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AMC Revamping Materiel Acquisition Process in PROMAP-70

Details of a Program for Refinement of the Materiel Acquisition Process (PROMAP-70), involving 38 elements of vast significance throughout the Army Materiel Command, were announced Dec. 8 by AMC CG General F. J. Chesarek.

Deputy Secretary of Defense David Packard and Secretary of the Army Stanley R. Resor have approved the program, requiring closely coordinated effort of six HQ AMC directorates and staff offices. Parallel programs on each of the 38 elements will be developed within all AMC commands.

AMC Deputy CG for Materiel Acquisition Maj Gen Paul A. Feyereisen heads the developmental program. General Feyereisen gained international prominence as the first U.S. program and project manager for the Mallard Project, a 4-nation, 10-year multimillion-dollar effort initiated in 1966 to develop an interservice tactical communications network.

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Judges Select Papers for 1970 ASC

Competition was never tougher, in the 12-year history of the U.S Army Science Conference, than for the honor of presenting a technical paper at the 1970 sessions, June 17–19, at the United States Military Academy.

Approximately 550 aspirants submitted narrative summaries of proposed presentations, exceeding the 1968 record total by about 75. Judges recently selected 100 papers for presentation. Twenty-one others are in the supplemental category—to be considered as alternate presentations in event of cancellations.

Under the Army Incentive Awards Program, prize-winning papers presented at the Army Science Conference received cash honorariums, usually totaling about $3,500, plus Certificates of Achievement. Consideration is being given this year to supplementing this form of recognition with two types of medallions for papers judged most outstanding.

All of the presentations of technical papers are limited to reports of research conducted in-house at Army laboratories. The conference enables scientific investigators to describe results of their experiments before a gathering of 400 to 500 of the leading scientists, engineers, technicians and R&D management personnel in the Department of Defense.

Under provisions of the Quadripartite Agreement between the United

(*Continued on page 30*)

Maj Gen Paul A. Feyereisen

NASA Permits AMC Joint Use of Facilities

Expansion of the national capability in low-speed aviation research, at a saving estimated at about $100 million—that is, avoiding cost of constructing a separate Army facility—is the payoff of a recent Army Materiel Command-NASA agreement.

Providing for joint use of existing National Aeronautics and Space Administration test chambers, wind tunnels and other facilities by scientists and engineers of the two agencies, the agreement is an expansion of a pact negotiated in 1965.

The original arrangement established the U.S. Army Aeronautical Research Laboratory at the NASA-AMES Research Center at Moffett Field, Calif. Now the Army has gained use of such NASA facilities as

(*Continued on page 5*)

OCRD Reorganizes to Offset Personnel Cutback

Impact of governmental economies requiring reductions in Department of Defense expenditures to save upwards of $3 billion in FY 1970 is evidenced in organizational realignments within the Office of the Chief of Research and Development, HQ DA.

Effected Nov. 24, the changes involve consolidation of certain elements, establishment of a directorate and two new divisions, assumption of additional duties by some directorates and offices, and transfers of functions to save manpower.

Resulting from several weeks of "hard head-knocking" to come to grips with the problem of reorganizing to carry on essential functions with 47 less military and civilian personnel, the changes are based on determinations of an OCRD working group. Personnel losses represent about 20 percent of former authorized strength.

Col Frank L. Taylor, chief, Management and Evaluation Division, Directorate of Plans and Programs, headed the group comprised of representatives of each OCRD directorate and office. The reorganization was accomplished principally by eliminating positions temporarily vacant. The M-E Division was the heaviest loser with a total of seven spaces.

In examining cutback and consolidation possibilities, the working group gave first consideration to eliminating or transferring those functions least directly related to basic OCRD functional responsibilities. The next cut hit at support spaces rather than those that are hardware oriented.

The Director of Advanced Ballistic Missile Defense is newly established, with Army General Staff responsibilities in this area, as well as national missile range activities formerly performed by the Missile Defense,

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Featured in This Issue . . .

Army R&D Newsmagazine

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Editor . . . . . Clarence T. Smith
Associate Editor . . . . George J. Makuta

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

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Army to Install CRFS in 11,6000 Aircraft by 1975

Deaths due to post-crash fires in U.S. Army aircraft are expected to be reduced 72 percent by installation of a newly developed Army crash-resistant fuel system (CRFS) in about 11,600 aircraft by 1975.

In announcing a decision to install CRFS in its entire aircraft fleet, the Department of the Army said the first planes to have the life-saving system will roll off production lines in the spring of 1970. Nearly all Army aircraft are expected to be converted to CRFS by 1975.

Army aviation safety experts "conservatively estimate the new fuel system will cut deaths due to post-crash fires by 72 percent, by minimizing fire hazards due to ruptured fuel tanks and lines."

Heralded by Army spokesmen as a "major aviation safety breakthrough," the new system incorporates a combination of design, high-impact-resistant materials, and self-sealing fuel tanks coupled with breakaway lines.

The system is expected to have wide application in civil as well as military aviation, Army researchers stated.

The Army provided the impetus and nearly $2 million in funds for initial research and development on the concept by Goodyear Tire and Rubber Co. and the Dynamic Sciences Division of Marshall Industries, Phoenix, Ariz. R&D was done under contract to the Army Aviation Materiel Laboratories, Fort Eustis, Va.

Designed for use in Bell UH-1D and H model helicopters built for the Army, CRFS was also approved for use in Bell's AH-1G "Cobras" and the UH-1B and C model helicopters. The UH-1 series aircraft has been the mainstay of mobility in U.S. and allied military operations in Southeast Asia.

CRFS units are being produced by Goodyear Tire and Rubber Co. under contract to Bell Helicopter under an initial $8.2 million contract.

The first CRFS production model was unveiled Dec. 9 to Army authorities at Goodyear's plant at Litchfield Park, Ariz.

Besides its ability to prevent fuel dispersion during crash impact, CRFS offers greater production from enemy gunfire than existing fuel tanks. The system will seal bullet holes from both .30 and .50 caliber machinegun slugs. UH-1 aircraft used in combat have only a .30-caliber hole-sealing capability.

To illustrate potential savings in human lives and resources which could be expected to accrue through the use of the new fuel system, Army spokesmen cited 1967, '68 and '69 post-crash fire statistics.

The Army experienced 334 aircraft accidents during this period and 206 were survivable except for post-crash fires, which caused 155 fatalities, with an additional 470 receiving burn injuries. Approximately $80 million in materiel losses occurred in these fires.

Citing the increase in survivability offered by CRFS, Army spokesmen said under comparable circumstances the mortality figure would be reduced from 155 to 44, and burn injuries would be reduced from 470 to 132. Materiel savings in terms of dollars would have amounted to $58 million.

Laird Sees Vietnam Med Evac Skill Saving Civilians

Secretary of Defense Melvin R. Laird sees medical evacuation techniques developed to save the lives of thousands of soldiers wounded in Vietnam as the bright hope of the future for recovery of persons injured in highway accidents.

Speaking recently at a meeting of the board of directors of Marshfield (Wis.) Clinic, Secretary Laird said:

". . . By use of the helicopter we have saved many from death and from disability in Vietnam. The same means of swift transfer of accident victims from the scene of an accident to medical facilities can reduce the accident toll here at home.

"If present trends continue, more than 56,000 Americans are expected to be killed and two million to be injured on our highways this year. In remote and rural areas, the death rate is four times greater than in urban areas because of delay in administering emergency medical treatment and transporting victims to medical facilities.

"According to one authority, at least 25 percent of the 170,000 Americans who will suffer permanent disability this year in highway accidents could escape disability with proper care shortly after their accidents.

"In order to reduce the frightful toll of death and disability on the highway, we in the Department of Defense have joined with the Department of Health, Education and Welfare and other federal agencies to form a committee that is now studying means of making the helicopter a flying ambulance here at home as it is in Vietnam. We have great hopes for the potential benefits we can obtain from applying what we have learned in Vietnam to the medical emergency we face here at home."

AMC Revamping Materiel Acquisition Process in PROMAP-70

(*Continued from page 1*)

Army Materiel Command headquarters elements charged with implementing PROMAP–70 are the Directorate of Research, Development and Engineering; Cost and Economic Information Office; Office of the Comptroller; Directorate of Personnel and Training; Special Assistant for Project Management; and the Directorate for Requirements and Procurement.

Some of the measures envisioned in PROMAP–70 call for immediate action; others involve long-range objectives. Early goals include reducing optimism in initial cost estimates; controlling changes in ongoing programs; improving assessment of technical risk and program costs prior to system development; improving test and evaluation; and reducing concurrency provisions.

Intermediate and long-range actions will be concerned with materiel acquisition management, formulation of concepts, contract definition and source selection, and engineering development and production.

In explaining the rationale for PROMAP–70, General Feyereisen said the massive effort calls for an "increase in AMC's emphasis on total weapon systems planning, developing long-range program guidance, and identifying future resource constraints over a 10-year period, in an effort to reduce the program and budget fluctuations impacting badly on production schedules and cost. . . ."

Each of AMC's seven commodity commands will establish cost centers whose function will be to validate cost estimates from an improved data base they must organize and staff.

The commodity commands are: Aviation Systems Command, St. Louis, Mo.; Electronics Command, For Monmouth, N.J.; Missile Command, Redstone (Ala). Arsenal; Mobility Equipment Command, St. Louis; Munitions Command, Dover, N.J.; Tank-Automotive Command, Warren, Mich.; Weapons Command, Rock Island (Ill.) Arsenal.

Involved also is the Army Test and Evaluation Command, another AMC element headquartered at the Aberdeen (Md.) Research and Development Center. Each of the commodity commands and TECOM will work through AMC project managers in implementing PROMAP–70 plans.

With respect to concept formulation, General Feyereisen said "we will be looking for better life cycle cost estimates. . . . We are improving system definition by added emphasis on the try-before-buy principle."

AMC source selection boards will be required to place more emphasis on judging contractors based on the cost realism in their proposals and their past performance. Introduction of a "vigorous program of risk analysis based on evaluation of technical, cost schedule and user requirements will be fundamental to this concept."

During engineering development and production, AMC project managers will be looking for better ways to motivate contractors and control mission and overhead costs.

Test and evaluation personnel, General Feyereisen said, will be provided necessary resources to avoid delays in testing—"so costly to us and industry. We will be testing more thoroughly before we commit large sums in production. . . . Less and less reliance will be placed on paper assurances and more in the way of component development and prototype fabrication to identify and resolve risks."

Changes scheduled in PROMAP–70 were detailed at a Dec. 11 AMC Commanders Conference where it was explained that the program originated as a result of recent budgetary R&D and procurement reductions.

In addition to an expanded contract definition and development phase, the Army will insist on hardware demonstrations during the concept phase. The idea is to avoid pitfalls of being in too big a hurry to start systems development or concurrent procurement of development and production. From the outset, more accurate estimates of total costs will be required.

Procurement cost-analyses teams will be established, utilizing both analysis and industrial engineering capability in the in-depth evaluation of contractor procedures. Stress will be on isolating and eliminating the impact of contractor inefficiency from prices negotiated in the non-competitive environment.

Much of the cost growth has been caused by inadequate control over introduction of engineering changes. Procedures being established will require total cost impact evaluation of all proposed changes in materiel.

When practical, AMC will insist upon a binding cost proposal for introduction of a change before authorizing its implementation. Approval authority will be stratified to assure that senior officials make cost decisions.

Expanded user participation will involve "greater utilization of the expertise available at the CONARC (Continental Army Command) Centers," with center commanders taking a key role in expanded service testing of materiel.

HQ CONARC teams will make independent evaluations of Test and Evaluation Command board reports and submit findings to HQ DA. Concurrently, HQ Combat Developments Command will increase participation in operational testing, and also make independent evaluations to HQ DA.

Expanded testing, will selectively involve operating more prototypes in typical field conditions for extended periods under the eyes of a broad audience of experienced Army commanders. Tests will not only evaluate hardware performance, but seek to determine battlefield utility against current and future doctrinal and tactical concepts.

Another area of expended effort will involve, an official explained, making greater use of technology of allies and also that of the enemy. Much is being accomplished by the Quadripartite Standardization Program, in which the U.S., United Kingdom, Canada and Australia are linked in mutual weapons development programs. The U.S.-Canadian Development Sharing Program also is successfully serving this objective.

Greater emphasis in PROMAP–70 also will be placed on adaptation of commercial equipment to military use, rather than supporting families of military design items, such as the current program to use commercial heavy construction equipment.

Chief of Engineers Moves Into Forrestal Building

The Office of the Chief of Army Engineers, located in Building T-7, adjacent to Washington National Airport since the end of World War II, has moved to the Forrestal Building complex at 10th Street and Independence Avenue, S.W., Washington, D.C.

"Returning to Washington is like coming home again," Lt Gen F. J. Clarke, Chief of Engineers, said as his office began operating at its new address. General Clarke was the engineer commissioner of the District of Columbia from 1960 to 1963.

The office employs some 1,300 military and civilian personnel who help the Chief of Engineers direct his broad water resources development and military construction programs, military engineering, real estate, and mapping responsibilities.

During the Second World War the Office of the Chief of Engineers was in the New War Building now a wing of the State Department Building at 21st and C Streets, N.W.

Dr. Ballard Succeeds Levin as ECOM IER Director

Director of the Institute for Exploratory Research, HQ U.S. Army Electronics Command, a position that led the past two incumbents to key jobs in the Office of the Director of Defense Research and Engineering, is Dr. Geoffrey E. H. Ballard's new title.

The 37-year-old Canadian-born scientist, who joined the ECOM staff in July 1968, succeeds Dr. S. Benedict Levin, Deputy Assistant Director (Research), ODDR&E, since Mar. 1, 1968. Dr. Ballard is a U.S. citizen.

Dr. Edward M. Reilley, who preceded Dr. Levin in that office, left to become the U.S. Post Office Department's first Director of Research and Development. Dr. Reilley also preceded Dr. Levin as IER director.

Dr. Ballard established his capabilities for promotion to his new position while serving first as scientific adviser to the director, Combat Surveillance, Night Vision and Target Acquisition Laboratories (CSNVTAL), and then as assistant to Dr. Robert S. Wiseman.

Signifying to the importance of these assignments in Dr. Ballard's career was Dr. Wiseman's recognition with a $5,000 honorarium and the Army Exceptional Civilian Service Award in 1968. Wiseman was cited for exceptional performance in organizing, staffing and directing the CSNVTAL and developing night-vision devices urgently needed in the Vietnam war.

Six years ago Dr. Ballard entered U.S. Government service as a Civil Service employe when he joined the staff of the U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, N.H. He served successively as research geologist, research civil engineer and general engineer, performing theoretical and experimental research in the mechanics of snow, ice, frozen ground and rocks.

In September 1966, he departed CRREL to become a physical science administrator in the Office of the Director of Research and Laboratories, U.S. Army Materiel Command, where he advanced to acting chief, Earth Sciences Division. The AMC is ECOM's parent command, and the move to ECOM followed.

Dr. Geoffrey E. H. Ballard

Dr. Ballard was born in Niagara Falls, Ontario, and was graduated from Queens University, Kingston, Ontario, with a BS degree in engineering. He earned a PhD degree in earth sciences from Washington University, St. Louis, Mo., in 1963.

His postdoctoral studies include courses in photoelasticity at Queens University and mathematics and physics courses at Dartmouth College, where he was a visiting professor. He is a graduate of the American Management Association's executive management course and has pursued postdoctoral management studies at George Washington University.

Known as author or coauthor of numerous publications in scientific journals in the U.S. and abroad, in addition to industrial and government technical and scientific reports, Dr. Ballard is a registered professional engineer. In 1967 he was chairman of the Defense Science Seminar Alumni Planning Group, and has participated in various DoD studies and panels.

He is listed in *American Men of Science* and is a member of Sigma Xi, the Geological Society of America, American Society of Civil Engineers, and the Committee on Rock Mechanics of the American Society for Testing and Materials.

AIB Displays Weapons at 'Golden Anniversary' Show

Half a century of test operations under the purview of the U.S. Army Infantry Board was marked recently at Fort Benning, Ga., where the observance included a display of old Infantry weapons and a demonstration of newly developed systems.

Weapons and equipment on exhibit included many items dating back to the AIB's early test operations, such as the Springfield 03 and the Stokes mortar, and also the new developments.

One of the features of the demonstration firing of flares, incendiary rounds, rockets and grenades was the use of a battlefield illumination system that fires high-intensity candles with self-deployed parachutes.

Among new systems shown to the visitors was a 4-shot rocket launcher that is scheduled for service testing and is designed to replace present flame throwers; also, the XM203 combining the M16A1 rifle and a 40mm grenade launcher. Other new items included the 5.56mm machinegun, the Stoner machinegun, and a 40mm grenade launcher that can fire at 300 rounds a minute or single rounds.

The Army Infantry Board was first established by the War Department in March 1903 at Fort Leavenworth, Kans., and it moved to Fort Benning in 1919. Its mission as the Infantry materiel test activity of the U.S. Army Test and Evaluation Command, Aberdeen (Md.) Proving Ground, is to test all weapon systems and items of equipment uesd by the Infantry soldier.

"Strategic Offensive/Defensive Missile Systems" was the topic of a Dec. 1-3 national meeting of the American Institute of Aeronautics and Astronautics in California. Julian Davidson (left) was chairman of a panel on "Antimissile Defense Technology." Davidson is director of the Huntsville Office, Advanced Ballistic Missile Defense Agency (ABMDA). With him is Dr. Ralph Pennington, who presented a paper on "Data Processing Hardware/Software" for ballistic missile defense. Dr. Pennington is special assistant for data processing to the commanding general of the Safeguard System Command and to ABMDA.

OCRD Reorganizes Due to Personnel Cutback

(*Continued from page 1*)

Ranges and Space Division (MDR&S). The U.S. Army Ballistic Missile Defense Agency (ABMDA), a Class II activity of OCRD, is under the staff supervision of this directorate.

MDR&S Division activities in mapping, geodesy and survey matters were transferred to the Army Research Office (ARO). MDR&S Division space activities were transferred intact with the Space Branch to the Communications-Electronics Division.

Another change affecting the ARO is discontinuation of the Research Plans Office and the Studies and Analyses Division. Functions of the latter are transferred to a new OCRD Studies and Analyses Division.

Another new OCRD division, Research Technology, supplants the Research Plans Office and also is charged with laboratory management DA proponency for Army Regulations 705–55. This function was transferred from the Management and Evaluation Division. Both of the new divisions continue as part of the Research Directorate.

Responsibility for avionics activities is now assigned to the Air Mobility Division, Director of Developments. Avionics was transferred from the Communications-Electronics Division.

Less responsibility for avionics, and also for projects oriented to requirements for STANO (Surveillance, Target Acquisition and Night Observation), the Communications-Electronics Division was transferred from the Directorate of Developments to the Directorate of Missiles and Space.

Newly established within the Directorate of Developments is a STANO Division, an action that reflects the recent high priority given by the Army Chief of Staff to this greatly intensified area of R&D effort. (See page 1 article, November 1969 *Army Research and Development Newsmagazine.*)

The OCRD Southeast Asia Division was redesignated the STANO Division, which continued its function of monitoring activities of the U.S. Army Limited War Laboratory at Aberdeen (Md.) Proving Ground. The laboratory is a primary quick-response agency to meet urgent demands generated in Southeast Asia.

Responsibilities for staffing the Tactical Satellite Communications Management Office is now transferred to the U.S. Army Materiel Command.

In other realignments, the OCRD Information Systems Office has been assigned additional responsibility for committee management, and the Plans and Policy Division has supplanted the Plans Division in the Directorate of Plans and Programs.

NASA Permits AMC Joint Use of Facilities

(*Continued from page 1*)

Langley Research Center, Hampton, Va., and Lewis Research Center, Cleveland, Ohio.

Under the new agreement, about 175 Army civilian and miiltary personnel will be assigned to the NASA facilities—60 at AMES, 70 at Langley and 45 at Lewis. Army Materiel Command officials said some personnel will be transferred from other facilities but most professionals will be recruited from June 1970 college graduating classes.

Army aeronautical research requirements, it was explained, have been met principally by contracts with industry and university investigators at the AMES facility, or by requests to NASA for assistance. Ongoing programs, however, have not been adequate to meet the Army's increasing demands for advanced technology.

Provisions of the new contract with NASA will enable the Army to increase its studies on helicopters; aerodynamics and structural dynamics of rotor types; wind tunnel wall effects tests for V/STOL aircraft; STOL model testing; performance of parachute canopies; and parachute employment and environment.

In recent years, much of the NASA effort to advance technology in low-speed aviation has been concentrated on V/TOL and STOL wind-tunnel studies and flight research; general aviation aircraft; approach and landing of subsonic jets; airplanes and terminal area operations.

Low-speed aircraft are generally considered those flying at a speed below 400 miles an hour. The Army's interest in helicopters, including the greatly expanding effort in development of those with heavy-lift capability (long-range goal of 50 to 60 tons), is in this category.

Planning calls for expenditure of $5 million to $6 million on the expanded aeronautical research program in FY 1970, with the expansion of activities under the AMC-NASA agreement to begin as soon as possible.

NEW YEAR RESOLUTION!

"Let us press toward an open world —a world of open doors, open hearts, open minds—a world open to the exchange of ideas and of people." ***From President Nixon's recent address to U.N. General Assembly.***

ECOM Advances Treece, McDowell to Key Positions

Special assistant for Aviation and Aviation Electronics recently became the title of Lt Col Frank L. Treece at HQ U.S. Army Electronics Command when he succeeded Lt Col Raymond W. Truex Jr., now commander of the ECOM Aviation Detachment, Naval Air Station, Lakehurst, N.J.

Lt Col Chester W. McDowell Jr. moved into Col Treece's former assignment as product manager, Navigation Control, after serving two years as a staff officer in the Office of the Assistant Chief of Staff for Force Development in Washington, D.C.

LT COL TREECE has served with the 34th General Support Group in Vietnam, the U.S. Army Aviation Test Board and the 47th Infantry Division at Fort Rucker, Ala., and the 304th Signal Battalion in Korea.

He holds a BS degree in electrical engineering from the University of Alabama and has done postgraduate work in aerospace engineering at the University of Southern California Extension Center.

He has graduated from the Officer Candidate School, Army Aviation Training School, Advanced Signal Officers Course, the Army Helicopter School, and the Command and General Staff College. Rated as a master Army aviator, he has received the Bronze Star, Air, and Army Commendation Medals.

LT COL McDOWELL has a BS degree in general education from the University of Omaha and is rated as a senior Army aviator.

He has had assignments at Fort Rucker and in Europe, Korea, Alaska and Vietnam. His decorations include the Meritorious Service Medal, Bronze Star Medal, Air Medal, Army Commendation Medal with 1st Oak Leaf Cluster, and VN Cross of Gallantry with Palm.

Lt Col Frank L. Treece

Lt Col C. W. McDowell Jr.

Armed Services Explosives Safety Board Issues Facilities Manual

How can a facility engaged in manufacture, handling or storage of high-energy explosives, or in chemical processes involving potential catastrophic explosions, be constructed to minimize possibilities of major loss of life and property?

Scientifically determined answers to that question, obtained from collaborative effort of numerous U.S. Government and private agencies over a 10-year period of continuing investigation, are contained in a new document, *Structures to Resist Effects of Accidental Explosions.*

Sponsored by the Armed Services Explosives Safety Board (ASESB), under the over-all direction of the U.S. Army's Picatinny Arsenal at Dover, N.J., the research effort represented in this joint services publication involved exhaustive testing of experimental structures.

Issued recently under direction of Secretaries of the Army, Navy and Air Force (ATM 5-1300, NAVFAC P-397, AFM 88-22), the manual is directed primarily to design engineers. It is expected to have a profound impact throughout the United States and in many foreign countries among explosives safety authorities.

In the foreword, ASESB Chairman Col B. B. Abrams (U.S. Army) says the document "is intended for the advice of individuals and organizations concerned with the design of protective construction to limit the effects of accidental explosions. It represents a significant advance in this design. . . ."

In stating that the manual "provides a basis for greatly increased protection against propagation of explosions, damage to facilities, and loss of life," Col Abrams says "A large part of the analytical and test work was performed by, or under the direction of, Picatinny Arsenal. . . ."

The foreword also acknowledges funding support by various agencies of the Department of Defense and the National Aeronautics and Space Administration, and expresses appreciation to the many contributing agencies that coordinated activities.

Potential far-ranging impact of *Structures to Resist Effects of Accidental Explosion* has been evidenced to date by application of technology advanced in this report to more than 30 Army structures embodying the design principles. Industrial organizations also are applying the concepts.

Typical of numerous design and consultative services provided by Army engineers at Picatinny Arsenal are such projects as: "Structural Concept Study for Proposed Sprint Missile Propellant Production Facility," prepared for the U.S. Army Safeguard System Command; "Concept Study of the Lead Styphanate Primer Mix Facility," prepared for the U.S. Army Corps of Engineers, Chicago District; and "Concept Study on a Proposed Vibration Test Facility," prepared for the Army Test and Evaluation Command, Aberdeen Proving Ground, Md.

Edward Cohen was the program supervisor and Norval Dobbs was project engineer for the New York consulting firm of Ammann & Whitney, which had a primary role in engineering design under continuing contracts, results of which contributed to publication of the manual.

Key personnel in the Picatinny Arsenal effort included Leon W. Saffian, deputy chief of the Munition Engineering Division and a noted expert on explosives who conceived and directed the over-all program. Stanley Wachtell was a consultant and coordinated the interagency activities. Richard Rindner was propect engineer. They joined in paying tribute to the key role of Russell G. Perkins as ASESB project administrator.

Testing of design models during the

Leon W. Saffian

Richard M. Rindner

Stanley Wachtell

LEON W. SAFFIAN, deputy chief of the Munitions Engineering Division at Picatinny Arsenal, received the Department of the Army Research and Development Achievement Award in 1966 for his work on the technology of design of protective structures. He began his Federal Civil Service career at Picatinny in 1950 in process engineering phases of explosives manufacture, and advanced to chief of the High Explosives and Loading Section in 1956, and in 1968 became acting chief of the Process Engineering Laboratory, where he served until promoted to his present position in 1969. Saffian earned a BCE degree from the City College of New York in 1949 and an MSCE degree from the University of Michigan in 1950. He completed postgraduate courses in mathematics, thermodynamics, chemical kinetics and fluid dynamics at Stevens Institute of Technology.

RICHARD M. RINDNER is recognized as an authority on safety design criteria pertaining to over-all propellant and explosive manufacturing and storage facilities. Employed at Picatinny Arsenal since 1957, he has been directing for several years a project aimed at the establishment of design criteria in construction of new and improvement of existing explosive storage, handling and production facilities. He received a Sustained Superior Performance Award in 1962 and a Quality Increase Award in 1969 for his work on this program. Born in Lwow, Poland in 1923, Rindner attended the Technical University in Berlin, Germany. He received a BS degree in chemical engineering in 1952 and an MS degree in industrial engineering in 1955, both from Columbia University. He has authored and presented technical papers for national and international meetings.

STANLEY WACHTELL was employed three years as a chemist with the New York Testing Laboratories and as an inspector of ordnance material with the Pittsburg and New York Districts for two years prior to his employment in 1942 as an analytical chemist with the Feltman Research Laboratories (FRL), Picatinny Arsenal. He became chief of the FRL Physioco-Chemical Unit in 1942 and remained until 1958. Then he transferred to the Ammunition Engineering Directorate as a specialist in process control in the manufacture of propellants and explosives. For the past year he has been acting chief of the Process Engineering Laboratory at the arsenal. Wachtell earned a BS degree in chemistry from the City College of New York in 1934 and has done graduate work at Columbia and New York Universities. He was the recipient of the Picatinny Arsenal Annual Technical Writing Award in 1961.

long-sustained investigation of comparative effects of various explosive charges ranged up to 10,000 pounds high-explosive equivalent on numerous types of designs. Dobbs, Cohen, Wachtell and Rindner have published numerous progress reports.

The cooperating agencies included the U.S. Naval Weapon Center, China Lake, Calif.; Naval Civil Engineering Laboratories, Port Hueneme, Calif.; U.S. Army Ballistic Research Laboratories, Aberdeen (Md.) Proving Ground; Office of the Chief of Engineers, U.S. Army; Corps of Engineers, Ohio River Division Laboratories, and the Army Waterways Experiment Station, Vicksburg, Miss.; and the U.S. Naval Weapons Laboratory, Dahlgren, Va.

Other organizations credited with important assists in the joint service effort are such contract agencies as Arthur D. Little, Inc., Cambridge, Mass., and Columbia University of New York City.

The manual, measuring 16½ by 11¾ inches, contains numerous illustrations and charts applicable to varying design problems of constructing protective facilities geared to precise requirements of various military and civilian establishments.

MODEL STRUCTURE, designed to resist effects of accidental explosion, is shown after tests with 2,000 and 3,500 pounds of high explosives by Picatinny Arsenal.

Primary objectives, it is explained, are to establish methods by which the propagation of explosions from one building or part of a building to another and/or mass detonations can be prevented, thereby protecting personnel, valuable equipment and/or explosives.

Guidelines are established for the siting of explosive facilities, obtaining maximum cost effectiveness in both site planning and structural arrangement, and providing protective closures to prevent damage to interior portions of structures.

Charts and tables in the manual, it is stated, are applicable to explosive detonations in the order of many thousands of pounds of high explosives. It is stressed, however, that the usual design stituation where the manual will generally apply is for explosive quantities less than 25,000 pounds.

The foreword to the manual states that "in a work of this magnitude it is expected that there may be points which require further verification or modification as a result of future tests and experience."

Continuing investigation is programed to refine determinations in the manual. Agencies or individuals desiring to recommend changes or offer comments regarding usefulness of the manual may address communications through appropriate military channels to: Chairman, Armed Services Explosives Safety Board, Nassif Building, Washington, D.C. 20315.

Initial distribution of the manual was made by the ASESB to U.S. Government agencies having a primary interest and to other sources that have evidenced concern with design of structures to minimize destructive effects and loss of life in accidental explosions. Copies are available through the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. ($5.25).

R&D Achievement Award Winner's Work Paying Off

Applications of an anodized "hard-coating" for titanium developed by Theodore M. Pochily are increasing, such as for weapons parts, helicopter engines, other aircraft components, and star-tracking devices.

Observations regarding current and potential uses for the anodizing process were made during recent ceremonies when Chief of Research and Development Lt Gen Austin W. Betts presented Pochily with a 1969 Army R&D Achievement Award.

In attendance at the ceremony at Watervliet (N.Y.) Arsenal, where Pochily is employed, were Maj Gen Richard H. Free, head of the U.S. Army Materiel Command Directorate of Development and Engineering; Col Arthur H. Sweeney Jr., former arsenal CO and now acting CO, U.S. Army Weapons Command; Col James J. Albertson, CO of Rock Island (Ill.) Arsenal; and Lt Col O. W. Lee Jr., acting Watervliet CO.

Pochily's process prevents titanium from "galling," or seizing upon itself when used as a bearing surface, thus enabling the lightweight metal to retain its excellent corrosion-resistant qualities. It has been used to protect the gas-turbine engine (T-53) for the UH-1 helicopter from destructive in-take of corrosives in operations over Vietnamese rice paddies and beaches.

First used at Watervliet Arsenal as a coating for experimental mortar tubes, the anodizing process has since been improved to improve qualities of resisting abrasion and wear on titanium components. Many industrial organizations are finding or experimenting with applications.

Pochily is the second Watervliet Arsenal researcher to win an Army R&D Achievement Award. In 1962, Dr. Thomas E. Davidson, Albert Reiner, David P. Kendall and Robert A. Petell shared an award for application of the autofrettage process in design and manufacture of high-strength gun tubes.

WATERVLIET ARSENAL chemist Theodore Pochilly explains application of anodized "hardcoating" of titanium components to Lt A. J. Wein, project engineer of the Materials Laboratory, Wright-Patterson Air Force Base.

Students Laud R&D Course In Third Year at Fort Belvoir

Training in the art of effective briefing to meet requirements of personnel in research and development managerial positions is the purpose of a course in its third year at Fort Belvoir, Va.

The U.S. Army Mobility Equipment R&D Center, which initiated the course, reported Oct. 31 that 115 students—managers, scientists, project engineers—had completed the course.

The 30-hour program is planned to improve communications between the user, developer and tester during the R&D life cycle of military hardware. Key personnel learn to improve their skill in planning, preparing and delivering an effective briefing, including workshop exercises. Two-thirds of the students termed the course "excellent."

Conducted by the Training Division, Fort Belvoir Civilian Personnel Office, the course is given as requested by laboratory chiefs. Among agencies participating in the program are the Army Engineer Topographic laboratories, the Engineer Reactors Group, and the Army Electronics Command Night-Vision Laboratory.

Chesarek Discusses Priorities on Use of Men, Money

Application of priorities and techniques to utilize effectively "our shrinking resources of men and money" was the keynote of Army Materiel Command CG General F. J. Chesarek in a recent address to the Economic Club of Detroit, Mich.

Toward this objective, he mentioned the city motto of Detroit—"Speramus Meliora" (We Hope for Better Things)—and his own progress from service there in 1933 as a file clerk in the Terstedt Division of General Motors.

With respect to the Army's current expenditure rate of $1.3 billion annually for materiel parts support, he cited complexities of reliability and maintenance problems, saying:

"In the Hawk antiaircraft missile system, there are 27,764 parts. The failure of any one of these will degrade the performance of the system, and the failure of a single critical item will render it inoperative.

"The lowly generator, providing power for a command post or a communications station, has 837 parts. In toto, there are 1.1 million parts in the catalogues supporting Army materiel.

"Obviously, merely maintaining today's equipment will not give our soldiers the best that modern science and technology can offer, so the Army spends about $1.7 billion a year on research and development of new weapon systems, munitions and support equipment.

"Actual procurement of hardware and munitions in FY 1969 totaled another $7.7 billion. When you add these expenditures and apply the cost of labor, plant and burden to execute these tasks—plus procurement for our sister services—the Army Materiel Command . . . spent approximately $14 billion this past fiscal year, or about 50 percent of the total Army budget."

General Chesarek devoted a substantial part of his address to Army procurement and R&D activities and "legitimate criticism" of those "who seek out soft spots in our defense budget. . . . I know of no industry, governing body, or any other institution that has reached an unchallenged summit of managerial excellence."

To illustrate that in a complex situation he who has traveled the route is in much better position to assess the course of events, he told a joke that rocked the audience, saying:

"This reminds me of a story concerning four people—a beautiful redhead, a Marine colonel, a little old lady, and an Army sergeant. They found themselves sitting together on opposite seats of a train heading from Washington to New York. The pretty redhead, of course, was the center of attraction and conversation.

"Suddenly, the train entered a tunnel, the lights flickered out, talk stopped, and the train lurched around a bend. Two distinct sounds were heard—that of a rather resounding kiss, followed by a sharp slap of flesh against flesh.

"When the train emerged from the tunnel and the lights were back on, our group of four found themselves flustered and curious. What had happened? Let's look at the inward thoughts of each of these people.

"The Marine colonel was the most flustered. His face was red and obviously the recipient of the loud slap. He knew he had been hit but also knew there was no reason for it. He had made no pass at anyone. He figured the Army sergeant had kissed the redhead and she, thinking he, the Marine, was the culprit, hauled off and socked him.

"The little old lady had it all figured out. The Marine had kissed the redhead and got what he deserved.

"The redhead was really confused. She hadn't been kissed, nor had she socked anyone. So she deduced that when the train lurched around the bend, the Marine inadvertently kissed the old lady, who in turn slapped him.

"The Army sergeant was the only one who had all the facts. He despised Marines in general and colonels in particular. He had been on this run many times and knew of the tunnel, the lights, and the lurch. So when these events occurred, he kissed his hand and then let the Marine have it.

General Chesarek then said, "Needless to say, we in the Army Materiel take very seriously the views of our informed critics."

Col Brown Designated to Command CDCEC

Some 280,000 acres of scientifically instrumented testing area known as the U.S. Army Combat Developments Command Experimentation Command (CDCEC), Fort Ord, Calif., will become the management rseponsibility of Col Thomas W. Brown Dec. 15.

Nominated for promotion to brigadier general, Col Brown will command what is sometimes called the "Army's live chessboard." The vast area, in effect, is an outdoor scientific laboratory serving HQ CDC at Fort Belvoir, Va., where many concepts and doctrine geared to envisioned requirements of the future Army originate.

The CDCEC serves to test many advanced concepts as well as new materiel, using techniques of mathematical modeling, simulating or war gaming to determine feasibility or merit of proposals or projects.

Col Brown, the son of an Army officer, was born at West Point, N.Y., in 1919 and attended the University of Missouri prior to entering the U.S. Military Academy, from which he graduated in 1943.

Col Thomas W. Brown

After completing the Infantry Officer Basic Course at Fort Benning, Ga., he was assigned to the 513th Parachute Infantry Regiment as a company commander. In 1945 he left Fort Benning to join the 11th Airborne Division in the Phillipines, returning in 1948 to complete the Infantry Advanced Course.

Twenty years later, in August 1968, following two years as chief, Ground Operations Branch, J3, Commander-in-Chief, Pacific, he returned to Fort Benning to command the Combat Developments Command Infantry Agency.

Col Brown has served in Korea, in England as a technical representative with the U.S. Army Standardization Group, and in Vietnam in 1965 with the 3d Brigade, 1st Cavalry Division (Air Mobile). He also has served as an assistant to the Dean of the Academic Board at the U.S. Military Academy.

Graduated from George Washington University, Washington, D.C., with an MA degree in international affairs, he is also a graduate from the Army War College at Carlisle Barracks, Pa.

Col Brown's decorations include the Legion of Merit (with OLC), the Silver Star (with OLC), Bronze Star (with OLC), Vietnamese Cross of Gallantry with Palm, Combat Infantryman's Badge, and Master Parachutist Badge.

ECOM Develops Simple Rechargeable Zinc-Air Battery

Recharging a new long-life, high-energy battery developed by the U.S. Army Electronics Command for such lightweight combat equipment as backpack radios, front-line radars and night-vision devices is the quintessence of simplicity.

Cells assembled like a deck of cards are placed in standard glass-fiber battery cases altered to allow air circulation. The soldier in the field can recharge the battery by removing the narrow zinc anodes in each cell, dropping in new anodes and adding water.

Known as a mechanically rechargeable zinc-air battery, the new electrical power source has much longer life than the most advanced dry cells. Unlike other rechargeable batteries, it does not require lengthy electrical recharge or special charging facilities.

The basic unit is a flat zinc-air cell, half an inch thick, whose height varies from 4 to 8 inches and width between 3½ and 6½ inches, depending on the energy required. The most common version resembles a 5–pack of small cigars.

The cathodes, which make up the sides of the cell case, contain a membrane that retains the water but permits the entrance of air to provide oxygen. This reacts with the potassium hydroxide electrolyte, impregnated in the zinc, to create current.

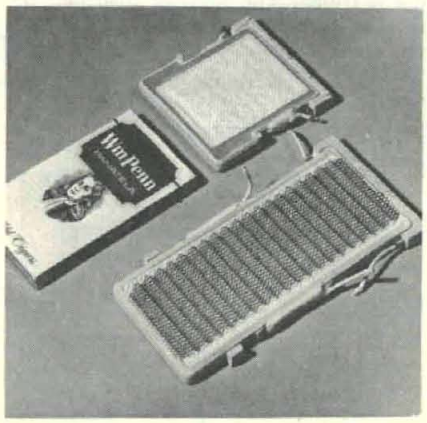
In addition to its easy recharge feature, the battery has many other advantages over those now in use. Its high energy density approaches 100 watt-hours per pound, twice that of other batteries. The power may be delivered over a wide current range, depending upon the size and number of cells and assembly configuration.

Completely silent, without moving parts, the battery requires a minimum of maintenance. It has long life, up to 100 replacements of zinc anodes. When not activated by water, it has indefinite shelf life.

Operating cost is competitive with other battery systems used in military operations, even without the intangible savings resulting from minimum maintenance and the elimination of bulky, heavy recharging facilities.

For military use, the battery is assembled in five standard 12 to 24-volt sizes, providing from 20 to 150 ampere hours and 480 to 3,000 watt hours. Outside dimensions range from 12.2x4x4.3 inches to 12.2x6.7x10 inches. Weight ranges from 7 to 35 pounds.

The new zinc-air batteries were developed in the Power Sources Division of the Electronic Components Laboratory, Army Electronics Command. David Linden, deputy chief of the Power Sources Division, was the project officer and engineer.



TWO SIZES of basic cell of Army's mechanically rechargeable zinc-air battery are shown above. Cigar pack is for size comparison. At left, David Sague, ECOM electronics engineer, inserts a zinc anode into 20-ampere version of zinc-air battery for field use. The battery in the background has a 48-ampere hour capacity. Both are in the 12 to 24-volt operational range.

TOPOCOM Prepared Exploration Maps for Apollo 12

Footsteps of Man's second expedition across the lunar surface, as left by Apollo 12 astronauts Charles (Pete) Conrad and Alan Bean, followed a path mapped more comprehensively than many regions of the earth.

The U.S. Army Topographic Command (TOPOCOM) prepared an Exploration Map Data (EMD) package to meet NASA specifications.

TOPOCOM is a class II installation under the Chief of Engineers, consisting of activities of the former Army Map Service, the Engineer Topographic Laboratories and the 30th and 64th Engineer Battalions.

The EMD package prepared for Conrad, Bean and moon-orbiting astronaut Richard Gordon included 128 maps of the landing area at three scales. Geological maps and data also were supplied by the U.S. Geological Survey.

The maps were drawn to cover the area of Site 7 at approximately 3 degrees south latitude and 23.4 degrees west longitude in the lunar equatorial zone. A backup package for Site 5 also was included.

The 1:100,000 scale photomap (one inch on the map is equivalent to 100,000 inches on the lunar surface) of the lunar landing area for Apollo 12 was required to establish the Landing Module's general location and as a recording base for visual observation of distant features. A companion geological map, at the same scale, provided data for the area.

Three maps at a 1:25,000 scale were used to refine the Landing Module's location within the landing site. The geological maps provided large-scale regional information on the immediate vicinity of the landing.

The TOPOCOM maps were derived from photography taken during the earlier Lunar Orbiter series. A lunar plastic relief map of the landing area at a scale of 1:2,000 also has been prepared in a limited quantity for planning purposes.

3 ECOM Scientists Author Paper for Physics Journal

"Ferromagnetic Resonance and Nonlinear Effects in Ferrites with Uniaxial Anisotropy," a paper prepared by three U.S. Army Electronics Command (ECOM) employes, was presented at the 15th Annual Conference on Magnetism and Magnetic Materials, Nov. 18–21, in Phila., Pa.

Samuel Dixon Jr., Maurice Weiner and Thomas R. Au Coin coauthored the paper, scheduled for publication in the March issue of the *Journal of Applied Physics*. Dixon and Weiner work in the Gaseous Electronic Devices Branch of the Electronic Components Laboratory. Au Coin is with the Institute for Exploratory Research.

NLABS' Freeze-Dried Food Research Contributes to Civilian Sales

Freeze-dried, rapidly rehydratable foods today contribute substantially to solving the problem of providing palatable, nourishing meals to soldiers in a variety of environments—and are products of rapidly increasing importance in the civilian market.

Statistics compiled in a recent survey showed about nine million pounds dry weight of freeze-dried foods, exclusive of the still relatively new freeze-dried coffee, were produced in the U.S. during 1968. This is the equivalent of at least 35 million pounds wet weight, and more than 53 percent of the products were directed to civilian consumers.

Freeze-dried foods constitute one of the nation's most rapidly expanding new industries, and the U.S. Army can properly claim a major share of pioneering developmental effort—as originated at the Natick (Mass.) Laboratories in the 1950s.

The role of NLABS in developing new processes of preparing, preserving and packaging food for the military man was recognized recently by the assignment of Dr. Edward E. Anderson as special assistant to NLABS Scientific Director Dr. Dale H. Sieling, to accelerate and expand the Department of Defense Food Research and Development Program.

More than 400 participants in a recent 3-day conference at the NLABS on "Feeding the Military Man" included many of the nation's leading authorities on techniques of food preparation, preservation and packaging.

With the objective of simplifying military food logistics and improving the quality of food served to the soldier in the field, NLABS researchers began investigating new food processing techniques in the late 1950s, including the concept of freeze drying to reduce greatly the bulk and weight of field rations.

In 1959 a survey of the food industry's production capabilities indicated there was no freeze drying, and that other dehydration techniques were inadequate. The survey also showed that, at that time, the civilian market could not be expected to give impetus to development and build-up of the required capacity.

Based upon these findings, the Army initiated a policy of continually orienting industry relative to its experimental food processes and products. Technical requirements were developed for commercial-scale production. Then came gradual introduction, initially on a test basis, of experimental foods in dining halls, followed by use in A/B rations.

Freeze-dried products currently used in the Armed Forces A/B ration include diced beef, beef patties, chicken, fish squares, pork chops, tuna, cottage cheese, cherries, corn, fruit mix, peas and spinach.

Other dehydrated food served to U.S. Forces include American cheese, egg mix, applesauce, green beans, cabbage, grapefruit juice, orange juice, sweet potatoes, white potatoes, tomato paste, onion soup and tomato-vegetable-noodle soup.

Freeze dehydrated casserole dishes which can be eaten as is, with drinking water—used as components of the "Long Range Patrol Food Packet"—include chicken with rice, chili con carne, pork and scalloped potatoes, ground beef with rice, beef hash, spaghetti with meat sauce, beef stew and chicken stew.

Many items similar to the A/B ration components are now utilized for civilian institutional feeding. A

Picatinny Engineer Simplifies Small Sphere Assembly

Simplified, ingenious designing has solved a problem of high-speed press-operation fabrication of small spheres for production of miniature bombs and detonation devices at the U.S. Army's Picatinny Arsenal.

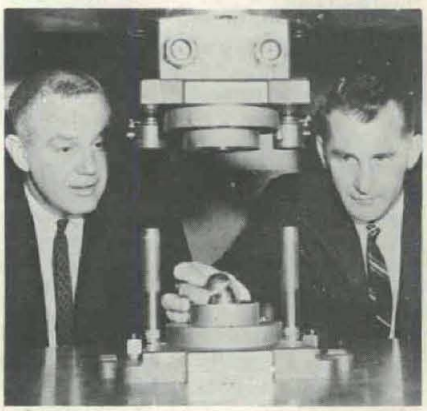
Joseph Homko, a mechanical engineering technician in the Ammunition Engineering Directorate at the Dover, N.J., installation, is credited with the design concept and development of experimental tooling.

Positive, permanent interlocking of the halves of the spheres is accomplished with a single press stroke. Efficiency and effectiveness of the method have been proved in pilot production, using experimental tools developed by Homko.

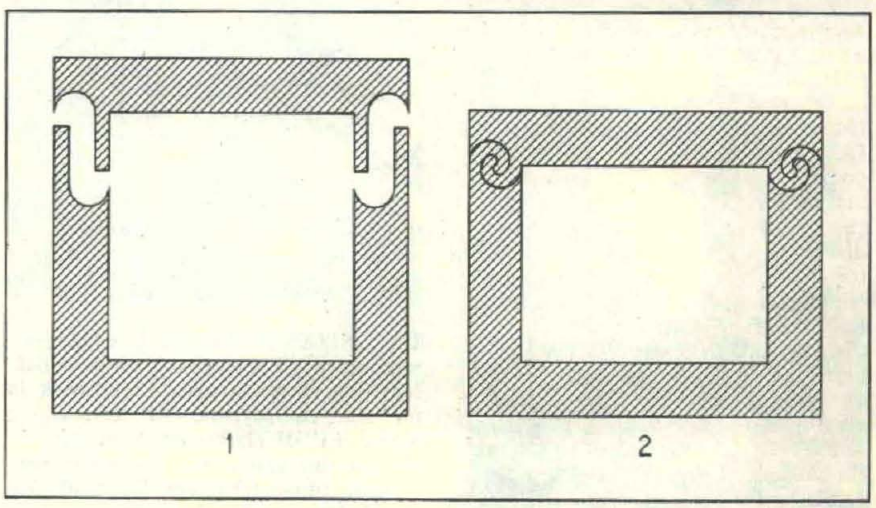
The next phase calls for production of a high-speed transfer press to form the spheres progressively, from strip stock with automatic feeding through die stations. The method also can be used to form the same kind of joint to mate parts of a closed cylinder.

The estimated production rate is about 15,000 spheres in an 8-hour day, with a single fabrication unit.

Current work material is low-carbon mild steel, though future tests may try out other metals. As long as the material is ductile and will take a permanent set, it is workable.



PROCESS INVENTOR Joseph Homko (right) discusses sphere assembly method with Joseph Matt, chief, Picatinny Ammunition Development Div.



CURLING-THE-CIRCLE technique used to assemble small spheres for military applications also can be used to join mating parts of a closed cylinder.

variety of products such as soups, vegetables, entrees and salads are appearing on grocery shelves.

While not a product developed by the Army or yet used by the Armed Forces, freeze-dried coffee reflects the impetus which the Army Materiel Command Natick Laboratories' advancement of this technique has given to industrial developers.

In early 1969, the freeze-dried coffee market represented six percent of this country's total coffee consumption.

Among other new products to appear on the commercial market are casserole dishes, similar to the "Long Range Patrol Food Packet," in reconstitution packages.

The effort of NLABS on dehydrated foods currently represents an average of 10 in-house professional man-years per year. Research, development, tests and engineering costs of developing the process and product information, including experimental ration procurement and field testing, for translation to commercial production are estimated at approximately $5–million.

Work is continuing towards better definition of the factors responsible for reproducible good quality under the wide variety of conditions that are found in competitive mass production. Reducing cost without degrading quality and establishing means of reducing volume as well as weight are goals.

AMC's Natick Laboratories also developed nine new meat items for the astronauts to eat during the flights of Apollo 11 and Apoll 12. Unlike the tube-encased food items provided for the earlier space flights, all of the new items can be eaten with a spoon.

The two categories of new meat items include "thermo-stabilized wet" entrees and "freeze-dried" dehydrated entrees. The "wet" entrees are turkey with gravy, beef with gravy, beef and potatoes, ham and potatoes, and frankfurters. The dehydrated entrees are chicken and rice, chicken stew, beef stew, and pork with scalloped potatoes.

The ready-to-eat "wet" meat items, heat-sterilized in laminated foil pouches, have a normal appearance, flavor and texture. A special package permits rehydration through a valve, after which the food may be squeezed from the package and eaten normally with a spoon.

Over the past decade, efforts of NLABS investigators have contributed to important advances in providing high quality food for members of the U.S. Armed Forces, operating in all types of environmental extremes.

Army Chief of Research and Development Lt Gen Austin W. Betts, however, in one of the major addresses given at the conference on "Feeding the Military Man," pointed to the problems ahead for the Department of Defense Food R&D Program, closing with:

". . . It will be a tough struggle! While what will emerge may not be 'revolutionary' in today's blase world, there are certainly opportunities available to us for major improvements; simply compare what we have with what we want. The question at issue is whether or not what we want is feasible, not only technologically but practically. Searching for the answers will define the program for future food developments."

Fluidics System Checks Frankford Arsenal Ammunition

Small-caliber ammunition produced at Frankford Arsenal is checked for defects by a new Fluidic-Controlled Automatic Inspection System.

Designed to meet the arsenal's Quality Assurance Program inspection requirements, the system is incorporated in the primer-inserting machine to to detect missing vent holes or primers, inverted primers and missing, inverted or cocked anvils.

Defective cases are automatically ejected from the production line and indicators give visual read-outs when rejection occurs. The operator thus is provided with rejection rate data; also the system automatically shuts down if six consecutive rejects occur, indicating a breakdown.

The visual-read of the inspection and ejection system permits an operator to monitor more machines, and the system is designed to minimize operator training requirements.

Developed by Charles Picozzi, a design engineer in the arsenal's Industrial Services Directorate, the Fluidic Controlled Automatic Inspection System—which has no moving parts other than control valves actuated by low-pressure air linked to logic and memory systems—has been in operation for six months. Effectiveness has been proved during this period.

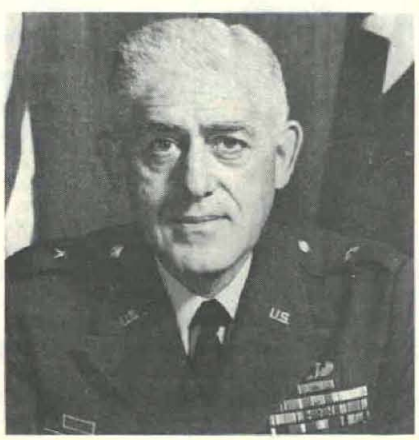
Gerace Heads Materiel Command R&P Directorate

Maj Gen Felix J. Gerace heads the Army Materiel Command's new Directorate of Requirements and Procurement, consolidating the former Procurement and the Production and Materiel Requirements Directorates.

Until reassigned, General Gerace had commanded the U.S. Army Natick (Mass.) Laboratories since May 1968. He is now responsible for over-all policy direction of AMC procurement activities at more than 150 installations in the United States. He also directs worldwide AMC logistics materiel management activities, including requirements determination, budgeting and programing.

General Gerace has served as commandant of the Army Logistics Management Center, Fort Lee, Va.; assistant chief of staff, G–4, HQ Eighth U.S. Army, Korea; executive officer to the Assistant Secretary of the Army (I&L); and chief, Logistics Division, HQ Military Assistance Advisory Group, Laos.

A 1941 graduate of the U.S. Military Academy, he earned an MBA degree at Stanford University in 1948. He is a graduate of the Command and General Staff College, the Infantry School, Armed Forces Staff College, and the Industrial College of the Armed Forces.



Maj Gen Felix J. Gerace

Veteran of Vietnam Assigned As MICOM Inspector General

Lt Col Robert E. Porter, recipient of the Air Medal and Bronze Star with Oak Leaf Cluster for service in Vietnam, has been named inspector general at HQ U.S. Army Missile Command, Redstone (Ala.) Arsenal.

Col Porter also has served as senior artillery adviser to the Royal Thailand Army and in assignments with the U.S. Army in Germany.

A native of Chicago, Ill., he attended Wilson Junior College in Chicago and was graduated from Florida A&M University with a degree in sociology. He has taken graduate courses at North Carolina A&T State University.

ARO-D Publishes Basic Research Accomplishments for FY 1969

"Scientific Accomplishments in Basic Research Supported by the U.S. Army Research Office-Durham During FY 1969" was distributed recently to disseminate new knowledge and focus attention on potential applications.

Projects in the annual report represent a selection of accomplishments in the ARO-D program supported by contracts and grants. An effort has been made to explain the accomplishments in simple terms comprehensible to nonspecialized readers.

In a foreword, ARO-D Chief Scientist John W. Dawson states: "It is obvious that the results are relevant to the interests of the U.S. Army, but one cannot be sure in advance in which way the scientific information will be used in applied research, and how it may aid technological progress.

"It is difficult in the more fundamental disciplines of mathematics, physics and chemistry to relate individual research projects to military requirements. Technological innovations are usually not based on a single discovery, but rather on the collective contribution and integration of a large number of individual research efforts followed by careful study and recognition of implications for use. The potential contribution of a basic research program should be evaluated from this point of view."

Results of 26 studies are condensed and indexed under six ARO-D operational divisions: chemistry, engineering sciences, environmental sciences, mathematics, metallurgy and ceramics, and physics.

In the chemistry field, Prof. George A. Olah, Case-Western Reserve University, has succeeded in generating the nitronium ion in a medium in which it is both relatively stable and unaccompanied by the formation of water in the production of trinitrotoluene (TNT).

Application of the Olah procedure in generating the nitronium ion, with inexpensive sodium or potassium nitrates as the source, could lead to a considerable improvement over present practices in TNT production.

In a plastics materials study, Profs. John A. Sauer and K. D. Pae, Rutgers University, achieved new yield strength and elastic modulus values while investigating the behavior of Lexan polycarbonate plastic under superimposed hydrostatic pressures.

Further findings in this field, the report states, should lead to improved plastic materials or more precise specifications for their most efficient use in military materiel such as rocket launcher handles, corrosion-proof plastic ball bearings, and protective mask lenses.

Prof. John L. Margrave, Rice University, reports on his investigations on "Graphite Fluoride as a Solid Lubricant." Daniel W. Brown and Leo A. Wall, National Bureau of Standards, report on "Glass Transition Temperatures of Fluorine-Containing Polymers."

The research by Brown and Wall indicates the possibility of synthesizing a polymer containing the necessary fluorine atoms to obtain enhanced resistance to degradation from exposure to high temperatures. Such a polymer may prove responsive to Army requirements for special-purpose gaskets and electrical insulation.

In the engineering sciences field, results of seven scientific accomplishments are described. "Dynamic and Static Tests of Thin-Walled Cylindrical Specimen Mild Steel and Other Materials in Biaxial Strees," by U. S. Lindholm, Southwest Research Institute, reports on new techniques to measure the required dynamic properties of materials with adequate accuracy for engineering applications.

However, the summary states, empirical testing alone is not sufficient and it is essential to develop an understanding and, if possible, a quantitative theory of inelastic behavior based upon the microscopic mechanisms governing deformation.

"Verification Tests and Methods of Theoretical Wind Tunnel Wall Corrections for High-Lift Aircraft Models," by W. H. Rae, University of Washington, reports on efforts to define the limits of flow-breakdown in wind tunnels used in testing V/STOL model aircraft.

N. D. Ham of the Massachusetts Institute of Technology reports on "Helicopter Blade Airload Distributions at High Advance Ratios." Results have improved understanding of the phenomenon of blade dynamic stall and its dependence on blade heaving and pitching motion.

In a project conducted at the University of Michigan, F. G. Hammitt reports on "An Investigation and Analysis of Asymmetrical Collapse of Cavitation Bubbles in Various Hydrodynamic Situations."

Results of the study may have po-

Boeing photo

TANDEM-ROTOR HELICOPTER with quadricycle gear is one of several designs being studied by the Advanced Materiel Concepts Agency (AMCA), U.S. Army Materiel Command, for very heavy-lift concepts that may be capable of lifting payloads in the 50-60-ton area in the 1990s. In the artist's concept of a Boeing heavy-lift concept above, the quadricycle very heavy-lift helicopter is shown acquiring a 155mm self-propelled howitzer. A major feature of this configuration is a loadmaster's station located in a forward landing gear fairing. From this station, the loadmaster could control the helicopter's approach and hover during cargo hook-up and delivery. (For further information on AMCA missions and objectives in advancing Army aircraft heavy-lift capabilities, see *Army R&D Newsmagazine*, November 1968 and June-July 1969 issues, p. 1.)

tential for the Army nuclear power programs as well as in applications involving pumps where cavitation may occur, internal combustion engines where cavitation in the coolant pump and passages has been a problem, and small boat propellers.

"Investigation and Analysis of Particle Drag Coefficients in Flow Regimes Experienced in a Rocket Nozzle" reports on research by C. T. Crowe, United Technology Center. R. M. White, University of California at Berkeley, describes findings of experiements in "Surface Elastic Waves in Acoustic Crystal Systems." D. O. Pederson and G. A. Rigby of the same university report on "Stable Monolithic Integrated Circuits."

In the environmental sciences, a group of six scientists, under the leadership of R. Pikul of the United Aircraft Corporate Systems Center, demonstrated feasibility of measuring the impact of meteorological factors upon artillery operations under combat conditions by means of computerized combat situations.

Mathematics division projects included investigations on perturbation techniques in differential equations by New York University Prof. Joseph B. Keller and some of his colleagues and students.

Prof. E. J. McShane, University of Virginia, developed a new theory of integration for stochastic processes. *Principal Functions*, a book that collects, correlates and unifies the theory of principal functions, was published for Prof. Leo Sario, University of California, Los Angeles. Prof. Sario acknowledges the Army's help and has dedicated the book to ARO-D.

In metallurgy and ceramics research, J. E. Hilliard, Northwestern University, reports on "Development of New Alloys with Improved Mechanical Properties." Results are expected to lead to marked progress in development of high-strength alloys with utility in ordnance.

Dr. G. E. Hallox, Research Institute for Advanced Studies, investigated the mechanical behavior of binary-alloy carbides as materials that may have considerable utility in high-temperature structures. Steps have been taken to obtain patent rights on titanium carbide-vanadium carbide alloys for high-temperature structural applications.

Prof. R. M. Spriggs, Lehigh University, is studying the use of thermomechanical treatments to strengthen ceramic materials to levels significantly above those attainable by conventional pressing and sintering. His method, termed "press-forging," entails coupling of pressure sintering with both compressive deformation and combinations of a decomposition reaction, a phase transformation, and/or the presence of a liquid phase at some stage in the process.

An important side effect of the new processing techniques has been the attainment of transparency in a number of oxides, e.g., yttria, in addition to increase in strength. This achievement of transparency in ceramic oxides is considered to be a major advance in the quest for transparent armor of high ballistic resistance.

Several ARO-D-supported chief investigators have been using modulation and phase-sensitive detection techniques to achieve important advances in physics research. Among these are Prof. D. E. Mapother, University of Illinois; Leo Esaki, IBM; and Prof. Manuel Cardona, Brown University.

Their accomplishments represent several new approaches to the study of band structure, surface plasma effects, and phase transition phenomena in solids which determine the electrical, optical and, in some, cases, acoustical properties. Surface plasma effects, for example, are already finding application in optical modulators.

Theoretical and experimental work by Profs. D. J. Scalapino, D. N. Langenberg and coworkers at the University of Pennsylvania indicates that considerable improvement can be achieved in systems consisting of weakly coupled superconductors.

Their research in "Josephson Tunnel Junctions" may stimulate renewed interest in these sources of small but useful amounts of radiation in the millimeter and submillimeter range.

Dr. P. P. Sorokin and Gerald Burns, of International Business Machines, have been doing research on new electro-optic materials. Detailed studies have been completed on a number of new ferroelectrics that have good potentiality in concepts for controlling and modulating laser light beams.

The new materials are niobates and molybdates. One compound, sodium barium niobate, known as "bananas," has received considerable publicity as a key to a practical tunable laser.

The IBM work on niobates and molybdates has included chemical studies on the phase diagrams, crystal growth, measurement of the electro-optic parameters, and the analysis of these parameters in terms of crystal structure and lattice vibrational spectra.

Potential applications of results of

(*Continued on page 14*)

Army R&D Pays Off in Apollo 12 Nuclear Power

Fifteen years of U.S. Army developmental effort climaxed in an instant on the lunar surface Nov. 19 when Cmdr Alan L. Bean, Apollo 12 lunar module pilot, slipped a tube of radioactive fuel into the SNAP 27 electric power generator.

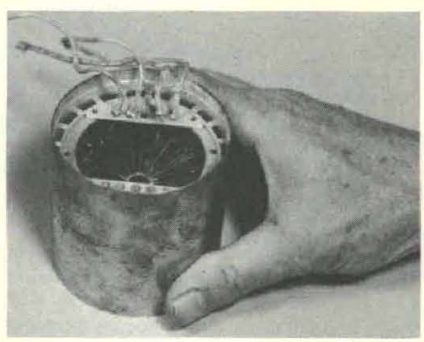
SNAP stands for Systems for Nuclear Auxiliary Power and the system hopefully will generate electricity on the moon for years to come. It works on the principle that heat generated by the radioactive source will create electricity.

Feasibility of encapsulating radioactive materials to provide heat for the generation of electric power was first proved at the Power Sources Division of the Electronic Components Laboratory in what is now the Army Electronics Command at Fort Monmouth, N.J.

The first U.S. Army nuclear-powered thermoelectric power source was a tiny metal cylinder, about half the size of a soup can. The radioactive capsule used Polonium 210 radioactive material and normal metallic thermocouples—much like those in a home thermostat—to generate power. SNAP 27 uses Plutonium and a solid-state lead telluride compound.

The Fort Monmouth granddaddy of such power turned out only 150 milliwatts—150 thousandths of a watt—while SNAP 27 generates 63 watts. Both work on the principle developed at Fort Monmouth to generate electricity with no moving parts—encapsulated radioactive materials for heat and thus electricity, first successful in 1954.

The contractor working with the Fort Monmouth laboratories on developmental effort was a division of Monsanto Co.



MOON POWER "GRANDDADDY," developed 15 years ago in ECOM labs, proved that encapsulated radioactive material could be used as a heat source for thermoelectric power generation. A tube of radioactive fuel was used in SNAP-27 by Apollo 12 astronauts.

ARO-D Publishes Basic Research Accomplishments

(Continued from page 13)

this research include use of the materials in sensing elements, control apparatus, transducers, capacitors as well as in electro-optical applications such as light modulation, beam deflection, harmonic generation, and parametric oscillation.

One of the materials studied, gadolinium molybdate, is ferroelectric at room temperature and is suitable for an electrical write- (using reversible polarization) optical read system with memory.

Julius Perel, Electro-Optical Systems, Inc., presented a key paper on atmospheric charge transfer at a recent DASA symposium on the upper atmosphere. Participants then concluded that charge transfer collisions are an important energy loss mechanism in both the normal and perturbed atmosphere.

Results of Perel's work, supported by ARO-D, show that the neutral atom emerging from each collision has a high probability of being internally excited; and the subsequent radiation is an important energy loss mechanism.

This information is needed to determine the dwell time of the electric charge ("blackout") as well as the level of electromagnetic radiation following an atmospheric nuclear detonation.

Dr. Leo Esaki, IBM scientist, well-known for his invention of the tunnel diode, has proposed a new class of semiconducting materials. Under an ARO-D contract, he plans to create a one-dimensional periodic structure, or "superlattice," in semiconductors by a periodic variation of alloy composition or impurity density, introduced during crystal growth.

His work on superlattices and negative conductivity in semiconductors suggests the feasibility of a new class of electronic devices for extremely high-frequency applications.

As a result of his ARO-D-supported theoretical studies, Prof. George W. Pratt of the Massachusetts Institute of Technology has been able to explain the unusually high charge mobility at low temperatures observed in lead salts—part of a general class of semiconductor materials important for lasers and thermoelectric generation.

This novel model involves impurity states which lie well up in the conduction band rather than in the energy gap, as in ordinary semiconductors.

Dr. Pratt has predicted that the result of his work will provide a connection between the band structure and the phase diagram of lead telluride, and provide new general ideas extending to non-stoichiometric doped semiconductors, including amorphous semiconductors.

The latter have received a great deal of attention recently because of their potentiality for comparatively easily fabricated, radiation damage-insensitive electronic switches and memory units.

Prof. David Douglass, University of Chicago, reporting research on the rare earth metal gadolinium, says impurities, rather than the main material, determine the behavior of the thermodynamic and transport coefficients at temperatures close to magnetic transition temperatures.

This research on the influence of impurities on magnetic critical point phenomena is considered important because of the effort by many investigators to understand the pheonomena common to all critical transitions, including ferroelectric, ferromagnetic and superconducting transitions. These transitions are the basis of electronic sensing and control devices.

Oral Pathology Course Offered Mar. 2-6 in Washington, D.C.

The 17th annual Armed Forces Institute of Pathology (AFIP) course in oral pathology, scheduled Mar. 2-6 in Washington, D.C., is open to both civilian and military dentists and physicians.

Lt Col Robert, chief of the Dental and Oral Pathology Division of AFIP, has urged prospective students to submit applications early, addressed to the Director, Armed Forces Institute of Pathology, ATTN: MEDEM-PAD, Washington, D.C. 20305.

The course this year is designed for oral surgeons, oral pathologists, diagnosticians and periodontists, including those engaged in dental research and cancer investigation.

Experts in these fields will report on recent developments pertinent to disturbances of the head, neck and oral region, inflammatory diseases of the oral mucosa and jaws, oral manifestation of certain system diseases and neoplasms of the oral cavity and related structures.

Lectures will be correlated with case presentations and microscopic slide seminars at evening sessions.

AMC to Dedicate Building in Honor of General Bunker

Memorializing the many contributions of the late Lt Gen William B. Bunker to logistics management and training will be a $3.7 million academic building at the Army Materiel Command's Logistics Management Center at Fort Lee, Va.

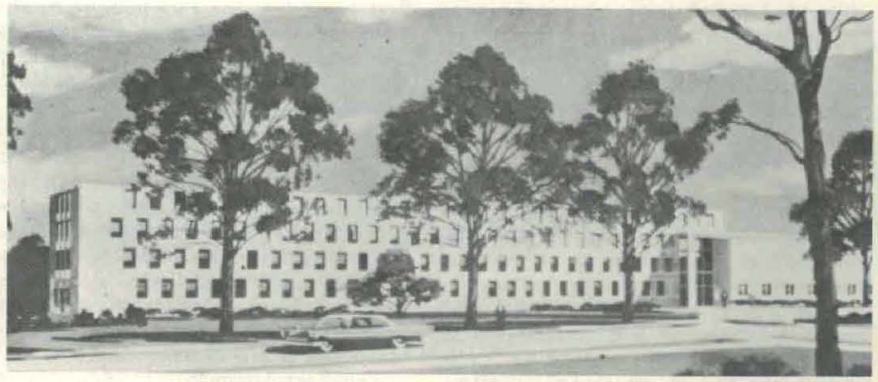
AMC Commander General F. J. Chesarek has announced that the building will be dedicated in either March or April 1970 in honor of the man who was deputy commanding general of the AMC when he died June 6, 1969.

The 4-story structure has been under construction since December 1967. Containing 126,500 square feet of floor space, it will have 16 classrooms accommodating 40 students each, four rooms for 25 students each, a 30,000-volume library, 500-person cafeteria, 400-seat auditorium, computer center with 12 additional classrooms, and 140 offices.

General Bunker had served since Aug. 17, 1964, as a member of the Army Logistics Management Center faculty, in recognition of his long and enthusiastic support of the institution. He served as commandant of the U.S. Army Transportation School at Fort Eustis in 1954–55, and was credited with doing much to shape the center's curriculum. He also was a frequent speaker at graduation ceremonies.

In the advancement of modern techniques of logistics management, General Bunker served as a transportation officer with the U.S. Seventh Army during the early occupation of Germany. With the beginning of the Berlin Airlift in 1948, he was placed in charge of terminal operations.

The outbreak of hostilities in 1950 led to his assignment to organize a similar system between Korea and Japan, and he later became chief of the Air Transport Division. His investigation of the use of helicopters for transport contributed to the rapid expansion of their logistics role.



BUNKER HALL Academic Building, USALMC, Fort Lee, Va.

Major RDT&E, Procurement Contracts Exceed $645 Million

More than half the total value of materiel procurement and research, development, test and evaluation orders issued by the U.S. Army from Oct. 16 to Nov. 9, (contracts exceeding $1 million each) went to one firm.

The total was $645,077,364, with $347,841,539 going to the Kaiser Jeep Corp. for 2½– and 5–ton trucks.

Four contracts totaling $44,554,474 went to Western Electric Co. for R&D and hardware for the Spartan missile and the Perimeter Acquisition Radar (PAR), and engineering services on the Nike Hercules missile system.

Hercules Engines, Inc., was awarded $37,472,224 for multifuel engines for 2½–ton trucks. Olin Mathieson Chemical Corp. gained $31,363,436 (four contracts) for propellants, illuminating projectiles, bomb-fin assemblies, and for loading, assembling and packing time fuzes.

Bell Helicopter Co. received $20,154,854 (two contracts) for UH-1H helicopters and spare parts. Sperry Rand Corp. gained a $14,850,915 order for loading, assembling and packing of ammunition. AVCO Corp. was awarded $12,301,799 (four contracts) for modification kits and overhaul of turbine engines.

An $11,081,522 contract with General Dynamics Corp. is for Redeye missile warheads. Thiokol Chemical Corp. is receiving $10,713,389 for artillery ammunition. Lockheed Aircraft Corp. will get $10,144,436 (two contracts) for YO–3A aircraft and work on the experimental system for the Hudson Moon event (classified).

Contracts under $10 million. Radio Corp. of America, $8,907,825 (three contracts) for engineering services and hardware for the Land Combat Support System and for test program for the TOW missile system.

Norris Industries, Inc., $5,626,909 (two contracts) for 105mm cartridge cases and 60mm rocket launchers; ITT Corp., $5,308,538 (two contracts) for module sets and engineering changes to radio sets; and

Muncie Gear Works, $5,191,902 for 2.75–inch rocket motors; HIPCO, Denver, Colo., $5,077,500 for 2.75–inch rocket motors; Marquardt Co., Ogden, Utah, $4,851,000 for 2.75–inch rocket motors; Day and Zimmerman, Inc., $4,792,262 for loading, assembling and packing ammunition; Ordnance Products, Inc., $4,481,585 for M18 colored smoke hand grenades; Ralph M. Parsons Co., Los Angeles, Calif., $3,673,-818 for engineering services on the Missile Site Radar site; Maremont Corp., $3,391,640 for 7.62mm machineguns; and

Jackson Products Co., Tampa, Fla., $3,372,000 for metal parts for rocket motors; Texas Instruments, Inc., $3,171,100 for electronics work; General Motors Corp., $2,908,800 for engines for OH–58A helicopters; Ford Motor Co., $2,784,033 for ¼–ton trucks; and

Dow Chemical Co., $2,678,000 for nose assemblies for bombs; ACF Industries, Inc., St. Louis, Mo., $2,640,460 for assemblies for mortar fuzes; National Presto Industries, $2,373,290 for parts for 105mm projectiles; Litton Systems Corp., $2,000,000 for test equipment for inertial navigation systems.

Contracts under $2 million. Firestone Tire and Rubber Co., $1,954,742 for track shoe assemblies for recovery vehicles; Chrysler Motors Corp., $1,845,638 for 1–ton cargo trucks; Northrop Corp., $1,830,000 for ammunition warheads; Rohm and Haas Co., $1,700,000 for propellant research;

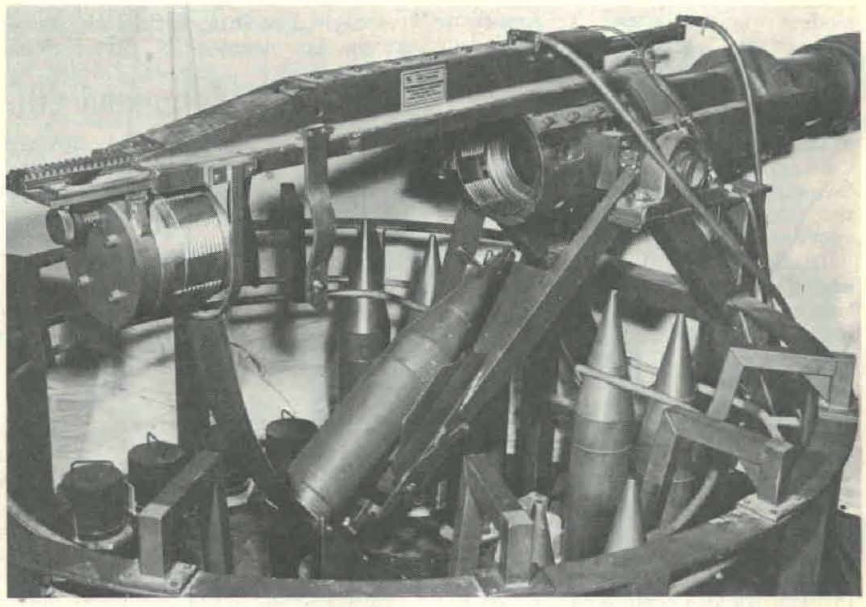
Maxson Electronics Corp., Macon, Ga., $1,617,000 for 60mm illuminating projectile assemblies; Sylvania Electric Products, Inc., $1,535,200 for R&D work in electronic warfare; Brunswick Corp., $1,514,501 for 66mm rockets; North Electric Co., Galion, Ohio, $1,481,971 for switchboards;

Raytheon Co., $1,470,000 to rebuild accelerators for the Hawk missile system; Honeywell, Inc., $1,460,494 for fuzes; National Presto Industries, $1,430,675 for projectile parts; Ammann and Whitney, New York, N.Y., $1,412,113 for engineering services for the Perimeter Acquisition Radar Site; and

M.C. Ricciardi Co., Alpha, N.J., $1,350,820 for containers for 2.75–inch rocket assemblies; E. I. Dupont de Nemours Co., $1,323,600 for support of TNT production; Ordnance Products, Inc., North East, Md., $1,-304,948 for hand grenade fuzes;

Pace Corp., $1,276,411 for parachute signals; Action Manufacturing Co., Philadelphia, Pa., $1,242,800 for metal parts for rocket fuzes; Sanders Associates, Bedford, Mass., $1,175,183 for prototype radar systems; Computer Sciences Corp., Huntsville, Ala., $1,169,979 for programing and maintenance of the Safeguard Management Information System; and

S. Tepfer and Sons, Inc., Deer Park, N.Y., $1,118,558 for parts for ammunition warheads; Amron Corp., $1,094,800 for 20mm cartridge cases; and Goodyear Tire and Rubber Co., $1,058,681 for track shoe assemblies for self-propelled howitzers.



PREPROTOTYPE of a fully automatic loader is being evaluated at the U.S. Army Weapons Command (WECOM), Rock Island, Ill. When perfected, the loader is expected to give tank crews at least eight rounds of firepower per minute. One new feature of the model is the capability of loading while the gun tube is moving up and down. This means that a tank-gun stabilization system could be used in conjunction with the loader. The crew could load and fire while traveling over rough terrain. Another advantage is that the cycling time is reduced because breech plug is also the rammer head. AAI Corp. built the model.

15 Staff Officers Report for Duty With Office of Chief of R&D

Five of 15 staff officers assigned recently to the Office of the Chief of Research and Development, HQ DA(OCRD), are in the Directorate of Army Research, three in Plans and Programs, two in the Developments Directorate and five in the Missiles and Space Directorate.

U.S. ARMY RESEARCH OFFICE (USARO). *Lt Col Albert L. Romaneski* is assigned to the Geophysical Sciences Branch, Environmental Sciences Division. In 1958 he was in Vietnam as a combat engineer and recently completed his second tour there, serving as deputy engineer, II Field Force, and later as commander, 168th Engineer Combat Battalion, Lai Khe.

In 1962 he served in the Congo and acted as interpreter between President Kennedy and General Mobuto during the latter's visit to the United States in the spring of 1963. He also has served as an Army attache in the American Embassy in Sweden.

Five years after entering the U.S. Army as an infantryman, he was graduated from the United States Military Academy at West Point and commissioned in the Corps of Engineers. He has advanced degrees in civil engineering from California Institute of Technology and Columbia University, and is a registered engineer in his home state of Oregon.

Col Romaneski has lectured in modern mathematics at American University, Washington, D. C., and served as an instructor and assistant professor of engineering at the U.S. Military Academy. He is a graduate of the Command and General Staff College, the Defense Intelligence School, and the Industrial College of the Armed Forces (ICAF) correspondence course.

Lt Col Charles J. Lowman Jr. was assigned to the Communications-Electronics (C–E) Division Nov. 24, following a tour of duty in Vietnam. He served in OCRD (1963–1968) as a staff officer with the C-E Division and as C-E standardization representative, U.S. Army Standardization Group-Canada, Ottawa.

Lt Col Lowman graduated from the USMA in 1953, earned an MS degree in physics from the University of Virginia and studied at the Oak Ridge (Tenn.) Institute of Nuclear Studies in 1959. He also completed the C&GSC (1965) and the ICAF correspondence course (1969).

Lt Col Daniel H. Bauer completed a tour of duty as CO of the 41st Civil Affairs Company in Vietnam prior to assignment with the Behavioral Sciences Division, USARO.

Graduated in 1959 with a BA degree in history from the University of Cincinnati, he has an MS degree in diplomatic history from the University of Illinois (1966), and completed the C&GSC in 1967.

He has served as assistant professor of military science at the University of Illinois; civil affairs officer, 4th Missile Command, Korea; and S–3, 32d Field Artillery Battalion, Fort Sill, Okla.

Maj Gerald R. Wetzel earned an MBA degree in operations research from George Washington University shortly before his assignment to the Studies Branch, Studies and Analyses Division, USARO. He received a BS degree in chemical engineering from the University of Notre Dame in 1958.

From March 1967 to May 1968, he was executive officer at the Sierra Army Depot, Herlong, Calif., subsequent to a tour as logistics adviser, Military Assistant Advisory Group (MAAG), Iran. From July 1964 to January 1966, he served as missile system coordinator at the Ordnance Guided Missile School, Redstone, Ala.

He has served tours as Nike Hercules battery commander and as a shop officer with a special weapons depot company, both at Okinawa.

OPERATIONS RESEARCH. *Capt Richard R. Sonstelie* has been assigned to the U.S. Army R&D Operations Research Advisory Group as a research associate, with duty station at the Los Alamos (N. Mex.) Scientific Laboratories.

Graduated from the USMA in 1966, he earned an MS degree in nuclear engineering from the Massachusetts Institute of Technology in 1968.

Capt Sonstelie recently completed a tour of duty with the 25th Infantry Division in Vietnam, subsequent to service with the 82d Airborne Division, Fort Bragg, N. C.

PLANS & PROGRAMS. *Lt Col John P. Haumersen*, staff officer with the Programs Branch, Programs & Budget Division, OCRD, recently served as CO, 4th Squadron, 7th Cavalry, 2d Infantry Division in Korea.

A 1951 graduate of the USMA, he has an MSE degree from the University of Michigan (1959) and completed the C&GSC in 1965.

Major assignments include service with the Armor and Engineer Board, Fort Knox, Ky., and the 14th Armored Cavalry Regiment in Germany.

Maj William L. Webster served with the U.S. Army Advisory Group, Korea (KMAG), prior to assignment as a staff officer with the Long Range Plans Branch, Plans Division, OCRD.

He completed the C&GSC (1968), subsequent to a tour of duty with the 101st Airborne Division, Fort Campbell, Ky. From April 1965 to June 1966, he was company commander, 3d Brigade, Fort Polk, La.

Maj Webster earned an AB degree in psychology from the University of

Kitchens to Command CDC Combat Arms Group

Col (Brig Gen nominee) Edward B. Kitchens Jr. will assume command of the U.S. Army Combat Developments Command (CDC) Combat Arms Group at Fort Leavenworth, Kans., Dec. 20.

The assignment follows service as materiel director, HQ CDC, Fort Belvoir, Va., and a tour of duty with the 1st Infantry Division in Vietnam. From 1963 to 1966, he served with the Plans and Air Mobility Divisions, Office of the Chief of Research and Development.

Commissioned in 1942, he served in World War II with Darby's Rangers in North Africa, Sicily and Italy. Later he was a faculty member of the Infantry School, Fort Benning, Ga., and served with the 82d Airborne Division prior to a tour of duty in Korea.

Col Edward B. Kitchens Jr.

Assigned to the Army General Staff in the Pentagon for three years, he was transferred in 1957 as secretary of the General Staff, HQ U.S. Army, Pacific, Fort Shafter, Hawaii.

Col Kitchens is a graduate of the Army Command and General Staff College, the Armed Forces Staff College and the National War College.

His decorations include the Silver Star with Oak Leaf Cluster (OLC), the Legion of Merit with OLC, Air Medal with 5 OLC, and the Army Commandation Medal with OLC. He also wears the Vietnamese Gallantry Cross with Palm, the Vietnam National Order and the Armed Forces Medal.

Georgia in 1965.

Maj Townsend A. Van Fleet is assigned to the Programs Branch, Programs & Budget Division, after serving as an adviser with the 32d Artillery Battalion in Vietnam.

From July 1964 to July 1967, he was a tactical officer and course director at the U.S. Air Force Academy. He also served as an instructor at Fort Sill, Okla. (1963–64) and as battery commander, A Battery, 9th Artillery Battalion, Hawaii (1961–62).

Maj Van Fleet graduated from the USMA in 1958 and completed the C&GSC in 1968.

DEVELOPMENTS DIRECTORATE. *Lt Col Alvin M. Quint* completed a tour of duty as chief, Systems Analysis Division, Advanced Aerial Fire Support Systems Office (AAFSSO) in the Pentagon, prior to his second OCRD assignment.

Serving now as the Army member of the Department of Defense (DoD) Air Munitions Requirements and Development (AMRAD) Committee, he was first assigned to OCRD with the Long Range Plans Branch, Plans Division, in September 1968, after serving as CO of the 9th Aviation Battalion, 9th Infantry Division, and with HQ U.S. Army Vietnam.

He served with the U.S. Army Combat Developments Command (USACDC) Infantry Agency at Fort Benning, Ga. (1963–65) and the 1st Cavalry Division in Korea (1962–63).

After earning a bachelor's degree in general education from the University of Omaha in 1961, he completed the C&GSC course. He earned an MS degree in business education from the University of Tennessee in 1967.

Lt Col Clifford J. Fralen became a staff officer with the General Materiel Branch, Combat Materiel Division, following duty as deputy G–2, 25th Infantry Division, Vietnam.

A 1955 graduate of the USMA, Lt Col Fralen earned an MSE degree from Johns Hopkins University in 1961 and completed the C&GS in 1968.

He served with the U.S. Infantry Brigade, Advanced Individual Training, Fort McClellan, Ala. (1966–67) after two years with the 2d Battalion, 18th Artillery, U.S. Army Europe (USAREUR).

MISSILES & SPACE. *Lt Col Pelham L. Felder III* returned recently from duty in Korea as battalion commander, 7th Battalion, 5th Artillery, and is assigned to the Low Altitude Systems Branch, Air Defense & Missiles Division, OCRD.

From 1964 to 1968, he was branch chief, Air Defense Directorate, Office of the Assistant Chief of Staff for Force Development (ACSFOR), HQ DA. Earlier assignments include missile adviser, MAAG, Brussels, and chief of the Data Reduction Branch, Air Defense Board, Fort Bliss, Tex.

Lot Col Felder earned a BS degree in chemistry from The Citadel in 1949 and completed the C&GS in 1964.

Lt Col Winston K. Evans became chief of the High Altitude Systems Branch, Air Defense & Missiles Division, after completing a tour of duty with the 2d Infantry Division in Korea.

Graduated in 1952 with a BS degree in civil engineering from The Citadel, he received an MS degree in electrical engineering from Georgia Institute of Technology in 1967 and completed the C&GSC in 1968.

From January 1964 to June 1965, he served with the Project TEAM (Test & Evaluation of Air Mobility) at Fort Benning, Ga.

Lt Col Cecil R. Sykes served in Vietnam until assigned as chief, Nuclear Branch, Nuclear, Chemical & Biological Division, OCRD.

For four years (1964–68), he was operations officer, Joint U. S. Military Advisory Group (JUSMAG), Thailand, following a year of language study at the Foreign Service Institute in Washington, D. C.

He has served as project officer, Nuclear Weapons Effects Test Group, Field Command, Defense Atomic Support Agency (DASA), Albuquerque, N. Mex., and as a research assistant at the Lawrence Radiation Laboratory, Livermore, Calif.

A 1952 graduate of the USMA, Lt Col Sykes has an MS degree in physics from the University of Virginia (1960) and completed the C&GSC (1965).

Lt Col Edgar G. Miles was assigned as chief of the Fire Support Missiles Branch, Air Defense & Missiles Division, after a tour of duty with the 35th Field Artillery Battalion and HQ U.S. Army Vietnam.

He has BS and MS degrees in mechanical engineering from Mississippi State University (1952, 1957) and completed the Air Command and Staff College in 1967.

Recent assignments include service with HQ U.S. Army Combat Developments Command, Fort Belvoir, Va., and with the V Corps, Artillery in Darmstadt, Germany.

Lt Col Joseph J. Skaff was battalion CO, 1st Battalion, 27th Artillery in Vietnam prior to his new assignment with the Low Altitude Systems Branch, Air Defense & Missiles Div.

From 1964 to 1967, he served with the Materiel & Safety Division at the Institute of Nuclear Studies, Fort Bliss, Tex., after graduating from the guided missile systems course.

Graduated from the USMA in 1955, he earned an MS degree in international affairs from George Washington University in 1968. He has completed the Command and Staff Course at the Naval War College.

MICOM Awards 2 Contracts For New Aerial Target System

Two contracts for prototypes of a new, low-cost Ballistic Aerial Target System (BATS) were awarded recently by the Army Missile Command, Redstone Arsenal, Ala.

Brown Engineering Co., Huntsville, Ala., and the Aeronutronic Division of Philco-Ford Corp., Newport Beach, Calif., received awards of $80,201 and $97,356.

BATS has been ordered for evaluation to meet a requirement for a light, expendable target missile for use in training. Intended to replace more expensive, sophisticated target missiles for firing on small ranges in the U.S. and overseas where high performance target missiles cannot fly, it is also to be tested and used on the larger ranges.

MERDC Assigns Lt Col Luther as R&D Coordinator

Coordinator for research and development, Engineering Laboratory, U.S. Army Mobility Equipment R&D Center, Fort Belvoir, Va., is the new assignment of Lt Col Jay E. Luther, upon return from South Vietnam.

In 1952, six years after he entered the Army as a private, Col Luther was graduated from the U.S. Military Academy at West Point and commissioned in the Corps of Engineers. Five years later he earned an ME degree in civil engineering from Purdue University.

Lt Col Jay E. Luther

Graduated from the Engineer Career Course at Fort Belvoir, he also has completed the Civil Affairs School course at Fort Gordon, Ga., and Defense Language Institute, Washington, D.C. He is a registered professional engineer in the District of Columbia.

During his recent assignment in Vietnam he was with the Office of the Assistant Chief of Staff for Civil Operations and Revolutionary Development Support. He served in Korea in 1968, Ecuador (1965–67), Greenland (1961–62) and earlier in Germany.

Col Luther has been awarded the Bronze Star Medal, Joint Service Commendation Medal, Army Commendation Medal, Expeditionary Forces Medal, Vietnam Service Medal and National Defense Medal with Oak Leaf Cluster.

USASASA Focuses on RDT&E Management of Small Weapons Systems

Intensified cooperative effort for two years to achieve more effective centralized management of the U.S. Army Small Arms Program (ARSAP) originating from a 1966 General Staff review, was marked in November.

The U.S. Army Small Arms Agency (USASASA) observed its first year of activity and is charged with over-all authority for accomplishing this objective, in accordance with a U.S. Army Materiel Command Letter of Instruction dated Nov. 25, 1968.

Collocated with the U.S. Army Test and Evaluation Command HQ and the U.S. Army Aberdeen R&D Center, at Aberdeen (Md.) Proving Ground, USASASA was established in late 1968 but was not declared fully operational until June 30, 1969.

Progress reports indicate that under the leadership of Col Walter E. Rafert, who has headed the agency since it was in the planning and organizational phase, USASASA is making encouraging advances in integrating efforts of the Army Materiel Command with the Continental Army Command, Combat Developments Command, and Army General Staff.

USASASA is empowered with full line authority for centralized management of the Army Small Arms Program, except for certain weapon systems still under project managers. It functions as a project management-like operation, with Col Rafert reporting directly to General F. J. Chesarek, CG of the Materiel Command.

The Director of Development and Engineering, HQ AMC, exercises the principal staff supervision and coordination for USASASA. Materiel Command staff elements provide support in functional areas of responsibility.

Various AMC commodity commands and other agencies support the USASASA in assigned areas of expertise. This includes configuration management, human engineering, value engineering, test and evaluation, advance production engineering, quality assurance and reliability, engineering in support of procurement, data bank services, and industrial liaison.

Integrated systems management and direct master planning are functions of USASASA as an Army Material Command focal point for Department of Defense, Department of the Army and industrial organizations concerned with the Army Small Arms Program.

Agency responsibilities include threat analysis/investigation, systems analysis, future weapons concepts, cost-effectiveness studies, budgeting and programing, financial management, technical supervision as assigned, and over-all coordination of production and procurement efforts.

USASASA's centralized management applies to weapons, ammunition and fire control for new small arms systems such as individual hand-held and crew-served weapons and accessories, up to and including .60–caliber.

Specifically excluded from USASASA control is the M16/M16A1 rifle as well as coproduction of M14/M60 weapons and 7.62mm ammunition under an agreement with the Republic of China.

USASASA's mission includes shotguns and infantry grenade launchers (but excludes the Grenade Launcher Attachment Program known as GLAD for the M16/M16A1).

The agency also is responsible for sights and fire control equipment for its specific projects, but excluding electronic night sights and those for the GLAD program.

Responsibility for certain ammunition items is assigned to the Project Manager for Selected Ammunition at Picatinny Arsenal, Dover, N.J. Likewise, the Project Manager for Rifles retains authority over 5.56mm ammo.

Among USASASA's high-priority areas of effort is the Future Rifle Program, involving consideration of at least four current contender concepts. The goal is a system that, compared to present systems, offers major advances in reliability, durability, high-hit probability and lethality. The development time frame to supplant the M14 and M16 series is the 1980s, subject to change as may prove desirable.

Considerable R&D effort has been devoted to a prospective system using a serially fired flechette that provides a controlled-burst dispersion at the target. Obstacles still to be surmounted include reliability and ammunition costs of this multiple-launch concept.

Engineering design tests have demonstrated the effectiveness of the serially fired flechettes, but further field testing is needed to determine superiority over a conventional weapon system.

Another contender concept is a serially fired bullet system, using conventional small-caliber bullets with controlled bursts to achieve optimum dispersion at the target. Consideration is being given to either a conventional gas system or an innovative piston-primer approach.

A simultaneously fired flechette system also is being investigated as a third concept, using either a puller or pusher sabot to launch the flechettes. The advantage is that multiple flechettes could be fired by a single trigger pull in the semiautomatic mode. This would eliminate the need for a burst-control and a high-cycle-rate mechanism.

Experiments have demonstrated a sufficiently high muzzle velocity and the required dispersion for effectiveness of this type of system, but many problem areas remain.

Caseless ammunition is a fourth contender in the Future Rifle Program, although a number of problems have been encountered in investigations to date. Included are obturator performance, firing-pin erosion, chamber fouling, reliability, breakage of ammunition, packing and storage methods and, in particular, vulnerability of the unprotected propellants to heat and flame.

Adaptability of the flechette system to machineguns is being investigated, including parametric studies of weapons mounts to predict the dispersion probabilities. Sabots have been modified for machineguns, and tests of 5.56mm weapons are planned. Improvement of the M73 tank machinegun is another area of prime effort.

Both high-velocity and low-velocity automatic grenade launchers are under consideration as future weapon systems, and the latter type is being evaluated in Southeast Asia.

Col Rafert said the Army needs "additional and high-quality effort in wound ballistics and work on flechettes and other lethal mechanisms."

Linking the over-all studies, planning, test and development effort will be a small arms data bank. Planning for this facility has the goal of a central capability for rapid storage and retrieval of essential information.

U.S. Army Small Arms Systems Agency activities are expanding as understanding of the magnitude of integrating the Small Arms Program is advanced by improved working relationships with AMC commodity commands and other agencies involved. Imaginative concepts are being formulated in line with the mission of developing superior small arms for the U.S. Army of the future.

Biographical sketches of USASASA key personnel follow:

COL W. E. RAFERT became director and commander of USASASA after serving from February 1967 to October 1968 as assistant director, Developments, Office of the Chief of R&D, HQ DA. He was chief, OCRD

Combat Arms Branch, June 1966 to February 1967.

Graduated from the Army War College in 1966, following duty in the Long-Range Technical Plans Branch, R&D Directorate, Army Materiel Command, he has served as an instructor at the Army Ordnance School and the U.S. Military Academy.

While at the USMA, he coauthored a text, *Elements of Armament Engineering.* He has written articles for professional journals, including "Planning Principles and Philosophy," *AIEE Journal* (December 1968) and "Focus on Management," *Ordnance Magazine* (March-April 1969).

Col W. E. Rafert

A career Ordnance Corps officer, he has served in various technical assignments in Europe and the Pacific Theater, including duty as U.S. Army Ordnance technical representative to the United Kingdom. He also has served at the Ballistic Resarch Laboratories, Aberdeen Proving Ground, and in HQ DA staff officer duties.

Col Rafert graduated from Purdue University in 1943 with a BS degree in mechanical engineering and earned his master's degree at Stanford University in 1950.

LEONARD R. AMBROSINI was chief systems engineer, AMC, until he was designated acting technical director of USASASA.

Born in Leghorn, Italy, he studied at the Italian Scientific Lyceum, the Geneva Calvin College, and obtained an MS degree at the Zurich Federal Polytechnicum in aerodynamics and thermodynamics in 1948. He continued studies at the University of California (L.A.) as a PhD candidate.

Ambrosini began his ordnance career with Hispano-Suiza, Switzerland, where he was chief engineer, after inventing, developing and marketing automatic weapons, antiaircraft fire directors and related equipment.

In 1957 he joined Lear Inc. (subsequently Lear-Siegler, Inc.) at Grand Rapids, Mich. He moved to California as assistant to the corporate chief

Leonard R. Ambrosini

physicist, held progressively responsible positions, and was vice-president for company-wide ordnance development when he joined AMC. He has patents on about 60 inventions.

DR. DAVID J. KATSANIS, staff physicist, earned BS, MS and PhD degrees (1952–54–62) in physics from Temple University. Fifteen of his 17 years as an Army scientist were with Frankford Arsenal, where he progressed to chief of the Special Projects Laboratory.

Dr. Katsanis is credited with a pioneering role in the automation of ammunition proof testing, the development of improved velocity pressure, and accuracy measuring instrumentation; also, the introduction of improved statistical design of experiment techniques for small-caliber engineering studies.

While with the Special Product Laboratory, he directed ammunition product improvement engineering studies, including low-density materials for cartridge cases and complete systems analysis for small-caliber weapon systems.

Dr. David J. Katsanis

Listed in *American Men of Science,* Dr. Katsanis has written more than 20 publications in physics of fluids, interior ballistics weapon system analysis, and designs of experiments. He has received numerous patents, commendations and awards.

JOHN E. REGAN joined the USASASA as chief of the Weapons Systems Synthesis Division in July, following more than 24 years with Frankford Arsenal, including duty as acting chief of the Small Caliber Ammunition Development Laboratory (1967–69). He was on temporary duty assignment as technical assistant to the chief of the USASASA from November 1968 to June 1969.

He was technical assistant to the chief of the Small Caliber Ammunition Development Laboratory (1962–67) and staff assistant to the Small Arms Ammunition Mission manager (1958–62), after serving as chief of the Propellants Branch in the Pitman-Dunn Research Laboratories.

He has an AB degree in chemistry from Temple University and has authored a number of technical reports

John E. Regan

and papers on small arms ammunition.

J. LARRY BAER, chief of the Advanced Concepts Division, has a BS degree in chemical engineering from City College of New York (1950), an MSCE degree from Iowa State University (1951), and an MBA in industrial management from Temple University (1961).

Baer was employed by the Department of Defense at Frankford and Picatinny Arsenals and the Limited War Laboratory prior to joining USASASA. He received the Meritorious Civilian Service Award in 1965 and in 1957 was awarded a scholar-

(*Continued on page 20*)

J. Larry Baer

USASASA Focuses on Small Weapons Management

(*Continued from page 19*)

ship by the Philadelphia Federal Personnel Council.

Born in Frankfurt-am-Main, Germany, he came to the U.S. in 1940. He has been employed by Foundry Chemicals Co. & Stoll Metal Corp., Long Island City, N.Y.; the Ames (Iowa) Laboratory; and Merck & Co., Inc., Rahway, N.J.

MAJ GEORGE O. JAMES, acting chief of the Combat Developments Division, recently completed two tours of duty in Vietnam. He also served in combat with the 7th Infantry Division in the Korean War.

Maj James served two years with the Combat Developments Command Experimentation Command, during which he participated in the Small Arms Weapons Study and the Infantry Rifle Unit Study.

He attended Infantry OCS, the Ranger and Airborne School, Infantry Career Course, and the Command and

Maj George O. James

General Staff College. His awards include the Silver Star, Bronze Star with Oak Leaf Cluster, Combat Infantryman Badge with Star, and Vietnamese Cross of Gallantry with Gold Star.

RAYMOND L. EVERNGAM joined the staff of USASASA in November 1968 as chief, Administrative Office. He had served at Aberdeen Proving Ground since 1952, when he was employed as administrative assistant to the chief of the Computing Laboratory, U.S. Army Ballistic Research Laboratories (BRL).

Promoted to chief, Administrative Division in 1953, he became chief of the BRL Program and Plans Division in 1958 and served until he assumed his current duties.

Raymond L. Everngam

International Conference Slates Honor for HDL Fluidics Success

Development of the concept of fluid amplification controls with few or no moving parts, now finding applications of incalculable significance in many nations, was announced nine years ago by the U.S. Army.

Next March, at an International Fluidics Conference in Warwick, England, the Army Materiel Command's Harry Diamond Laboratories will be honored for the epochal achievement. It has been acclaimed widely as being of importance comparable to development of transistors.

HDL Technical Director Billy M. Horton is credited with the basic individual patent for fluidic control. In 1966, along with Raymond W. Warren and Dr. Romald E. Bowles, he was presented with the exceptionally prestigious John Scott Award. Recipients have included such immortals as Edison, Mme Curie and Marconi.

Fluidic devices use the flow of gases or liquids for sensing, logic and control. They are finding rapidly increasing military and civilian applications where simplicity and reliability are prime factors.

HDL investigators have applied fluidics successfully to the Army Artifical Heart Pump, the Army Emergency Respirator, the Army External Cardiac Compressor, and the Army Volume-Cycled Respirator. Other military applications of major importance include missile guidance systems and controls of jet engines.

Product Engineering, in a Feb. 13, 1967 "special report," stated that the great increase of industrial interest is explained by the fact that: "Neither heat, nor steam, nor oil, nor dust can spoil fluidic operation. A well-chosen fluidic device can tolerate almost any environmental abuse. You can make amplifiers out of almost any material, can stack them like pancakes to eliminate interconnecting tubing, and can mount them anywhere. . . ."

To apprise the scientific community of its continuing developmental work in this important field, HDL has held hundreds of "Fluidics Symposiums" for industry, educational institutions and scientific organizations during the past 10 years.

Approximately 50 scientists have been employed through the years on fluidics R&D. HDL officials say total cost of the program over a 10-year period has been about $16 million—$12 million in-house and $4 million with industry.

Industry is spending millions of dollars in fluidic applications such as:

- One U.S. automobile manufacturer uses fluidic power steering on its 1970 car as an option.
- Frontier Fluidics uses fluidic controls to regulate filling of large containers with powder.
- Ramco, Inc., engineers have been using fluidic sensing and controls to develop a device which measures the frosting on coils of a refrigeration system and defrosts it when required.
- In Scandinavia (Excenter Press, Kalmar), a fluidic control system is being used on a punch press to determine when the work piece is correctly located on the punch table.
- The Jarrett Compressor and Equipment Co. has built a sensing system for the Arrow Converting Equipment Co. Used with photographic film, it senses the surface position of a movable rewind roll in relation to a fixed idler roll, eliminating physical contact with the film.
- Link Engineering (Japan) has built a fluid system which controls a coil winder for an industrial concern.
- Grinding machines are being controlled in Italy by fluidic air gauging.
- General Foods uses fluidic envelope inspection devices which automatically reject empty or partly filled packages on their production lines at the Kool Aid Plant in Chicago.

Army Nuclear Physics Expert Retires After 23 Years Service

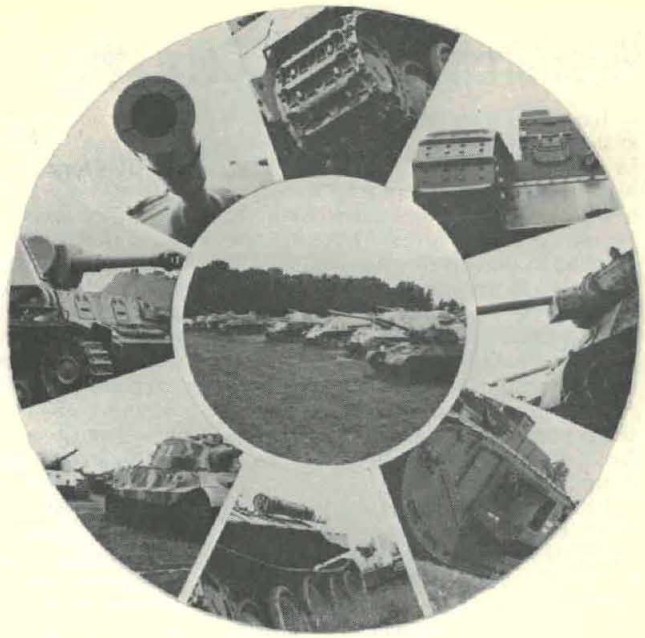
One of the U.S. Army's leading experts in nuclear physics, blast phenomena, terminal ballistics and propagation of high-pressure waves in soil and rock, Dr. Curtis W. Lampson retired recently after 23 years service as an Army career scientist.

Dr. Lampson retired as technical director of the Aberdeen (Md.) Research and Development Center. Most of his Federal Civil Service tenure was devoted to work at this installation and its predecessor organizations.

In addition to his reputation as a distinguished research scientist and a consultant in wide demand in his varied field of expertise, Dr. Lampson was widely known for his technical publications.

Dr. Lampson was graduated from South Dakota State College in 1929 with a BS degree and earned MS and PhD degrees from Princeton U.

U.S. Army Ordnance Center Museum Displays 'History of Tanks' at APG



One of the best places in the world to go to get "tanked," that is, oriented on the history of tanks, is the U.S. Army Ordnance Center and School Museum, Aberdeen (Md.) Proving Ground.

Rows of long-inactivated tanks are on display for visitors, who come by the thousands, including children who find the exhibit more fun than a circus as they scramble around to view the various types.

One of the oddities in the collection is a German "grasshopper" tank. Built toward the end of World War II, it was constructed with a detachable turret that could be deposited at any desired location to serve as a self-contained "pillbox" viewpoint.

The "monster" is a 75-ton King Tiger tank, also produced by the Germans. Although too heavy and cumbersome for rapid deployment, it featured an 88-millimeter gun that effectively could penetrate nine inches of armor.

Smallest of the tanks in the exhibit is a 3-ton American Ford built during World War I. One of the two of its type still in existence, and the only one with its original power system, it never was in action, except that it still is used in occasional military demonstrations.

German Panther tanks were among the most deadly used in World War II and the Aberdeen display includes a 50-ton Model G. Introduced in 1943, it was equipped with a 75mm gun and armor four inches thick at key points.

One of the early tanks that incorporated a number of deficiencies with respect to speed and mobility (70 horsepower motor), but which featured a hooked nose that functioned as a wire-cutter for barbed-wire barriers, is a 1916 model of the French Schneider tank. It served effectively, however, in tank development.

Three years later, the progress in tank design was evidenced in the American-British-produced Mark VIII. Weighing 36 tons, it was powered by an American-built V-8 engine, had a top speed of 5½ miles an hour, and was equipped with two British 6-pounder naval guns and five American designed machine guns.

Another rarity is a German observation car that was used in World War II. Built on the lines of a small tank, this armored vehicle achieved cross-country mobility by running on either wheels or tracks. The tracks could be lowered easily when the going became rough.

The U.S. Army Ordnance Center and School Museum displays many other historic, rare and unusual tanks, including models from Russia, France, Italy, Japan and other nations in addition to the German, French, British and U.S. types.

Now that you know where to get "tanked" without becoming inebriated, Aberdeen welcomes your visit.

Brough Heads Quality Assurance Office at MERDC

Quality Assurance Office functions at the U.S. Army Mobility Equipment Research and Development Center (MERDC), For Belvoir, Va., are now directed by Walter L. Brough, appointed recently to succeed the late Bonnie Williams.

Brough was chief, Project Control, Plans and Operations Office, prior to his promotion. The QAO exercises staff supervision over the centers' QA activities and coordinates the program with the Mobility Equipment Command, other Army Materiel Command subcommands, Defense Supply Agency, and other Department of Defense agencies. The objective is to assure a total QA program for material from concept to use.

Walter L. Brough

Registered as a professional engineer in Ohio and Alabama, Brough held top level engineering and management positions in industry before entering Civil Service, including chief engineer of a 6-plant division of a major steel company and executive vice president of a leading manufacturer of internal combustion engines.

In February 1967 he became principal engineer in the MERDC Electrical Materiel Branch, Production Engineering Division, until transferring to Plans and Operations.

A native of Warren, Pa., he was graduated from Fenn College of Engineering, Cleveland University, in 1937 with a BS degree in mechanical engineering. He is a graduate of the Advanced Management Program, Harvard Graduate School of Business Administration.

Odeen Gets 2 DoD Roles In Combining of Offices

Responsibilities of two Department of Defense deputy assistant secretaryships were assumed recently by Philip A. Odeen, who has been a Civil Service employe since 1960.

The title of Deputy Assistant Secretary (Regional Programs) vests in Mr. Odeen duties formerly assigned to the DAS (Regional Forces Programs) and DAS (Southeast Asia Programs), following their abolishment.

The 34-year-old executive is a native of Vermillion, S. Dak., and he was graduated in 1957 from South Dakota University with a BA degree in government (Phi Beta Kappa and graduate cum laude). Awarded a Fulbright Scholarship, he attended the University of Liverpool in 1957–58 to study British local government and urban planning.

Upon his return to the United States, he enrolled at the University of Wisconsin and in 1959 was graduated with an MS degree in political science. An 18-month tour of duty in the Army, during which he completed the basic Infantry officer's course at Fort Benning, Ga., and became a 1st Infantry Division platoon leader, preceding entry into Civil Service.

Research Analysis Corp. Work Program Lists 37 Army Projects

Large-scale operations research and systems analysis capabilities acquired by the Research Analysis Corp., McLean, Va., a U.S. Army nonprofit contract agency for more than 21 years, are reflected by 37 Army projects in its new work program.

RAC, however, is steadily expanding its operations with agencies other than its traditional major sponsor, the Office of the Chief of Research and Development, HQ DA. RAC is broadening its efforts through the Army Materiel Command, Combat Developments Command, and overseas commands.

In line with the federal administration's recent change of policy, urging Federal Contract Research Centers (FCRCs) to make their highly specialized expertise available under contract to other government and outside agencies, RAC also is increasing its efforts in this area.

Much attention is directed in this year's program to the search for methods of providing better "visibility" for logistic managers and decision-makers through use of automatic data processing procedures. This effort includes methods for measuring effectiveness of logistic operations in the continental U.S. and overseas.

Using experience gained over many years in collection of logistics data and in development of analytical techniques, such as computerized models, RAC is examining competing concepts of future logistics systems.

Several ongoing studies are designed to assist the Army in reducing costs, speeding delivery of end items to the consumer, and improving logistics readiness for support of contingency operations. RAC is developing a special logistics data bank, focused on a centralized system of maintenance of stockage lists overseas, for Army-wide use.

Another major area of study is the projected impact of introducing much larger transport aircraft, particularly with respect to the capabilities of Army depots and other facilities to handle the logistics involved.

The Army has generated requirements for RAC studies on ways to standardize systems and methods for validating logistics information to the point where it is generated in 20 to 40 subsystems supporting the over-all logistics program. This effort includes methods of calculating future wartime replacement requirements for missiles and equipment.

FOREWON, a study for an automated force planning system to determine future U.S. Army requirements for general purposes forces, and predicting capabilities of those forces, was completed by RAC in August 1969.

The FOREWON effort was a 2-year program sponsored by the Office of the Assistant Vice Chief of Staff, HQ DA. RAC is now transferring the system (skills and computer programs) to the Army. This involves training and assisting Army personnel in using the system.

The Deputy Chief of Staff for Military Operations (DCSOPS) has been designated as the operating manager of FOREWON. The first application in the Army planning system cycle is expected early in 1970.

Concurrent with this major effort to bring the FOREWON system to operational status within the Army staff, the system is being refined and improved in efficiency and scope according to a priority schedule recommended by a Project Advisory Group.

FOREWON is concerned with general purpose land forces, determination of theater force requirements, and efficient roundout of those forces as critical objectives. Separate ongoing studies emphasize the influence of resource limitations on the size and character of a combat force.

Pioneering research also is under way by RAC to develop a technique for determining the influence of force structure to dominate terrain—not by the customary physical occupation but by use of advanced surveillance and target acquisition methods, together with highly mobile ground combat and fire support reaction forces.

Comparatively little attention is directed in the 1970 RAC/Army pro-

ACTIV Sets Up Division To Promote R&D Program

Addition of a Research and Development Division to the U.S. Army Concept Team in Vietnam (ACTIV), responsible for coordinating and directing all U.S. Army R&D activities in that theater, was announced in late November.

Col Harry A. Buzzett, enrolled in the Army R&D Officer Specialist Career Program for many years, is chief of the new unit. Other divisions are Ground Combat; Air Mobility; and Logistics-Electronics.

The R&D Division also is designated the implementing agency in Vietnam for the Vietnam Laboratory Assistance Program, Army (VLAPA), which was established to enhance quick-reaction of the U.S. Army Materiel Command in providing in-country scientific and engineering aid to U.S. Army Forces in Vietnam.

Under the VLAPA program, representatives of a number of Army in-house laboratories in the United States are in residence in Vietnam to provide a rapid means for scientists and engineers to levy their parent organizations for quick solutions to R&D problems encountered in Vietnam combat.

The U.S. Army Limited War Laboratory at Aberdeen (Md.) R&D Center has long assigned a liaison officer to Vietnam and he will now be a part of the new R&D Division of ACTIV. The division is charged with evaluating new or improved operational and organizational concepts, doctrine, tactics, techniques, procedures and materiel.

Col Martin Assigned as C-E Deputy Director, MACV

Col Doyne K. Martin is newly assigned as deputy director, Communications-Electronics (J-6) for the Military Assistance Command, Vietnam.

Since 1967 until reassigned to his new duties, he was at HQ STRATCOM, Fort Huachuca, Ariz. Prior to that he was deputy chief of staff for engineering at STRATCOM-Pacific, Hawaii.

Col Martin served four years as an instructor at the Army Signal School, Fort Monmouth, N.J., and is credited with installing and operating one of the first satellite tracking stations for Project Vanguard.

Commissioned as a second lieutenant in 1943, he has served in Alaska, the Aleutian Islands, New Guinea, Korea, Japan, Puerto Rico and Cuba, twice receiving the Legion of Merit.

Col Martin earned a BS degree in military studies from the University of Maryland and is a graduate of the Army Command and General Staff College. This year he was elected president of the Southern Arizona Chapter of the Armed Forces Communications Electronics Association.

Col Doyne K. Martin

gram to cost-effectiveness studies per se. Rather, priority is given to the study of actual cost factors and how the Army may best calculate costs.

RAC is collecting data in South Vietnam to develop cost factors for estimating what U.S. Army funds are spent in indirect support of Republic of Vietnam Army, Regional Forces, and Popular Forces. This includes specific items of equipment and the environment in which it is used, the level of operations, and the type of equipment usage.

"Cost-tracking" is aimed at establishing methods for relating current costs of ongoing weapons systems to past estimates, and isolating the environmental factors which influence costs and cost changes.

Under Project PRIMAR (Program to Improve Management of Army Resources), RAC is developing a computerized operational model. The objective is to enable the Army to project the status of the Reserve Components in terms of authorized and personnel available in the Reserves—this as input to an earlier RAC model of the personnel assets of the Regular Army.

RAC also in engaged in a series of technological analyses of Army weapons and equipment, and improved means of using them. Included is a "Family of Army Aircraft Study (FAAS–85)," which is concerned with cost effectiveness and possible mixes of candidate aircraft systems.

A companion study will evaluate effectiveness of the aircraft as a function of the degree of instrument flight capability.

Another RAC project is aimed at defining the utility of newly proposed fire support weapon systems. Effort also is being devoted to future development and refinement of a model which has been and continues to be used by the Army to address strategic nuclear warfare problems.

Akin to the latter project is an effort to determine "decision points" for alternative uses of theater nuclear weapons in wartime.

The long-developed capability RAC has acquired in design of automated procedures for preparing frequency and voice call-sign assignments is being extended to the FM radio nets within U.S. Army divisions.

RAC also is seeking to identify and characterize circumstances under which tactical vehicles may be pooled profitably, and methods of evaluating effective pooling procedures.

War-gaming activities of RAC are continuing on a reduced scale, currently in support of Combat Developments Command studies. The purpose of Air Mobility in Mid- and High-Intensity Environments is to examine the feasibility of airmobile operations, and to compare effectiveness with mixed armor and mechanized units.

The AM/HI games seek to provide a basis for estimating Army requirements for airmobile and airlift forces. The RAC Field Office at HQ U.S. Army Europe is also working on this problem for the European Command. Prior RAC analyses have helped USAREUR to reduce the scope and costs of Air Cavalry troop evaluation tests.

RAC's 1970 Army Work Program involves several strategic planning and policy studies designed to provide input to Army planning documents. These include the Basic Army Strategic Plan (BASE); Joint Strategic Objectives Plan (JSOP) of the Joint Chiefs of Staff; Draft Memorandum to the President (DPM); and specific actions such as comments on National Security Staff Memoranda (NSSMs), and Army Chief of Staff studies.

One of the RAC projects representative of direct assistance to HQ DA study groups is "Centralized Asset Visibility and Management Program for Vietnam (CAVAMP–V)."

Illustrative also of this effort is "Combat Loss and Expenditure Data —Vietnam (COLED–V)," in which RAC provides assistance to the Combat Developments Command by designing programs and processing data from Vietnam to produce reports required by HQ CDC, Army Materiel Command, U.S. Army Vietnam, and the Army General Staff.

USAEPG Using New Mobile Data Test Facility

Evaluating the operation of Army radio sets under super-high-speed digital data transmission loads is the function of a new facility established by the U.S. Army Electronic Proving Ground (USAEPG), Fort Huachuca, Ariz.

Known as the Mobile Digital Data Transmission Test Facility, it is designed to answer a pressing question: Can today's military radios handle the almost lightning speed of digital data transmission?

Many radios serving the Army were developed for voice or teletypewriter transmission. The Army would like to use these same radios for transmitting digital data, which flows at speeds of 600, 1,200 and 2,400 bits per second—compared with teletypewriter speeds of only 50 to 75 bits per second.

The problem is that digital data must be handled with precision to transmit the message intelligibly. To use the analogy of human speech, one must enunciate carefully to be heard clearly. Saying a tongue-twister slowly is no problem; but try to say "Peter Piper picked a peck of pickled peppers" fast. You may slur or garble a few words—and this is essentially what may happen when one of today's radio circuits is fed digital data.

The Mobile Digital Data Transmission Test Facility uses a high-speed computer. A message sent through the radio set under test is received by the computer, which then matches the received message with an exact copy of the original.

The computer, as it scans the incoming message, compares it with the original, adds up the errors and automatically computes the mean error rate. Engineers have a printed readout of the test results and can decide whether or not the radio set is capable of handling high-speed transmission.

Army communications engineers have gone more and more to digital data transmission in recent years to handle the increasing amounts of message traffic—traffic that would backlog excessively under older transmission methods.

Results of the test program hopefully will lead to development of future radio sets capable of the precision required for digital data.

USAEPG's Mobile Digital Data Transmission Test Facility, contained in two mobile shelters, can be moved to any site required.

Picatinny Arsenal Claims $2.5 Million Cost Saving

Cost reduction suggestions applied to production and inspection procedures at Picatinny Arsenal, Dover, N.J., are saving the U.S. Government an estimated $2.5 million during FY 69 and FY 70.

Changes in inspection procedures for high-explosive and practice 60mm cartridges have resulted in a $767,900 saving for FY 69 and anticipated $570,400 FY 70 saving.

This suggestion was submitted by Louis Anastasia, Quality Assurance Directorate at the arsenal, and Arthur Williams, Army Materiel Command (AMC) product managers officer for mortars. Williams was with the Picatinny Arsenal Ammunition Engineering Directorate (AED) when the cost reduction idea was conceived.

Three employes of the AED Applications Engineering Laboratory suggested the use of less expensive components in XM483 155mm artillery ammunition. Anthony Herold, Anthony Ignacki and Robert Shafran are credited with a $612,400 saving in FY 69 and estimated 1970 saving of $609,200.

AMMRC Successfully Service Tests 175mm Gun Tubes

Three civilian scientists from the U.S. Army Materials and Mechanics Research Center (AMMRC) are back on their jobs at Watertown, Mass., after more than two months of voluntary special duty testing gun tubes at the front lines in South Vietnam.

Physicist Harold P. Hatch, mechanical engineer Stephen J. Doherty, and Henry S. Wysocki, an industrial engineering technician, combined their skills to evaluate more accurately the service life of 175mm gun tubes.

Success of the tests and the large amount of valuable information obtained was attributed in large part to the design of a small field version of the Magnetic Recording Borescope.

The MRB nondestructive testing system was developed over the past 25 years at AMMRC and its antecedent, the Watertown Arsenal. Operating on the principle of electronic detection of the magnetic leakage associated with cracks in a circumferentially magnetized tube, the MRB is designed to detect and locate discontinuities such as fatigue cracks near the surface of the bore of the 175mm, M113E1.

To accomplish this, a magnetic tape recording head is rotated close to the bore surface while traversing axially. This type of detector is sensitive to changes in leakage field only; the voltage output is proportional to the rate of flux change induced in the core of the detector.

The technique is equivalent to the more familiar magnetic particle method of inspection for surface cracks. In the latter case, ferromagnetic powders are used as the "detector," and the powder is collected by the leakage field from the free magnetic poles associated with a crack.

For a significant leakage field to exist near a crack, the material must contain an appropriately oriented flux, or residual field.

The cracks of particular interest in the bore of cannon tubes are oriented in the longitudinal direction, which therefore requires a circumferential or circular flux that will be intercepted by a crack at approximately 90 degrees to produce leakage.

This requirement is satisfied by exposure of the gun tube to a strong momentary magnetic field produced by an axially positioned d.c. current-carrying conductor, which is accomplished at the gun site.

The instrumentation for inspecting the gun tubes for bore defects consists of three major units—a scanning mechanism containing the motor-driven, rotating detector head; a control console; and the recording instrumentation.

The scanning mechanism includes an outer positioning and fixturing tube, an inner tube serving the dual purpose of detector unit holder and traversing mechanism, and the detector unit mechanism. The inner tube is keyed for rotational stability and gear-racked for traversing a distance of 72 inches. This includes the entire chamber, the forcing cone, the origin of rifling, and about 10 inches into the rifled portion of the tube.

The control console contains the signal processing and marking amplifiers and a control panel for operating the scanning mechanism. Instrumentation for the MRB includes a strip chart recorder, a 2-channel magnetic tape recorder, and an oscilloscope.

Field testing of the gun tubes in South Vietnam was directed to increasing the safe service life of the 175mm gun tube by a factor of approximately three. The AMMRC team was given support by the 1st Logistical Command, with every precaution taken to minimize the dangers involved.

Tests were performed in the Central Highlands, where the climate is very similar to that in New England except that it rained at least once every day.

ON LOCATION in Central Highlands of South Vietnam, Henry Wysocki (center) and Stephen Doherty (right), AMMRC, operate Magnetic Recording Borescope in field tests to evaluate more accurately the service life of 175mm gun tubes.

High-Altitude Research Programed at WSMR

High-altitude scientific research above White Sands (N. Mex.) Missile Range will be increased greatly in 1970 by a program that will more than double the 1969 rate of firing of Aerobee and other sounding rockets.

The U.S. Naval Ordnance Missile Test Facility, which conducted a total of 34 rocket launchings from Jan. 1 to Nov. 4, 1969, plans to send up 80 Aerobee, Nike-Apache and Nike-Cajun rockets. Studies will include solar flares, mircometer detection, magnetic fields and other phenomena.

More than half of the launchings will be the Aerobee 150, known as the work-horse of the Aerobee family. Designed to carry scientific instrumentation packages to altitudes ranging from 70 to 190 miles, the Aerobee 150 was first used in 1947.

In addition to 46 launchings of the Aerobee 150, the NOMTF has scheduled 17 Aerobee 170 rocket firings from December 1969 to December 1970. The 170 has a more powerful motor and can carry instrumentation packages up to 250 pounds to altitudes of about 200 miles.

Four launchings of the Aerobee 350 rocket are programed. This vehicle can carry payloads weighing up to 500 pounds to altitudes of 207 miles and lighter payloads to 294 miles.

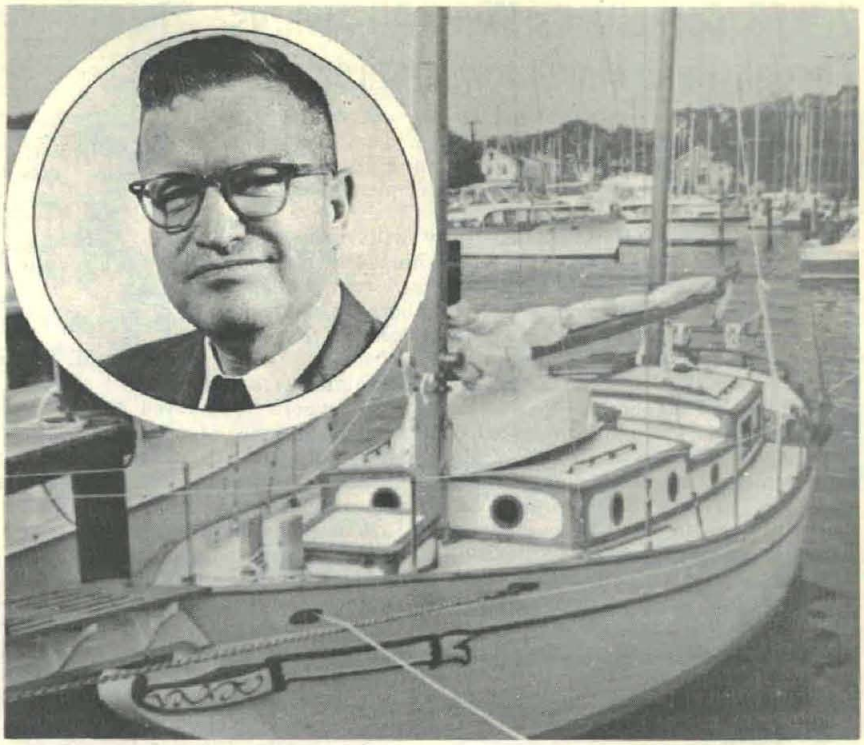
Included in the firing schedule are 11 Nike-Apache rockets and two Nike-Cajun vehicles. The Navy recently assumed responsibilities for research programs involving these rockets.

The WSMR based naval contingent launches the vehicle in conjunction with agencies such as the National Aeronautics and Space Administration, the Air Force research activities, Naval Research Laboratory in Washington, and Kitt Peak Observatory in Arizona.

U.S. universities, other U.S. Government agencies and friendly foreign nations provide research criteria for the projects.

Dream Realized

Explorer With Byrd Sails To Bahamas Retirement



Shirley Temple setting off on "The Good Ship Lollipop" could not have evoked more pure joy than was evident in "Captain and First Mate" Donald C. Hilton when he and his wife Grace embarked on *The Quest*, a 40-foot "dream boat," for retirement in the Bahamas.

Hilton is well-known to the Army scientific community as one of the hardy breed of adventurers who joined Admiral Byrd on his 1939–41 Antarctic Expedition, spent 12 years with the U.S. Navy Bureau of Yards and Docks, and in 1961 joined the Environmental Sciences Division, Army Research Office.

Retirement to a South Seas Island is a dream that has been shared by millions during a life of toil and struggle. But few men have worked harder at making the dream come true than Don, a self-professed "lifelong sailor at heart."

The special retirement incentives in November prompted final action.

In the early 1930s he spent four years as a sailing master/navigator with a professional crew. Then he established a private engineering practice and construction business in Florida from 1935 until he joined the Byrd Antarctic Expedition. But he kept right on sailing from 1935 to 1939.

During the bleak winters in the Antarctic he became a close friend of the late world-renowned cold regions explorer Dr. Paul A. Siple, whose career as an Army scientist began following return from the expedition. They worked together in the Army Research Office until Dr. Siple died in late November 1968.

Hilton resumed the engineering and construction business (1941–43) in the Middle East, where he was engaged in building facilities to get lend-lease aid to the Soviet Union.

Subsequently, he spent three years with the Seabees. In 1946 he returned to private engineering and construction until he entered the Arctic R&D Program of the Bureau of Yards and Docks. Part of his work was on the nuclear power program in the cold regions.

Grace Hilton shares her husband's love of the sea and is likewise "an old sailor," able to take over navigation and helmsman duties as necessary.

The Quest, on which they traveled from Annapolis, Md., by way of the inland waterway to the home of Mrs. Hilton's brother (8500 S.W. 107th St., Miami, Fla. 33156), will take off for Hopetown, Abaco, in the Bahamas, about the middle of January.

Don became fascinated with the climate and the beauty of the Hopetown area in the early 1930s, which is when the dream of retiring there originated. Two years ago he made another trip to see if it was still "substantially as I remembered it," and found that the charm of the place, at least for him, had changed but little.

Built in Formosa, *The Quest* is a 40-foot ketch with a fiber glass hull, a 12-foot beam, 6-foot draft and a luxurious all teakwood interior. Finished according to Don's specifications, the interior is as beautifully compact with all the conveniences of home as a sailor might expect.

The 40-horsepower diesel engine is good for 7 to 8 miles an hour, but Don expects that "sail power" will be used most of the time.

What about the future? Don says much of it will be spent aboard *The Quest*, relaxing, fishing or just adventuring through the Bahamas. He also will do as much, or as little, as he desires of private engineering and construction, for which his skills should be in plentiful demand.

Now that they have their "dream boat," Don and Grace will make their next major project the building of their "dream home." It will be a "Rondette," a 12-side house of prefabricated design, with 750 feet of floor space mounted on stilts. What's more, they intend to build it with their own hands—"well, quite substantially, that is!"

Army Chief of R&D Lt Gen Austin W. Betts presented the Exceptional Civilian Service Medal to Hilton upon his retirement after more than 26 years of civilian service.

The citation acclaimed him for contributing immeasurably toward advancing the capability of the U.S. Army to operate in the cold regions and to the successful accomplishment of the missions, goals and objectives of the Department of the Army."

Scientific Calendar

5th General Meeting of the Society for General Microbiology, Norwich, England, Jan. 6-7.

Solid State Physics Conference, sponsored by Institute of Physics and Physical Society, Manchester, England, Jan. 6-8.

4th DoD Conference on Laser Technology, sponsored by OCRD, ARPA, USAF and ONR, San Diego, Calif., Jan. 6-8.

22d Annual Meeting and Convention Industry Showcase, sponsored by Helicopter Association of America, Las Vegas, Nev., Jan. 11-14.

9th International Symposium on Radioactive Isotopes in Clinic and Research, Bad Gastein, Austria, Jan. 12-15.

International Conference on System Sciences, sponsored by IEEE, U. of Hawaii, and Society for Industrial and Applied Mathematics, Honolulu, Hawaii, Jan. 14-16.

Topical Meeting on Engineering with Nuclear Explosives, Las Vegas, Nev., Jan. 14-16.

8th Aerosace Sciences Meeting, sponsored by AIAA, N.Y.C., Jan. 19-21.

IEEE Winter Power Meeting, N.Y.C., Jan. 25-30.

Institute on Technological Change in Printing and Publishing: An Evaluation, sponsored by American U., Arlington, Va., Jan. 26-28.

Mechanical Properties and Mechanical Testing of Polymers, sponsored by the Plastics Institute of America, Inc., Hoboken, N.J., Jan. 26-30.

International Seminar on Data Management, Geneva, Switzerland, Jan. 27-29.

2 WES Consultants Win R&D Awards Though Past Mandatory Retirement

Dr. M. Juul Hvorslev

Dr. Garbis H. Keulegan

Mandatory retirement at age 70 did not deprive the U.S. Army Engineer Waterways Experiment Station of the services of Dr. M. Juul Hvorslev and Dr. Garbis H. Keulegan, world-renowned recent recipients of 1969 Army R&D Achievement Awards.

Come Christmas Day, Dr. Hvorslev will have special cause for celebrating. That will be his 74th birthday. Dr. Keulegan marked his 79th birthday July 12, 1969. In the opinion of many WES staff members, their service as consultants makes them about as close to being indispensable as anyone ever might expect to be.

Invited by the Chief of Engineers to continue as consultants at WES following mandatory retirement, in recognition of their "unique capabilities," Drs. Hvorslev and Keulegan are hailed as "shining examples of the thoroughness and scientific creativity necessary to achieve meaningful results in careers devoted to research and development."

Army Chief of Research and Development Lt Gen Austin W. Betts traveled to the Waterways Experiment Station, Vicksburg, Miss., to present the Army R&D Achievement Awards to the distinguished scientists.

Dr. Hvorslev was cited for his significant contribution to the literature of soil mechanics in his report on "The Basic Sinkage Equations and Bearing Capacity Theories." Dr. Keulegan was recognized for his studies of tsunamis—giant waves that often cause a great deal of damage, as in the case of the 1964 Alaskan earthquake.

Dr. Hvorslev's report, including a set of equations which "brought together for the first time all the significant factors that influence the bearing capacity of soils," is considered of tremendous importance.

Use of the report by Department of Defense agencies concerned with mobility problems in the design of military vehicles, and in predictions of their trafficability, according to WES officials, "will result in significant dollar savings and great improvement in planning military land operations."

Crescent City, Calif., sustained millions of dollars of damages from tsunamis following the Alaskan earthquake. The primary purpose of the research for which Dr. Keulegan was cited was to provide input information for a hydraulic scale model that will be used to determine feasibility of proposed barrier plans to protect Crescent City from destruction by tsunamis in the future.

Results of his comprehensive study, however, are expeced to be used in many future studies of how to protect other valuable coastline areas from the damage of tsunamis.

DR. HVORSLEV was born in Denmark, where he received a civil engineering degree from the Technical University in 1918. Three years later he came to the United States on a travel scholarship, remained, and in 1929 became a naturalized citizen.

After more than 10 years of work on design and construction of dams, hydro-power and water supply projects in California, Washington and in Colombia, South America, he visited hydraulic laboratories in Europe.

Continuing his studies and research on soil mechanics at the Technical University in Vienna, he earned a doctorate in 1936. His thesis, "Physical Properties of Remolded Cohesive Soils," published in Denmark in 1937, is considered a classic of soil mechanics literature. It was republished in English for the first time by Waterways Experiment Station.

Upon returning to the United States in 1937, Dr. Hvorslev became a research engineer in the Soil Mechanics and Foundations Division, American Society of Civil Engineers, and a Harvard Research Fellow.

In 1949 the results of his research on methods of obtaining undisturbed samples of soils were published in a report, "Subsurface Exploration and Sampling of Soils for Civil Engineering Purposes," a work that became world renowned.

Nineteen years after he joined the staff of the Waterways Experiment Station as a technical consultant to the Soils Division, he retired in December 1965, but was on the job the following day as a special assistant—an appointment that testified to the high regard in which he is held by his superiors and associates.

Recognized by the presentation of numerous awards, Dr. Hvorslev received the American Society of Civil Engineers Research Prize in 1957, and in 1965 was the winner of the Karl Terzaghi Award, considered the highest honor that can be conferred on workers in soil mechanics and foundation engineering. He is a registered engineer in Mississippi.

DR. KEULEGAN was born in Sebastia, Armenia, July 12, 1890, received a BA degree from Anatolia College in Asia Minor, and in 1912 emigrated to the United States to obtain advanced education. In 1914 he earned a second bachelor's degree in physics and mathematics and in 1915 a master's degree from Ohio State.

From a teaching fellowship at Ohio State, he went to the research department of Westinghouse Electrical and Manufacturing Co. In 1918 he entered the U.S. Army and during World War I served with the American Expeditionary Force in France.

Dr. Keulegan joined the staff of the U.S. National Bureau of Standards in 1920, did research on properties of elastic materials, and in 1928 concluded graduate work in mathematics and physics at Johns Hopkins University by earning his doctorate.

When the National Hydraulics Laboratory was established by the NBS in 1932, Dr. Keulegan became, by request, a member of the original staff. One of his numerous publications, "Laws of Turbulent Flow in Open Channels," gained recognition as a classic of literature on this subject. In 1960 the Department of Commerce honored him the Gold Medal Award.

Upon his retirement after 42 years of service with the National Bureau of Standards, he started a new career with WES as a consultant. Presently he is leading the analysis of tides, tidal currents and density current phenomena in the projected Atlantic-Pacific Seal Level Canal. He is also doing research in the mechanics of the vortex and density flow involved.

DoD Publishes 'Idea for Managers'

If you happen to be a member of that rather rare breed (says Uncle Sam) of employes whose prime purpose in life is to conceive practicable money-saving ideas—for the U.S. Government, that is—a new "gold mine" is available for exploitation.

"Ideas for Managers" is a new Department of Defense publication that lists more than 1,000 money-saving methods adopted by the DoD in its Cost Reduction Program. The ideas represent problem-solving or imaginative thinking of military and civilian personnel.

The booklet is being distributed to all logistical activities within the Department of Defense. Copies may be purchased for $1 from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

CRESS Separates From American University, Affiliates With AIR

CRESS (Center for Research in Social Systems), major U.S. Army contract agency for social science studies, announced Dec. 5 its separation from the American University and its affiliation with the nonprofit American Institutes for Research.

The realignment made CRESS the second of the Army's principal contract agencies providing expertise for special studies to terminate its link with a major university in recent months. HumRRO (Human Resources Research Office) ended 18 years as an element of George Washington University, Washington, D.C., as announced in October *Army Research and Development Newsmagazine.*

CRESS, like HumRRO, which maintained its organizational structure essentially intact as a new nonprofit corporation, will preserve the same top management team and basically the same group of highly specialized professional personnel.

HumRRO, which remains the U.S. Army's major source of research in its specialty field, explained its change in status as a move to achieve more flexibility for broadening its sphere of operations by accepting work from other agencies. CRESS, likewise, will continue as the U.S. Army's main source for social science studies, but will engage in other ventures.

Dr. Preston S. Abbott is continuing as the CRESS director, a position he assumed early in 1967. CRESS will retain the name it assumed July 1, 1966, when it became successor to the Special Operations Research Office (SORO), which also functioned for a decade as part of the American U.

When CRESS was created, the announced purpose was to increase capabilities for Army missions in special warfare studies, military assistance, and rapid response to Southeast Asia and other counterinsurgency information requirements of the Army.

CRESS has continued to operate from offices at 5010 Wisconsin Avenue, N.W., Washington, D.C. 20016, into which SORO moved late in 1962 after being located on the American University campus for six years. Plans as of mid-December were still pending for relocation of CRESS to new Washington area offices early in 1970.

American Institutes for Research, headed by Dr. S. Rains Wallace as president and chief executive officer, works in the social and behavioral sciences under a variety of contracts for the U.S. Government as well as for outside agencies. Corporate offices are in Pittsburgh, Pa., with research offices there as well as in Silver Spring, Md., Palo Alto, Calif., and Bangkok, Thailand.

CRESS does basic and applied research and prepares scientific information responses from its data bank and other readily available primary and secondary sources of information. Research is focused in areas that emphasize the psychological and social factors of attitudes and behavior of persons in most countries of the world.

General areas of effort include inter- and intra-cultural communication, orientation and adaptation of personnel to foreign cultures, measurement of effectiveness of U.S. overseas programs, military roles in socioeconomic development, and methodologies for understanding foreign cultures.

The Social Science Research Institute (SSRI) and the Cultural Information Analysis Center (CINFAC) are the major components of CRESS. Headed by associate directors, Dr. Arnold E. Dahlke and L. D. Brummitt, SSRI performs R&D leading to a basis for programs.

Recent publications include: *Challenge and Response in Internal Conflict; Community Relations Advisory Councils in the Republic of Korea; Intercultural Communications Guide, Thailand; Vietnam: The Origins of Revolution (1935–1946); and Communist Insurgent Infrastructure: A Study of Organization and Strategy.*

Under the management of James R. Price, CINFAC provides information, analyses, and syntheses on a rapid-response basis to urgent Army requirements. Recent publications include: *The Middle East: A Study of Conflict; United States Military Assistance and Latin American Relations; CRESS Research on Vietnam: A Bibliographic Essay;* and *Phases of Civil Disturbances: Characteristics and Problems.*

Dr. Abbott has announced the following objectives for CRESS:

- To engage in research aimed at developing precise methodologies, including quantitative techniques, for assessment of communication, both between and within subcultural groups.
- To apply the accumulated knowledge and expertise of its social scientists in the study of specific problems in a wide variety of geographic and sociopsychological contexts.
- To utilize its information and bibliographical retrieval systems to prepare immediate responses to problems of a social science nature for industry, government (national, state and local) and to basic research for foundations.
- To make available in-depth knowledge of documentary sources to prepare a synthesis of pertinent information stuctured to the consumer's problems in dealing with questions of a subcultural nature both domestically and internally.
- To disseminate through publications, lectures and seminars the results of its research programs.

AMC Initiates CSC's 1-Year Trial Retirement

Initiation of trail retirement from Federal Civil Service for eligible employes, with returns to positions at the same grade and pay guaranteed if desired within one year, was announced Dec. 8 by the U.S. Army Materiel Command.

AMC CG General F. J. Chesarek approved the program to assist eligible employes in eliminating some of the uncertainties they may have regarding desirability of retirement. The plan was inaugurated earlier this year by the U.S. Civil Service Commission.

AMC officials estimate the command has more than 30,000 employes who are 55 years of age and over, and that about 14,000 will become eligible for retirement in 1970. Eligibles include those age 62 and older with 5 years service; 60 and older with 20 years; and 55 and over with 30 years.

Only about 50 percent of the eligibles actually apply for retirement each year. Under provisions of the trial retirement program, employees who become eligible for optional retirement each quarter will receive individual letters explaining the program. They and their spouses will be invited to attend a preretirement briefing for a full explanation.

An employe desiring to participate will submit a signed written request to his immediate supervisor. This will be reviewed by the Civilian Personnel Office to verify eligibility.

When the request is approved, a "Trial Retirement Agreement" is signed by the employe and his commander, providing for reemployment upon completion of one year of separation. An exception to the same grade and pay guarantee applies to PL–313 and supergrade employes, who will be guaranteed reemployment at the GS–15 level.

Retirees desiring reemployment after a one-year trial separation must apply to their proper Civilian Personnel Office for reinstatement not later than the beginning of the 11th month of trial retirement.

Kudos

EXCEPTIONAL SERVICE. The Exceptional Civilian Service Medal, the highest civilian employe award possible by the Secretary of the Army, was presented recently to John D. Gast, director, Telecommunications Center Automation Directorate, U.S. Army Strategic Communications Command, Fort Huachuca, Ariz.

Gast was commended for his work on the project known as SOMISS (Study of Management Information Systems) and the follow-on plan for establishing the Computer Systems Command. This work was performed while he was chief, Information Sciences Group, Management Information Systems Directorate, Office of the Assistant Vice Chief of Staff, HQ DA, Washington, D.C.

MERITORIOUS SERVICE. *Francis B. Patrick*, optical physicist, received the Meritorious Civilian Service Award (MCSA) for notable performance during 30 years of service at Frankford Arsenal, Philadelphia, Pa.

His most important achievements relate to design and development of optical fire control materiel for the U.S. Army. Credited with assisting in developing the T41 rangefinder, he is recognized mostly for his work on the T155 sight, the T35 periscope, an optical system for the T46 rangefinder, an erecting prism assembly, the universal articulated telescope, and the articulated (single-joint) telescope.

Patrick also has received a letter of commendation from the U.S. Military Academy for his enthusiasm and originality in creating a chapter on "Military Optical Instruments," for inclusion in Vol V, *Applied Optics and Optical Instruments*, to be published by Eastman Kodak Co.; and selection by the Department of Defense to serve as the leading U.S. representative at meetings of the NATO Group of Experts on Optical Instruments.

John W. White, chief of the Propulsion Division, U.S. Army Aviation Materiel Laboratories (AVLABS), Fort Eustis, Va., received the MCSA for his part in increasing the Army's capability to initiate and manage aircraft propulsion technology research programs from 1962 to May 1969.

"His exceptional leadership, profound technical competence and professional knowledge contributed immeasurably to the successful accomplishments of each major phase of the highly complex Demonstrator Engine Program," the citation states.

White has been with AVLABS for more than 10 years, is a member of the American Helicopter Society, and is a 1951 graduate of North Carolina State College with a BS degree in mechanical engineering.

LEGION OF MERIT. CWO John D. Thompson was awarded the LOM for his outstanding contributions to development of flight standardization procedures for the AH–1G helicopter while with the New Equipment Training (NET) team in Vietnam.

Currently serving as a support pilot at the Army Aviation Systems Test Activity (ASTA), Edwards Air Force Base, Calif., CWO Thompson's performance was a key factor. the citation states, in the successful introduction and deployment of the Huey Cobra helicopter in Vietnam. He was instrumental in developing many of the tactical employment techniques utilizing the vast potential of the attack helicopter.

BRONZE STAR MEDAL. Three staff officers assigned to the Office of the Chief of Research and Development (OCRD) received the Bronze Star Medal (BSM) for hercism in recent tours of duty in Vietnam.

Recipients are *Lt Col Robert W. Noce*, Combat Materiel Division; *Lt Col Robert J. Cottey*, Southeast Asia Division; and *Lt Col Robert A. Flory*, Air Defense and Missiles Division.

Lt Col Selvyn H. French, head of the Installation and Services Directorate, Fort Detrick, Md., received the BSM for meritorious service in a previous tour as logistical support activity commander in the Mekong Delta, Vietnam.

MERITORIOUS SERVICE. *Lt Col Louis G. Klinker* was awarded the Meritorious Service Medal for performance of duty with the U.S. Army Research Office, OCRD, from July 27, 1965 until Oct. 31, 1969.

As a staff officer with the Physical and Engineering Sciences Division, he was cited for outstanding contributions to research and exploratory development programs in metals, composite materials, nondestructive testing, and hardening of materials for antiballistic application.

Specifically, he maintained a comprehensive, accurate and up-to-date knowledge of the various developmental programs. His work insured that supporting materials exploratory development programs were maintained in balance to satisfy hardware application requirements and to promote exploitation of scientific and technological achievements.

Chief of R&D Lt Gen A. W. Betts presented the award to Col Klinker during retirement ceremonies.

AIR MEDAL. *Capt Charles S. Nichols* of the U.S. Army Mobility Equipment R&D Center, Fort Belvoir,

Bjerhammar Receives Carl-Friedrich-Gauss Medal

Dr. Arne Bjerhammar

Award of the prestigious Carl-Friedrich-Gauss Medal to Prof. Arne Bjerhammar, director, Institute of Geodesy, Royal Institute of Technology in Sockholm, Sweden, has been announced by the U.S. Army Research and Development Group (Europe).

The Braunschweigsche Wissenschaftliche Gesellschaft bestowed the medal on Prof. Bjerhammar, who was the first director of the U.S. Army Research Institute for Geodetic Sciences of the Army Engineer Topographic Laboratories, Fort Belvoir, Va. Since returning to his native Sweden, he has been doing geodetic research for the U.S. Army.

Presentation of the Carl-Friedrich-Gauss Medal recognizes Prof. Bjerhammar for "outstanding services to international geodetic research during the last decade." Among his numerous other honors is a U.S. Army Certificate of Achievement awarded Sept. 20, 1967, when he departed from the U.S. Army Research Institute for Geodetic Sciences.

Prof. Bjerhammar has patented and is producing three "geodimeters," electro-optical instruments that permit extremely accurate short-, medium- and long-range measurement in geodetic research. Currently he is engaged in studies of the gravitational field of the moon.

Col Robert B. Bennett, chief, U.S. Army R&D Group (Europe), and Dr. Hoyt Lemons, chief of the group's Environmental Sciences Branch, reported on Prof. Bjerhammar's latest achievements in detailing their survey of U.S. Army contract research in Sweden, Denmark and Norway.

Va., received the AM for participating in more than 25 aerial missions from Nov. 18, 1968 to Apr. 3, 1969.

Now serving as an R&D coordinator in the Marine and Bridge Division, Capt Nichols was cited for "the highest order of air discipline . . . in spite of the hazards inherent in repeated aerial flights over hostile territory."

JOINT SERVICE. *S/Sgt Kenneth F. Whitcomb*, a member of the nuclear power training class at the U.S. Army Engineer Reactors Group (USAERG), Fort Belvoir, Va., received the Joint Service Commendation Medal for service from Jan. 3, 1965 to Aug. 14, 1969, as communications noncommissioned officer of Field Unit "B," Communications Support Element, U.S. Strike Command.

COMMENDATIONS. Certificates for the Outstanding Performance Rating in OCRD recently were awarded to:

Plans and Programs, *Management and Evaluation Division.* Mrs. Priscilla S. Banks, Mrs. Elinor J. Rousseau (with Sustained Superior Performance Award), Mrs. Frances R. Hartman, Mrs. Frances L. Jones (with Quality Step Increase). *Plans Division,* Mrs. Mary E. Jackson (with Sustained Superior Performance Award), Mrs. Sherrie L. Collison (with Quality Step Increase).

Programs and Budget Division, Miss Edith L. Burkle; Developments, *Office of the Director.* Mrs. Ellen J. Curry; *Air Mobility Division,* Mrs. Marylee M. Norton; *Combat Materiel Division,* Mrs. Anna R. Strobeck (with Quality Increase), Mrs. Joanna L. Smith (with Quality Increase); *Communications-Electronics Division,* Mrs. Betty F. Kleindienst.

Missile Defense, Ranges and Space Division. Mrs. Edna T. Jernigan (with Sustained Superior Performance Award), Mrs. Mary C. Williams (with Sustained Superior Performance Award), Mrs. Helen E. George (with Sustained Superior Performance Award).

Army Research Office, *Office of the Director,* Miss Mary K. Williams; *Adjutant's Office,* Miss Jo Ann Cole; *Physical and Engineering Sciences Division,* Richard L. Ballard, Mrs. Phyllis Mr. Brown, Dr. Ivan R. Hershner Jr. and Dr. Thomas E. Sullivan.

Behavioral Sciences Division. Jacob L. Barber Jr.; *Studies and Analyses Division,* Miss Martha V. Carter, Mrs. Glorine D. Johnson and Miss Ruth L. Reedy; *Research Programs Office,* Mrs. Lura H. Ferrone; *Research Plans Office.* Mrs. Sally C. Kennedy, James W. Sterling and Mrs. Ruthe I. Vaughn; *Life Sciences Division,* Mrs. Jeanette H. Merritt; *Environmental Sciences Division,* Mrs. Anna R. Owen, Mrs. Frances L. Whedon and Dr. Valentine E. Zadnik; *Information Systems Office,* Morton H. Marks.

CONARC Reports Behavorial Research Program Benefits

"Utilization of Behavioral and Social Science Research Products (Fiscal Year 1968)" is the title of a recently published CON Pamphlet 70–1, issued by HQ U.S. Continental Army Command, Fort Monroe, Va.

Applications of new or expanded knowledge resulting from behavioral and social science research are listed in six categories: Individual Training and Performance; Training for Leadership, Command and Control; Language and Area Training; Training Technology; Unit Training and Performance; and Special Operations Training.

Three agencies are responsible for major portions of the over-all program sponsored by the Army Chief of Research and Development to provide for improved performance, motivation and leadership of military personnel. They are the U.S. Army Behavioral Science Research Laboratory (BESRL); the Human Resources Research Organization (HumRRO); and the Center for Research in Social Systems (CRESS).

BESRL functions as an Army in-house research activity and is concerned principally with personnel management research and human performance measurements, and advanced training techniques and devices to achieve effective use of personnel.

HumRRO is a contract agency that recently terminated 18 years of operation as an element of George Washington University. CRESS also functioned for 13 years as an organizational element of the American University in Washington, D.C., and recently became a part of the American Institute for Research.

CON Pam 70–1 reports on 1968 programs and progress of each agency, including bibliographies of reports and related publications.

Frankford Arsenal Presents 'Woman of Year' Award

Frankford Arsenal's first Woman of the Year Award was presented recently to Mrs. Esther M. Gresham, a mathematics technician who resides in the Philadelphia, Pa., Germantown area.

Cited for achievements "representative of what the Federal Women's Program is trying to achieve," Mrs. Gresham has been recognized over the years for continuing achievements and "exceptional contributions" to the mission of the arsenal.

Since 1951, when she entered the Civil Service career system, she has progressed from a Grade 3 computer operator to the GS–11 level, essentially by improving her capabilities by night-school courses in mathematics and data processing courses at U.S. Government installations and the Universities of Rochester, Michigan and California at Los Angeles.

Working in an organization of professional physicists, she has become, according to her superiors, the "indispensible link between optical physicists and high-speed electronic computers" in design of military optical and electro-optical fire control instruments.

In addition to operating small in-house computers for design of optical components, she is credited with "highly significant contributions to several important military projects, including development of the M18 infrared binocular, the day-night far infrared periscope, and camera optics for the Cheyenne helicopter."

Awarded a Sustained Superior Performance rating in 1967, she was nominated for the arsenal's Woman of the Year distinction by her supervisor, Marvin Elnick, for a "sustained record of exceptional leadership qualities, technical achievements and career self-development without detracting from her role as wife, mother and participant in community activities."

Judge Juanita Kidd Stout, guest speaker at the presentation dinner, lauded Mrs. Gresham along with other women who have contributed importantly to betterment of American society.

Esther M. Gresham

Trailers Trail Her Everywhere!

Going to work for Nancy Rewis is like going home, but not exactly!

Mrs. Rewis is an employe of the U.S. Army Combat Developments Command (CDC), Fort Belvoir, Va. She claims to have lived most of her married life in a house-trailer. In addition, her late father managed a trailer agency.

Nancy and her husband, Jim, recently decided to make the break from trailers, and bought a real house in nearby Alexandria, Va.

So guess what! When Nancy came back to work at CDC after settling into her new home, her section had moved into an office trailer.

Judges Select 121 Papers for 1970 ASC

(*Continued from page 1*)

States, United Kingdom, Canada and Australia, representatives of defense R&D establishments from the other member nations also participate.

Forty-one of the papers selected for presentation in 1970 have only one author, but the increasing trend toward team effort is reflected by a total of 195 authors, with one paper coauthored by 8 persons. The supplemental papers have a total of 48 authors, with nine being the work of individual investigators.

Seventy-three of the papers chosen for presentation are representative of researchers in U.S. Army Materiel Command laboratories. The Office of The Surgeon General and the Office of the Chief of Engineers have 10 papers each. Seven are authored by personnel in other agencies. For the first time, two papers will report on research conducted at the United States Military Academy.

Each of the proponent agencies selected the papers to be presented by evaluating the narrative summaries. A select panel of judges, representative of leaders in the major scientific disciplines, will select the papers to be recognized by special awards at the conference.

Titles of the papers to be presented, the supplemental papers, authors and the agencies they represent are as follows:

OFFICE, SURGEON GENERAL —*Investigation of a New Disease of Military Dogs,* by Robert M. Nims, David L. Huxsoll, Paul K. Hildebrandt and Jerry S. Walker, Walter Reed Army Institute of Research (WRAIR), Washington, D.C.; *A Research Concept for the Interpretation of Human Missile Wounds by the Pathologist,* by Col Pierre A. Finck, Armed Forces Institute of Pathology, Washington, D.C.; and

Tactical Implications of the Physiological Stress Imposed by Chemical Biological (CB) Protective Clothing Systems, by Dr. Ralph F. Goldman, U.S. Army Research Institute of Environmental Medicine (USARIEM), Natick, Mass.; *The Effect of Diet on Jejunal Enzymes in Man,* by Col Robert H. Herman, Dr. Norton S. Rosensweig, Capt Fred B. Stifel and Dr. Yaye F. Herman, Fitzsimons General Hospital, Denver, Colo.; and

Observations on Early Detection and Therapy of the Defibrination Syndrome in Meningococcemia, by Maj C. L. Lutcher, Maj L. A. Lindesmith, Maj F. S. Pettyjohn, Capt W. T. Steudel, Capt T. B. Dunkel, Lt Col J. A. Ionno and Lt Col E. B. Cooper, Madigan General Hospital, Tacoma, Wash;. *Biological Effects of Staphylococcal Enterotoxin B,* by Col Dan Crozier and Lt Col Harry G. Dangerfield, U.S. Medical Research Institute of Infectious Diseases, Fort Detrick, Md.;

A Study of the Military Blood Program in War and Peace, by Col Richard B. Krakaur, Military Blood Program Agency, Washington, D.C.; *Obstacles in Oxygen Transport Observed During Aeromedical Evacuation,* by Brig Gen George Hayes, Lt Col Teruo Matsumoto and Maj John N. Henry, WRAIR; and

Comparative Analysis of Mandibular and Mid-Face Fractures in Missile and Blount Trauma: 4,012 cases, by L. E. Tinder and G. E. Lilly, Letterman Army Institute of Research, San Francisco, Calif.; *Retinal Damage by Q-Switched Ruby Laser,* by Maj George H. Bresnick, Maj Edwin S. Beatrice, Maj Maurice B. Landers and Capt James O. Powell, Frankford Arsenal, Philadelphia, Pa.

CORPS OF ENGINEERS—*Far Field Characteristics of Ground Shock Induced by Explosions,* by J. Drake and A. Sakurai, U.S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Miss.; *Hydraulic Characteristics of Inter-Oceanic Canals With Intermediate Basins,* by Dr. J. Harrison and Dr. G. H. Keulegan, WES; and

Response of Selected Materials to High-Speed Fragment Impact, by Jerry W. Brown, WES; *Creation of Massive Offshore Surf Zones by Underwater Explosions,* by R. W. Whalen and John N. Strange, WES; *Some Mechanical Properties of Rocks in Cold Environments,* by Malcolm Mellor, U.S. Army Cold Regions Research and Engineering Laboratory (CRREL), Hanover, N.H.; and

A Deterministic View of Spectrum and Cross-Spectrum Analysis, by Dr. D. Lee Harris, U.S. Army Coastal Engineering Research Center, Washington, D.C.; *Applications of Sensing Arrays to Photogrammetry and Metrology,* by Dr. Desmond C. O'Connor and Pi-Fusy Chen, U.S. Army Engineer Topographic Laboratories (ETL), Fort Belvior, Va.; and

Advanced Computational Algorithms for Large Scale, Three Dimensional, Artillery Survey Applications, by Lawrence A. Gambino, ETL; *Determination of Latitude and Longitude of Unknown Stations From Photographs of a Satellite Against Stellar Background Independent of Any Distance,* by Dr. Agnel A. Baldini, ETL; *A Concept of Row Crater Enhancement* by Bruce B. Redpath, U.S. Army Engineer Nuclear Cratering Group, Livermore, Calif.

OTHER R&D AGENCIES—*An Investigation of the Dynamic Pressure Response of Flueric Transmission Lines,* by Dr. Larry C. Atha, U.S. Army Advanced Ballistic Missile Defense Agency (ABMDA), Huntsville, Ala.; *Tactics in the Development of Mine Detector Dogs,* by John J. Romba, U.S. Army Limited War Laboratory, Aberdeen Proving Ground, Md.; and

Phase Behavior in Fluid Mixtures at High Pressure I: (Experimental), by Lt Col William B. Streett and Maj James L. E. Hill, U.S. Military Academy (USMA), West Point, N.Y.; *ABM Discrimination Technology,* by Lyle McDysan and Elmer Mitchell, ABMDA; *Reentry Measurements Program,* by Donald S. Russ and Milton C. Hawie, ABMDA; and

The Application of a Solid State Helium-Neon Gas Laser to Missile Guidance, by W. H. Gibson, ABMDA; *The Effect of Undifferentiated Mass Punishment on the Cohesiveness of the Group and the Attractiveness of the Rebel,* by Maj William B. Selley, USMA.

ARMY MATERIEL COMMAND —*"Tetra-Core": A Three-Dimensional Space Structure,* by I. E. Figge Sr., U.S. Army Aviation Materiel Laboratories, Fort Eustis, Va.; *Night Vision Viewers Using Thermal Techniques,* by William S. Sims and Patrick J. Daly, Night Vision Laboratory, Fort Belvoir, Va.; and

The Insignificant Twig which Cries "Alarm" when the Enemy Moves Down the Jungle Trails, by John P. Schoening, Electronics Command (ECOM), Fort Monmouth, N.J.; *Feasibility Study, R. F. Detonation of Command Detonated and Pressure-Electric Mines,* by Samuel Stiber and George Haber, ECOM; and

An Electro-Magnetic Technique for Wire Location, by Ralph L. Dunn, ECOM; *The Development of a Kalman Filtering Algorithm for Hybrid Navigation Systems for Army Aircraft,* by Capt J. A. Knight, ECOM; *Automated Raw Environmental Data Processing,* by William A. Huber, ECOM; *Analysis and Application of Gallium Arsenide Avalanche Transit Time Devices,* by J. J. Baranowski and V. J. Higgins, ECOM; and

Neodymium YAG Laser for Optical Radar Applications, by J. W. Strozyk and V. J. Rosati, ECOM; *A New Approach to Detection of Enemy Arms Caches,* by Gerhart K. Gaule and Donald Foiani, ECOM; *Threshold Effects of Chemical Mixtures in the HCN Laser,* by Maj T. R. Mooney, G. E. Morris, H. Jacobs, and C.S. Brand, ECOM; *Reduction of Biological Effectiveness of X-Rays at Very High*

Dose Rates, by Stanley Kronenberg, Robert A. Lux and Kristian Nilson, ECOM; and

A Lightweight Electronic Scanning Radar, by H. N. Tate, ECOM; *A Similarity Model for a Planetary Boundary Layer with Horizontal Variations*, by W. B. Ohmstede, Atmospheric Sciences Laboratory, Fort Huachuca, Ariz.; *A More Rigorous Expression for the Rate of Droplet Growth*, by Richard D. H. Low, White Sands Missile Range, N. Mex.; *Open Cycle Hydrocarbon-Air Fuel Cell Power Plant*, by E. A. Gillis, O. F. Kezer and W. G. Taschek, U.S. Army Mobility Equipment R&D Center (MERDC), Fort Belvoir, Va.; and

A Theoretical and Experimental Evaluation of a Biconical Antenna Nuclear Electromagnetic Pulse Simulator, by Janis Klebers and Stanley Bukalski, MERDC; *Experimental Superconducting Alternators with Iron-Core and Iron-Free Armatures*, by Carl Heise and James H. Ferrick, MERDC; *Testing for an Organic Superconductor*, by Forest J. Agee Jr. and Glenn E. Spangler, MERDC; and

Simulation of Ionized Air with an Artificial Dielectric, by William Gray and George Merkel, MERDC; *Polarization Agility for Radar Glint Reduction: Experimental Program;* by John Hatcher, Missile Command (MICOM), Redstone Arsenal, Ala.; *Thermally Stable Organometallic Polymers*, by Shelba P. Brown. MICOM; and

Laser Mode Coupling Producer by Sinusoidal Cavity-Length Modulation, by Albert L. Pardue, MICOM; *Echo Amplification in Magnetic Materials with Application to Pulse Compression Radar*, by A. C. Daniel, B. D. Guenther and C. R. Christensen, MICOM; *On the Propagation of High Intensity, Relativistic Electron Beams*, by Thomas G. Roberts, MICOM; and

Human Incapacitation Produced by Burns, by Robert R. Ingram Jr., Raymond F. McHugh Jr. and James H. Lewis, Edgewood Arsenal, Md.; *A New, Simple, Direct, and Ultrasensitive Method for the Detection of Ammonia and Aliphatic Amines*, by David N. Kramer and John M. Sech, Edgewood Arsenal; and

Conformational Studies on the Active Site of Acetylcholinesterase by Electron Parmagnetic Resonance, by Joel D. Morrisett, Clarence A. Broomfield and Brennie E. Hackley Jr., Edgewood Arsenal; *Temporary Cavity Effects in Blood Vessel Injury by High Velocity Missiles*, by Maj Joseph J. Amato, Lt Col Norman Rich, Maj Noel S. Lawson, Capt Ronald O. Gruber and Capt Lawrence J. Billy, Edwood Arsenal; and

Denver Earthquake, by Louis E. Garono, Edgewood Arsenal; *Genetic Transformation in the Genus Pasteurella*, by Franklyn J. Tyeryar Jr. and William D. Lawton, Fort Detrick, Md.; *Pathogeneses, Prophylaxis, and Therapy of an Incapacitating Disease*, by H. T. Eigelsbach, R. B. Hornick, R. L. Schricker, W. A. Hankins and W. R. Griffith, Fort Detrick; and

Optimization Analysis of a Compact Lightweight Laser Rangefinder, by J. Costantino, D. Reago and C. Ponte, Frankford Arsenal, Philadelphia, Pa.; *The Nature and Formation of the Bond in the Explosive Bonding of Metals*, by James F. Kowalick, Frankford Arsenal; *Mathematical Model for Projectile Body*, by F. Shinaly, Frankford Arsenal; and

M16 Rifle/Ammunition Malfunction Modeling, by H. Greveris, Frankford Arsenal; *New Techniques for Entry into Explosive Warheads*, by W. B. Steward and J. D. Corrie, Frankford Arsenal; *Effect of Environment on Crack Propagation in High Strength Steel*, by J. V. Rinnovatore and J. D. Corrie, Frankford Arsenal; and

An Experimental Investigation of Flueric Explosive Ignition Device, by A. Corrado, Picatinny Arsenal, Dover, N.J.; *The Preparation and Properties of New Oxidizers for Propellants; NH_4ClO_4–$KClO_4$ and NH_4ClO_4–NH_4NO_3 Mixed Crystals*, by Scott I. Morrow, Picatinny Arsenal; *Gaseous Illuminant Pryotechnic Systems*, by A. D. Kirshenbaum and F. R. Taylor, Picatinny Arsenal; and

Lattice Dynamics of Light-Metal Azides, by R. D. Mical, H. J. Prask, H. Rafinzadeh, K. R. Roa, S. Trevino and S. Yip, Picatinny Arsenal; *Linear Suspension System Parameter Identification*, by James W. Grant and Glenn A. Jackson, U.S. Army Tank-Automotive Command, Warren, Mich.; *Evaluation of Automatic Fire Effectiveness of Small Arms Weapons Systems in an Operational Environment*, by Ronald D. Klein and Col Charles B. Thomas, Fort Benning, Ga.; and

Kinematics of Diffusion, Fluids and Plasma by Continuous Movement and Finite Velocities, by Ronald E. Myers, Deseret Test Center, Fort Douglas, Utah; *The Determination of Aluminum and Chlorine in Composite Propellants by Non-Destructive Activation Analysis Using a Mixture of 14.5 MeV and Slow Neutrons*, by Alex Harrison and A. E. Richardson, WSMR; and

The Role of Fracture Toughness and Residual Stresses in the Fatigue and Fracture Behavior of Large Thick-Walled Pressure Vessels, by T. E. Davidson, J. F. Throop and A. N. Reiner, Watervliet Arsenal, N.Y.; *Anisotropy of Fatigue Crack Propagation in Hot Rolled Banded Steel Plate*, by Francis A. Heiser, Watervliet Arsenal; and

Development of a Mathematical Model for Use in Designing Functional Controls of a Soft-Recoil Mechanism, by J. W. Frantz and M. C. Nerdahl, Weapons Command (WECOM), Rock Island, Ill.; *Mechanical Dispersion of a Machine Gun System with Stochastic Excitations*, by H. M. Hung, WECOM; *Holographic Inspection of Laminate Bonds*, by R. J. Iversen, J. W. McGarvey and L. B. Gardner, WECOM; and

Mass Flow Velocity and In-Flight Thrust Measurements by Ion Deflection, by 1st Lt R. S. Rudland and Rande Vause, Army Aeronautical Research Laboratory, Moffett Field,

(Continued on page 32)

TACSAT I Provides Apollo 12 Communications Link

Tactical Communications Satellite (TACSAT) I and strategically located airborne, land, sea and shipboard terminals provided the primary communications link between the *USS Hornet* and mission control in Houston during Apollo 12 splashdown.

Success of this recovery operation matched that of the same communications set-up for Apollo 11. The tactical satellite communications system is a joint R&D venture of the Army, Navy, Air Force and Marine Corps.

TACSAT I is a 1,600–pound synchronous satellite "parked" 22,000 miles above the equator. Launched in February 1969, it is designed to test the potential for satellite communications for military field forces.

An in-depth feasibility test program is now in progress to determine the technical capabilitites and develop the operational procedures required. Coordinated tests are being performed under direction of the TACSATCOM Joint Service Test Directorate, located at HQ Army SATCOM Agency, Fort Monmouth, N.J. The directorate is headed by a representative of the Air Force, with Army and Navy deputies.

The Apollo 12 communications effort was an important part of the tests, designed to demonstrate the capability of satellite communications with portable terminals to provide flexible, high-quality, reliable communications, on demand, in an environment similar to joint service operations.

For further information on the TACSATCOM program, Apollo 11 assistance, and terminals used in the program, see *Army R&D Newsmagazine*, August-September 1969, pp. 10, 26; and March 1969, pp. 11, 36.

Judges Pick 121 Papers for 1970 ASC

(*Continued from page 31*)

Calif.; *Prediction of High Velocity Solid Propellant Gun Performance by Gas Dynamic Computer Program,* by Paul G. Baer, Ballistic Research Laboratories (BRL), Aberdeen Proving Ground, Md.; and

Detonation Structure in Condensed Phase Explosives, by Capt P. M. Howe, BRL; *The Effect of Structure on Radiation Chemical Reactivity,* by Nathan Klein, Nuclear Effects Laboratory, Edgewood (Md.) Arsenal; *Reactions of Target Materials to Attack by Particulate Shaped Charge Jets,* by A. Merendino and R. Vitali, BRL; *Predictions of Shaped Charge Warhead Lethality Effectiveness,* by Julius Simon and Robert DiPersio, BRL;

The Generation and Penetration Characteristics of High Density Shaped Charge Jets, by J. M. Regan and G. H. Jonas, BRL; *Electrophysiological Measures of Cross-Sensory Interaction in the Central Nervous System,* by Lynn C. Oatman, Human Engineering Laboratories, Aberdeen Proving Ground, Md.; *Wound Data and Munitions Effectiveness as Based upon Battlefield Surveys in Vietnam,* by Col Joseph R. Blair and Joseph Sperrazza, Edgewood Arsenal and Aberdeen Proving Ground; and

A Study of the Internal and External Flow Field Associated with Parachutes During Inflation, by Gregory C. DeSantis, Natick Laboratories (NLABS), Natick, Mass.; *Alteration of Taste Qualities through Natural Products,* by Linda M. Bartoshuk, NLABS; *T–T Indicating Systems,* by K. H. Hu and J. D. Loconti, NLABS;

New Foods for Military Use. A Physico-Chemical Approach to Research and Development, by John G. Kapsalis, John E. Walker Jr. and Max Wolf, NLABS; *Modern Counter-Surveillance in Combat Clothing,* by A. O. Ramsley, NLABS; *Internal Electromagnetic Pulses in Irradiated Enclosures,* by J. A. Rosado, R. M. Gilbert, W. L. Vault and J. E. Tompkins, Harry Diamond Laboratories (HDL), Washington, D.C.; and

A Flueric Oscillator for Military Timer Applications, by Carl J. Campagnuolo and Stacy E. Gehman, HDL; *Computer Operated Automatic Fuze Testing Systems,* by Roger P. Chase, HDL; *An Experimental Comparison of Some Doppler Radar Clutter Reduction Techniques,* by J. D. George, HDL; *Exploitation of Contoured Double Cantilever Beam Specimens in Crack Growth and Arrest Studies,* by Joseph I. Bluhm, Bennett E. Gordon Jr. and Robert J. Morrissey, Army Materials and Mechanics Research Center (AMMRC), Watertown, Mass.; and

Use of Activation Analysis for Determining Weight of Pellet in M34 Primers, by F. C. Burns, G. L. Priest and H. F. Priest, AMMRC; *Rubber Toughened Acrylic Polymers for Armor Applications,* by R. W. Lewis, M. E. Roylance and G. R. Thomas, AMMRC; *"Gradient Armor,"* by Capt J. Sighlich and Capt T. Rankin, AMMRC.

Supplemental papers follow:

OFFICE, SURGEON GENERAL—*The Effects of Muscular Exercise on Neuroendocrine Secretion,* by Lt Col LeeRoy G. Jones, Maj L. Howard Hartley, Capt R. P. Hogan and Dr. Martin J. Gerben, USARIEM; *Properties of n-Butyl-a-Cyanoacrylate Restorative Materials,* by Lt Col Simon Civjan, U.S. Army Institute of Dental Research, Washington, D.C.; *The Friction Blister,* by Col William A. Akers and Dr. Marion B. Sulzberger, Letterman Army Institute of Research.

CORPS OF ENGINEERS—*Field Test of a Stream Condensed Heat Sink Concept,* by W. Quinn, H. Aamot and M. Greenberg, CRREL; *A Mathematical Analysis of the Propagation and Reflection of Plane Electromagnetic Waves in a Non-Homogenous Isotropic Medium,* by Richard A. Hevenor, ETL; *Rapid Assessment of Aircraft Landing Sites,* by Richard G. Ahlvin and George M. Hammitt II, WES.

OTHER R&D AGENCIES—*Controllable Rocket Motor for ABM Interceptor Missile,* by Dr. Lewis J. Hurt, ABMDA; *Systematic Application of Simulation Models to Weapon Systems Development,* by Ronald S. Morris, Red River Army Depot, Texarkana, Tex.; *Social Status Variables in the Military and Their Effect on Expressing Aggression,* by Maj William Baker II, USMA.

ARMY MATERIEL COMMAND—*Atmospheric Transfer Functions for Laser Propagation,* by Edward Collett, ECOM; *Investigation of Radar Anomalies,* by W. Fishbein, E. L. Frost and W. Vander Meer, ECOM; *Improved Sensors for Thermal Imaging,* by Wolfgang Elser, Juergen L. W. Pohlmann, Reinhard D. Ennulat, Louis M. Cameron, Phillip R. Boyd, Clifford W. Chapman and Lynn E. Garn, Night Vision Laboratory; and

Direct Solution of Complex Crystal Structures by Electron Microscopy, by J. A. Koun, C. F. Cook Jr. and D. W. Eckart, ECOM; *The Characteristic Coefficients Technique for Probability Models of Wind Profiles in Missile Design and Environment Analysis,* by O. Essenwanger, MICOM; and

Physical Model for the Penetration of Clothing by Chemical Agents, by Harry A. Brown Jr., John J. Callahan, Eduard Wulkow, Elwin C. Penski and Donald R. Bowie, Edgewood Arsenal; *Luminescence of Nitroaromatic Molecules,* by Ingo W. May, BRL; *Detonation Pressure Measurements in TNT and Octol,* by R. L. Jameson, BRL; and

Microclimate-Controlled (Thermalibrium) Clothing Systems for Military Applications, by L. A. Spano and V. D. Iacono, NLABS; *Development of New High Fragmentation Shell Steel,* by P. V. Riffin and E. Kinas, AMMRC; *The Use of Martensite Materials in the Design of Thermally Activated Springs,* by F. Rothwarf, A. Auerbach and D. Ford, Frankford Arsenal; *Chemiluminescent Organic Phosphides,* by G. P. Sollott, J. L. Snead and R. A. Strecker, Frankford Arsenal.

Foreign Scientists Attend Natick NAS Meet

Scientists from England, Germany and Switzerland were among guest speakers at the 13th annual Organic Chemistry Conference sponsored by the National Academy of Sciences-National Research Council, Oct. 7–8, at the U.S. Army Natick Laboratories.

Prof. Duilio Arigoni, conference dinner speaker, discussed "Some Stereochemical Aspects of Biochemical Transformations." Associated with the Eidgenoissiche Technische Hochschule, Zurich, Switzerland, he is currently visiting professor at Penn State and Harvard Universities. In 1968 he was the Falk Plant lecturer at Columbia University.

Prof. Allen W. Johnson, University of Sussex, England, presented a paper on "The Anti-Tubercular Antibiotic Viomycin and Related Compounds." The topic of Prof. Sigfried Hunig, Universitat Wurzburg, Germany, was "Weitz-Type Redox Systems with Stable Radical Ions."

Among other featured presentations were: "Organometallic Rare Earth Sandwich Complexes," Prof. Andrew Streitwieser, University of California at Berkeley; "Conformational Analysis in Heterocyclic Systems," Prof. Ernest L. Eliel, University of Notre Dame; and "The Electronic Structure of Methylenes," Prof. Roald Hoffman, Cornell University.

The conference moderator was Dr. Louis Long, head of the Organic Chemistry Group, Natick Labs.

TACOM Developing Field Simulation System for Testing Vehicles

By Peter C. Manning

Peter C. Manning has been a test engineer in the Power Systems Evaluation Division of the United States Army Tank Automotive Command's Propulsion Systems Laboratory for the past four years. Manning received a BS degree in physics from Michigan State University in 1964 and a BS degree in mechanical engineering from Wayne State University in 1966.

Dynamic engineering design testing of U.S. Army vehicles and automotive components was done until recently by subjecting them to actual field conditions at Army proving grounds. In the past four years, however, the Army Tank-Automotive Command (TACOM) has been developing a field simulation endurance system for testing propulsion subsystems in vehicles and mock-ups.

Although this research and development program is incomplete, tests have provided detailed information on an engine-driveline's durability and performance characteristics under dynamic, simulated field conditions.

All tests are conducted in the highly controlled and observable environment of the Propulsion Systems Laboratory (PSL) dynamometer test cells at HQ USATACOM, Warren, Mich. This new facility has increased the PSL's extensive vehicular testing capability, and has added a new area of scientific investigation to the USATACOM's sophisticated data acquisition retrieval systems.

The dynamic nature of field simulation testing requires equipment that must respond and control conditions by instantaneous stimuli from both the test specimen and recorded field data. The purpose is to complement field testing of propulsion subsystems under similar environmental conditions.

Advantages of simulation testing are in the reduction of engineering development lead-time and development costs. Because experimental propulsion systems can be operated against field work profiles unique to the vehicle in which they would operate, the normal requirement for complete vehicular prototype development prior to experimental propulsion system testing can be avoided.

Simulation testing provides the Army with a method for rating a number of competitive propulsion systems for a particular vehicular application. All power trains operate against a known field work cycle, which makes it possible to determine the propulsion system with the best over-all durability and performance.

Performance in simulation testing is measured by maximum torque, horsepower, field consumption (miles/gallon), oil consumption (qt/100 miles), and the propulsion response to controlled driver input commands.

All these performance parameters cannot be readily determined in field operation without special test equipment and procedures. However, they can be acquired as standard data in USATACOM Propulsion Systems Laboratory (PSL).

Durability can be readily determined with simulation testing by failure incident rate. This has been indicated in previous field durability correlation tests conducted at Yuma (Ariz.) Proving Ground and at PSL, with the XM520E2 (GOER) propulsion system operated in accordance with simulated Yuma field conditions.

Simulation tests can reduce development costs, as demonstrated in the laboratory with two power packs operated simultaneously by one technician. By testing only the propulsion subsystem, the cost of "down time" in maintaining other vehicular components, such as tires, frame components, shock absorbers and similar support items, is reduced.

Eliminated also is the need for a large number of expensive prototype vehicles since experimental propulsion systems may be tested in the same way in the laboratory for simulation of field conditions considered most significant to its life cycle.

Operating under simulated conditions, the test specimen experiences speed, torque, power, and ambient temperatures similar to actual field operations. Environmental conditions

(*Continued on page 34*)

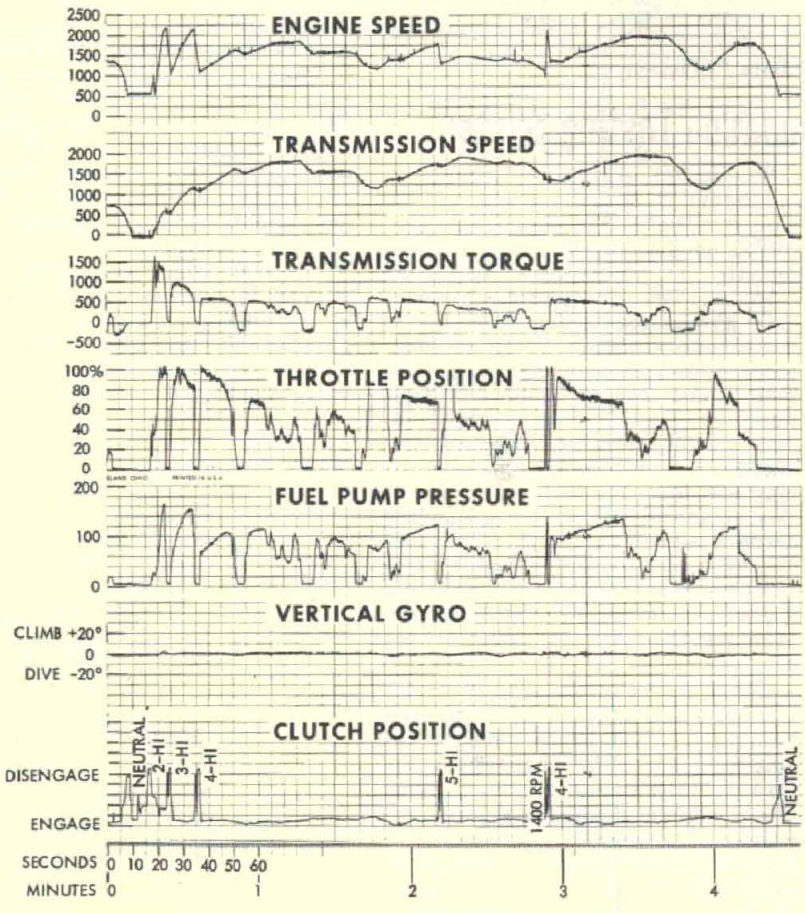


Fig. 1. 5-Ton Truck Field Data (With 10,000-lb. Payload, Munson Gravel)

Time (Seconds)	Speed (Mi. Hr.)	Power (BHP)	Percent Power	Ratio	Engine (RPM)	Trans. (RPM)	Tork (Lb. Ft.)	Piston (Miles)
1	.0	.0	.0	$$$$$$	706.	.	-15.	.01
2	.0	.0	.0	$$$$$$	634.	.	189.	.02
3	.0	.0	.0	$$$$$$	1213.	.	662.	.04
4	.3	5.5	35.9	73.83	2106.	27.	1074.	.07
5	.2	2.8	31.0	148.22	2375.	16.	930.	.10
6	1.3	18.0	30.6	22.65	2661.	117.	806.	.14
7	9.9	107.3	73.4	3.10	2758.	892.	632.	.18
8	13.3	142.9	84.6	1.95	2345.	1207.	622.	.21
9	14.8	162.5	91.7	1.91	2562.	1340.	637.	.25
10	16.1	146.4	82.3	1.78	2583.	1458.	527.	.28
11	17.2	125.1	77.6	1.41	2180.	1554.	423.	.32
12	18.2	162.0	97.6	1.39	2277.	1645.	517.	.35
13	19.2	156.2	91.2	1.38	2396.	1736.	473.	.38
14	20.0	126.9	71.9	1.41	2542.	1810.	368.	.42
15	20.9	155.8	87.0	1.39	2625.	1890.	433.	.46
16	21.6	175.9	97.1	1.39	2703.	1955.	473.	.50
17	22.3	145.3	79.2	1.40	2816.	2019.	378.	.54
18	23.0	153.9	84.4	1.33	2760.	2083.	388.	.57
19	23.7	172.4	108.5	1.00	2136.	2141.	423.	.61
20	24.3	155.9	96.3	1.00	2192.	2195.	373.	.64
21	24.8	144.8	87.7	1.01	2257.	2248.	338.	.67
22	25.4	154.8	92.5	1.00	2305.	2302.	353.	.70
23	26.0	162.8	96.2	1.00	2349.	2355.	363.	.74
24	26.6	152.5	89.0	1.00	2400.	2403.	333.	.77
25	27.1	153.2	38.4	1.00	2452.	2451.	328.	.80
26	27.6	167.7	95.9	1.00	2490.	2494.	353.	.84
27	28.0	170.6	96.8	1.00	2532.	2537.	353.	.88
28	28.5	158.3	89.2	1.00	2583.	2579.	323.	.91
29	29.0	163.9	91.6	1.00	2619.	2622.	328.	.95
30	29.3	168.1	93.5	1.00	2647.	2649.	333.	.99
31	29.6	165.0	91.4	1.00	2677.	2681.	323.	1.03
32	29.9	156.4	86.3	1.00	2709.	2707.	303.	1.07
33	30.2	168.3	92.6	1.00	2731.	2734.	323.	1.10
34	30.6	172.9	94.3	1.00	2758.	2766.	328.	1.14
35	30.8	161.0	88.0	1.00	2788.	2733.	303.	1.18
36	31.0	162.0	88.4	1.00	2804.	2804.	303.	1.22
37	31.2	165.6	90.2	1.00	2820.	2820.	308.	1.26
38	31.5	153.7	83.6	1.00	2848.	2846.	284.	1.30
39	31.6	151.5	82.3	1.00	2858.	2857.	279.	1.35
40	31.6	141.0	76.6	1.00	2864.	2868.	259.	1.39
41	31.7	119.5	64.9	1.00	2868.	2868.	219.	1.43
42	31.6	132.6	72.0	1.01	2866.	2857.	244.	1.47
43	31.6	146.4	79.5	1.00	2860.	2862.	269.	1.51
44	31.6	135.5	73.6	1.00	2866.	2862.	249.	1.55
45	31.6	122.0	66.2	1.00	2868.	2862.	224.	1.59

Fig. 2. PSL Digital Data Reduction

TACOM Developing Field Simulation Testing System

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can be altered to permit 120° F. ambient temperatures, 20-mile-per-hour wind velocity and simulated solar infrared radiation equivalent to 360 Btu per square foot per hour.

To collect field data for the simulated tests, an FM magnetic tape recorder is placed on a vehicle to record the needed information while the vehicle is operating over selected courses. In the Propulsion Systems Laboratory, the data is reduced into analog and digital forms to determine the dynamic conditions which the vehicle experienced on the selected courses. Examples are shown in Figures 1 and 2. A block diagram of the complete data reduction system is shown in Figure 3.

The analog data is recorded on an 8-channel ink pen recorder. Engine and transmission speeds, recorded in the form of frequencies, are converted to analog voltage levels by frequency-voltage converters and routed to the ink pen recorder.

Transmission torque and pressure signals pass through low-frequency filters which attenuate frequencies in excess of ten Hz. The purpose of these filters is to eliminate the high-frequency torsional vibration pressure pulsations transmitted by the engine.

The digital reduction system shown in Figure 3 is independent of the analog system. FM frequencies recorded on the magnetic tape are sent directly into six preset frequency counters. The binary coded decimal data at the counters is then transmitted into a high-speed digital computer, converted to engineering data, and logged by a high-speed tape punch.

A crystal-controlled standard frequency, recorded on one track of the magnetic tape during the field operation, serves as the timing clock for the digital reduction system. This frequency is used to control the time base of the preset counters and a preset digital controller. The controller determines the sampling rate of the counters.

Use of a crystal frequency provides ultra-precise on-line control for digitizing. It also cancels the effect of instability caused by changes in the tape recorder's capstan speed when the machine is exposed to severe environmental accelerations of a vehicle in field operation, as well as speed fluctuations in the tape playback system. The gate time is set for 970 milliseconds, with the repetitive sample rate of the counters at one per second.

Counters provide integration of the FM signal on each tape channel 97 percent of the time. This digitizing system has a long sample time as contrasted to the high-speed, analog-to-digital converters often used in digital data reduction systems.

High-speed converters often create errors due to the small aperture time inherent in the conversion process. In addition to eliminating this problem, the direct method of extracting field signals from the tape bypasses the FM reproduced electronics which must be tuned to perform satisfactorily.

The digital computer collects the data from the counters in 30 milliseconds, and converts it into engineering data by the linearization and offsetting of the normal center frequency on the magnetic tape. Following this, the computer interfaces with the high-speed digital punch, and logs the data during the succeeding 970-millisecond sample period. The punch tape is then read back off-line into the computer, and logged in typewritten form as shown in Figure 2.

Digital data is further processed to obtain time-density distribution of speed and torque conditions during operation. This information is used for setting the 15 dynamometer load conditions in simulation equipment.

After presetting these loads, the throttle-control panel is set in 10 percent power increments. To operate and select combinations of these preset conditions, a tape program is written and punched to program the simulated field conditions into the dynamometer test cell equipment.

The maximum rate of the punch tape through the equipment controller is one step per second. Step time is programable from one second to 10 minutes. The maximum step is comparable with the minimum time con-

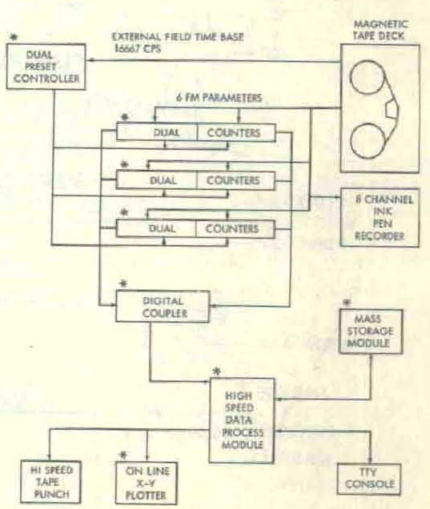

Fig. 3. PSL Field Data Reduction System

stants of the mechanical actuators and dynamometers used for simulation testing.

Two tests are in progress at the Propulsion Systems Laboratory. One involves two XM–520 (GOER) alternate power packages. One power package has 662 hours, equivalent to 11,702 miles of endurance, and the second has just begun simulation testing.

In the second test, an M–39 5-ton truck is undergoing a driveline endurance test. Field data has been reduced into analog form, and engineers are presently obtaining transmission baseline performance.

Field data used for the GOER test was collected at the Army's Yuma Proving Ground, and in Vietnam during a combat supply mission between Plieku and Dakto. Field data to be used on the M–39 was recorded at the Aberdeen (Md.) Proving Ground.

Concurrent with these tests, PSL engineers started a project last year to advance and improve simulation test equipment and testing techniques.

Objectives of the system are to reduce the lead time and manhours necessary to develop simulation tape programs, and to provide more sophisticated control and monitoring of simulated conditions.

The main component of the system will be a high-speed digital computer with a large disk storage and retrieval capacity for mass field data. This will permit on-line control of a multiple test cell system with complete field data and simulation program storage. A block diagram of the system's main components is shown in Figure 4.

After development of necessary software programs, the system will permit closed-loop test cell control with the application of a reiterative technique used for creating the optimum simulation program. It will be possible to maintain continuous test specimens monitoring and logging of critical simulation cycle parameters through existing test cell digital data acquisition systems.

Parameters include: distance, fuel consumption, average power, and critical temperatures and pressures. Maximum cycle times will be increased from minutes in the present system to hours in the system being constructed. The disk storage will allow 350,000 words of storage. (The GOER test alone will require storage of 20,000 words.)

PSL engineers expect the new testing system to be operational sometime in FY 1970. Benefits of simulation field testing are already apparent although development work is incomplete. It provides more detailed information than present methods on power package durability and performance characteristics. It also offers PSL engineering personnel better insight into the dynamic conditions affecting vehicular propulsion systems in field operation.

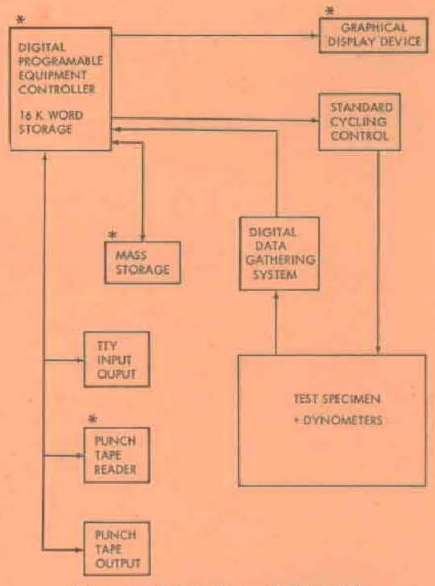

Fig. 4. High-Speed Digital Field Simulation System.

Reservist Completes C&GSC By Special Permit as Civilian

Graduation as a civilian from the U.S. Army Command and General Staff College is the unusual achievement completed recently by Bernard M. Ames, an Army Reservist employed at the U.S. Army Combat Developments Command Maintenance Agency, Aberdeen Proving Ground, Md.

The explanation is that he completed 9 of the 10 required phases of instruction while on active duty, and then was granted his request to complete the final phase of the resident nonresident course.

Currently employed as a logistics analyst, one of his duties is to review and write requirements and doctrine of the Army in the field through the time frame of 1985.

Until he entered U.S. Government career service in 1956 at the U.S. Army Ordnance School, Aberdeen Proving Ground, Md., Ames was a newspaper managing editor and television program director. He is a 1951 journalism graduate of Pennsylvania State Univ.

STRATCOM Commanders Hold Annual Meet at Huachuca

Commanders of the U.S. Army Strategic Communications Command's (STRATCOM) far-flung communications-electronics operations concluded their 5–day sixth annual Commanders' Conference Nov. 21 at Fort Huachuca, Ariz.

Some 30 commanders came from Vietnam, Alaska, Hawaii, Europe, Panama and STRATCOM elements within the continental United States. Discussion was centered on progress and actions necessary to insure STRATCOM's ability to continue to meet the Army's expanding demands for rapid, reliable, responsive communications.

STRATCOM CG Maj Gen William B. Latta welcomed the group and members of his headquarters staff were among key speakers. Brig Gen Thomas M. Rienzi, CG of STRATCOM's 1st Signal Brigade in Vietnam, spoke at a luncheon on Communications in Southeast Asia.

Brig Gen I. R. Obenchain Jr., CG of the Safeguard Communications Agency, discussed the challenges of designing, engineering, and installing a complete communications systems for the Safeguard ballistic missile defense system. Other commanders made presentations concerning their commands.

Maj Gen Walter E. Lotz Jr., former CG of STRATCOM who now heads the US. Army Electronic Command at Fort Monmouth, N.J., was a guest speaker, along with Brig Gen Richard C. Horne III, commandant, Signal School and Center at Fort Monmouth, and Col Edward E. Moran, commandant, Signal School, Fort Gordon, Ga.

Enlisted men's activities were also in the spotlight during the week as STRATCOM's Command Sergeant Major Charles R. Sutey hosted more than a dozen sergeants major from the command in their second annual worldwide meeting. The top NCOs discussed a variety of plans and programs of interest to the STRATCOM's nearly 30,000 enlisted men.

AVLABS Award $480,000 Contract For Centrifugal Type Compressor

Design, fabrication and testing of a high-pressure-ratio centrifugal compressor for use in advanced small gas turbine engines are required under a $480,000 contract announced by the U.S. Army Aviation Materiel Laboratories at Fort Eustis, Va.

Generally less efficient than axial flow compressors, the centrifugal type has the advantages of simplicity, ruggedness and low cost. Considerable effort has been expended in recent years to improve operational efficiency of centrifugal compressors.

AVLABS project engineer Robert A. Langworthy explained that the centrifugal compressor also has the advantage of compressing air to high pressures in a single stage, as compared to several axial stages used to perform the same job with a conventional flow compressor.

Objective of the program under which the Pratt and Whitney Aircraft Florida RD Center will develop the centrifugal compressor is to bring together the most advanced design criteria and techniques currently available as a basis for future improvements.

Defense Department Credits 3 Army Men With $9 Million Cost Reduction

Cost reduction actions credited with saving the Department of the Army more than $9 million (estimated through FY 1971) gained recognition for a colonel and two civilian employes as a climax to observance of Defense Management Improvement Week.

Vice President Spiro Agnew presented awards at a ceremony honoring 10 individuals and 5 organizations for outstanding contributions to the DoD Cost Reduction and Management Programs.

Secretary of Defense Melvin R. Laird was host during the Pentagon ceremonies, attended by Deputy Secretary of Defense David Packard, Chairman of the Joint Chiefs of Staff General Earle G. Wheeler, Secretaries of the Army, Navy and Air Force, and numerous other high-ranking dignitaries of U.S. Government agencies.

In a report to President Richard M. Nixon, Secretary Laird said more than 36,000 verified management improvement actions had effected cost-reduction successes totaling more than $1.5 billion in FY 1969. The report said the DoD had instituted a Logistics Performance Measurement and Evaluation System to focus additional management attention on critical problem areas.

LIONEL P. HERNHOLM, an equipment analyst at HQ U.S. Army Combat Developments Command, Fort Belvoir, Va., was cited for the largest individual contribution to the Army's Cost Reduction Program. The validated saving in FY 1970 is $1,775,106 and $4,327,790 in FY 1971, totaling $6,102,896.

VICE PRESIDENT Spiro T. Agnew presents citation to Lionel P. Hernholm, equipment analyst with CDC, for contributions to the Department of Defense Cost Reduction and Management Improvement Program for FY 1969.

While conducting a special study of the distribution of battery chargers used with the TOW antitank missile system, he discovered that chargers issued at direct support maintenance levels provided all the needed combat support capability.

As a result, the Army deleted requirements for back-up chargers in the individual battalions and amended the procurement contract.

LT COL JAMES R. VANCE, executive officer, Department of Tactics, Armament Division, U.S. Army Aviation School, Fort Rucker, Ala., developed a cost-saving gunnery technique for training helicopter pilots.

The idea reduced training costs $260 per student, with a validated saving of $592,800 in FY 69 and $2,470,000 in FY 70 and FY 71, totaling $3,062,800. Trainees receive the same number of practice bursts with less ammunition consumption by employing weapons having a slower cyclic rate of fire.

DAVID E. CIRULI, general engineer trainee, Pueblo (Colo.) Army Depot, developed an air-driven, shock absorber puller tool. This eliminated losses of up to $39.23 per vehicle due to parts damage during removal by the wedged tool and hammer method.

The validated saving is $3,600 in FY 69 and $16,400 in FYs 70–71.

Among the five organizations cited for outstanding achievements in cost reduction and management improvement during FY 69 is the U.S. Army Watervliet (N.Y.) Arsenal. Col William Mulheron Jr., commander, received the citation which states, in part, "The motivation, initiative and dedication exhibited by the personnel and staff of Watervliet Arsenal generated management improvements that saved $24,900,000 for the Department of the Army, far exceeding established goals.

"The exemplary performance . . . resulted from exceptionally well organized programs and extensive application of cost reduction and management improvement principles. . . ."

ECOM Deputy for Laboratories Elected as IEEE Fellow

Dr. Robert S. Wiseman

Honors recognizing his outstanding achievements in developing night-vision devices that have served to "take the night from Charlie" in South Vietnam are continuing to pile up for Dr. Robert S. Wiseman.

The Institute of Electrical and Electronics Engineers announced early in December that Dr. Wiseman, U.S. Army Electronics Command Deputy for Laboratories, has been elected an IEEE Fellow. The honor followed by approximately one year his receipt of a $5,000 award and the Army's Exceptional Civilian Service Award.

In June 1969, Secretary of Defense Laird presented him with the DoD Distinguished Civilian Service Award.

Numerous countries besides the United States are represented among the 122 IEEE Fellows selected for 1969. Dr. Wiseman was cited "for scientific leadership and research and development in devices for image detection in darkness."

MICOM Awards $20 Million For Production of Chaparral

Continued production of Chaparral guided missile fire units and test equipment is the basis of a definitized $20,378,000 contract announced recently by HQ U.S. Army Missile Command, Redstone (Ala.) Arsenal.

Aeronutronic Division of Philco-Ford Corp., which had received $4.2 million of the total under an earlier agreement, is the contractor. The Chaparral was ordered into production in 1966 and three purchase contracts preceded the new procurement.

The air defense missile system consists of a launch and control assembly, vehicle, missiles and support equipment. The program is directed by the Missile Command Chaparral Management Office.

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