Materials Research Agency, Watertown, Mass. (8) ELISE McABEE, Picatinny Arsenal, Dover, N.J. (9) JOHN CULLINANE, Harry Diamond Laboratories, Washington, D.C. (10) KALMAN M. SCHULGASSER, Frankford Arsenal, Philadelphia, Pa. (11) CARMINE J. SPINELLI, Picatinny Arsenal, Dover, N.J. (12) CHARLES CRICKMAN, Harry Diamond Laboratories, Washington, D.C.

Army Announces Selection of 24 R&D Achievement Award Winners

Twelve of 24 Research and Development Achievement Award winners for 1965, selected from 11 Army in-house laboratories, are pictured on this page. For other winners and the achievements that earned them the awards, see pages 42-43.

(1) HARREL L. WALKER, U.S. Army Surgical Research Unit, Brooke Army Medical Center, Fort Sam Houston, Tex. (2) FRANCIS W. BOTSCH, U.S. Army Research Institute of Environmental Medicine, Natick, Mass. (3) CHANDLER STEWART, U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va. (4) DR. FREDERICK D. BENNETT, U.S. Army Balistic Research Laboratories, Aberdeen Proving Ground, Md. (5) BENJAMIN D. PILE, U.S. Army Medical Equipment Research and Development Laboratory, Fort Totten, Flushing, N.Y. (6) DR. PAUL D. FLYNN, Frankford Arsenal, Philadelphia, Pa. (7) DR. ROBERT S. WISEMAN, U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va. (8) DENNIS D. KASPAREK, U.S. Army Electronic Research and Development Activity, U.S. Army Electronics Command, White Sands, N. Mex. (9) DR. JOHN H. GIESE, U.S. Army Ballistic Research Laboratories, Aberdeen Proving Ground, Md. (10) ANTHONY L. ALESI, U.S. Army Natick (Mass.) Laboratories. (11) MILTON LEVY, U.S. Army Materials Research Agency, Watertown, Mass. (12) DR. RICHARD L. WILBURN, Dugway Proving Ground, Utah.