ARMY
RESEARCH AND DEVELOPMENT

January–February 1977

Defense Posture Statements To Congress Offer Analyses Of Needs Vis-a-Vis 'Threat'

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WSMR Functions as Largest of 8 National Missile Ranges

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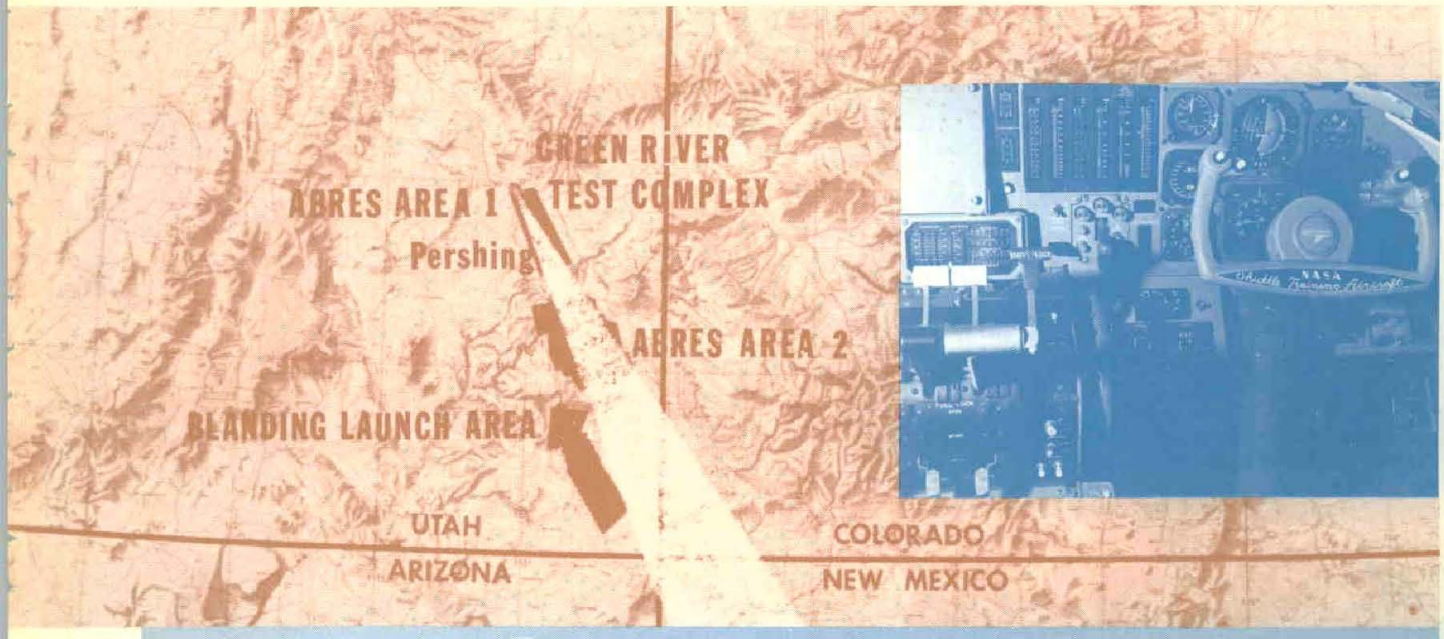

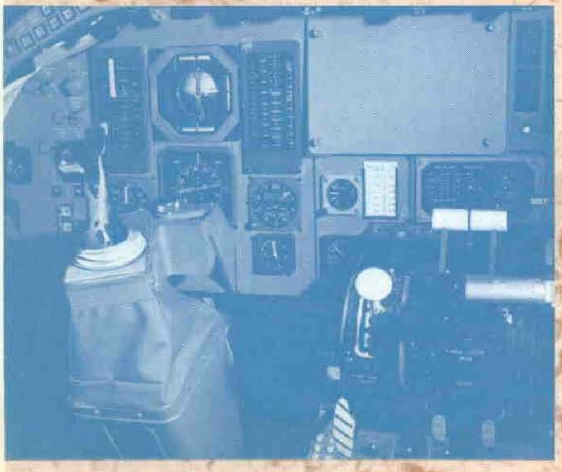

SPEAKING ON . . . ★★★

Defense Posture Statements to Congress . . .

Focus on Need to Counter Rapid Advances in Soviet Weapon Systems

Department of Defense Posture Statements — submitted annually to Congress by U.S. military leaders in justification of annual budget proposals, including intelligence reports calculations on warfare capabilities of the potential enemy — are customarily foreboding presentations on the power buildup poised and ready as the "threat" to NATO and the U.S.

The 1977 Posture Statements — many hundreds of pages of reports prepared by Chairman of the Joint Chief of Staff GEN George S. Brown, recently resigned Secretary of Defense Donald H. Rumsfeld, resigned Secretary of the Army Martin R. Hoffmann and numerous other military leaders — are concerted in perhaps the most sobering analyses of the existing Soviet power and continuing buildup presented to Congress to date.

GEN George S. Brown

GEN Brown's 123-page statement is a detailed analysis of all known weapons systems which U.S. Armed Forces may encounter in the event of a major conflict. In the overview introduction to his report on evaluation of the Soviet weapons systems as opposed to countering NATO and U.S. systems and forces, he states:

"The Soviet Union is steadily developing and deploying new general- purpose forces and weapon systems. In the past few years, these . . . (efforts) have gained momentum.

"The Soviets maintain a quantitative advantage over NATO in combat divisions, tanks, armored fighting vehicles, artillery and combat aircraft, and are modernizing these forces to close the qualitative gap which, in the past, has favored NATO. The Soviet rationale for this numerically superior edge appears to be related to their desire to have a preponderance of forces to reduce risk in any undertaking."

GEN Brown states in the conclusion to his presentation to Congress:

"The defense of the United States is a long-range effort and should not be subject to large annual program and appropriation fluctuations. The threat posed by Soviet military capabilities is in no way diminishing or stagnating. Rather, Soviet military power is growing consistently across the board at a measured and determined pace.

"If we are able to meet challenges to our security in the coming decade, the current relative military trends must not be continued or the equivalency of strategic nuclear forces will be lost and the advantage will pass to the Soviet Union. This must not happen.

"The Joint Chiefs of Staff pledge their support in seeking to make full use of the resources made available for our nation's defenses. We have participated in the development of President Ford's budget request and believe it is in consonance with the realities of the world we face. Our defense posture is approaching lower limits below which we can encounter risks dangerous to the security of our nation."

GEN Brown used many charts to compare weapons systems and general purpose forces of USSR and Warsaw Pact nations opposed to NATO and the United States.

Donald S. Rumsfeld

Former Secretary of Defense Donald H. Rumsfeld's 326-page (plus 23 pages of appendices and tables) Annual Defense Department Report FY 1978 was submitted to Congress shortly before his resignation.

President Carter and new Secretary of Defense Harold Brown were reviewing the report for suggested changes in the proposed $123.1 billion DoD FY 1978 budget as the *Army R&D Newsmagazine* went to press. The section of the report titled Research and Development follows:

Research, Development, Test and Evaluation Goals. The Defense research, development, test and evaluation (RDT&E) program supports U.S. national security objectives by focusing on two major goals:

• First, the program supports near-term defense policies and forces by developing high-quality, affordable and test-proven weapon systems which satisfy specific military needs.

• Second, it provides options for future policies and forces by maintaining a superior technology base consisting of basic and applied research and technology. The technology base is the source of those innovative concepts and alternative solutions to future military problems which will enable us to maintain credible deterrence over the long haul, reduce the possibility of technological surprise, and retain the ability to exploit new opportunities and meet the challenges of a rapidly changing and uncertain future.

Program Basis. RDT&E planning, programatic decisions and management are characterized by the selection of new and improved systems from among many promising technological possibilities. The decision process includes an explicit assessment of several key factors summarized below and discussed in detail in the FY 1978 Statement to the Congress by the Director of Defense Research and Engineering.

The Technology Base. Since World War II, the U.S. has led the world in most areas of technology crucial to military hardware. This lead has helped our nation to maintain key military balances by offsetting quantitative inferiority in many mission areas with systems of relatively high quality. In recent years, however, the U.S. technological lead has been diminishing. This is the result of worldwide technological diffusion; declining real investments by the U.S. in both civil and military R&D; and a serious and growing long-term Soviet effort.

This Soviet program is manifest in two ways: the technological quality of their military developments is increasing, and their high rates of production of military hardware are being sustained or increased, notwithstanding the increased technological content of that production.

For example, from 1970 to 1976, Soviet production of fighter aircraft increased by 36 percent. A large fraction of that production was devoted to swingwing aircraft. At the same time, the sophistication of weapons and instrumentation on such aircraft has been increasing significantly.

Similar considerations pertain to other developments and products of the Soviet military/industrial complex, across all mission areas.

A gross measure of the over-all magnitude of these trends is provided by the intelligence community estimate that Soviet annual military investment expenditures have steadily increased in the last decade. From 1972 to 1975, the total increase was on the order of 25 percent.

As a result of this Soviet effort, their military equipment in most areas is being modernized at a faster rate than ours, and the technological advantages held by U.S. forces are diminishing to a point where U.S. ability to offset quantitative inferiority with superior technology will be increasingly challenged. The current trends in the U.S./USSR technology balance cannot be permitted to continue.

Concurrent with their modernization efforts, the Soviets have embarked on a wide range of programs to develop new kinds of military technology. Their closed society prevents us from reliably determining their objectives and forecasting the capabilities they will achieve through such endeavors, which span most, if not all, of the frontier disciplines of science and engineering.

However, the level of Soviet effort, the increasing competence of their scientific base, and their apparent commitment to develop weapons which could shift the military balance in their favor, require that we be alert to the possibility of technological surprise and act decisively to prevent it.

U.S. RDT&E plans and programs are based on the conviction that technological competition, already real and urgent, will intensify. Superior technology is a primary source of future military and economic strength. This requires a multi-year investment program which exploits our technological balance trends.

The FY 1978 RDT&E funding request of $12 billion is designed to continue the real program growth begun in FY 1977 and to develop the long-term momentum which can ensure — if sustained — the continuity of U.S. technological superiority into the 21st Century.

Mission Requirements. While the evolving technology balance trends directly influence RDT&E investment strategy for the long term, major programatic decisions in RDT&E for FY 1978 are focused on correcting current and projected deficiencies in the capabilities of our forces.

The process of selecting programs which will do so involves assessments of trends in the military balance in key mission areas, tactical military requirements, intelligence on foreign technology, the status of current R&D programs, and technology opportunities and needs.

Resource Allocation. RDT&E planning and program decisions recognize explicitly that human and material resources are not unlimited, that all technological opportunities cannot be exploited, that selectivity must be exercised throughout the weapons acquisition process, and that considerations of cost and efficiency must be given continued management emphasis. The factors affect RDT&E strategy and programs in several ways:

• First, since we have obviously not matched the quantity of all deployed Soviet weapons, we emphasize applying our technological strengths to developing and producing those essential systems which provide the greatest fighting capabilities, and which can significantly multiply the military effectiveness of U.S. combat forces.

• Second, we continue efforts to reduce the costs of new systems throughout their life cycle by expanding the use of several management

(Continued on page 15)

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ABOUT THE COVER . . .

Map of WSMR extended flight corridor for missile testing forms the background for NASA Shuttle Training Aircraft, a modified Grumman Gulfstream II jet equipped with shuttle orbiter controls and instruments (bottom left) and conventional controls (top right), being used to simulate the "Enterprise" (see page 16) space shuttle orbiter during astronaut-pilot training. Back cover shows WSMR's Missile Park with 9,000-foot Organ Mountains (San Andres Range) in the background; the Operations Control and Display Facility, which is the nerve center of each test operation at WSMR; and the Nation's largest solar furnace, capable of intensifying rays of the sun into temperatures approaching those generated by a nuclear blast (5,000° F.).

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Grateful acknowledgement is made for the valuable assistance of Information Offices within the Army Materiel Development and Readiness Command, Office of the Surgeon General, Office of the Chief of Engineers, Army Health Services Command, Army Training and Doctrine Command, Army Forces Command, Office of the Assistant Chief of Staff for Communications-Electronics, Computer Systems Command, and related activities. Use of funds for printing of this publication has been approved by Department of Army, Jan. 1, 1976.

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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FEATURES

DEPARTMENTS

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CHANGE OF ADDRESS for R&D and AE Officer Program enrollees should be addressed to U.S. Army Materiel Development and Readiness Command, ATTN: DRCDE-LN, 5001 Eisenhower Ave., Alexandria, VA 22333. R&D Mobilization Designees should report changes of address to Commanding General, USARCPAC, ATTN: AGUZ-CMD-M, P.O. Box 12467, Olivette Branch, St. Louis, MO 63132.

OTHER GOVERNMENT AGENCIES' requirements should be submitted directly to: DRCDE-LN, 5001 Eisenhower Ave., Alexandria, VA 22333.

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Selective Scanner

DoD Approves Plans for GSRS Development

Approval to proceed with development of a General Support Rocket System (GSRS) has been announced by the Department of Defense. The U.S. Army Missile Research and Development Command (MIRADCOM) is preparing a Request for Proposal to solicit bids for award of competitive contracts in June.

Authority to proceed with development came from the Defense Systems Acquisition Review Council, following a study group's report on what a GSRS is, what it will do, why the Army needs it, and estimated project cost.

The planning concept is that of a simple, rugged, reliable artillery rocket system which can deliver a high volume of nonnuclear fire and be rapidly deployed.

COL Kenneth Heitzke, project manager designee, described the proposed system as a supplement to cannon artillery "when targets such as artillery, troops and light materiel appear rapidly in great numbers. We have nothing like it."

Envisioned is a mobile, tracked launcher vehicle carrying several rockets for rapid succession firing. The GSRS will use conventional munitions and have a potential to employ terminal homing as development advances.

MIRADCOM (then MICOM) awarded concept definition study contracts for technical approaches in March 1976. Competitors include Boeing Co., Emerson Electric, Martin Marietta, Northrop Corp. and Vought Corp.

Based on extensive research in free-flight rocketry in MICOM laboratories, the GSRS Project Office is located at Redstone Arsenal, AL, in Bldg. 7120.

Roland to Undergo Complete Assembly Testing

Stringent testing of the warhead section for the U.S. Roland surface-to-air missile system culminated recently in certification for assembly of complete test missiles.

Detonation of warheads to prove out fragmentation and explosive characteristics was accomplished during tests that included measurements of the velocity of fragments and the degree of shockwave. Army Systems Division of Boeing Aerospace Co. produced the test warheads detonated by New Mexico Institute of Mining and Technology.

Furnished by the U.S. Army, the explosive is identical to that used in the European Roland Missile system.

The U.S. Army Missile R&D Command is directing transfer of European Roland technology to the United States. The supersonic missiles, developed by Euromissile, a French-German consortium, are designed for short-range, low-altitude defense against advanced aircraft.

Hughes Aircraft Co. is the main contractor and Boeing is principal subcontractor under a joint licensee arrangement for fabrication of fire units and missiles, and will jointly conduct a series of test flights.

DoD Health Council to Coordinate CONUS Programs

Creation of a Department of Defense Health Council to coordinate planning, programing and evaluation of CONUS health care operations and CHAMPUS activities was recently announced.

Chaired by Assistant Secretary of Defense (Health Affairs) Dr. Robert N. Smith, the council will be composed of Surgeons General of the three military departments, representatives of the Joint Chiefs of Staff and the Uniformed Services University of the Health Sciences.

Requirements for establishing the council resulted from recommendations of a recently completed Office of Management and Budget, Department of Health, Education and Welfare, and DoD Military Health Care Study.

The council charter calls for evaluation of resource requirements, overseeing of operations of regional health programs, and recommendations to the Secretary of Defense for health service policies.

DSA Redesignated Defense Logistics Agency

Renaming of the Defense Supply Agency as the Defense Logistics Agency, along with revision of its charter, authorized in Department of Defense Directive 5105.22, became effective Jan. 1.

Since its establishment in 1961 at Cameron Station, Alexandria, VA, the DSA broadened its responsibilities to such an extent that redesignation was necessary to reflect more adequately its mission, involving $5.9 billion annually for procurement of equipment, supplies and services, requiring more than 48,000 employes. The agency manages about 50 percent of all items used by the Army, Navy and Air Force.

DLA's expanded role includes worldwide responsibilities for defense fuel, subsistence items, property disposal, and operation of the Defense Logistics Services Center, Battle Creek, MI; Defense Industrial Plant and Equipment Center, Memphis, TN; Defense Property Disposal Service, Defense Contract Administration Service, and Defense Documentation Center, all in Alexandria, VA.

Army Plans Intelligence Activities Reorganization

Planned reorganization of intelligence activities, announced recently by the Department of the Army, is intended to improve support to field commanders, eliminate duplication of effort and streamline over-all operations.

Under study for two years, the realignment will affect intelligence functions in the U.S. and abroad while impacting primarily on the Army Security Agency, Arlington, VA, and the Army Intelligence Agency, Fort Meade, MD.

Emphasis will be on in-place transfer of functions with minimum personnel turbulence involving relocation of 66 military and 43 civilian jobs to five other CONUS sites.

Transfer of the Army Security Agency Training Center and School, Fort Devens, MA, and the agency's Combat Development Activity (Arlington Hall) to the U.S. Army Training and Doctrine Command has been accomplished.

Savanna Army Depot, IL, and Jefferson Proving Ground, IN, will continue operations.

Army Tests New Division Reorganization Concepts

More than 6,000 personnel from 38 artillery batteries recently participated in "FIREX 76," a major field exercise testing new Army division reorganization concepts featuring four howitzer battalions of eight guns rather than three batteries of six guns.

Examined also was a new multiple rocket launcher termed "The Slammer," under development at Redstone (AL) Arsenal. It has the capability of firing 114 2.75mm rockets in less than 30 seconds. Designed to train artillerymen to improve their ability to provide on-target and timely artillery fire under combat conditions, FIREX was conducted by XVIII Airborne Corps Artillery personnel.

8-Man Team Earns Patent for XM235 Machinegun

An 8-man engineering team from the U.S. Army Armament Command's Rodman Laboratory, Rock Island (IL) Arsenal, has been granted a patent for a lightweight machinegun described as having "one-half the weight, 40 percent fewer parts and half the production cost" of the Army's standard M60 weapon.

The XM235 Squad Automatic Weapon (SAW) was selected through competitive evaluation as having "the most potential to fulfill Army requirements for increased firepower and mobility in infantry rifle squads."

More commonly referred to as the Rodman gun, the new weapon earned a patent award for Curtis Johnson, head of the engineering development team, Lonnie Atweiler, Fred Skahill, Doyle White, Richard Wulff, Larry McFarland, Keith Witwer and Arthur Meyer.

The XM235 will not be adopted by the Army until a development contract is awarded, expected soon.

$2.2 Million Contract Orders 2 Twin Otter Aircraft

Acceptance of its first full-warranty (for one year) aircraft, the UV–18A Twin Otter, for the Alaskan National Guard, was announced recently by the U.S. Army Aviation Systems Command (AVSCOM).

The $2.2 million contract with DeHavilland of Canada calls for delivery of two aircraft, plus a year's supply of spare parts and related equipment, as well as flight training for the Army crews. The twin engine UV–18A carries a 2-man crew, 20 passengers, and can be converted to ferry up to 4,341 pounds of cargo 100 nautical miles.

The Twin Otter is designed for use at remote locations and it can be fitted with pontoons, wheels or skis. It has been used by the Canadian armed forces.

An Appeal for Aid to Those Desiring Our Magazine

May the *Army Research and Development Newsmagazine* staff hope for your full cooperation in helping to alleviate a problem that persists despite all the instructions and appeals that have been made for two years?

If your response is wholehearted, perhaps the result will increase our readership, save a lot of time spent by long- distance telephone callers complaining that their agency or unit is not receiving enough copies of the *Army R&D Newsmagazine* to go around—many callers say "it never filters down to me"—and minimize time required by our staff to explain what to do.

Until the Army Ad Hoc Periodicals Authorization Review Committee started swinging the broad axe to cut down costs of what a commercial journal brought to the attention of Congress as "the Pentagon Publications Empire," demand distribution for our publication under the DA Form 12–4 system was averaging about 60,000 copies

Nearly two years ago a new DA Form 12–5 system of requesting Army periodicals was effected. Requesters were put under a formula distribution—a limitation of copies according to a grade structure. If requirements of our readers at that time were not resubmitted by the agency or installation printing control officer within a given time— and revised thereafter periodically, according to a current certification—an automatic cutoff resulted.

OUR APPEAL TO YOU IS: Whenever you hear anyone complaining about not receiving the *Army R&D Newsmagazine*, refer them to the *required procedure for submitting a request which appears on page 1 of each edition.* HELP THEM TO LOCATE A COPY if one is not readily available within an agency—or refer them to the Administrative Officer or Printing Control Officer for aid.

The solution of the problem, of course, is submitting a revised DA Form 12–5 without delay.

DoD Directive Details Metric System Policies

Policies relative to U.S. Department of Defense use of the metric system of measurement, in conformance with Public Law 94–168 which provides for increased use of the system, are detailed in a new DoD Directive 4120.18.

Guidance is provided for introduction of the metric system at an evolutionary pace to keep abreast of conversion activities in the industrial community. Metric units will be used in design of new weapon systems and equipment when there are no significant technical or cost penalties. Metric conversion of existing designs is discouraged.

Intended to foster a favorable climate for metric use, the Directive 4120.18 is intended to foster more effective standardization among members of the North Atlantic Treaty Organization, and to facilitate use of metric measurement units in joint production programs. The U.S. is the only nonmetric NATO member.

Directive Establishes Affirmative Action Board

Department of Defense Directive 5120.46 establishes an Affirmative Action Board to promote increased employment and promotional opportunities for women and minority group members in executive positions.

Board responsibilities include creation of an Executive Search Group to provide guidance on opportunities and selection criteria relative to staffing of positions in grade GS–15 and above.

All actions will be in full compliance with merit system requirements and the Secretary of Defense will be advised periodically on the status and progress of all DoD elements in meeting stated goals.

Chaired by the Assistant Secretary of Defense (Manpower and Reserve Affairs), the AAB will include representatives from the military departments, Defense Logistics Agency, OASD (Comptroller) and (M&RA) and Deputy Assistant Secretaries of Defense (Administration), (Equal Opportunity) and (Civilian Personnel Policy).

White Sands Schedules Additional Aries Launches

A record-breaking single-stage rocket launch of 318.77 miles, established in January by an Aries I at White Sands Missile Range (WSMR), NM, will be followed by launches scheduled in March. The previous record was 260.9 miles.

The 14,000-pound Aries, 30 feet in length and 44 inches in diameter, set the record during tests designed to evaluate in-flight modifications incorporated into the over- all design. The launch was sponsored by the U.S. Naval Research Laboratory (NRL) and the Max-Planck Institute of Munich, West Germany.

The January launch at WSMR will be followed in March by a Max-Planck/NASA launch at Kiruna, Sweden, in support of the International Magnetospheric Studies Program. The Aries uses obsolete Minuteman I second stages for its propulsion system. The rocket's 10,500 pounds of solid propellant has a burn time of 60 seconds.

R&D News...

Army Scientist Managing Federal Technology Transfer Consortium

Program management of the Federal Laboratory Consortium for Technology Transfer, which in less than five years has expanded to embrace 70 U.S. Government laboratories and centers, is now the responsibility of an Army scientist detailed to the National Science Foundation.

Nick Montanarelli is an employe of Edgewood Arsenal, an element of the U.S. Army Aberdeen (MD) Proving Ground. In 13 years of Civil Service employment with the Department of the Army, he has amassed an impressive collection of honors.

Nick Montanarelli

Federal agencies participating in the FLCTT are representative of the Department of Defense, Army, Navy, Air Force, Transportation Department, National Aeronautics and Space Administration, Environmental Protection Agency, Small Business Administration, Department of Commerce, Veterans Administration, the Smithsonian Institution, General Services Administration, Department of Justice, Department of Interior, and the Energy Research and Development Administration.

The President's Mar. 16, 1972 Message to Congress on Science and Technology stated:

"Federal research and development activities generate a great deal of new technology which could be applied in ways which go well beyond the immediate mission of the supporting agency.... The government has a responsibility to transfer the results of its research and development activities to wider use."

Montanarelli's record shows selection for Edgewood Arsenal's R&D executive training, two Sustained Superior Performance Awards, a Certificate of Outstanding Achievement, some 20 Letters of Commendation, and several suggestion awards. Another honor was selection as a U.S. Department of Justice representative to the North Atlantic Treaty Organization Advanced Study Institute for the transfer of information on industrial technology.

During his Edgewood tenure, Montanarelli was instrumental in development of lightweight body armor currently in use by law enforcement agencies throughout the United States. He also is recognized for his prominent role in development and use of static and hand-held weapons detectors as one of the methods used to prevent airline hijacking.

Formerly an adviser to the Federal Bureau of Investigation Law Enforcement Assistance Administration, as well as the U.S. State Department, Montanarelli is credited with more than 40 technical publications.

One FLCTT approach is for a defense laboratory to perform civilian-oriented R&D work with funds provided by the requesting institution. These DoD R&D projects are directed toward application to civilian problems. Solutions usually are based on technology advances resulting from research performed for military requirements. Thus, the American taxpayer derives double benefit from military R&D expenditures.

Unlike the DoD labs, other members of the consortium are chartered and funded to work specifically in response to industrial and civilian community problems. Thus, they direct T^2 efforts toward increasing the use of research results by decision-makers in the public and private sectors.

In addition the consortium arranges for temporary exchange of scientists between federal agencies and between federal and local government organizations through the Intergovernmental Personnel Act.

Consortium laboratory personnel also assist state and local government agencies in a variety of nonrefundable ways, such as serving on scientific advisory boards, acting as consultants to specialized groups (e.g., law enforcement or pollution control agencies), providing library services and identifying sources of surplus government equipment.

Private industry also can benefit from the consortium through the acquisition of government patents originating from member laboratories. With these patent rights, the private company can produce and sell a product in the commercial marketplace without having to expend funds for basic R&D.

Each member laboratory has a technology transfer coordinator who can explain in detail about the consortium T^2 programs. In addition to representing their own laboratories, these individuals maintain contact with counterparts in other consortium labs; also, with other federal agencies (e.g., Environmental Protection Agency, U.S. Bureau of Mines, etc.), which have technology transfer programs but are not in the consortium.

Because of the nature of their activities, these T^2 representatives also are exposed frequently to new technologies developed by private industry, local and state governments. Coordinators thus become familiar with technical resources beyond their own labs. Consequently, they often serve as "technology brokers," bringing together the individual or agency that has a problem with those who already have solved the same problem or are working in the area.

This "broker service" has been especially useful for local (i.e., city and county) governments who are often unaware of the scientific support available in the federal laboratories.

The consortium maintains a permanent Washington representative located in the Office of Intergovernmental Science and Public Technology, National Science Foundation (NSF) - the position currently filled by Montanarelli.

The Federal Council for Science and Technology Committee on Domestic Technology Transfer has compiled a "Directory of Federal Technology," an index of the programs, resources and contact points at the federal level which can be drawn upon by government agencies and the private sector to achieve transfer of technology.

Published in June 1975, the 202-page directory includes the enabling legislation, missions and research bases for the Departments of Agriculture; Commerce; Defense; Health, Education and Welfare; Housing and Urban Development; Interior; Justice; Labor; Transportation; Energy R&D Administration; Environmental Protection Agency; Federal Energy Administration; General Services Administration; National Aeronautics and Space Administration; National Science Foundation; Small Business Administration; Veterans Administration; and the Smithsonian Institution.

Technology transfer contact locations for these agencies are included in the back of the index, along with each of the agencies' capabilities. T^2 involves agriculture, business and commerce, community development, construction, consumer protection, disaster prevention and relief, education, employment, labor and manpower, energy, health, housing, income security and social services, law, justice and legal services, science and technology, transportation, and natural resources.

Copies of the directory are on sale (price $4.30) by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Missile Command Reorganization Completed Jan. 31

Transition from the U.S. Army Missile Command to separation into two new elements of the U.S. Army Materiel Development and Readiness Command (DARCOM), involving about 8,000 U.S. Civil Service employes and military personnel, became effective Jan. 31.

MICOM's abolishment was followed by activation of the U.S.Army Missile Materiel Readiness Command (MIRCOM) and the U.S. Army Missile Research and Development Command (MIRADCOM), both charged with improved missile management.

Generally in line with recommendations of the high-level study group known as AMARC (Army Materiel Acquisition Review Committee), appointed by the Secretary of the Army, the reorganization separates essentially all supply and maintenance (readiness) functions from missile R&D activities.

Although the realignment of responsibilities involved moving about 1,000 employes to different jobs, the remainder of the working force was impacted minimally. They are drawing the same pay, performing in general the same tasks they did in MICOM, and working in about the same locations.

MIRCOM has management responsibility for the Chaparral and Hawk ground-to-air missile systems, Dragon and TOW antitank weapons, Lance surface-to-surface missile, and various target missiles.

Systems assigned to MIRADCOM for management include the Stinger and the U.S. Roland ground-to-air missiles; the 2.75-inch rocket and Hellfire, both helicopter weapons for ground attack; the new General Support Rocket System (GSRS) and the improved Pershing II, surface-to-surface weapons; Viper and other small rockets; Precision Laser Designators (PLDs) and high-energy laser systems.

Army Closing Sturgis Nuclear Floating Powerplant

"Feasibility mission accomplished" is now part of the 9-year operating history of the *Sturgis*, the world's first floating nuclear electric power generating plant - mounted aboard a converted Liberty Ship as a U.S. Army Corps of Engineers research and development project.

Battered by a severe storm early in January while being towed from the Panama Canal, where it provided auxiliary power from August 1968 until July 1976, the *Sturgis* was taken into port at Sunny Point, NC.

Damage was light, without release of radiation, and repairs are being made in the Savannah River nuclear disposal area, in accord with Nuclear Regulatory Commission policy.

When it is seaworthy again, the nuclear barge (built without a propulsion capability) will be towed to its "home port" at Fort Belvoir, VA, where it was operated initially. Expected to arrive in March, the vessel will be put through a decommissioning process for six to nine months. Then it will be towed to a long-term anchorage site, unannounced at press time.

Built at a cost of $19.1 million and dedicated Apr. 18, 1968, at Fort Belvoir, the *Sturgis* was the result of a concept originated in 1954, when LTG Samuel D. Sturgis Jr. was the Army Chief of Engineers. A contract was awarded in 1962 and research, development and construction completed in 1967.

From a commercial practicability viewpoint, as applied to its operation for the Panama Canal Co., the critical fault of the 10,000 kilowatt hour plant in the *Sturgis* is that it is too small to produce electrical power on a competitive cost-effectiveness basis at most sites for peacetime use—even with recent fossile fuel oil cost increases. Average lifetime operational cost, including salaries of the 70-man military crew (67 enlisted, including 43 trained as nuclear power plant operators), was about $2 million annually.

From the U.S. Army objective, that of providing a safe, reliable source of emergency power adequate to meet foreseeable emergency requirements, the *Sturgis* experiment was outstandingly successful. LTC Mark H. Magnussen, commander of the 535th Engineer Detachment which operated the plant at the Panama Canal, commented about its final operation.

"During the fourth quarter of FY 1976, our operational availability was better than 99.0 percent. That exceeded the availability of all 58 commercial nuclear power plants in the United States. In fact, our availability operation for the entire year also exceeded that of all commercial plants - 72.4 as compared to their 69.6 percent."

Except for the fact that such a capability would have exceeded any anticipated military requirement, he said that a 100,000 KWH plant (10 times as large) could have been built in the *Sturgis* in about the same space. That could have resulted in cost effectiveness more favorably competitive with commercial plants.

"Our basic goal was achieved," LTC Magnussen said. "The U.S. Army Corps of Engineers nuclear power R&D program demonstrated that we can design, engineer and operate, safely and reliably, a floating vessel nuclear source of electrical power adequate for any foreseeable emergency military requirement.

"Our experience showed, however, the importance of economic and political considerations in employment of this type of plant."

The nuclear power plant in the *Sturgis* is capable of providing about 200 million kilowatt hours of electricity annually on a load of fuel.

Four options for decommissioning the *Sturgis* are under consideration, LTC Magnussen said. One option is a "layaway" plan that would require removal and disposal of all solid and liquid radioactive material. The vessel would then be manned and monitored about 50 years.

A "protective storage" option would require removal and disposal of all radioactive material, constructing seal-up barriers to contaminated areas, and keeping protective systems operating, with on-board surveillance. Essentially, this would be "mothballing" for future use.

A third option is to remove salvageable uncontaminated parts, encapsulate in concrete contaminated portions, and to provide continuing unmanned surveillance. The fourth option is total dismantling and safe disposal of the nuclear plant and all contaminated materials.

Additional options composed of two or more of the four options are under consideration. With the exception of dismantling, each option would require continuing maintenance and surveillance for about 50 years.

The Army Nuclear Power Program was established in 1952 as part of a joint U.S. Atomic Energy Commission and Department of Defense effort to demonstrate the feasibility of using nuclear sources to generate electrical power and heat for requirements in remote areas where fuel logistics was a problem.

In April 1957, a pressurized water nuclear plant at Fort Belvoir was the first of its kind to be interconnected with a commercial power system. The SM-1 was used for 16 years to train more than 1,000 operators, technicians, engineers and managers for all U.S. Armed Forces.

Serving now as a visitors center, the SM-1 was shut down in 1973. The plant used in the *Sturgis* was designated the MH-1A.

Army R&D progress in mobile medium-sized nuclear power plants was evidenced in 1962 by the SM-1A at Fort Greely, AK; the PM-1, operated by the Air Force at Sundance Radar Station, WY; the PM-2A at Camp Century in Greenland; and the PM-3A, operated by the Navy at McMurdo Station, Antarctica.

While the Army no longer has any operating nuclear power plants, the Corps of Engineers is still actively involved in nuclear research and development. Currently, major effort is being placed in analyzing the feasibility of using nuclear power plants on large installations to provide steam, process heat, and electricity.

ERDA is cooperating in the evaluation of using waste radioactive materials from commercial nuclear plants to produce heat for military installations. Efforts are also under way to investigate and evaluate the use of underground nuclear power plants, radioisotope thermionic power generators, and gamma radiation for teritiary treatment of sewage and clean-up of waste water from military activities.

$5.6 Million Allocated for Production of 200 LDNS

Production of 200 AN/ASN-128 Lightweight Doppler Navigation Systems (LDNS), the first designed for fleetwide application to U.S. Army aircraft, will be accomplished under an initial $5.6 million contract awarded early in January.

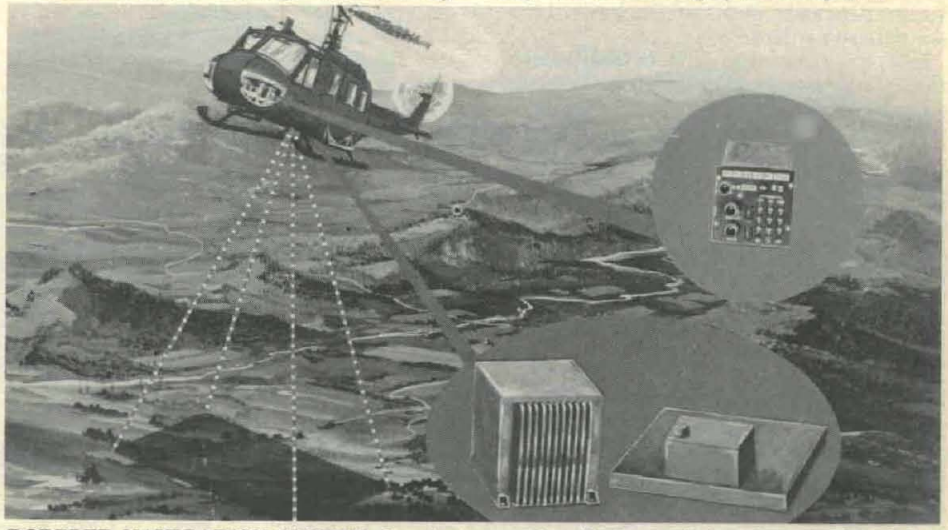
Scheduled for installation in Cobra AH-1S, Utility Tactical Transport Aircraft (UTTAS), and Advance Attack Helicopters (AAH) during mid-1978, the units will be produced by the Kearfott Division of the Singer Co., Little Falls, NJ. Plans also are being made to use the LDNS in CH-47 medium-lift aircraft.

U.S. Army Electronics Command (ECOM) scientists describe the LDNS as a lightweight, self-contained, low-cost, accurate unit that needs no signal from a ground-reference point, greatly reducing vulnerability to electronic countermeasures.

Four radar signals to the ground (shown by broken lines in the photo below) serve to measure the doppler effect between the transmitted and received signals when data are fed into a minicomputer for comparison with each other and with a ground-reference point inserted before or during flight. The computer then feeds the data to a control-display unit on the aircraft's console.

The cockpit display permits digital presentation of present position, pre-determined way points, course or distance off course, targets, range and compass bearing, ground speed, wind speed and direction.

A Reliability Improvement Warranty (RIW) clause to the contract calls for servicing and repair of the LDNS units by the manufacturer for approximately four years. This is an incentive to design and produce a system that will meet requirements for a highly reliable system.



DOPPLER NAVIGATION SYSTEM showing computer display unit (top insert), signal data converter (bottom insert, left) and receiver-transmitter antenna (right).

AMRDL Reports on Major Accomplishments During FY 1976

Quick response to technical and management support requirements of the Remotely Piloted Vehicle (RPV) program of R&D is listed among major accomplishments in the FY76 annual report of the U.S. Army Air Mobility R&D Laboratory. AMRDL is under control of the U.S. Army Aviation Systems Command (AVSCOM), St. Louis, MO.

Director Dr. Richard M. Carlson manages AMRDL as a unit, but its four directorates are geographically dispersed. The Ames Directorate is at Moffett Field, CA, the Eustis Directorate at Fort Eustis, VA, Langley Directorate at Hampton, VA, and Lewis Directorate, Cleveland, OH.

The AMRDL report lists, as key executive items, support provided to Source Selection Evaluation Boards (SSEB) and to technical risk assignments requested by AVSCOM. TRAs include the AQUILA RPV, the AH-1Q Improved Main Rotor Blade, and the OH-58A Main Rotor Mast.

Other special assistance included acoustic signature evaluations of all four AAH and UTTAS candidates, utilizing a far-field, in- flight measurement technique developed by the AMRDL Ames Directorate.

A significant action reported by AMRDL resulted in cost savings of about $300,000 for an antenna modification on the RU-21H Gardrail aircraft. The 18 antennas on this system were failing after 500 to 1,000 flight hours. Using the expertise developed on composite materials under the technology base programs, the Eustis Directorate developed, tested and installed an inexpensive field repair for the antennas.

The report lists several accomplishments in laboratory management including actions that have contributed to and expanded the DARCOM Field Engineer Program and the AMRDL/TRADOC Liaison Program.

Including a 9-page listing of titles and authors of technical presentations and publications, the report is a 47-page document. *Army Research and Development Newsmagazine* authorized page space does not permit mention of the listed AMRDL technical achievements. A brief outline of some of the more significant projects, divided into 6.1-Research, 6.2-Exploratory Development, 6.3a-Advanced Development, and 6.3b-Laboratory Support Action, follows.

AIRMOBILITY PROGRAM, Category 6.1, *Aerodynamics*. A wide range of effort was directed to advancing the fundamental areas of aerodynamics. R&D activities included 2-D airfoil sections, rotary-wing airfoil dynamics stall, rotor flow-field test techniques, aerolastic stability analysis, a rotor dynamics model, and high-speed helicopter impulsive noise.

Propulsion. Conducted jointly by the Lewis Directorate of AMRDL and Lewis Research Center of NASA, basic research was directed toward solving special problems involved in development of small gas turbines (20-lb/sec airflow), and investigation of advanced concepts in mechanical devices employed in drive trains.

Structures. Research in developing safe and economical ways of transmitting loads throughout an aircraft, with minimum weight penalty, was conducted largely by the Langley Directorate with support from Watervliet (NY) Arsenal. Investigations included composite materials, adhesive bonding, fatigue analysis, and analysis/design of composite structures.

Mathematics. Basic mathematical research efforts were directed to solution of problems of aerodynamics, propulsion, structures, and decision analysis - to fill technological needs and requirements of advanced airmobile systems.

AERONAUTICAL TECHNOLOGY PROGRAM, Category 6.2, *Aerodynamics Technology*. AMRDL effort in exploratory development of aerodynamics is continuing in the 6.1 technology subdisciplines of fluid mechanics, dynamics, flight control and acoustics. The work is shared by the Ames, Eustis and Langley Directorates.

Areas of R&D included the controllable twist rotor, rotor test apparatus, helicoptor flow field and drag, handling qualities and man-in-loop simulation.

Structures Technology. The Langley and Eustis Directorates' investigations to improve aircraft structures were concerned with design criteria, weight reduction, material engineering, internal/external loads, and fatigue methodology for design of helicopters.

Propulsion Technology. The 6.2 propulsion activities, conducted by the Eustis and Lewis Directorates, involve inlet protection devices, compressors, combustors and emissions, turbines, controls and accessories, and drive trains.

Reliability and Maintainability. R&M efforts, also concentrated in the Eustis and Lewis Directorates, included development of an Aircraft R&M Simulation (ARMS) Model for UTTAS cost and operational effectiveness analysis (COEA), a diagnostic logic model test set, ground base reliability testing, and a superhard aircraft canopy coating.

Safety and Survivability. Eustis Directorate development efforts included programs in flight safety, UTTAS seat testing, ballistic protection, signature reduction and vulnerability reduction (VR). Considerable effort was expended on defining the VR efforts that should be pursued, specifically the OH-58C and AH-1S

Ware Center Completes Tests on 2 Weapons for AAH

Extensive tests made on two 30mm weapon candidates for the Advanced Attack Helicopter (AAH) were completed recently at the Ware Simulation Center, Thomas J. Rodman Laboratory, Rock Island, (IL) Arsenal.

Known as the Data Acquisition Test (DAT), the project involved performance evaluation of data on the XM188 3-barrel gatling-type weapon built by General Electric, and the XM230 single-barrel weapon by Hughes Helicopters.

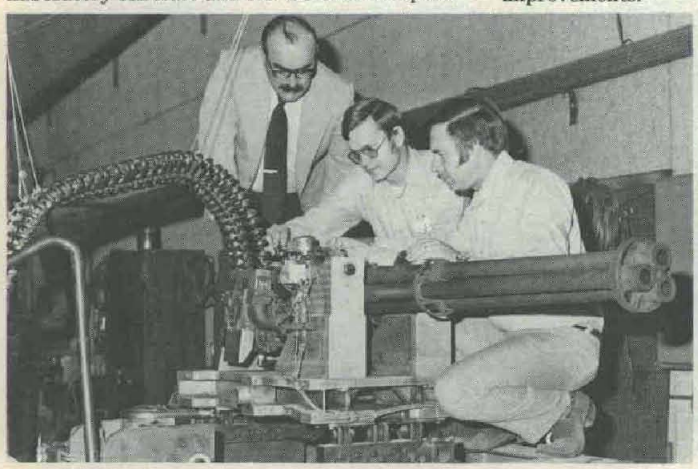
To acquire data on performance and operational parameters of the weapons in rigid-mount and aircraft-simulated test fixtures, two weapons of each type were fired about 25,000 times, expending more than 1,000 rounds at temperatures ranging from 165° to −65° F. Twenty-eight data items including recoil forces, accelerations and motions, accuracy and dispersion pattern were collected.

DAT was initiated in 1973 by the Rodman Laboratory Aircraft and Air Defense Weapons Systems Directorate as a multimilion-dollar effort to provide the project manager with adequate information on which to base the AAH weapon choice.

Engineers and technicians by working 6-day weeks, 12 hours each day since the weapons were delivered by the contractor in March 1976, completed the test and delivered a preliminary summary to the AAH Source Selection Board in September. Information needed was delivered three years ahead of schedule.

The indoor testing, which included one- and six-degree-of-freedom simulators, was uninterrupted by weather and aircraft maintenance, resulting in estimated savings of nearly $1.4 million. Conventional test methods would have required many aircraft and vehicle mounts to acquire the range of DAT information collected.

Test results will be considered in future design efforts for necessary weapon and mount improvements.



XM188 mounted on one-degree-of-freedom simulator at RIA

XM230 subjected to extreme cold conditions during DAT.

flight-control systems and transmissions.

Mission Support. Cargo handling and ground support equipment received primary attention from the Eustis Directorate in technological development directed toward improved effectiveness of military operational capabilities of Army aircraft, particularly in the forward areas.

Aircraft Systems Synthesis. The Advanced Systems Research Office, AMRDL HQ, and the Systems Research Integration Office, St. Louis, performed evaluation of advanced aircraft concepts, analysis of Army aviation R&D programs, orderly planning and programing of Army aviation R&D, and focal point activities for Army airmobile R&D.

Aircraft Subsystems. This project is a new start in FY76 which will provide visibility to technological development efforts of aircraft subsystems that have been overshadowed in the past by subsystem RAM programs and/or off-the-shelf equipment.

The objective of the project is to advance the state-of-the-art for Army aircraft subsystems so that significant improvements in operational effectiveness and/or reduction in life cycle costs can be achieved. Among projects in this area are the Nickel-Cadmium Battery and Helicopter Ice Protection.

RPV Supporting Technology. RPV activities conducted by the Eustis Directorate seek to eliminate technological voids in air mobility which hamper development of mini-RPVs (less than 200 pounds) for military applications.

The key air mobility disciplines necessary to the development of mini-RPVs are propulsion, launch and recovery, survivability/vulnerability, RPV configuration, structures and flight control.

Aircraft Weapon Technology. The Army aircraft weaponization program provides the capability of delivering ordnance to destroy, neutralize, or suppress those targets jeopardizing ground or airborne forces in the conduct of the land combat role. Among projects at AMRDL are Precision Gun Point and Constant Recoil, Automatic Target Cueing, and Common Ammunition and Gun Technology Test Bed.

ADVANCED TECHNOLOGY PROGRAM, Category 6.3, *Tilt-Rotor Research Aircraft.* In this joint Army-NASA program, engine acceptance, canopy proof load, canopy ballistic jettison, and ejection seat ballistic tests were completed to demonstrate advanced technology pertaining to the tilt-rotor aircraft concept. Bench tests of the transmission and engine coupling gear box as well as most other major components also were completed.

Rotor System Research Aircraft. The RSRA program, also a joint Army/ NASA effort, will provide a flight research capability to evaluate the potential of promising new advanced rotor concepts, verify numerous areas of supporting research technologies, and test product improved rotors.

Advanced Rotor Technology. Development of a bearingless main rotor concept, the advancing blade concept, and a second-generation comprehensive helicopter analysis system are listed in the annual AMRDL report among major objectives in this area.

Other programs in Category 6.3 are being conducted on advanced aircraft structures, propulsion, reliability and maintainability, cargo handling equipment, remotely piloted vehicles, helicopter ice protection, and an in-flight simulator.

AMRDL's FY76 report also features information relative to miscellaneous support actions, managerial and operational systems, patent awards, special activities, and major facilities available for Army and aviation community research and development activities.

Battelle Forecasts $42.925 Billion for R&D During 1977

Federal Government research and development funding during CY 1977 is estimated at $22.655 billion, up $2.535 billion (12.5 percent) from 1976 - 52.8 percent of the national projection of $42.925 billion for R&D.

Industrial funding is forecast at $18.750 billion (43.7 percent of total) an increase of $2.2 billion or 13.3 percent from 1976. Academic institution funding is estimated at $800 million (2.1 percent) and non-profit organizations $640 million (1.5 percent).

Projections were prepared by Dr. W. Halder Fisher and assistants Dr. S.R. Simon, Ms. K. Smoler Smith and Ms. Melanie A. Mees at the Battelle Columbus (OH) Laboratories. Computations are based on data from the National Science Foundation, McGraw-Hill Annual Survey of Business Plans for R&D Expenditures, and analyses by Battelle's Department of Resource Management and Economic Analysis.

A national increase of $4.835 billion (12.7 percent) over the $38.090 billion that the NSF estimates was actually spent for R&D in 1976 is forecast, with more than half of this increase (7.2 percent) attributed to inflation.

Federal R&D increases impact from three sets of interacting forces: increased emphasis on energy problems, inflation, and a continued favorable congressional attitude toward national defense R&D.

Little change in R&D funding patterns is anticipated in 1977, due primarily to the federal government fiscal year starting in October rather than July. The Battelle forecast anticipates that President Carter will be able to exert little influence on 1977 federal R&D budgets.

Four agencies are expected to account for almost 87.7 percent of total 1977 federal R&D funding: Department of Defense, 47.8 percent; National Aeronautics and Space Administration, 15.1 percent; Energy R&D Administration, 14.0 percent; and the Department of Health, Education and Welfare, 10.8 percent. The NSF, Department of Transportation and the Environmental Protection Agency will share about 5.6 percent.

Emergence of ERDA as the fastest growing source of R&D programs reflects the continuing national concern for finding solutions to energy problems. Nuclear energy R&D remains the largest but geothermal, solar and "advanced energy systems" programs are growing fast.

Industrial and academic sectors remain two of the faster growing areas of national R&D funding. Between 1971 and 1976, industrial funding increased by 53 percent and academic funding by 54 percent, both faster than government or nonprofit sectors.

Industries expected to increase R&D support faster than the average sector are lumber and wood products; furniture; chemicals and allied products; stone, clay and glass; transportation equipment and missiles; and miscellaneous manufacturers.

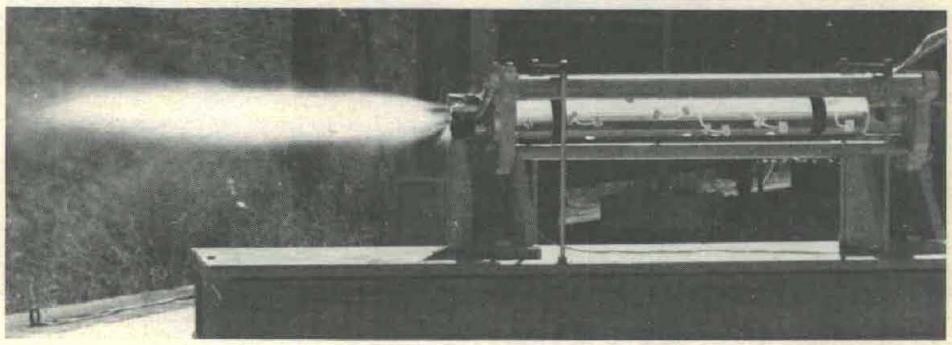
Fabricated metal products, petroleum extraction and refining, and rubber products are expected to reduce R&D support while electrical equipment and communications will expand.

Battelle indicates that the recent shift from basic research to more pragmatic (applied) research has changed the nature of industrial R&D. This trend is attributed to federal emphasis on environmental protection, health and safety of workers and consumer issues.

The forecast observes that more and more R&D effort in recent years has been directed toward these areas to limit corporate liability. Previous R&D activity was keyed to product or process improvement. Uncertainties generated by inflation forced the business community to alter its attitude regarding long-term investments. Greater emphasis is now placed on short-term cost reductions.

Despite U.S. Government dominance in research funding, performance of R&D by industry is expected to rise to $30.030 billion (70.0 percent). This contrasts with 14.7 percent by government, 12.2 percent for academia and 3.1 percent for nonprofit organizations. Between 1971-76, industry increased its R&D performance by 45 percent, academia 47 percent, the government 35 percent and the nonprofit sector 18 percent.

Relative to the composition of R&D activity, the expected pattern is one of stability and slow change. Federal regulations, energy, and science and technology-base problems will provide the major impetus for change. The proportionate composition of R&D funding and performance are expected to change very little.



U.S. ROLAND surface-to-air missile is shown during propulsion unit tests at Boeing Aerospace Co. facilities near Seattle, WA. The firings are part of a qualification program leading to fabrication and testing of complete missiles. Boeing's Army System Division is principal subcontractor to Hughes Aircraft Co., and a joint licensee for U.S. manufacture of the Roland, a European-developed system. BG Frank P. Ragano is Roland project manager and his office is located with Army Missile Research and Development Command, Huntsville, AL.

Major R&D, Materiel Acquisition Contracts Total More Than $716 Million

Research, development and materiel acquisition major contract awards (each over $1 million) by the Department of the Army from Dec. 16 through Jan. 7 totaled more than $716 million—including $224.5 million issued through the U.S. Army Aviation Systems Command (AVSCOM), headquartered at St. Louis, MO.

The largest AVSCOM award (two contracts totaling $144,623,306) went to United Technologies Corp., Sikorsky Aircraft Division, to accomplish the UH60A helicopter maturity phase, verification testing and producibility engineering planning (Phase II); also, procurement of UH60A helicopters and related supplies and services.

General Electric Co. will receive $49,450,813 in three contracts for procurement of T700-GE-700 engines and related supplies, services and data for the UTTAS program. Beech Aircraft Corp. was awarded an economic adjustment of $16,011,360 for C12A aircraft.

Textron, Inc. (Bell Helicopter Textron Division) gained two contracts, a $7,194,000 for UH-1H helicopters, and an $3,500,000 modification for development of universal turret and stores management subsystems for the AH-1S.

AVCO Corp. was awarded a $2,815,758 contract for T53-L-13B turbine engines, and $1,204,658 for remanufacture of T53-L-11A engines to the T53-L-13B configuration.

The U.S. Army Tank-Automotive Materiel Readiness Command (TARCOM), Warren, MI, awarded contracts totaling $194,519,918. The largest individual award, $71,060,855, went to Teledyne Continental Motors as a modification of a contract for AVDS-1790-2D engine assemblies for the M48 chassis for the Armed Vehicle Launched Bridge, M88 vehicles, and M60A1 and M48A5 tanks.

FMC Corp. is being awarded a $54,220,800 modification to a previous contract for M113A1 vehicles. Three awards totaling $23,838,759 were issued to Chrysler Corp. ($21,375,182 for technical and technology support services for the M48/M60 family of tanks, and a $2,463,577 modification to procure additional facilities for XM1 Full-Scale Engineering Development).

A M General Corp. will receive $23,563,389 ($15,539,363 for M151A2 series trucks, $5,373,845 for M809 series trucks, and $2,650,181 for M44 series trucks). General Motors Corp. was awarded $9,317,676 ($5,476,176 for 6V53 diesel engines for M113A1 family vehicles, $2,076,000 for PX100-1 transmissions for M113A1 vehicles, and $1,765,000 for XTG-411-2A transmissions for M578 recovery vehicles and U.S. Roland vehicles).

Heil Co. will be paid $11,048,839 as a third increment to a 3-year procurement contract for M857 semitrailer tankers. Norris Industries, Inc., was awarded $1,469,600 for solid- rubber-tire wheels for M551 vehicles.

The *U.S. Army Missile R&D Command (MIRADCOM)* and *U.S. Army Missile Materiel Readiness Command (MIRCOM)* at Redstone Arsenal, AL, issued contracts totaling $118,605,520, as follows:

MIRADCOM: Aeronutronic Ford Corp., $1,027,743 for R&D of SIAM, Phase IIa (control flight demonstration).

MIRCOM: Raytheon Co., $81,981,091, of which $31,771,040 is for MIM 23B Guided Missile Intercept Aerial for Hawk Missile System; $24,386,971 for Hawk ground support equipment; $21,726,250 for Dragon Guided Missile Launchers; $4,096,830 for modification kits for Hawk missiles and ground support equipment.

Emerson Electric Co., $24,890,299 contract modification (CM) for TOW launcher components; Kollsman Instrument Co., $3,260,838 (CM) for Dragon Missile Tracker Tests Sets, and $2,909,427 economic price adjustment contract for Dragon Missile System Infrared Trackers.

Texas Instruments, Inc., $2,001,842 for TOW CCM supplemental kits for the Land Combat Support System; Beech Aircraft Corp., $1,500,000 CM for AQM-37A target missiles; and Champion Co., $1,034,280 for containers.

Ballistic Missile Defense Systems Command (BMDSC), Huntsville, AL. System Development Corp. was awarded a $3,481,858 CM for continuation development of data processing analysis and evaluation in support of the Ballistic Missile Defense Advance Technology Center.

The *U.S. Army Armament Command (ARMCOM), Rock Island, IL,* issued contracts totaling $65,616,819. General Electric Co., Armament Systems Department, will receive $43,780,000 for M163A1 (20mm self-propelled) and M167A1 (20mm towed) air-defense guns.

AEL-Emtech Corp. was awarded $11,146,920 for AN/VPS-2 range-only radar less the x-band component kit; Optic Electronic Corp., $5,079,218 for M105D telescopes, and M32, M32E1 and M35E1 periscopes; and Sperry Rand Corp. $1,656,000 for helmet sight subsystem for AH-1S helicopters.

Hamilton Technology, Inc., will be paid $1,507,500 for M577 fuzes for M483 projectiles; Honeywell, Inc., $1,240,181 for stabilization systems and modification kits for M60A1 tanks; and National Presto Industries Inc., $1,207,000 for M1 105mm high-explosive projectile parts.

U.S. Army Frankford Arsenal, Philadelphia, PA, awarded a $22,500,000 CM to Hughes Aircraft Co. for AN/VVG-2 laser rangefinders, XM-21 solid-state computers and XM-21 reticle projectors.

U.S. Army Picatinny Arsenal, Dover, NJ, awarded $13,700,000 to Honeywell Inc. for 155mm M731 and M692 projectiles and firing train test housing; also, $1,100,756 for M811, GM, high-explosive Lance fuzes.

U.S. Army Watervliet (NY) Arsenal awarded $1,663,886 to Ladish Co. for 105mm M68 cannon breech ring body forgings.

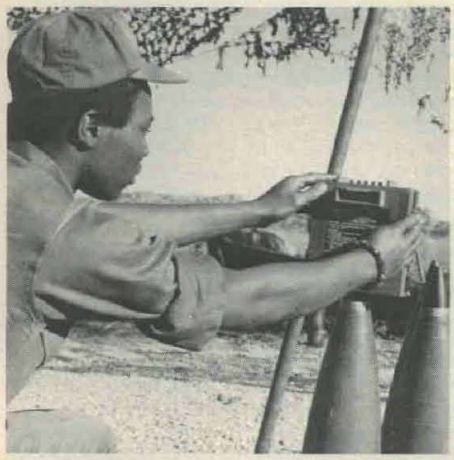
U.S. Army Electronics Command (ECOM), Fort Monmouth, NJ, awarded contracts totaling $62,257,589. Hughes Aircraft Co. received a $27,007,755 CM for Phases I and II of the Artillery Locating Radar, AN/TPQ-37;

E S L, Inc. was issued a $9,239,189 CM for Guardrail V system and ancillary equipment, and $7,616,762 for the AN/TSQ-114 Detecting System, and equipment and ancillary items.

The Singer Co. will get $5,660,925 for AN/ASN-128 Lightweight Doppler Navigation Systems; Motorola, Inc., $3,757,457 for RO-495 silver film processors; U.S. Small Business Administration (USSBA), Region IV, Atlanta, GA, $2,247,104, and USSBA, Bala Cynwyd, PA, $1,200,800 for AN/ASM-189A semitrailer-mounted electronic shops.

Numax Electronics Inc. will receive $2,634,271 for AN/VSS-3 one-kilowatt searchlights with adapter kits and technical data; Litton Systems, Inc., $1,831,576 for AN/ASN-86 inertial navigational sets and MT-447/ASN-86 gyro-stabilized platform mounts; and ITT Corp., $1,060,750 for AN/PVS-5 NV goggles.

The *U.S. Army Troop Support Command, St. Louis, MO,* awarded three contracts totaling $7,878,172. Brunswick Corp. will receive $3,355,200 for expandable shelters on the Transportable, Self-Contained Medical Unit; G. W. Galloway Co., $3,277,005 for scissor type, armored vehicle launched bridge; and Penn Metal Fabricators Inc., $1,204,658 for trailer-mounted field kitchens.



XM587 ELECTRONIC TIME FUZE is set instantaneously with an XM36 setter that checks and verifies fuze electronics prior to firing. The fuze was tested during a recent Helbat VI firing conducted by the U.S. Army Artillery School, Fort Sill, OK. It was modified by the U.S. Army Harry Diamond Laboratories (HDL) so that the desired setting could be calculated and introduced into the setter directly from a battlefield computer, thus eliminating the need of a man to determine and enter the required information into the setter. Based on this test, using also an M564 mechnical time fuze for control comparison, HDL scientists and the U.S. Army Human Engineering Laboratories (HEL), Helbat VI test sponsor, have theorized that the saving of precious seconds, as well as near-perfect set times, can be used in all fire control computer systems.

SKID-MOUNTED firefighting unit designed to fit in a pickup truck for getting to a burning aircraft in a hurry - possibly in one-third the time it takes heavier fire trucks - is demonstrated by Charles L. Deane, project engineer at the U.S. Army Mobility Equipment R&D Command, Fort Belvoir, VA. Aqueous film-forming foam (AFFF), a low-expansion synthetic foam that leaves a thin film which prevents reignition, and halogen 1211, an inert gas that hangs low and suffocates the fire, are two of the agents used with the new firefighting unit, which has finished testing and is awaiting adoption.

AMMRC Tests Show 'Long Service' From Ceramic Bearings

Experimental fabrication of ceramic roller bearings that have exhibited "an extremely long service life in tests" is reported as a part of the Manufacturing Methods and Technology (MM&T) Program at the U.S. Army Materials and Mechanics Research Center (AMMRC).

AMMRC research scientist George Harris reported on the new surface experimentation as a joint MM&T task involving the AMMRC and the U.S. Army Troop Support Command (TROSCOM). He is employed in the Ceramics Division, Materials Development Laboratory.

Roller bearing elements were fabricated of hot-pressed silicon nitride, grades HS-110 and NC-132. The effect of surface finish on the rolling contact fatigue (RCF) life was investigated using 27 surface finish variations. Methods ranged from finish grinding with silicon carbide wheels to lapping or honing with diamond and tin oxide.

Bearings with several of the smoother surfaces exhibited an RCF life greater than 50 times the life expectancy of M-50 steel bearings and more than twice the life of the best silicon nitride bearing elements previously tested. For the best bearing surfaces, RCF life could not be calculated as bearing failures did not occur after more than 100 million cycles at 800 ksi (1,000 pounds per square inch) Hertz stress.

The normal failure of standard M-50 steel roller bearing elements occurs at 2 million cycles at 700 ksi Hertz stress. Because of the long test times and the large number of bearings tested, it was not possible to predict the ultimate bearing life. It was noted, however, that the post-test surface finish on long-lived bearing elements was substantially equal to, and in some cases better than, the pre-tested surface finish.

Ceramic bearings are being considered in Army applications where low mass density (3.24 g/cc), long life, higher operating temperatures or short term operation under lubrication-starved conditions are required.

APG Dumped Tires Aid Ocean City Fishing Reef Project

Disposing of used, unserviceable tires often presents problems for organizations concerned about protecting the environment. Until recently this fact applied to Aberdeen (MD) Proving Ground - until an ecological "call for help" came from officials in Ocean City, MD.

Suitable waste materials were needed to help build two mile-long, half-mile wide fishing reefs. APG responded with an offer of more than 15,000 "dumped" tires.

The new reefs hopefully will result in better fishing for vacationing anglers. Ocean City Councilman William Purnell said the marine growth around the tires will attract plankton which, in turn, draws small bait fish to lure scavenger fish like porgies and seabass and larger predators such as bluefish and cobia.

Two large tire companies also are providing 20,000 tires monthly in addition to commitments from local county dumps.

APG's tire surplus was amassed over the last four years and will be transported to Ocean City by the Maryland National Guard's 1229th Transportation Truck Company, based in Salisbury, MD. Weekend hauls will tie-in with overall training requirements.

About 80 percent of the rejects are 16-inch and small automobile tires; 20 percent are large industrial types. APG ceased burning tires some years ago and throwing them into landfills creates a problem in that they have a strange way of often rising eventually to the surface.

The project has received approval from the U.S. Environmental Protection Agency and the Maryland Environmental Service (MES). The MES even purchased a $23,000 baler and loaned it to the city.

The baler presses 10 tires into a tied bundle about three feet high and weighing more than 200 pounds. Holes are cut into the tires to vent air. About 1,500 bales provide a barge load.

Bales are then strung on cables with a concrete-filled base spaced at intervals to serve as anchors and dropped at about 40-foot depths.

Ocean City officials estimate that up to 300,000 used tires a year will eventually be baled and barged for the two proposed reefs, located within a 3-mile radius.

Improved Casting Methods . . .

May Lead to Increased Horsepower, Fuel Economy

Substantial increases in gas turbine horsepower and fuel economy by improved casting methods and preoxidization treatment of columbium alloy components are envisoned by researchers at the U.S. Army Materials and Mechanics Research Center, Watertown, MA.

Milton Levy recently described some of the work AMMRC scientists and engineers are doing in efforts to increase the turbine inlet temperature (TIT) to the 2500 to 2600°F. (1371 to 1427°C.) range to increase fuel economy.

Levy said in currently used nickel-base alloy materials such an increase in TIT would necessitate adoption of transpiration-cooled blades and vane designs. Diversion of more air from the compressor and its introduction into the turbine for cooling, he said, would tend to cancel out benefits of higher TIT.

An alternative approach is the use of refractory metal alloy components with higher melting temperatures than nickel-base alloys. Columbium alloys appear the most prominent candidates because of favorable strength-to-weight ratios.

However, like other refractory metal alloys, columbium alloys lack intrinsic oxidation resistance to operate for long periods of service without an improved protective coating.

AMMRC effort has resulted in a preoxidation treatment that eliminates "pesting" (enhanced oxidation) in complex silicide coatings. Recently, with U.S. Army Aviation Systems Command support, the Solar Division of International Harvester Co. reportedly has optimized procedures for applying an NS-4 silicide coating to columbium alloy SU-31 and C-103.

The final treatment utilizes a preoxidation procedure developed by AMMRC. Thermal fatigue tests at 2500°F. (1371°C.) in a high-velocity simulated turbine environment were performed on NS-4 coated SU-31 alloy specimens with leading edge radii of 0.25 and 0.50mm (0.01 and 0.02 inches).

Test results showed that the coating gave excellent protection. No coating failures were observed after 500 thermal cycles of exposure (from 2500°F. to 500°F.). Further, columbium alloy vanes cast by REM Metals Corp. were satisfactorily coated by Solar Division as shown in Figure 1.

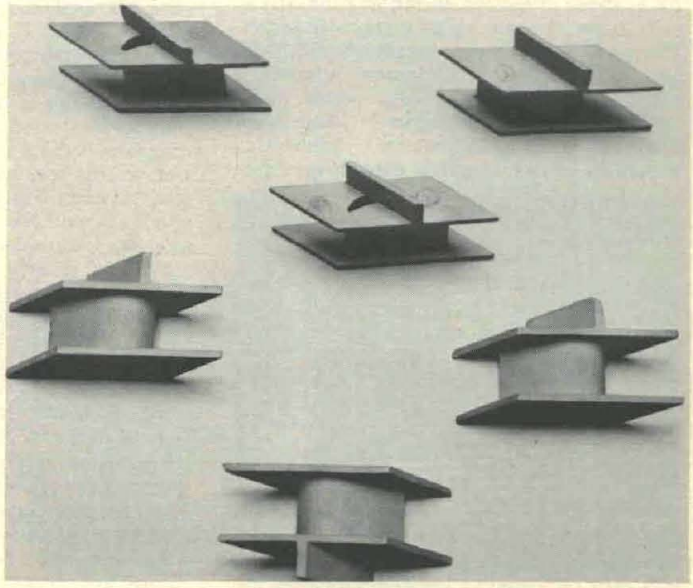
Work is being continued to demonstrate producibility of coated complex precision-cast columbium alloy nozzles for advanced turbine engines.

Scientist S. L. Lopata of the AMMRC reports that increasing the TIT by 400°F. could increase horsepower of a turbine engine as much as 20 percent without a change in design. Redesign to take advantage of higher TIT, he says, could increase horsepower as much as 55 percent.

The high melting point that promotes good high-temperature strength in columbium alloys adds to difficulties in casting the alloy into useful shapes. With the Army Aviation Systems Command, AMMRC researchers are exploring feasibility of commercially casting useful airfoil shapes of various configuration out of columbium alloys.

REM Metals Corp., working under contract, has cast representative vane configurations from columbium alloy C103. Vanes have been cast with solid cores, hollow cores with 0.060-inch wall thickness, and hollow cores with 0.040-inch wall thickness—the latter representing various size cooling passages.

With appropriate control of casting parameters, sound castings have been produced of all three configurations. Work is continuing, under contract with Solar, on refining the casting and coating techniques with a higher strength alloy, C129Y, and evaluating the resulting product. This is expected to lead to utilization of commercial columbium alloys in coming generations of more efficient gas turbine engines.



Columbium Castings

MERADCOM Traces Radioactive Eyepiece to Raw Materials Impurities

Considering the known harmful effects of over exposure to radioactivity upon the human body, imagine your response if inspection showed your eyeglasses were subjecting you to that hazard.

If you believe that possibility is a far-fetched assumption, you may be interested in reading about how the U.S. Army Mobility Equipment Research and Development Command, Fort Belvoir, VA, has spent some four years in coping with problems posed by such a discovery.

Investigation started when Steven Horne, employed in MERADCOM's Materiel Technology Lab Radiation Research Group (RRG), discovered a radioactive eyepiece while performing a routine radiation survey for the Electronic Command's Night Vision Laboratory at Fort Belvoir.

When he informed his supervisor, Bob McMillan, head of the RRG, the resulting assumption was that the glasses contained thorium, a rare radioactive element. Tests verified a concentration greater than 15 percent, as opposed to the regulatory maximum concentration of 0.05.

What to do about it? Trying to find the source of the concentration, determine the degree of hazard, and develop corrective measures led to a long and intricate series of actions. Night Vision Laboratory studies involved a maze of regulations, radiation dosimetry investigations, a look at glass maufacturing procedures, digging into medical library publications, and checking on nondestructive testing techniques.

Evident early in the investigation, McMillan stated, was that no requirement existed for thorium in the eyeglasses. Moreover, the radiation could not be detected by survey-type instrumentation.

Because many of the testing techniques for such low thorium concentration were either destructive or required a long time, the investigation involved development of eyeglass standards and the acquisition of special test equipment. Then another question was raised:

"Even though thorium concentration is less than 0.05 percent, can wearers of the eyeglasses receive more than maximum safe exposure in a given year?"

The answer to that query required study of the anatomy of the eye, identifying the critical cells and evaluating alpha energy deposition. The result: Safe exposure for an individual who uses an eyepiece with 0.05 thorium is less than 1,000 hours annually, McMillan reported.

After evaluating the degree of hazard, the RRG researchers traced the primary problem to impurities in raw materials used in manufacturing the glass. Next they developed techniques to control the acceptance of eyepieces from the manufacturer. Testing is continuing to insure that regulatory and contractual requirements are met.

RADIATION RESEARCH Group's Ed Heck works with Ratio Recording Spectrometer to measure transference and reflectance properties of liquid and solid materials.

Presumably this Materials Technology Lab research has been interesting to you. Would you like to know more about MERADCOM programs? If so, read on.

Radiation research is just one of seven groups of Materials Technology Lab effort. The others are chemistry and biodeterioration, metallurgy, organic and chemical coatings, packaging development, engineering, plastics and ceramics, and rubber-coated fabrics.

Officially, the over-all mission is research, development, engineering and evaluation of materials essential to support equipment and/or systems development - including fabrication, construction and maintenance, and assuring the best utilization of available materials.

"An end item is no better than the materials of which it is made," states the sign over the door to building 363, where the lab office and most of its facilities are located.

Emil J. York, Materials Technology Lab chief, said it exists primarily to support the work of MERADCOM's seven R&D labs, although it does do some basic materials research. Services include failure analysis, corrosion studies, chemical analysis of metals and materials, RDT&E (research, development, testing and evaluation) of organic coatings, investigation of product contamination, and environmental and biodeterioration of materials.

Instrumentation includes an energy-dispersive X-ray spectrometer, a scanning electron microscope, an infrared spectrophotometer, 314 and 1.5-meter emission spectrometers, a fluids particle counter, liquid scintillator, and a gamma spectroscope.

Facilities include capabilities electroplating and papermaking, a pilot plant for rubber, plastics and organic coatings, and equipment for testing the aging and weathering effects of oxygen, rain, heat, cold and salt.

"While the lab does some outside contract work," York said, "the bulk of our money comes from payment for the expertise and assistance we provide in support of specific MERADCOM projects - as varied as bridges and camouflage, fuels handling equipment, security sensors, compasses and air-cushion vehicles."

As an example of effort, he offered the development and ongoing revision of paint specifications for MERADCOM's camouflage paint pattern program by the Organic and Chemical Coatings Research Group (CCRG), currently headed by Fred Lafferman.

When the Army decided to use the patterns on most tactical mobility equipment, scientists in the Camouflage and Topographic Lab assumed responsibility to help insure that painting was done properly.

"To facilitate this effort," Lafferman said, "a fact sheet was prepared explaining the application procedure and how to deal with such variables as environmental conditions, thinner, primer, substrate and thickness of the sprayed coating."

Another example of the diversity of MERADCOM effort is the Chemistry-Biodeterioration Research Group, headed by Sid Levine. This unit was involved in a long-range project with the Electrical Power Lab to determine the feasibility of increasing the 100-hour oil change interval for the Department of Defense Family of Diesel Engine-Driven Generator Sets.

The result is an interim oil change policy by the project manager for Mobile Electric Power directing that the oil and oil filters be changed every 300 hours of normal engine running or after six months, whichever comes first - with estimated annual savings of $1.5 million.

The Materiel Technology Lab support is not restricted to direct involvement in long-term, high-cost projects. Personnel are available to answer questions, give advice and run simple tests that take from four hours to a few days.

The lab also handles unusual problems that may not be directly related to the development of a MERADCOM end-item. For example, the Rubber-Coated Fabrics Program identified the rubber components from a Russian mine marker so that identical substitute parts could be fabricated for evaluating the system.

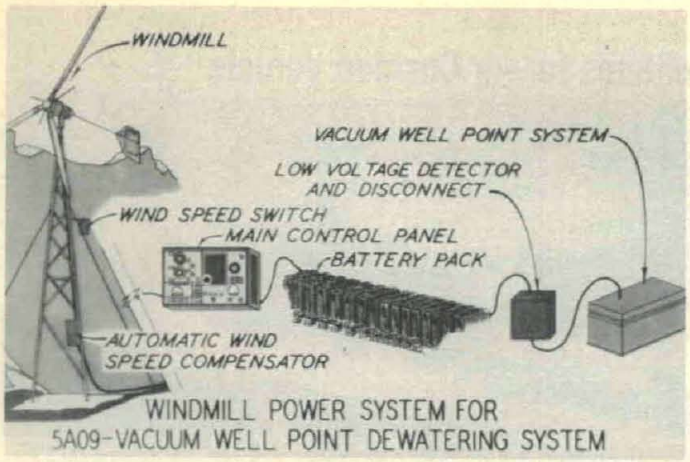
However, with MERADCOM's recent reorganization and the changeover in personnel during the past four or five years, York and his colleagues are a little worried that many project engineers and scientists who could use the lab's facilities and expertise are unaware that those resources exist within MERADCOM.

To deal with this potential problem the lab has published a brochure for distribution within MERADCOM listing its major equipment, facilities and problems it is equipped to handle.

Earlier in the year, the command also issued a new regulation detailing procedures each office and lab must take to insure that the Materiel Technology Lab is kept aware of their projected material and packaging needs as well as specific problem areas.

RUBBER-COATED FABRICS Research Group's Paul Touchet checks items for text in a cold box used in low-temperatures research to develop ozone-resistant rubber.

CHEMISTRY BIODETERIORATION Group's Frank Harris works with a Direct Reading 1½-Meter Spectograph used for spatial analysis of oils and rapid analysis of alloys and other metallic substances.



WINDMILL POWER SYSTEM FOR 5A09-VACUUM WELL POINT DEWATERING SYSTEM


SITE for dredged material disposal near Mobile, AL.

WES Wind System May Aid Dredged Material Disposal

Dredging the nation's waterways to keep them open for navigation - one of the major responsibilities of the U.S. Army Corps of Engineers in its Civil Works Program budgeted this year at $2.47 billion - involves an average annual disposal of more than 350 million cubic yards of dredged material.

The U.S. Army Engineer Waterways Experiment Station (WES), Vicksburg, MS, is conducting a nationwide research program to provide more economically feasible and environmentally compatible alternatives for dredged material disposal.

Scientists and engineers of the Dredged Material Research Program (DMRP), currently scheduled over a 5-year span at a projected cost of about $30 million, are investigating methods for improving the quality and reducing the volume of dredged material by dewatering.

Under consideration is the development of permanent disposal sites for drying, separating and rehandling the material so that it may be easily removed from the site, and treatment of contaminated material. Adequate sources of energy will be required to operate equipment at remotely located disposal sites.

In some instances commercial power or portable generating equipment is available; however, if an energy crisis becomes acute, it is doubtful that these sources of power would be available for future field operations.

Consequently, WES engineers are studying energy resources available at the site, such as the wind, a free, clean and inexhaustible source of energy in many areas. Windmills have been used for centuries where a non-periodic source of power could be tolerated for such jobs as pumping water and grinding grain.

The high-wind regions of the United States (10 mph or more average yearly wind velocity) are a north-south strip 350 miles wide midway between the Atlantic and Pacific Oceans, the coastal areas around the Great Lakes, the Atlantic Seaboard, the Gulf Coast, and other isolated areas around the country.

WES researchers selected an area on the Gulf Coast near Mobile, AL, because the site was available and the yearly average wind speed represents the minimum condition recommended for successful operation of the system.

Customarily, small windmill systems have been connected to charge storage batteries as a power source for use during periods of calm or intermittent wind. However, for larger systems, such as the wind machine being tested in Ohio by the National Aeronautics and Space Administration, it was decided not to store the energy. Instead, generated energy is fed directly to a commercial utility grid. The power will be used as it is generated. Under this plan during calm or intermittent wind, power would be generated by conventional methods.

The WES wind machine chosen for the demonstration consists of a 3-bladed, 16½-foot-diameter propeller mounted atop a 40-foot tower. It produces 200 watts of power in an 8 mph wind (minimum operational velocity), and reaches its rated power output of 6,000 watts in a 23 mph wind.

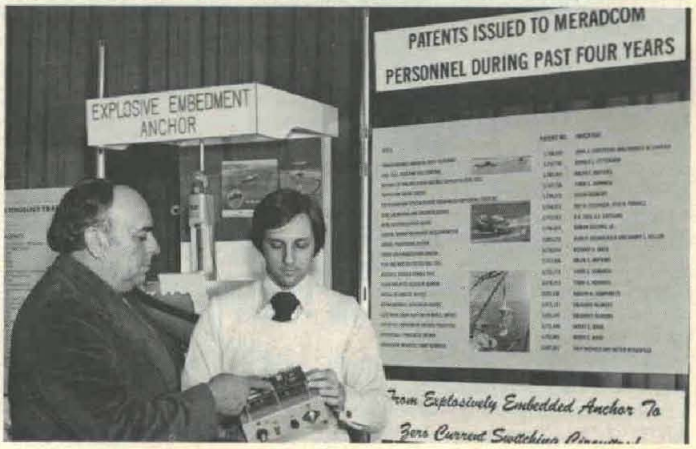
The device is used primarily to maintain the charge on two 57-cell banks of lead-acid storage batteries and their power is used alternately to drive vacuum and water pumps. Sufficient reserve power is provided to drive the system for about two days of dead calm.

Project Engineer A. W. Ford explains that the primary purpose of the field investigation is to demonstrate a vacuum wellpoint dewatering system. Such methods are needed to reduce the water content of fine-grained dredged material.

The premise of the experiment is to draw water out of the ground, deposit it in a common sump and, when the sump is full, automatically drain, monitor and record the volume of effluent removed from the tank. To accomplish this effectively, the sequence of events must be controlled precisely.

Simple design of the system is directed to a minimum of maintenance. Solid-state electronics control circuits are incorporated in automated safeguard systems designed to assure that the batteries are not totally discharged or over-charged, and to protect the windmill apparatus during periods of high wind.

U.S. Army Mobility Equipment R&D Command (MERADCOM), Fort Belvoir, VA, inventor Walter G. Taschek displays fuel-cell-powered landing light being developed for remote, unattended operations requiring large amounts of electrical energy at low-power levels. Taschek has a pending patent for a miniature hydrogen generator for the light, shown at World Fair for Technology Exchange, Feb. 7-11.



COINVENTOR of zero-current circuit breaker that eliminates detrimental arcing at electrical connections, Walt Pierce (left), explains operation to Dave Safran of the Legal Office at MERADCOM. Invented by Pierce and George Lange (ret.) the device was displayed by MERADCOM at the National Inventors Exposition, Feb. 5-6.

Are Gremlins at Work?

Bellows Attachment Eases Test Problems for Air Cushion Vehicle

"Going goony about the gremlins" could well have been the response of the U.S. Army Mobility Equipment R&D Command test team assigned to evaluation of the 30-ton LACV-30 (Lighter, Amphibious Air Cushion Vehicle) - when subjected to the common daily query, "How are things going, old buddy?"

The cause of that response started with delivery of two pilot craft which had looked and performed identically alike during the contractor's predelivery tests. One of the vehicles was scheduled for Development Test II and the other for Operational Test II, with one going to Aberdeen (MD) Proving Ground and the other to Fort Story, VA.

The DT vehicle functioned properly at the APG, after the air-filtration system to protect the main turbine was improved. But Fort Story reported that the OT II vehicle performance was posing a mysterious problem - that of a "voracious appetite" of the APU (Auxiliary Power Unit) turbine powering a supercharging air flow fan. The fan is designed to draw 31,000 cubic feet of air a minute through an elevated (25 feet from ground level) intake stack.

The APU function is to distribute air to the main power turbine and itself, through a series of filtering devices intended to remove debris, sand and salt water particulates. High rotational speeds of critical turbine components, engineers realized, might have made the particulates create explosive repercussions.

This problem delayed initiation of OT II about five months and placed in jeopardy the project goal for LACV-30 Type Classification by the second quarter of FY 1978.

LACV-30, Lighter, Amphibious Aircushion Vehicle

During World War II, when technical problems developed in aircraft for which no physical explanation appeared logical, it became common practice to blame the fault on "gremlins at work." That is what perplexed and frustrated MERADCOM Project Engineer John Sargent and Bell Aerospace Textron engineers (developers of the LACV-30) were increasingly tempted to do.

Similarly mystified were personnel of SOLAR (APU turbine manufacturer) and Alterdyne (designer of the total APU), since the turbines used had performed in extensive service for other applications without such a problem.

Compounding their frustration was the fact that the DT II vehicle was experiencing no rejection by the APU. They concluded that the cause was induced by structure of the OT II vehicle.

Concerted effort by government and contractor engineers to collect data led to the discovery that a 250 Hz hi-amplitude response, which corresponded with the first flexual resonance frequency of the turbine shaft, caused a roller-bearing failure in the APU.

The "fix" of the problem was a 6½-pound bellows attachment which anchors the turbine exhaust flange to the APU housing, thus dampering effectively the causative frequency amplitude. More than 60 operational hours of the fix have produced no return of the problem - thus clearing the way for OT II testing to begin in January 1977.

However, research on the problem is continuing. LTC Vargo and other engineers on the project still are looking to find the gremlins that caused the high amplitude response problem.

Mortar, Artillery Radars (MALOR) Redesignated Firefinder System

Firefinder is the new designation for MALOR (Mortar and Artillery Locating Radars), a change denoting that the U.S. Army's new indirect fire hostile weapons locating system has transitioned from the research and development phase.

Firefinder is termed a "major breakthrough" to solve the age-old problem of locating enemy mortars and artillery for accurate counterfire, thus responding to a high-priority requirement. The subsystems are designated AN/TPQ-37 Artillery Locating Radar and AN/TPQ-36 Mortar Locating Radar.

The Army has announced that limited production of the AN/TPQ-37 is expected to begin early this year and that further developmental testing of the AN/TPQ-36 will set the stage for production in late 1977.

Both Firefinder subsystems use electronic scanning, sophisticated signal processing, and computer-aided analysis to detect and track projectiles. Speed of the electronic processing normally permits location of a hostile weapon before the fired round has landed.

The Army's development effort for a new weapons locating system was initiated in 1972 with competitive prototype development for the AN/TPQ-37. A separate development of the AN/TPQ-36 started in 1973.

The programs were conducted under COL William J. Harrison, project manager for MALOR at the U.S. Army Electronics Command, Fort Monmouth, NJ, who is continuing PM for Firefinder.

Army's Fort George Meade Presents Opposing Forces Training Exhibit

Numerous items of foreign materiel representative of Soviet, Warsaw Pact members and other nations were displayed late in January by way of implementing the U.S. Army's Opposing Forces Training Program.

The exhibit attracted thousands of First Army personnel to Fort George G. Meade, MD. Materiel displayed was assembled by Company D, 519th Military Battalion, Aberdeen Proving Ground, MD, and shown twice daily for a week.

Japanese television released a video tape of a Soviet military exercise. The display included two types of Soviet tanks, Soviet CBRs and other communications equipment, the ASU-57 airborne assault gun, the BTR wheeled armored personnel carrier, other wheeled vehicles, and numerous small arms.

The Army's Opposing Forces Training Program is arranged to give the individual U.S. soldier an awareness of capabilities of the potential adversary, including recognition training and instruction on battlefield conditions that may be encountered.

Mobility Equipment Command R&D Developing METRRA Mine Detector

METRRA (METal Re-radiation RAdar), an airborne system designed to detect surface mines, bobby traps, munitions, armed troops and vehicles, is being developed at the U.S. Army Mobility Equipment R&D Command (MERADCOM), Fort Belvoir, VA.

The system, which uses a transmitting and a receiving antenna mounted on the side of a helicopter, can penetrate dense foliage and operate in rain or fog to locate targets that do not move or emit heat.

In operation, VHF radio waves are transmitted outward, reflect off the surface, and return at the same frequency to give a terrain picture that is displayed and stored by monitoring equipment inside the aircraft. Small amounts of energy change to a harmonic frequency as they reflect off the junctions of metal parts of semiconductors of targets. For example, electronic parts in air-scatterable mines are detected and displayed on the METRRA monitor.

In addition to the airborne METRRA, a portable backpack unit is being developed for use by ground troops to detect surface mines and booby traps at safe distances.

HELICOPTER-MOUNTED antenna, which uses a metal reradiation radar (METRRA) to detect surface mines, is undergoing tests.

Soviet Nuclear Reactor Power Plants

By Roy P. Nebiker

The Soviet nuclear reactor industry is flourishing. Similarly to the United States reactor industry, Soviet investigators are considering the current and potential uses of many types of available reactors, including light water-cooled, gas-cooled, and liquid-metal-cooled systems.

The Soviet industry is manufacturing competitive power reactors (which they have for sale), experimenting with promising new types of reactors, and sealing down large power plants to a level at which they are transportable and adaptable to meet possible military demands.

My purpose is to discuss what reactors the Soviets are considering for export, what reactors look most promising for the future, and what reactors are most likely to be considered for military use.

The Soviet reactor available for export to other countries is the large 440-MW electrical pressurized water reactor (PWR), and the original five reactor power plants of this type are located at Novovoronezh. This reactor uses low-enriched uranium oxide for fuel and light water for the primary and secondary cooling loops. Its design is similar to the PWR constructed in the United States.

Rapid progress has been made in the development of the liquid-metal (sodium) cooled fast-breeder reactor (LMFBR), expected to replace the PWR. (See Peter Van Nort speech on fast-breeder reactor work in U.S.- back cover, May-June 1976 edition of *Army Research and Development Newsmagazine* article on National Junior Science and Humanities Symposium.)

The Soviets are ahead of the United States in the construction of commercial size LMFBR plants, but in technical competence they lag this country. The Soviet demonstration plant at Shevchenko, the BN-350, produces 350 MW equivalent electrical power. About 200 MW is used to operate a desalinization plant that daily produces about 120 tons of fresh water.

This plant currently faces problems with fuel distortion and steam generator leakage. Still the Soviets are confidently going ahead with design and fabrication of a much larger reactor, the BN-600 LMFBR.

Another Soviet endeavor in the fast-breeder reactor field is the gas-cooled, fast-breeder program. This concept is behind the LMFBR in development, but enjoys a high priority. This type promises a theoretical fuel doubling time of about 5 years versus about 10 years for the LMFBR - thus offering the greater potential for keeping pace with the Soviets' growing demand for electrical power.

Concurrently with this large, ambitious program, the Soviets are fabricating and producing small transportable and mobile reactors. Intended to supply commercial power for drilling and mining operations at remote locations, these reactors (specifically the ARBUS, the TES 3 and the SEVER) could provide the Soviet Army with logistic electrical power.

The ARBUS is an organically cooled and moderated nuclear power station that produces 750 KWe and is housed in a building 12.36 meters wide, 28.5 meters long, and 6.36 meters high. The plant consists of 19 separate, fully mounted, factory-tested, prefabricated units, none of which weighs more than 20 tons. The units can be transported by water or by land routes. Start-up of the plant is accomplished through power supplied from a 135 KW diesel generator.

The main reason for design and construction of reactors utilizing organic coolants and moderators is to allow the use of cheap structural and lightweight shielding materials. Based on cost, the initial concept was favorable but the reactor was impractical. Clean-up of the organic loop from decomposition products, consisting of tar-like compounds, was more difficult than anticipated.

The TES 3 produces 1500 KWe and is mounted on four caterpillar-tracked vehicles. The first vehicle contains the nuclear reactor. The second contains a specially shielded primary water circuit, the heat exchanger, and the secondary steam circuit. In the third carrier are the steam-driven turbine, the electrical power generator, and the condenser. The fourth vehicle houses the control panel and the auxiliary equipment. Viewed externally the vehicles are probably identical (see Figure 1).

Support facilities at the operational site of the TES 3 include a storehouse for spares, a prefabricated building to house the turbogenerator switchboard, and a radiation monitoring facility.

Additional construction is necessary to provide shielding. A 2.8- meter-deep trench, lined and overlapped with high-density ferroconcrete, is large enough to accommodate the reactor and heat transfer units. The trench walls and overlap are covered with earth to provide shielding.

The reactor also has a lead shield placed inside the surrounding tank, filled with a boric acid solution to absorb slow neutrons that escape from the reactor during operation.

The TES 3 is extremely mobile. In less than two hours, the equipment can be disassembled and readied for movement to a new location. However, if the reactor has been in operation immediately prior to an unexpected move, a 2-week delay is necessary for nuclear fuel to decay.

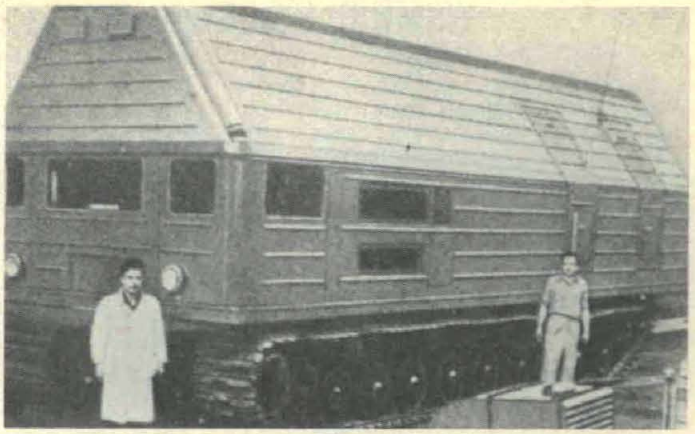


Fig. 1. ONE OF FOUR Caterpillar-tracked Vehicles of the TES-3.

The boric acid shielding solution is drained from the reactor before a move. Fuel elements can be left in the reactor because the lead shield provides sufficient protection against radioactivity after cooling down.

The SEVER (North) is a water-cooled reactor utilizing light water as the moderator and coolant. Considered an improvement over the TES 3 although it has the same power output (1500 KWe), it has good operability and maintenance features.

Designed to permit doubling of electrical output without an increase in the operating staff it is self-regulating, based on turbine load, transportable by ship or aircraft, and it can be produced in assembly line fashion.

In contrast with the ARBUS, the SEVER does not have to provide a regeneration loop for the coolant, and it produces twice as much power. The entire plant, including the reactor complex, is produced in 24 separate blocks, each weighing about 15 tons.

The variety of reactor designs under investigation and the number of reactors placed in operation during the last decade indicate impressively the determination of the Soviets to use nuclear power to complement their conventional fuel resources.

ROY P. NEBIKER is a nuclear engineer employed by the U.S. Army Foreign Science and Technology Center, Charlottesville, VA, where he analyzes foreign nuclear power capabilities. He received a BA degree from Columbia University in 1947, followed by post graduate training at Oregon State College, the University of California at Los Angeles, and George Washington University. He has been in the nuclear power business more than 28 years.

* The U.S. engineering definition of doubling time is the operating time required for the fissionable fuel initially present in the reactor to double. The Soviets define the doubling time in terms of breeding enough fuel in time to satisfy the future need for twice the present electrical demand.

AORS Paper Describes Camouflage Analysis Method

Effectiveness of camouflage techniques in the field can be determined by a new method reported in a paper presented at the 1976 Army Operations Research Symposium, Oct. 27-29, at Fort Lee, Va.

Developed by the U.S. Army Combat Developments Experimentation Command, Fort Ord, CA, the technique was reported by Gary Love, a CDEC civilian employe, who described the feasibility of measuring observable differences between a tactical target and the background it appears against, as viewed by a potential enemy.

Field tested at CDEC's Fort Hunter Liggett Laboratory in California, the method involves computer analysis of photography under simulated combat conditions.

WSMR Optical Evaluation Facility

By Joe L. Rosson

The Optical Evaluation Facility (OEF) at White Sands (NM) Missile Range was developed to support the complex array of optical instruments and systems required for missile performance data gathering. Completed in December 1972, the facility provides broad evaluation and development capabilities.

General responsibilities of the OEF are prototype evaluation, acceptance testing, optical system development and the continuing optimization and development of optical equipment.

Fig. 1. Versatile Tracking Mount

TYPICAL WSMR OPTICS. Typical of the tracking mounts at the range using optics for photographic data gathering are the Versatile Tracking Mount (VTM) (Figure 1), the Contraves and Askania Cinetheodolites, and the Distant Object Attitude Measuring System delivered early in 1977 - the first of nine DOAMS will be installed to replace some of the modified gun carriage units which have been in use for many years.

In the WSMR configuration, the VTM mounts three photographic objectives consisting of 1.3, 2.5 and 4.6-meter focal lengths with f4, f8 and f10 ratios. These objectives are of the catadioptic type, constructed primarily of fused silica for thermal stability, and have near diffraction- limited performance.

The cinetheodolites use various lenses including a specially designed f8, 2.3m focal length, lightweight (12 kilogram) athermal catadioptic design. The DOAMS features 2.5 and 5m focal length T5 and T10, athermal objectives of a new catadioptic concept to minimize veiling glare.

While the WSMR systems provide a continuous workload for the OEF in the above areas, the Facility also performs similar services for a number of other Army, Navy and Air Force test ranges.

TEST ENVIRONMENT CONTROLS. The OEF was designed to provide optimum test conditions. Temperature control is maintained to ±1 degree Celsius at a mean temperature of 22 degrees Celsius. Actual temperature variation is less than 1 degree. This is due to the basement level location of the laboratory, which provides natural insulation from external climatic influences. The air-conditioning system is filtered to prevent entry of dust particles larger than 10 microns into the laboratory areas and humidity is limited to 50 percent.

Stratified air layers, caused by temperature differentials from floor to ceiling, are a problem in any evaluation lab, especially if large optics are to be tested. Eddy currents of hot air are generated by light sources, electronic equipment and certain individuals, (body heat is a prime source), and will also cause variations in a system's performance.

In order to reduce these effects as much as possible, without resorting to a vacuum chamber or vertical test tower, which have their own inherent problems, the WSMR OEF is equipped with some 20 oscillating fans, wall-mounted along all optical test paths. The fans are used to stir and mix the layered air when atmosphere averaging is possible with such methods as Foucault or knife-edge tests.

If instantaneous results are required, the air conditioning system is momentarily turned off and the fans are started. After thorough mixing, temperatures are monitored at six levels from floor to ceiling to an accuracy of 0.1 degrees Celsius.

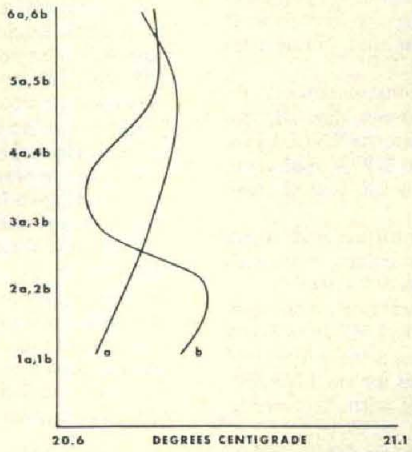


Fig. 2. Temperature Profiles

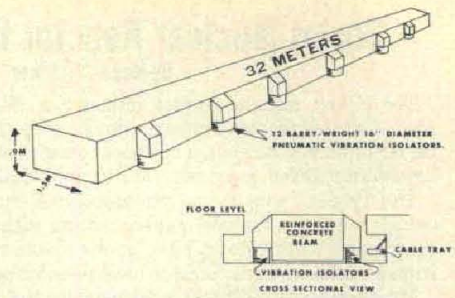
When sampled temperatures reach a predetermined uniformity, test data are recorded. Temperature profiles shown in Figure 2 are samples taken during interferometric wavefront analysis of two 1-meter diameter mirrors in autocollimation. Acceptable data were obtained when the temperature profile was within these boundaries.

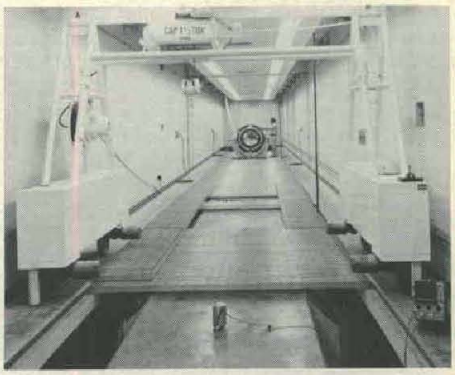
The tests must be completed with a brief time span (2 to 3 minutes) during which both the temperature profile and the test output are monitored for optimum conditions. Even with these procedures, special cases have required mathematical averaging and modifications to the atmospheric controls.

One of the unique features of the OEF is its vibration isolation equipment (VIE) necessary due to the extreme sensitivity of the optical test equipment. Normal street traffic formerly produced disturbances to such a degree that most critical testing was conducted after hours, but VIE has been very effective. Any test now can be accomplished during a normal workday.

Several 1½-ton, solid-granite surface tables are supported on Barry Controls pneumatic isolation systems, featuring an air-servo system which senses load changes and automatically adjusts air pressure to hold table levelment.

Included in the laboratory, and unique in the United States, is a 32-meter long (106 foot) 0.9- x 1.5-meter reinforced concrete beam weighing 130 tons (Figures 3 and 4). This beam is on 12 of the Barry isolators.





Figs. 3&4. 32-Meter Beam

The beam system effectively isolates seismic disturbances to a maximum of 1×10^{-5}g in the 1-5 Hertz range and 1×10^{-4}g in the 5-200 Hertz range. The lab also contains an 8m concrete beam on similar pneumatic isolators. The granite tables and the 8m beam are effective to 1×10^{-6}g in the 1-5 Hertz band and 1×10^{-5}g in the 5-200 Hertz area.

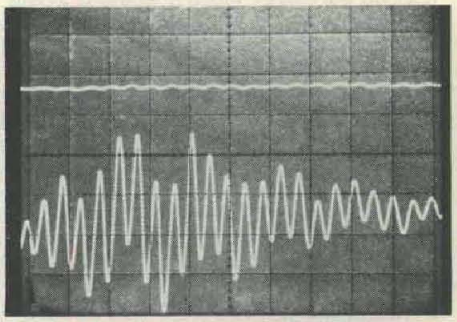


Fig. 5. Vibration Isolation of 32-Meter Beam (Upper trace is seismometer output on the 32-meter beam surface and lower trace is seismometer output of floor disturbance under beam, recorded simultaneously.)

Shown in Figure 5 is a dual-beam oscilloscope trace which is the recorded output of two vertical seismometers. One seismometer is located on the 32m beam's isolated surface and one on the concrete floor beneath the beam. An artificial floor disturbance has been recorded in the lower trace, indicating acceleration of 0.01g.

The upper trace, from the beam's isolated surface, illustrates a very low frequency reaction with negligible amplitude. The beam does move at frequencies below one Hertz, where damping cannot be precisely controlled with such a large mass, but this poses no problem in testing if all test components are located on the beam.

LABORATORY AND EQUIPMENT. The main laboratory (Figure 6) consists of a 92-square- meter area containing the granite surface tables and the 8-meter beam. This area is equipped for the evaluation of small and intermediate size optics up to 61 cm in aperture,

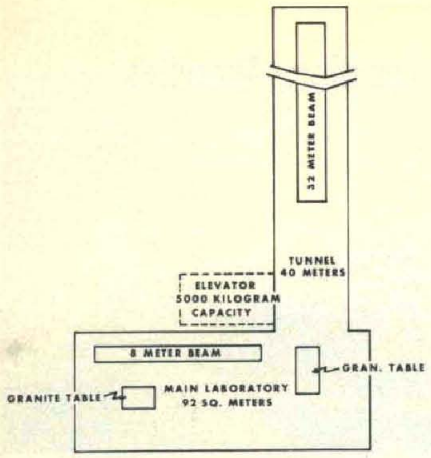


Fig. 6. Main Laboratory Layout

depending on physical size and weight.

Intersecting the main lab is a 40-meter horizontal tunnel 4 meters wide, housing the 32-meter beam in a pit which places the top of the beam at floor level. Opening into the tunnel is a 5,000-kilogram capacity 3.7 x 5-meter elevator, connecting to a high bay (7-meter ceiling height) assembly area on the ground floor.

Large optics can be handled easily by utilizing the 1,400-kilogram traveling "A" frame. Electrically powered drive wheels travel the length of the optical tunnel and the frame can be transported to the high bay area via the 5,000- kilogram capacity elevator. The high bay area contains a 15-ton bridge crane to aid in the assembly and disassembly of large optical systems.

The high bay area also includes a small camera test lab and a tool room. Two electro-optical labs, a precision microdensitometer room, a measurements room and a darkroom complete the basement wing.

SOFTWARE CAPABILITIES. In the past, optical evaluation was totally dependent on the technologist's experience, judgment and eyesight. This provided, at best, a qualitative analysis which, especially in compound optical systems, resulted in inconclusive test data. The quest for more quantitative analysis has led to more complex test equipment, including computers for reduction and analysis of test data.

Considerable effort at WSMR has been expended to develop and conduct optical evaluation in the most quantitative manner possible. Interferometric wavefront analysis is the primary evaluation tool used at the facility and its application has been adapted to a broad range of uses.

A comprehensive selection of software has been developed to enable the reduction of an interferogram to a map of the wavefront deformation showing optical path differences in hundredths of a wavelength at 6328Å with a routine accuracy of 0.02γ. A 2-dimensional Modulation Transfer Function (MTF) can be derived from the interferogram by the WSMR reduction program.

SPECIAL TEST EQUIPMENT. A Tropel Miniscan (electro-optical knife-edge-scanner) is available and an MTF can be derived through the transform of the edge scan data. The target required for this instrument is a simple point source. Extensive calibration of the unit is unnecessary. The Miniscan normally is used to evaluate objectives containing large quantities of aberrations which make interferometric data difficult to reduce.

Other optical test equipment includes a complete Ealing lathe bed optical bench, a 51-cm diameter 1-arc second divider head, a spectroradiometer, a SIP measuring microscope and the normal complement of equipment such as reference flats, resolution targets, autocollimators, etc.

Test mirrors include three 61cm diameter mirrors (a parabola, flat and sphere) with wavefront deformations not exceeding 0,05γ peak-to-valley at the mercury-e line. These mirrors are manufactured from Corning Optical Co.'s ULE (trademark) fused silica which has a near zero expansion coefficient. Two fused silica 1- meter diameter mirrors are used (a parabola and a flat) with wavefront degradation not exceeding 0.125γ peak-to-valley at the mercury-e line.

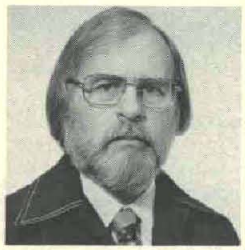
The facility's equipment also includes a programable microdensitometer which scans photographic films and plates up to 25x25cm in both x and y coordinates with an accuracy of one micron. The data can be recorded on magnetic tape and displayed by video or chart recorder.

Software in process will allow the microdensitometer to measure and record fringe position of an interferogram from which wavefront data can be reduced.

The facility darkroom contains nitrogen-burst processing for roll, cut film and photographic plates up to 20x25 cm. In addition to the support of the Optical Lab, the darkroom is used for the manufacture of pseudo missile data film for data reduction studies, the manufacture of special optical targets, and the evaluation of new photographic emulsions for use at the Missile Range.

FUTURE. Capabilities of the WSMR OEF are being expanded to include evaluation in the infrared region of the spectrum. Future plans include an environmental test unit and the continuing development of test methods including multi-wavelength interferometry.

The OEF has proved its adaptability to a wide range of evaluation problems and considerably decreased the tie previously needed to conduct a given test. We are pleased with the OEF, believe it is well suited to the special problems imposed by the Missile Range, and that it has great future potential.



JOE L. ROSSON is in charge of the WSMR Optical Evaluation Laboratory where he is involved in application of new test methods and development of optical instrumentation. He was also involved in the design and implementation of the new evaluation facility.

Rosson is a physical science technician, civilian employe of the Department of the Army with 20 years experience in missile range instrumentation. Fifteen years have been in optics-related R&D.

Speaking On . . . *(Continued from inside front cover)*

techniques discussed in Chapter IX in Section II of this report, by developing new technologies which offer the promise of less expensive but highly effective military systems, and by placing greater emphasis on competition throughout the R&D process. We believe that competition is . . . encouraging innovation and enhancing cost-effectiveness.

- Third, we seek to make better use of technology by requiring that a proposed new system be fully assessed in terms of tactics, alternative and complementary systems, and mission requirements at the earliest stages of the design and development process.
- Finally, we have decided to complete the development and testing of those systems whose near-term deployment to our forces is urgent, while retaining other systems in the early stages of development at lower funding levels, where a high priority for deployment does not yet exist.

Lead Time Requirements. The long lead time encountered in the weapon systems acquisition process introduces major uncertainties into RDT&E decisions. It requires us to plan and to implement R&D programs on the basis of projected trends, since today's decisions will result in weapons which will not be deployed for a number of years. Moreover, even after these weapon systems enter service, they must be able to perform effectively against threats which will appear during their planned operational life times.

Clearly, there must be the flexibility in both the short and the long term to react to change: flexibility is needed in the short term to make program adjustments and to shift funds where necessary; in the longer term, flexibility is necessary to react to any Soviet technological breakthrough — by retaining our technological leadership in areas vital to our future military strength, and by developing options which can be exploited rapidly.

On the other hand, changes must be accommodated without upsetting the over-all funding and program continuity that is essential to a successful and efficient RDT&E effort. We are attempting to reduce the lead time for new systems in a number of ways:

- More extensive use of "off-the-shelf" technology for subsystems.
- Reducing changes in the requirements and specifications of new systems as they are being developed.
- Using simulators and simulations more widely in test and evaluation.

We will also continue to work with the Congress to eliminate the following actions which increase lead time: stop-and-start funding, and stretching out some programs beyond what is reasonably required to reduce risks. Both of these incur higher costs in addition to reducing weapons acquisition efficiency.

R&D Cooperation With NATO. NATO members possess the bulk of the Free World's technological, industrial and military resources. Unfortunately, duplication and lack of standardization within the alliance continue to reduce the over-all effectiveness of NATO's forces and have diluted resources expended on R&D, production and logistics support.

The growing threat has created an atmosphere in the alliance conducive to addressing this collective deficiency. The U.S. has taken initiatives which will apply NATO's technological and industrial strength more effectively through several cooperative efforts, including: mutual planning and executing of national R&D programs to reduce duplication; standardizing selected weapon systems; and increasing interoperability in key areas . . . communications, aircraft armaments, ammunition and fuels.

(Continued on page 21)

WSMR Functions as Largest of 8 National Missile Ranges. . .

Vast Complex of Facilities, Sophisticated Equipment Serves Many Agencies

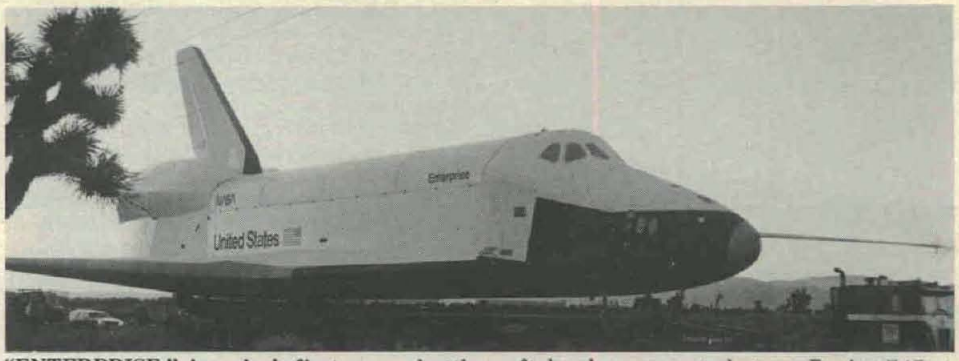
Judged by even the most fanciful imaginations of neighboring-state "Tall Tale Texans," White Sands (NM) Missile Range is big, a 4,000-plus square-mile "spread" that sprawls over parts of four states. It tails off - for special long-range missile experiments - as far west as Green River, UT. Conceivably, its off-range flight corridor could be extended to the Gulf of Alaska without affecting populated areas.

WSMR is by far the largest (and only all-land) of 8 U.S. national missile ranges. Its mind-boggling collection of facilities includes some of the world's most sophisticated instrumentation for measuring test findings, transmitting data and instantaneous real-time computer processing of data on advanced weapon systems.

WSMR is also the senior national missile range, established in 1945 as a U.S. Army facility and converted in 1952 by the Department of Defense to serve equally the requirements of the Military Departments. Much of the work is performed for defense contractors on a non-interferable, cost-reimbursable basis.

Today the mission of the range is continually growing. The latest additions are involved with research and development of solar energy - for which WSMR is particularly well suited geographically - and the just-embarking program of training crewmen for the Space Shuttle Orbiter Program of the National Aeronautics and Space Administration (NASA).

Tests conducted at WSMR include surface-to-air, surface-to-surface, air-to-air, air-to-surface dispenser and bomb drops, meteorological and upper atmosphere probes; also, target systems, space programs, equipment, components and subsystems.



"ENTERPRISE," America's first space shuttle craft, has been mounted atop a Boeing 747 at Edwards Air Force Base, CA, where it is undergoing airstrip taxi tests, prior to "captive" flight tests. The 122-foot-long, 100-ton Enterprise, which has a wingspan of 78 feet and a 60-foot-high tail, is scheduled to be fired into space by disposable rockets in March 1979 from Kennedy Space Center, Cape Canaveral, FL, then return to earth without power and land like a glider. *(Photo by Rockwell International.)*

Magnitude of WSMR operations is indicated by a few statistics. During FY 1976, records show 5,309 missions were conducted and coordinated by the Range Control Division; the projection for 1977 is for more than 7,000. WSMR uses more than 6,800 civilian and military personnel.

Physical assets are valued in excess of $1 billion. Airspace scanning is accomplished at over 1,100 instrumentation sites - each surveyed to an accuracy ratio of about one part per 200,000.

Roughly 700 of the most modern mobile and fixed types of optical and electronic instruments are used, including long-range cameras, tracking telescopes, ballistic cameras, radars and advanced telemetry. More than 10,000 test reports are prepared annually.

Aerobee, Aries and other sounding rockets carry test pay-loads up to 300 miles. Huge balloons (one block high - about as long as a football field) are used for instrumentation pay-loads that have attained altitudes of more than 30 miles to record atmospheric and stratospheric data. Numerous nations may have sponsorship interest in the experiments - as they have been reported routinely in the *Army R&D Newsmagazine.*

WSMR also has a solar furnace that is the largest in the United States and the second largest in the world. This facility is engineered to focus magnified rays of the sun onto a small surface and to simulate thermal radiation bursts emitted by nuclear weapons (heat up to 5,000 degrees F.) - with a view to advancing technology for "hardening" (protecting) weapon systems against such bursts.

In response to the nation's critical energy shortage, WSMR currently is being considered for development of solar energy systems for remote test sites. Dr. John W. (Jack) Bond, a research physicist with the Army Mobility Equipment R&D Command, Fort Belvoir, VA, is working on a Department of Defense project in conjunction with the U.S. Energy R&D Administration, NASA and the Jet Propulsion Laboratory. Recently he made a second survey visit to WSMR.

During an earlier visit to inspect sites in the U.S. having the best environmental potential for the project, Dr. Bond commented: "With 1,100 instrument sites scattered over its main range, and many more along its off-range corridor, WSMR is an ideal place to pioneer a project of harnessing sun power for electrical power...."

Primarily, however, ever since it was established as White Sands Proving Ground - about 175 miles from the Roswell, NM site where Dr. Robert H. Goddard, "father" of American missilery did much of his pioneering research in rockets during the early 1930s - WSMR has been and is concerned with missile tests.

On July 16, 1945, one week after it was

NASA Officials View Shuttle Spaceflight Capabilities

NASA officials from the Goddard Spaceflight Center (GSC), Greenbelt, MD, and the Johnson Spaceflight Center, (JSC), Houston, TX, inspected and were briefed on shuttle spaceflight capabilities during a recent tour of Las Cruces and White Sands Missile Range (WSMR), NM.

Two of the NASA Shuttle Training Aircraft, modified Grumman Gulfstream-II twin-engine jets, were airborne during the Northrup Strip visit, and continued to make simulated shuttle-craft landing approaches throughout the afternoon. (See November-December issue, p. 8 for STA training at WSMR.)

Director of the NASA JSC Dr. Christopher C. Kraft and his deputy Dr. Sigurd Sjoberg headed the visitors. Joining them on the tour were MG O.L. Tobiason, WSMR commander, LTC L.T. Brown, director of Army Air Operations, and U.S. Senator-elect Harrison (Jack) Schmitt, former astronaut and first civilian to walk on the moon.

The Houston group included George Abbey, director of Flight Operations; Donald Cheatham, chief of Shuttle Operations; Bailey Chaney, Labor Relations officer; Aaron Cohen, Shuttle Orbiter project office manager; William Easter, GSC representative at JSC; Joseph Algranti, chief of the Aircraft Operations Division; and J.G. Thibodaux, chief of the Propulsion and Power Division.

Also attending were Edward Smith, vice president and Shuttle program manager with Rockwell International; Edward P. Shales, manager of Lockheed Electronics Co. operations at the NASA White Sands Test Facility (WSTF); Kenneth Cooney, Lockheed vice president, and H. William Wood, deputy director of Network Operations at GSC.

Dr. Kraft held a press conference at the airport upon arrival at Las Cruces Dec. 6, the date that coincided with the fourth anniversary of the launching of the flight that took Schmitt and two others on their journey to the moon.

Both Schmitt and Kraft were in full agreement that several facilities in the U.S., including WSMR, will be needed as space ports in the future. They pointed out that WSMR's advantages include higher elevation and lower humidity as compared with coastal launching and landing sites. Kraft said he envisions space ports around the country, much like the seaports of today.

He added that the recent selection of WSTF as the site for the Tracking Data and Relay Satellite System (TDRSS) ensures the permanence of the facility in NASA's plans for the future. The TDRSS will centralize NASA's ground-to-space communications facilities at WSMR, and replace a worldwide network of tracking and space communications facilities.

Schmitt believes men will walk on Mars before the end of this century. He spoke of advantages of the space environment for many kinds of research and development. Dr. Kraft compared space explorations with man's efforts to explore the Antarctic. At first it was difficult to get there, he said, but it became easier with development of the right kind of airplane. Right now it is tough to get to the moon - expensive and often risky, he said. "But in 10 to 15 years it will be easy, and that is when the next real steps will be taken."

COL Harold E. Stubbs
Director
National Range Operations

COL William R. Madden
Director
Army Materiel Test & Evaluation

MG Orville L. Tobiason
Commander
White Sands Missile Range

Dr. Richard H. Duncan
Technical Director,
Chief Scientist

COL Charles R. Cranford
Director
Instrumentation

created, the northern portion of the range was the scene of detonation of the world's first atomic device.

U.S. Army control of WSMR is exercised with the aid of a Joint Scheduling Services Committee chaired by the chief of the WSMR Control Division. Through the Ballistic Missile Defense Command, the Army has similar responsibility for Kwajalein Test Range in the Pacific Ocean.

Four of the national ranges are under Air Force control: Arnold Engineering Development Center in Tennessee; the Satellite Control Center and the Space and Missile TC, both in California; and Eastern Test Range, FL.

Under Navy control are the Pacific Test Range and the National Parachute Test Range, both in California.

WSMR claims three main advantages over the other national ranges. One is long-range visibility due to exceptional weather conditions (long periods of clear days) and vast open spaces. Precision instrumentation sites are spaced effectively along the entire test area. Ground vehicles and helicopters join in rapid recovery of test vehicles, upon landing, for evaluation. The range baseline is surveyed to an accuracy ratio of one part per million.

Mentioned earlier was that the WSMR test facility, 40 miles wide and 100 miles long, is limited for long-range tests except through fly-over arrangements to use land adjacent to range boundaries. Off-range launch complexes are in Utah at Green River and Blanding, in New Mexico at Fort Wingate, and the Army Air Defense Command's McGregor Range southwest of WSMR. The WSMR commander assumes responsibility for flight safety in a 500-mile-long corridor when the Green River site is used.

One of the unique factors in WSMR operations is an occasional requirement to evacuate some families of ranchers, under a contracted "co-use" program, for some test flights - usually for much less than 12 hours. Local radio stations cooperate by announcing evacuation needs and "all clear" for return to homes.

One of the sources of WSMR pride is that there never has been a death or civilian injury within established boundary areas of off-range flight corridors due to test operations. Use of the Blanding extension involves evacuation of about 1,200 people and about 60 when the Green River site is used.

Historically - actually dating about two years before it was formally established - WSMR has been the test site for almost all Army-developed missile systems and many developed by the Navy and Air Force.

Prior to the advent of the German V-2 rocket during World War II (which was to lead to much of the early R&D at the facility), WSMR

(continued on page 18)

NASA Plans Year-Long Tests Of Space Shuttle Orbiter

Year-long testing of the Space Shuttle Orbiter, mounted atop the fuselage of a Boeing 747-100 modified superjet delivered in mid- January to the National Aeronautics and Space Administration, is scheduled to begin in February.

Modification of the superjet for piggyback mounting of the 150,000-pound (68,040 kilograms) SSO was accomplished ahead of schedule and under the target cost of a contract totaling about $30 million. The contract provided for transport of the SSO and an airborne platform to launching of a series of Orbiter approach and landing tests intended to prove out capabilities.

Flown to the NASA/Dryden Flight Research Center, Edwards, CA, the superjet SSO carrier will be used initially for six unmanned and inert Orbiter tests. Next will come a series of manned flights, followed by a series in which the SSO will be released at about 27,000 feet (8,229 meters) above the California desert for glide landings at Edwards AFB.

Modification of the superjet SSO transporter, capable of carrying more than 200,000 pounds, included bulkheads and skin reinforcements and addition of tip fins to the plane's horizontal stabilizer for aerodynamic stability during mated flights.

Purchased from Boeing Co. by American Airlines in October 1970, the superjet was used for almost 3,000 flights as a commercial carrier before it was purchased by NASA in July 1974 for its SSO role.

NASA Funds Medical Spaceflight Shuttle Operations

Development of Space Shuttle flight medical operations and support plans, including design of a concept for a rapid-access medical consultation system, will be performed under funding by the NASA-Johnson Space Center.

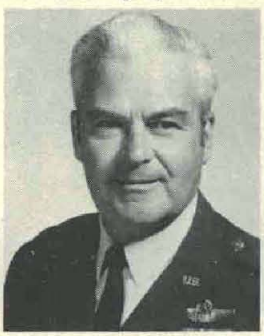
The Boeing Co. Space Systems Division also will develop conceptual designs of medical support consoles and clinical instruments, such as surgical tools, for the spacecraft. The contract is an 8-month extension of an agreement which called for use of space technology to provide advanced health care for people in remote regions; also, assistance to the space center in planning and preparations for life sciences missions scheduled for Spacelab flights.

The European Space Agency is building the medical laboratory, scheduled to make its first flight aboard the Space Shuttle Orbiter in 1980. A number of flights will be dedicated to life sciences experiments involving physiological, biological and diagnostic-type research.

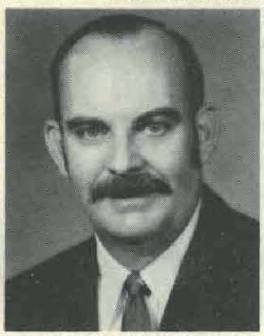
Providing for extension of the work through June 1977, each of the Boeing Co. contracts for modifications is funded at about $100,000.

COL Joseph F. Paradis
Commander, U.S. Army
Communications Command Agency

CPT Mell Peterson
Deputy for Navy & Commander,
Naval Ordnance Missile Test Facility



COL John P. Jones
Air Force Deputy
to WSMR Commander



Dr. Wilbur B. Payne
Director, TRADOC
Systems Analysis Activity

COL William C. Petty
Director
Atmospheric Sciences Laboratory

was used by the U.S. Army Ordnance Corps. California Institute of Technology was requested to investigate long-range, surface-to-surface guided missiles, and Aberdeen (MD) Proving Ground was assigned to prepare a study on such rockets.

The National Defense Research Committee, American industry and the U.S. Armed Services pooled efforts to develop missile guidance systems, and some of the results were used against the enemy late in World War II.

Currently under control of the U.S. Army Test and Evaluation Command, headquartered at Aberdeen PG, facilities at WSMR are used to support missile development test programs for the Army, Navy, Air Force, National Aeronautics and Space Administration (the latter on a steadily increasing basis) - and even, on occasion, the interests of nations allied with the United States.

The WSMR National Range Operations Directorate (NRO) supports this immense effort, principally through the Range Control Division. Other divisions are Range Services; Missile Flight Surveillance; Date Collection; Range Programs; Analysis and Computation; Programs; and the Utah Launch Complex.

All work performed at the range is performed on a priority basis. Except for designated national priority programs, R&D of guided missiles rates top priority. Then comes continued testing and refining of existing missile systems.

The third priority is testing all other weapons systems and related hardware, a category that may include programs sponsored by federal agencies other than the Department of Defense, state government agencies, educational institutions, and industry or allied countries.

All requests for support are handled consecutively as received. Exceptions are made only for support of tasks at the top of the DoD "Master Urgency List"; programs which deal with celestial conditions; programs requiring large-scale troop deployment, and joint operations with other national test ranges.

Customer waiting time after a requested support effort is programed depends on the priority listing and the complexity of support needed. In some cases, WSMR scientists and engineers may have to design special instrumentation to accommodate a test. Existing instrumentation and support systems normally are adequate or can be modified to accomplish test objectives.

The centralized procedure under the Joint Scheduling Services Committee, as mentioned earlier, assures an equitable distribution of test time and facilities to each authorized user. It also permits testing in multiple configurations for an average of four simultaneous tests.

One of the recent improvements in control capabilities is a reconfigured Operations Control and Display Facility (OCDF). When test projects are in progress, OCDF range and instrumentation controllers, flight safety officers, computer programers and operators, and other personnel cooperate closely in monitoring flights and collecting data.

OCDF personnel thus combine efforts in real-time data systems that show the exact location, direction and velocity of a missile at the precise instant it is being viewed on television monitors and tracked by radars and other sophisticated instrumentation.

Flight safety officers have continuous courses plotted, indicating the impact area of missile debris should an in-flight destruct be ordered. When the project is completed, each customer receives a complete report on all flight aspects and missile performance.

Meteorological and physical sciences atmospheric and stratospheric probes, as cited earlier, are an important part of WSMR operations, as conducted by the Atmospheric Sciences Laboratory. The ASL is under control of, and part of, the U.S. Army Electronics Command, headquartered at Fort Monmouth, NJ. Scientists from many U.S. agencies and foreign nations take part in these probes.

The U.S. Defense Nuclear Agency, the U.S. Army Corps of Engineers, and various other national and allied international agencies have combined resources in an extended program of simulated nuclear effects tests.

Reported in a series of articles in the *Army Research and Development Newsmagazine,* this program has been concerned with determination of nuclear blast effects upon weapons systems; also, surface and below ground effects upon structures (bridges, buildings, fortifications, etc.) as well as upon surface and air vehicles of numerous types and configurations.

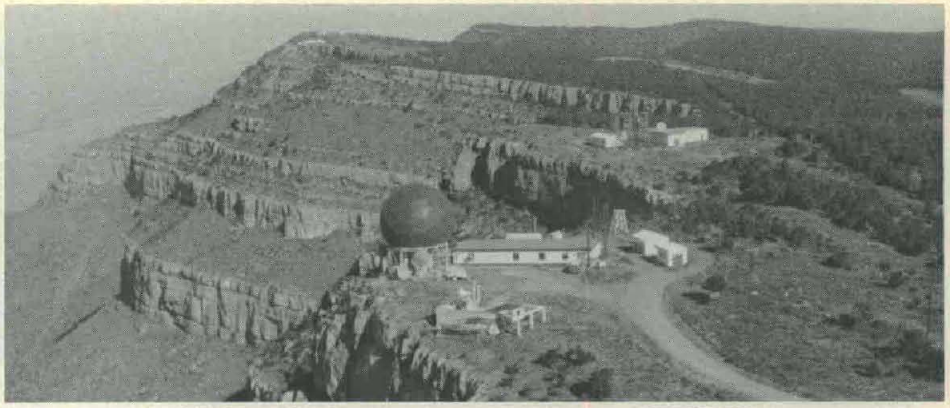
The objective of this series of detonations of high-powered explosives is advanced knowledge of how to construct stronger frames or apply improved protection against vulnerability.

WSMR has numerous tenant organizations, the largest being the Atmospheric Sciences Laboratory. It dates in range history to World War II when it was under the U.S. Army Signal Corps, and was concerned with radar and communications support for the V-2 rocket program. ASL's current mission is 3-fold.

Thirteen ASL meteorological support teams provide highly specialized support to Army R&D, including evaluation activities throughout the Continental United States, Alaska, and the Panama Canal Zone.

In addition to research, development and engineering activities linked to weapons systems and other military equipment, ASL personnel conduct extensive atmospheric and stratospheric phenomena investigations. They also are involved in development of meteorological equipment and techniques.

Another tenant is the *Naval Ordnance Missile Test Facility,* sometimes termed a "desert-locked arm" of the sea services Missile Development Agency. The NOMTF launch site is the USS Desert Ship (LLS-1), which from the inside looks like a seagoing vessel.



ATOM PEAK Telemetry Acquisition Station at WSMR, NM.

Aries I Instrumentation Collects Data at 200-Mile Altitude Range

Collection of physical sciences data in the 200-mile altitude range was the mission of an Aries I sounding rocket carrying instrumentation for three scientific experiments and launched Jan. 26 from White Sands Missile Range.

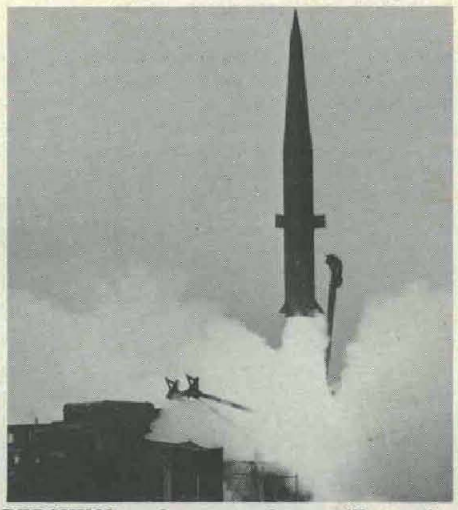
Two of the experiments were sponsored by the U.S. Naval Research Laboratory and the Max Planck Institute of Garching, West Germany. The purpose was to observe low-energy diffuse X-ray background above the earth's atmosphere; also, to observe the Vela and Puppus Super-nova remanants in the soft X-ray region.

Johns Hopkins University, Baltimore, MD, sponsored an experiment to study the extragalactic component of ultraviolet background. Detection of this type radiation has importance concerning the geometry of the universe.

Instrumentation packages and supporting equipment from all of the experiments were recovered and will be used in future space probes.

Kiruna, Sweden will be the site of another Aries I launch in March in support of the Magnetospheric Studies Program. White Sands Missile Range has scheduled additional launches in 1977-78.

Using obsolete Minuteman I missile second-stage motors for propulsion, the Aries I has had four launchings from WSMR. An all-time high-altitude record for single-stage sounding rockets was attained Dec. 16, 1976, when an Aries I reached an altitude 318.7 miles above White Sands Missile Range.



PERSHING surface-to-surface artillery missile test and evaluation has been a continuing program at WSMR since the early 1960s.

Navy-launched missiles and various other areas of investigation, including rocket probes of atmospheric conditions, have been a part of WSMR activities since 1946 when the Navy was interested in the Viking and Vanguard programs. More recently, the NOMTF has been concerned with NASA's "Man in Space" program, calibrating the Skylab equipment, and follow-on effort in Skylab zero gravity experiments; also the Aegis system designed for ships of the 1980s.

A tenant detachment of the *658th Test Group* is an element of the Air Force Systems Command's Armament Development and Test Center, headquartered at Eglin Air Force Base in Florida. The center operates a fleet of high-performance jet aircraft in support of weapons systems and subsystems tests. The detachment sponsors on-range Air Force projects.

The Troop Command has about 1,400 authorized Army personnel on the range, in support of troop facilities for the Army, Navy, Air Force and many other Army technical functions, including administrative, logistical and test activities. This force is the largest military population of any post within the Army Test and Evaluation Command activity.

The Defense Mapping Agency Topographic Center is responsible for collecting data on geodetic positions, orientations, elevations, geoid heights, gravity and astro-geodetic information on instrumentation sites and relative to test missiles.

Office of Missile Electronic Warfare. Operational at WSMR since 1952, the OMEW comprises almost half of the U.S. Army Electronic Warfare Laboratory, an element of the Electronics Command headquartered at Fort Monmouth, NJ. OMEW is interested in tests to determine vulnerability to electronic countermeasures (ECM) of all U.S. Army missiles and other systems utilizing or affected by electromagnetic radiation.

OMEW personnel define vulnerability and recommend electronic counter-countermeasure (ECCM) fixes to developers to degrade or negate the discovered vulnerability. They also prove vulnerability of foreign missiles to ECM and develop electronic warfare systems to combat foreign guided missiles and defense systems of interest to U.S. Army elements in the field.

TRASANA denotes the U.S. Army Training and Doctrine Command's Systems Analysis Activity, established in July 1974 as an evolution from the Nike-Zeus Project Office - progressively redesignated the Safeguard System Evaluation Agency, Sentinel System Evaluation Agency, and the Nike-X Engineering/Service Test Operation.

Currently staffed with 338 authorized civilian and military personnel, TRASANA is responsible for assessment of Army materiel in test operations. Predominately the staff consists of physical scientists, physicists, operations research analysts, mathematicians and statisticians, electronic and missile system engineers, economists and psychologists.

Test results are published in technical reports available within security constraints to users with a certified need to know, including cost and operational effectiveness analyses.

ARMTE is the acronym for Army Missile Test and Evaluation, a big agency at WSMR which has tested numerous missile systems until they were approved as ready for operation. Among the missile systems tested are the Nike Hercules, Pershing, Nike Zeus, Hawk and Sergeant - to list only a few.

ARMTE is concerned with nuclear radiation effects upon weapon systems, shock causes during flight, propellants and guidance systems, exhaustive environmental testing, thermal radiation, and various other performance and reliability factors. Missile systems are subjected to the most extreme operational conditions conceivable - shock, tropic heat, arctic cold, ingested dust, salt and dampness exposure, operational safety, etc.

Army Air Operations is a directorate of WSMR at Holloman Air Force Base, responsible for air support of tests with 21 aircraft, OH-58 and UH helicopters. Operations involve aerial observation, photography, transportation, aircraft maintenance, and missile recovery. Aviation support is provided for the Green River Launch Complex in Utah.

The Utah Launch Complex is at Green River, about 500 miles northwest of WSMR HQ, and functions as the principal facility for off-range testing. Established in 1963, the complex has served the Army's Pershing and the Air Force Athena Programs. Satellited on the complex are the nearby Black Mesa launch and White Mesa radar installations.

Army Communications Command responsibilities at WSMR include engineering, installation, operation, modification and maintenance of telecommunications and data transmission systems, surveillance and analysis, and frequency management.

Among other performance requirements are ground-to-air communications, teletypewriter networks, mobile radio systems with base station and remote-control units, radio command guidance and destruct signals, and instrumentation control circuitry. The ACC has about 500 employes at WSMR, 22 communications stations, 18 frequency management facilities, and 25 timing facilities.

Total value of ACC facilities and instrumentation is about $50 million.

Holloman Air Force Base on the eastern border of WSMR is "home" to the 49th Tactical Fighter Wing, the largest combat wing in the U.S. Air Force, and to the WSMR Army Air Operations Directorate, as well as the 6585th Test Group.

The group directs R&D activities of the Central Inertial Guidance Test Facility, a radar target scatter site, the Maintenance Support Division, and a 50,000- foot high-speed sled track known as the "most precisely aligned and completely instrumented test track in the Free World." The track claims the world's land speed record of more than 5,600 mph for an earth-bound vehicle.

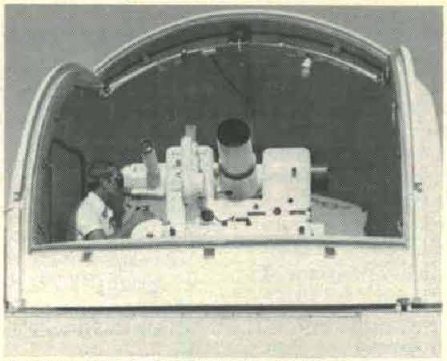
The NASA Johnson Space Center selected WSMR in 1962 to test the Apollo Space Flight Program command and service modules in suborbital tests of launch escape and earth landing systems; also, related flight dynamics and structural investigations. NASA was assigned an 88-square-mile area for development of a propulsion systems test facility.

NASA is now a large-scale user of WSMR facilities for an expanding area of investigations, including the Space Shuttle Orbiter maneuvering system, reaction control system and the auxiliary power system. Considerable R&D effort on the Viking spacecraft, which in 1976 landed on Mars, was performed at WSMR. NASA also conducts probes of upper atmosphere clear air turbulence at the range.

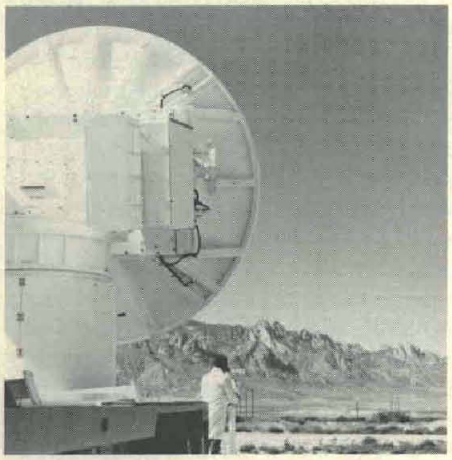
Known as the birthplace of the U.S. missile R&D program in 1945 and in the late 1950s of the U.S. expedited space program, WSMR is today increasingly prominent as a "place where the action is" - busy, busy, busy!

Somewhat incongruously, perhaps, the wide open spaces of the vast military reservation serve as a wildlife refuge for many animals including big horn sheep, wild horses and a growing herd of African gemsbock.

Fundamentally, its national range role is growing as a research, development, test and evaluation asset of tremendous importance to the United States and its allies.



CONTRAVES CINETHEODOLITE (mobile) permits angular position recording of the pointing axis from the instrument to target, which provides azimuth, elevation and angular data tracking for tests at WSMR.



AN/MPS-36 RADAR used for precision missile-tracking at WSMR can be moved from site to site and operable within eight hours.

VERSATILE TRACKING Mount with 180", 100" and 50" lens at Frank Site, WSMR.

Developing Methodologies for Helicopter Analyses

By Donald J. Merkley

U.S. Government agencies and helicopter manufacturers as well as other organizations involved in research, development and operation of rotary-wing aircraft need a capability to predict accurately structural design loads, aeroelastic stability, stability and control, and performance characteristics for helicopters of various sizes and rotor types.

Government scientific and engineering personnel need this capability to reduce development and procurement risks for new helicopters; prevent delays in deployment; reduce reliability and maintainability problems of operational aircraft; and to prevent undue restriction of usage due to unsolved technical problems.

Each airframe manufacturer presently employs several analysis methods of varying complexity. These methods, particularly the more simplified ones, are applicable only to the type and size of rotor system in which the airframe manufacturer has specialized.

Furthermore, most manufacturers have limited capability to account for the effects of coupling of advanced flight control systems, fuselage motions, and inadvertent high-frequency pilot inputs (pilot-coupled oscillations) with the rotor.

Structural design, aeroelastic stability, stability and control, and performance of rotary-wing aircraft employing advanced rotor concepts and flight control systems cannot be predicted with sufficient accuracy to meet Army and industry needs.

Analysis methods such as the Bell Helicopter Textron (BHT) Rotorcraft Flight Simulation (C-81), the Lockheed California Co. REXOR, and the Sikorsky Aircraft Co. Normal Modes (Y-200), constitute the state-of-the-art in comprehensive analysis mathematical models. These are referred to as first-generation comprehensive analysis methods.

The Eustis Directorate of the U.S. Army Air Mobility Research and Development Laboratory (AMRDL) is responsible for managing the development of a system of analysis methods to satisfy the needs of U.S. Government agencies and industry. This has been designated as the Second Generation Comprehensive Helicopter Analysis System, objectives and applications of which are depicted in Figure 1.

System development requires a close working relationship between the government and the industry to ensure that it will be user-oriented to encourage widespread acceptance and application. A Government/Industry Working Group (GIWG) with representatives from six helicopter airframe manufacturing companies, AMRDL, the RD&E Directorate of the Army Aviation Systems Command (AVSCOM), and the National Aeronautics and Space Administration has been established to serve in an advisory capacity to enhance the user orientation.

Architecture of the system has not been defined but will be evolved during planning and development phases. The system is expected to consist of an executive routine and assortment of technology modules (Figure 2) which can be utilized in combinations to solve specific problems.

Modules will contain such mathematical descriptions as the helicopter structure, aerodynamics, dynamics, and inflow velocities. First-generation comprehensive analysis methods will be evaluated to determine their strong and weak points, and to maximize the benefits of lessons learned in their development and application.

The system is expected to provide a framework for "testing" and validating new technology modules and will provide a unifying end item orientation to the development and validation of these modules.

The system will be designed using a 3-part iterative approach. The first step is a detailed definition of the needs for the program, i.e., the required functional capabilities. Next is a synthesization of an architecture or configuration of an executive routine and modules. The third step is to assess system capabilities. This 3-part process will be repeated until a satisfactory configuration for the system and reliable function capabilities have been determined.

Development effort consists of five phases: planning (started in FY 75), pre-design (FY 77), design, validation and maintenance. The design phase calls for functional demonstration of the system in three to four years, followed by the validation phase requiring extensive participation by user organizations.

The maintenance phase will correct errors and deficiencies in the system and incorporate evolutionary improvement changes in technology modules. The final analysis system must be reliable and economical without undue compromise in accuracy.

Herman I. MacDonald, who heads the system development at the Eustis Directorate, stated: "A very challenging technical development program is being undertaken to make a major improvement in the capability of rotary-wing aircraft manufacturers and the Army...and reduce the risk associated with acquisition of rotary-wing aircraft weapon systems which incorporate advanced technology."

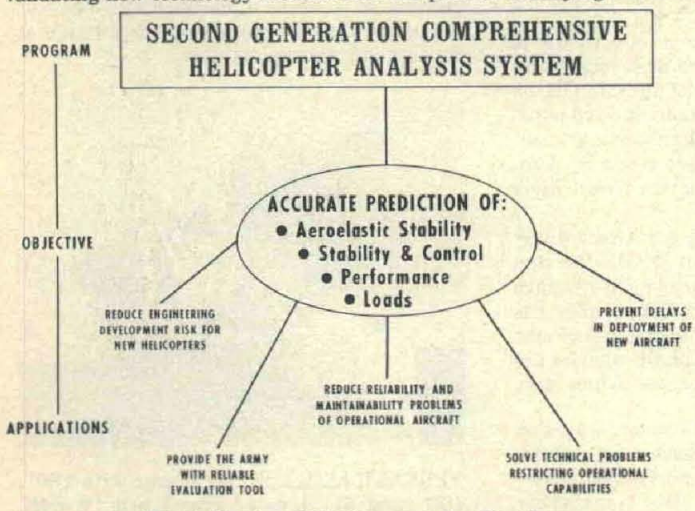


Fig. 1. System Objective and Applications.

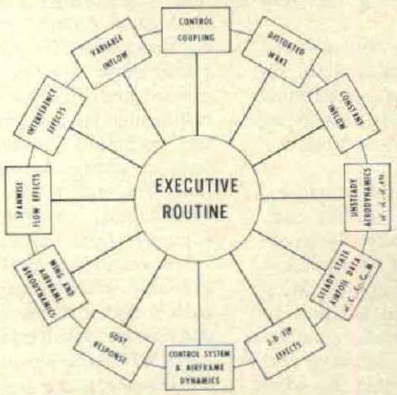


Fig. 2. Possible System Configuration

DONALD J. MERKLEY is an aerospace engineer with the Eustis (VA) Directorate, U.S. Army Mobility Research and Development Laboratory (AMRDL). He graduated from the University of Texas at Arlington with a BS degree in aerospace engineering (1969) and an MS in mechanical engineering (1971). Prior to joining AMRDL in 1971, Merkley was an aerodynamics design engineer at LTV Aeronautics.

Engineers Select 16 Sites for Shoreline Erosion Study

Selection of 16 U.S. coastal sites as the first phase of a 5-year program to test and evaluate shoreline erosion control measures was announced recently by U.S. Army Chief of Engineers LTG J. W. Morris.

Authorized under Section 54 of the 1974 Water Resources Development Act, the projects are not designed to solve problems of individuals. The purpose is to demonstrate effectiveness of various erosion control measures at different types of shorelines. Solutions to the selected erosion site problem will enable private owners to choose an approach best suited to their requirements.

Selected sites, 10 of which were recommended by the Corps of Engineers Shoreline Erosion Advisory Panel, are Kotzabue and Unalaklett, AK; Alameda, CA; Bowers, Kitts Hummock, Lewes, Pickering, Broadkill and Slaughter Beaches, DE; Basin Bayou State Park and Stuart-Jensen Causeways, FL; Geneva State Park, OH; Bulls Island, SC; Sand Point, TX; Oak Harbor, WA; and Port Wing, WI.

The second phase of the program will entail planning and design of specific devices for installation at the sites and environmental impact evaluations of proposals.

Speaking On . . .

(Continued from page 15)

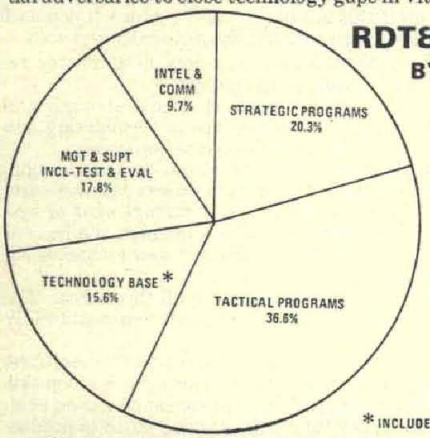
These cooperative efforts are an important factor in the U.S. weapons acquisition strategy because they are highly leveraged, yielding large payoffs in return for relatively few resources. The FY 1978 RDT&E program will continue to build on the momentum already achieved within NATO toward increasing alliance force effectiveness and lessening the burden on the resources of all NATO members.

U.S. R&D in the Private Sector. The close interrelationship among U.S. defense, industrial and academic R&D communities has been a major contributor to the technological leadership on which our military security and economic vitality have depended since World War II. Defense must continue to support and draw on the wide base of advanced technology and efficient production processes of our civil sector for the superior military hardware essential to meet future security requirements.

RDT&E planning consciously seeks to improve the ties among the components of our national R&D community and to strengthen the competitive forces on which we depend for innovative, efficient and high-quality military systems. The FY 1978 RDT&E program will continue to emphasize competitive prototyping and independent R&D as important elements of our R&D strategy. In addition, we must increase the participation of industry and universities in technology base programs.

Technology Transfer. Although technological diffusion is a fact in today's highly competitive international environment, we must continue to minimize its impact on U.S. technological leadership in areas of importance to our defense. We can do this in two ways.

- First, we must ensure that investment and other incentives to continued innovation are sufficient to keep our lead in advanced technology despite the losses that result from the transfer of technology.
- Second, we must continue to restrict the transfer of those technologies — particularly production technologies — which would enable potential adversaries to close technology gaps in vital defense areas.



RDT&E FY 78 BUDGET
BY MISSION AREA

	(MILLIONS)
TECHNOLOGY BASE	1,879.8
ADV TECHNOLOGY DEV	638.4
STRATEGIC PROGRAMS	2,439.5
TACTICAL PROGRAMS	4,408.1
INTELL & COMM	1,169.8
PROGRAMWIDE MGMT & SUPPORT	1,458.0
TOTAL	12,043.6

* INCLUDES ADV. TECH. DEVELOPMENT

FY 1978 RDT&E Program Emphasis. The distribution of the FY 1978 RDT&E budget request by mission area is shown in the chart.

The major programs supported by these (fund) allocations include:

Strategic Programs. We will proceed with RDT&E programs intended to prevent or redress unfavorable assymetries and to counter any Soviet developments and deployments which appear to be aimed at upsetting the future strategic balance. These programs include:

- $1.94 billion to maintain the survivability and increase the effectiveness of the Triad of U.S. strategic retaliatory forces: B-1, MX, Trident, cruise missiles and improvements to strategic retaliatory systems.
- $249 million to improve U.S. strategic defensive and warning systems and to hedge against future requirements: Advanced Interception Technology, Joint Surveillance Systems, the Mosaic Sensor Project, and Ballistic Missile Defense R&D.
- $108 million for space defense R&D. Soviet development and testing of a potential antisatellite capability clearly threatens the survivability of our space systems and raises the specter of space warfare as a new dimension of conflict. We are responding to this Soviet initiative in space by expanding those RDT&E programs which will provide a capability for protecting U.S. satellite systems. These programs include: Space Surveillance, Ground-Based Electro-Optical Deep Space Surveillance, Satellite-borne Long-wave Infrared Sensors, Satellite Systems Survivability.
- $129.7 million to support the Space Shuttle. Be reducing the cost and increasing the flexibility of transporting large payloads to and from space, the Space Shuttle will permit much more effective and efficient military space operations. Defense RDT&E funds are requested to support development of a capability to use the Shuttle, including an Interim Upper Stage which will permit DoD space systems to achieve high-altitude orbits, and a shuttle launch and landing capability at Vandenberg AFB which will permit continuing polar launches.

Nonnuclear Forces. Owing in a large part to the emergence of perceived nuclear parity and the increased premium placed on the deterrence of conventional warfare, we are requesting $4.4 billion in RDT&E to improve the readiness of and to modernize U.S. general-purpose forces. The main focus of this effort is to provide the basis for a force structure that, with our allies, will maintain the Central Europe maritime balance.

Primary emphasis in FY 1978 is being given to removing current deficiencies in U.S. air defense, antiarmor, electronic warfare and area-denial capabilities for the land forces; to modernizing U.S. naval forces so that they are fully capable of countering the Soviet sea-denial threat; and to developing precision and area weapons and improved electronic warfare capabilities for our tactical air forces.

C^3 Capabilities. We are requesting $633.7 million in FY 1978 for RDT&E in C^3 systems (major command, control and communications).

The real-time integration of the functions of surveillance, target acquisition, and command and control offers the potential for greater force effectiveness leverage in the future. New capabilities such as AWACS and the NAVSTAR Global Positioning System, among others now in R&D, can achieve force effectiveness multiplication, thereby assisting in our attempts to offset Soviet quantitative superiority.

The Technology Base. Two years ago a funding policy was instituted aimed at strengthening the technology base by allocating a 10 percent real increase in the research program and a 5 percent real increase in the exploratory development program each year. This policy, approved by the Congress, will be continued in FY 1978.

In the case of the Defense Advanced Research Projects Agency (DARPA), whose role is to forestall major technological surprises, decisions have been made to expand funding to allow aggressive technology development which would make a significant difference to national security.

The technology base, which includes DARPA, is the source of new technologies and innovations which could lead to major payoffs for our national security in the future. These efforts include: investigating greatly improved infrared sensor systems for surveillance from space; demonstrating low-cost terminally-guided munitions; developing advanced signal processing techniques for submarine detection and localization; developing lower drag concepts for improving the range, speed and endurance of undersea vehicles; flight testing an integral rocket-ramjet engine prototype; exploring the potential of a high mobility/agility armored vehicle with automatic cannon; developing technology options for greatly improved command and control capabilities; improving rotary-wing (aircraft) technology.

Technology inititatives (planned) to reduce the costs of manpower and future systems include ceramic turbines, alternate aircraft fuels, advanced composite structural materials, superalloy tooling and molding techniques, ring laser gyroscopes, nondestructive inspection techniques, improved nuclear propulsion reactor cores, mini-remotely piloted vehicles, and new training and evaluation methods.

These programs are examples of investment in new, higher payoff technology that will retain our technological initiative and can provide lower cost options for retaining U.S. deterrent capabilities in a highly uncertain future. We are requesting $2.6 billion in FY 1978 for these TB efforts.

DEFENSE RDT&E OVERVIEW.

Dr. Malcolm R. Currie

This is my last statement to the Congress as Director of Defense Research and Engineering. I want to restate a fundamental conviction which I have emphasized over the last several years and which underlies our program of Defense RDT&E: I believe that this nation must maintain a posture of unequivocal technological superiority.

A willingness to settle for technological "equivalence" is not sufficient; it would be a step to eventual disaster. My overriding concern is that we ensure that we have the climate, the direction, and the national commitment always to seize and maintain the technological initiative. This is fundamental to our security, fundamental to our economic well-being, fundamental to our role in the world. It is our strength. We must recognize it as a national imperative for our future survival and prosperity.

Last year, in assessing the technological balance and trends vis-a-vis the Soviet Union, I voiced concern that these trends, if continued, could lead to a precarious position for us by the mid-1980s. I stated that we must reverse them. Congress responded and appropriated the second consecutive real increase in Defense RDT&E, thereby continuing to reverse a decade-long downward trend in investment in our future security. This action was an important step toward assuring a posture of technological superiority into the 21st Century.

This request of $12 billion for FY 1978 Defense RDT&E, which represents a real growth of some 6 percent, will sustain that commitment. It is an important phase of the prudently paced multiyear investment which

(Continued on page 22)

SPEAKING ON . . . *(Continued from page 21)*

I discussed with the Congress last year. It will assure the projection of our technological leadership into the future. It constitutes less than 10 percent of the total defense program, as contrasted with more than 14 percent in the early 1960s. It has been scrubbed by more than $1 billion from a fully justifiable and carefully planned program. However, if managed vigorously, I believe that it will still maintain the needed momentum and permit us to achieve this national objective.

TECHNOLOGY BALANCE UPDATE. During the last several years we have studied extensively the scope and quality of military research and development in the Soviet Union and have compared it with our own effort. From this we have derived a feeling for relative trends and relative strengths and weaknesses and how these might impact us in the future.

In my over-all assessment last year — in which I described many numerical indicators and analyses of the quality of the products emerging from Soviet R&D in the strategic, general-purpose forces, and space areas — I concluded:

- That today the U.S. has a technological lead in most areas crucial to our security but that lead is eroding and in some areas is already gone.
- That, without appropriate action on our part, the Soviets could achieve, on balance, a position of clearly perceived military superiority in terms of the combination of quantity and quality of their deployed military weapons at some point during the 1980s.

I suggested that the "appropriate action," which would prevent this sober assessment from becoming a prediction of future reality, should be a strong national commitment to retain our technological *leadership, backed by a multiyear investment having continuity and real annual growth of at least 6 to 10 percent in R&D and procurement . . . .*

Nothing during the last year has changed my basic technology balance assessment. The Soviet Union's determined drive toward supremacy in deployed military technology has not abated. It continues on a broad front. There have also been some surprises: I note, for example, the deployment of the powerful new HIND D attack helicopter; further demonstration of antisatellite capability; and the profuse armament aboard the Kiev, including long-range, supersonic, tactical cruise missiles.

All of this underscores the fact that the technological competition is very real and is intense. The Soviet leadership stresses explicitly the necessity of acquiring and maintaining the initiative in military-technological developments so as to insure that the qualitative level of Soviet weapons *becomes unsurpassed and ultimately "that the USSR triumphs over the U.S. in the struggle for military-technological supremacy."*

This belies any direct action-reaction mechanisms which may have existed in the past. It also explains the sheer magnitude of the Soviet effort in basic science and military R&D, which is far larger than our own effort in terms of over-all commitment of people and resources.

Soviet *production technology* is becoming increasingly sophisticated; the Soviet Union is steadily gaining the ability to manage the production of large-scale complex systems. This means that, instead of needing to offset just a quantitative advantage with our own quality, we are increasingly facing "quantity *and* quality" — and this, in turn, places a still greater premium on the quality of output from our own technological efforts.

We have a strong advantage in having a large and competitive high-technology civil sector upon which we can draw. We also have an advantage in certain *critical technologies* such as *microelectronics, computers* and *materials*. We must vigorously exploit these technologies and continue to build on our advantage in the future. The Soviets understand this and are *seeking to acquire Western products and production technologies.*

In the *strategic* area, we have *generally underestimated the momentum of Soviet programs* and their rate of progress in technical performance (e.g., high-accuracy guidance technology). A Soviet countermilitary advantage is clearly coming into existence and, along with it, a war survival posture that could seek to place the USSR in a stronger position than the United States if war occurred.

In *general-purpose forces* the Soviets have undergone and are continuing massive expansion and technological transformation in mission areas:

- Although I believe that we maintain decided performance advantages in our *tactical air forces,* an area in which we *must maintain a clear margin of superiority,* the Soviets are rapidly acquiring a new generation of *offensively oriented* aircraft and deploying them in large quantities.
- In the *maritime balance* the situation is not as clear although, on balance, we still probably lead. The Soviets are developing *formidable attack submarine technology, a variety of offensive strike cruise missiles global command and control involving use of satellites, and a worldwide land-base naval aviation arm in the Backfire* — all of which lead to the ability to interdict the sea lanes so vital to the Western World.
- It is in the area of *land warfare systems* that I am most immediately and urgently concerned. The Soviets have mounted a modernization program of unprecedented magnitude. In many cases they are widely deploying technology *now* for which we will not have roughly comparable counterparts until the early-to-mid 1980s. For example:

Mobile air defense	sophisticated, dense
Attack/assault helicopters	very impressive, new aerial platform for advanced weaponry and tactics
Infantry combat vehicles	superb new systems; amphibious, armored, heavily armed
Self-propelled artillery	long-range, high-firing rate
Tanks	new T-72 in large quantities
Mobile multiple-rocket launchers	enormous firepower; we have no comparable weapon
Antitank weapons	long stand-off, precision guidance
Electronic warfare	organic part of doctrine
Mine-laying	a Soviet specialty
Chemical warfare	clear Soviet lead
Support vehicles/equipment	extensive, complete
Sophisticated command & control	an area of Soviet concentration

Their new capabilities aggregate to a revolutionary change in land warfare. They are clearly designed for the surprise and rapid movement associated with a massive breakthrough blitzkrieg strategy involving high mobility, unprecedented massed armor and firepower and new kinds of tactics. *And always — along with this striking technology progress — is the issue of deployment in huge quantity.*

Finally, in assessing an over-all technology balance, we must always be sensitive to the unknown but real possibility of technological surprise. We are competing with a closed society. We lay out in the open and debate our plans, our thinking, our accomplishments; the Soviets do not.

In our highly complex and technologically dependent society, we may be particularly susceptible to numerous possibilities for technological surprise which could have disastrous economic or security consequenses.

This over-all assessment portrays a magnitude of commitment and momentum on the part of the Soviet Union which inevitably will carry long into the future. I believe the net technology balance is clearly on our side today, but it is deteriorating. The Soviet Union has the expressed determination and has mounted an effort whose inexorable goal is to further erode and erase that lead. If this is a blunt, sober picture, it is not of our making. Trends must be dealt with realistically, *prudently and now.*

This assessment forms the background for our own programs of research and development and modernization investment.

U.S. DEFENSE RDT&E; Status and Perspectives. I have strongly and explicitly emphasized the following three objectives in formulating and managing the Defense RDT&E program over the last several years:

Maximize the *output* of R&D in terms of completed system developments which can be produced and fielded to provide the needed near-term modernization of our armed forces; strengthen the *management* of systems development and acquisition; strengthen and broaden the base of *technology* to insure innovative new options and major new technological directions for our long-range security.

I believe we have made very significant progress in all three areas. The FY 1978 program will build directly on this base. I will comment briefly on each of these objectives.

Output of RDT&E Program. In the end, the measure of a successful research and development program is superior and affordable weapon systems in the hands of the Armed Forces. We have concentrated on completing existing programs and successfully transitioning them to production, even at the expense of postponing some important developments.

TABLE 1—Programs in Final Stages of Development Or Early Production (FY 1978)

UTTAS Transport Helicopter—HARPOON Anti-Ship Missile—AWACS, Advanced Warning Communication System—AIM-9L SIDEWINDER Air-to-Air Missile—AIM-7F SPARROW Air-to-Air Missile—F-16 Air Combat Fighter—SM-2 Standard Missile— STINGER Air Defense Missile—PHALANX Ship Defense—B-1 Bomber—TRIDENT I Strategic Missile—TRIDENT Submarine— Laser MAVERICK Air-to-Ground Missile—MICV Infantry Combat Vehicle—TACFIRE Artillery Control System—EF-111A EW Aircraft—CH-53E Cargo Helicopter—FLEET SATCOM Communications Satellite—A-6E TRAM—FLIR on A-7E—GBU-15 Glide Bomb—AN/TSQ-73 Air Defense System—XM-198 Howitzer—AN/TPQ-36 and AN/TPQ-37 Mortar and Artillery Locating Radars—JTIDS Secure Data Link Terminals for AWACS—ALQ-131 Jammer—CAPTOR Mine—PHM Hydrofoil—Low-Cost EW Suite for Ships—Artillery Delivered Mines—Advanced WILD WEASEL Aircraft.

I believe the program has been extraordinarily productive in terms of this objective — 1975 and 1976 have been banner years in reaching critical milestones. Table 1 shows a representative list of major systems which have been introduced into production or are reaching that point. It is an impressive list. It represents part of the "return-on-investment" in Defense R&D, and I believe that return for the taxpayer is high.

All of this illustrates that, in fact, we are in the midst of a broadly based modernization program which is reaching fruition. The need for this program is evident when we examine the military hardware we have in the field today and look at the vintage of its basic design and its physical age. Examples are shown in Table 2, page 23.

Although we have continued to upgrade these equipments over many years (such as the M-60 tank, the F-4 fighter, the B-52 bomber, helicopters, air defense, etc.), many of them have been operated for 10 to 20 years. They are being replaced by the new capabilities which are the output of the RDT&E process, and which must compete with the massively

(Continued on page 23)

TABLE 2 — MODERNIZATION
INITIAL OPERATIONAL CAPABILITY DATES

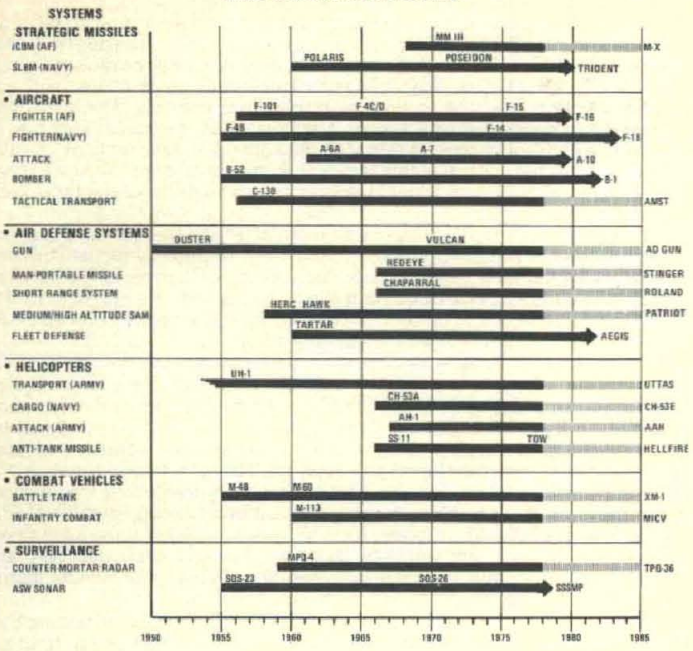


TABLE 3
Programs Continued in Full-Scale Engineering Development (FY 1978)

XM-1 Main Battle Tank—Tomahawk & ALCM, Cruise Missiles—COPPERHEAD CLGP, Precision Artillery Projectile—HELLFIRE, Anti-Tank Missile—AAH, Advanced Attack Helicopter—DSCS III, Communications Satellite—TRI-TAC, Tri-Service Tactical Communications—ROLAND, Mobile Air Defense System—PATRIOT (SAM-D) Air Defense—F-18, Navy Lightweight Fighter— Imaging Infrared MAVERICK Missile—AEGIS Fleet Air Defense—BUSHMASTER Automatic Cannon—E-4 Advanced Airborne Command Post—TACTAS, Tactical Towed Array Sonar—PLSS, Precision Target Location System—RIM-7 SEA SPARROW— HARM, High Speed Anti-Radiation Missile—LAMPS III, ASW Helicopter—Tank Thermal Night Sight—Vertical Launch STANDARD Missile—COMPASS COPE, Remotely Piloted Vehicle—SURTASS, Surveillance Towed Array Sonar.

deployed new generation of Soviet equipment (I have) described.

On the whole, we can see that our modernization will not be felt until the early-to-mid-1980s. The lead times are long. It is urgent that we press forward to achieve our modernization goals. Table 3 indicates a large number of important modernization programs also continuing in full-scale development. We are giving their success top priority.

In order to achieve this high output, we have purposefully been very selective in the number of programs allowed to enter the expensive full-scale engineering development phase. This is illustrated in Table 4, which also shows a number of programs delayed and held in the relatively less expensive early or advanced development status.

TABLE 4
Programs to Enter Full-Scale Development (FY 1978)

SOTAS, Stand Off Target Acquisition System—AMST, Transport Aircraft—NAVSTAR, Global Positioning Navigation System— Space Shuttle Interim Upper Stage—5-Inch Guided Projectile—ASMD, Anti-Ship Missile Defense—M-X Strategic Missile— WAA, Wide Aperture Array Sonar.

Programs Deferred or Maintained As Options in Advanced Development (FY 1978)

V/STOL Aircraft (Type A)—AV-8B Harrier—TAW, Thrust Augmented Wing V/STOL—GSRS, General Support Rocket System— BVR, Beyond Visual Range Air-to-Air Missile—BRAZO, Air-to-Air Anti-Radiation Missile—TASES, EW Exploitation System—Electronically Agile Radar—SINCGARS, Field Army Radio—Integral Rocket Ramjet—Air Defense Gun System—MK-500 Evader Warhead—VCX/COD Aircraft—Propelled Ascent Mine—Surface Effects Ship—Advanced Satellite—SIRCS, Shipboard Intermediate Range Comac System—Data Relay Satellite—Amphibious Assault Landing Craft—P-3X Advanced Vehicle for Ocean Control.

IN SUMMARY — over-all we have a large number of important new systems maturing toward production. We have many problems and sometimes fall short. But, in general, I think the productivity is high as measured against the rigid standards of performance and cost we set for ourselves and which are necessary for a secure posture in the 1980s.

Management of Systems Acquisition. I believe our emphasis on more rigorous management is paying off. Last year I reported that the annual cost growth rate for all programs (about 50) in the Selected Acquisition Reports, adjusted for escalation and quantity, dropped from 6.4 percent in December 1972 to 4 percent in 1975. This has since been further improved to 3 percent. These results are often masked by inflation. But the progress is real and steady. We have a long way to go — but I believe we are learning how to do a better job.

As I stated last year, my goal is to better anticipate and manage the problems inherent in the development of systems operating on the forward edge of technology and, when problems occur, to treat them openly and effectively in a way that inspires confidence from Congress and the public. We are stressing the following:

• *Competitive Prototyping.* Competitive hardware demonstration rather than paper competition has an enormous pay-off which is worth many times the investment in terms of better products and lower cost. We have seen this over and over again (examples: F-16/F-18 lightweight fighters, XM-1 tank, UTTAS, F-16 radar, Cruise Missile Guidance, AAH, AMST).

• *Design-to-Cost.* Becoming a way of life and has paid off; 69 major defense systems are now at various stages in the DTC program.

• *Better Program Management.* The most important of all. The Defense Systems Mangement College has been expanded. Program management has been established as a career path in the Services.

• *Independent Cost Estimating.* We are developing this discipline in the Services and it is leading to more realistic prediction of program costs at their inception.

• *Rigorous Management Review.* The Defense Systems Acquisition Review Council (DSARC) process has been improved continually and is reflected now in similar reviews in the Services.

• *Mission Area Needs.* We are implementing OMB Circular A-109 by emphasizing stronger program concept formulation and justification before a program is initiated. This is critical to better use and management of our defense resources.

• *Emphasis on Life-Cycle Costing.* Objective is to reduce escalating operation and maintenance costs. We are beginning to make progress, but still have a long way to go.

• *Better Contracting.* Better incentives for performance are being developed. We have initiated a "Four-Step Process" to help eliminate technological leveling, buy-ins and *de facto* auctioneering of programs which have led to large overruns in the past. *We now allow interest on capital investments which will reduce costs.*

• *Emphasis on Software Management.* Software accounts increasingly for cost and schedule overruns and constitutes a large fraction of the total cost of modern systems. We are attempting to reduce these costs.

• *Manufacturing Technology.* We have introduced extensive investments in manufacturing technologies which will increase productivity and reduce costs.

• *System Test and Evaluation. We are emphasizing independent and more realistic operational testing* early in the development cycle to discover problems. The result is better products.

At times I feel that progress is slow, but these and other similar management actions are having a significant effect. Furthermore, I firmly believe that, in research and development, firm and exacting management not only decreases costs but improves the quality of the research and the quality of the resulting products. This emphasis on management in defense R&D and systems acquisition should be expanded and continued in the future.

Base of Technology. Our long-range security and our insurance against technological surprise depend directly on the creation of a broad, dynamic and innovative base of technology on which we can build for the future. A strong research and development program must always provide options for policy decision-makers. This is our hedge for the future against surprise — and increasingly in the future, we will need this flexibility.

I have given special attention to this area because the support for this part of the over-all RDT&E program had eroded by almost 50 percent in real terms during the 1960s and early 1970s.

Two years ago, I outlined a general approach or strategy for managing the Defense RDT&E effort. In it, I divided the over-all program into two parts: Group One: Creation and Demonstration of Options. Group Two: Full-Scale System Development.

Group One includes the technology base, demonstration of new concepts, competitive prototyping, pursuit of alternative solutions to military problems — i.e., the creation of a broad base of advanced technology and technological options from which decision-makers select only those few programs which should enter the expensive Group Two category.

In Group Two, the concepts (of materiel) are fully developed for production and deployment in the field. A rigorous DSARC review controls this process and the number of programs transitioning from Group One to Group Two has been reduced significantly over the past several years.

Within this framework, I have taken the following actions to rebuild the quality of the Group One or technology base part of RDT&E effort:

Funding Policy. Because of the serious erosion in support, I outlined to Congress two years ago a multiyear plan for correcting this situation in which I requested a 10 percent annual real growth rate in Research (category 6.1) and 5 percent in Exploratory Development (category 6.2).

Congress has fully supported this plan for two years and I can already feel the uplift and new vigor resulting from this action. I ask for your continued support and promise that it will have a major and longlasting impact. The total request for the technology base program (categories 6.1

(Continued on page 24)

SPEAKING ON . . . *(Continued from page 23)*

and 6.2) for FY 1978 is $1,880 million.

DARPA. I regard the Defense Advanced Research Projects Agency as the "corporate research laboratory" of DoD. We use DARPA to concentrate on a number of specific high-risk but potentially very high-payoff directions which can have a major or revolutionary impact on our capabilities. Examples are high-energy lasers in space, revolutionary advances in submarine detection, new forms of digital communications and command and control, ceramic turbines, artificial intelligence, new types of lightweight fighting vehicles.

Because of the high probable success for these and similar thrusts and the impact they will have, I am asking for a significant increase in the DARPA budget as part of the Technology Base revitalization program.

DoD In-House Laboratories. To improve the quality of the in-house laboratories, we are moving toward block-funding and increasing the accountable responsibility of their leadership for the quality of the technology base work. At the same time, we are proceeding toward an objective of restoring the ratio of in-house to contract R&D to the lower and better balanced ratios which existed in the early 1960s. We are proceeding with consolidations, where reasonable, to reduce the . . . in-house establishment.

Industrial Independent Research and Development (IR&D). IR&D is absolutely central to the quality of defense RDT&E and weapons acquisition and I believe that its "independence" must be maintained. It is the heart of a competitive and competent industrial base: it results in lowering the cost of acquisition and it is a uniquely efficient source for new technology and the innovative new options of Group One. It is well managed, and excellent visibility is provided to the Congress. It pays for itself many times over. I feel that further controls such as separate line item budget approval in advance by Congress would destroy its independent and innovative character and be a serious loss.

DoD-University Relations. The traditionally strong and mutually supportive relationship between DoD and the university community has greatly attenuated over the years. Starting with World War II, it was the well-spring for the surge in our technical strength in terms of both critical research and people. I believe this relationship must be rebuilt; we are encouraging greater support of university research and participation by young university faculty and students in DoD laboratory activities. This trend is vital; it should be expanded.

Direction of Great Promise. With our prime focus on achieving a secure posture in the 1980s and, therefore, with most of our resources devoted to the maturing programs of today, we must keep in mind the directions which could afford radically new capabilities or, alternatively, could present us with technological surprise. Here are a few:

- The greatest force effectiveness leverage for the future lies in integrating in real time the functions of surveillance, target acquisition and command and control of forces. Building on concepts such as AWACS, NAVSTAR, packet communications, and battlefield fusion of intelligence, force multiplier factors of three and upwards can be achieved. We must rely on such force multiplier technology to compensate for "quantity *and* quality" on the Soviet side.
- Cruise missiles — already changing military thinking — are in their infancy and offer revolutionary potential. Future characteristics such as "zero CEP" accuracy at large stand-off ranges and supersonic dash, at relatively low cost, will fundamentally change land, sea, and air warfare.

Dr. Currie also listed: High-energy lasers. New forms of undersea submarine detection. New capabilities in space, including satellites used for targeting, missile guidance and surveillance. Applications of the Space Shuttle Aircraft with low observables to make them virtually undetectable and with V/STOL capabilities (EW) forms of defense against missiles.

All of these and others will dominate future thinking and our future programs. A vigorous technology base must be created now.

NATO STANDARDIZATION. There is increasing recognition of the importance of achieving efficiencies and improved effectiveness through standard and interoperable systems in NATO.

I fell the U.S. should take the lead in bringing this about through a policy of international cooperation with our allies which will encompass joint industrial programs, licensing both ways, and co-production.

We have been pursuing this goal vigorously. We have made a great deal of progress despite the complexities of national interests, international economic factors, and industrial pressure groups here and abroad. But we still have a long way to go. The Culver-Nunn legislation has been very supportive of this effort.

The F-16 is a successful adoption of NATO standardization on a U.S. product. The U.S. adoption of the German/French ROLAND is an example of an excellent system which fills a high-priority need for us and achieves a high degree of standardization and interoperability in NATO.

Other recent examples include adoption of common consumable logistic items on the XM-1 tank, adoption of our A1M9-L missile, cooperative programs on air-to-surface ordnance, ship defense missile, secure communications, ammunition, field radios, Harrier V/STOL, and others. NATO AWACS, which would provide a powerful and cohesive capability for the Alliance, may yet become a reality.

I urge Congressional understanding and support for this thrust.

TECHNOLOGY TRANSFER. The subject of technology transfer is controversial. On one hand, our free enterprise system allows and encourages the export of products and technology, and this is of economic importance to the nation. On the other hand, much of this technology is the lifeblood of our future security, both military and economic.

Moreover, the Soviets are clearly seeking to narrow critical areas of deficiency (e.g., microelectronics, materials, computers, instrumentations, production technology, etc.) by importation of Western technology.

The Defense Science Board, at our request, has studied this issue and made recommendations on how to improve our controls. The board proposes that we concentrate less on the myriad of individual controls on products *per se* and concentrate more on control of development, production and process control technologies and on control over the more "revolutionary" technologies which are emerging (versus "evolutionary" technologies).

I am convinced that stronger and more effective treatment of technology transfer is required. We are taking steps to implement the DSB recommendations. New guidelines are badly needed. Changes in the bureaucracy of munitions and export control may be needed. We cannot afford to deplete the reservoir of technology vital to our national interests and leadership faster than that reservoir can be refilled.

Joint Service Programs. The time is long past when we can have the luxury (and waste) of individual Service developments for every "requirement." In addition to fiscal realities, the complexities of modern systems and requirements for intimately integrated and interdependent tactics between (Military) Services dictate that we increasingly approach requirements and systems developfts on a truly joint-Service basis.

I have stressed Joint-Service programs with a designated lead Service as a preferred alternative to total centralization of management in DoD. I am encouraged by our progress: we now have some 60 or more joint development programs and another 15 or so Joint Operational Test and Evaluation programs. Progress is sometimes difficult, but results justify efforts.

Some outstanding examples are the NAVSTAR Global Positioning System, internal countermeasures for the F-16/F-18 (aircraft) fighters, GATOR mine, and AIMVAL/ACEVAL air-combat test. The new Beyond Visual Range air-to-air guided missile is another example, as well as the Cruise Missile Program.

Joint programs will be increasingly important in the future. They save money. They provide a common and well-integrated military capability . . . .

Dr. Currie at this point in his Posture Statement presentation turned to a discussion of "Highlights of FY 1978 RDT&E Program," pointing out that materiel development proposals call for $4.4 billion of the recommended $12.0 billion budget to be spent on general-purpose forces. He covered each of the DoD proposed major weapon systems, and concluded with:

A strong program of Defense R&D is a powerful guarantor for our future. We have such a program. Congress has reversed a deteriorating pattern and, with a continued commitment for FY 1978 to an unequivocal goal of U.S. technological leadership, I believe we can look to the 1980s and beyond with optimism.

People in Perspective...

Epitome of Job Satisfaction...

Chief of DARCOM OPM Elated Over Extension

Any claimants to the good fortune of having the most exciting and satisfying job in the United States Army may be challenged by COL Lauris M. Eek Jr.

When interviewed for this article, COL Eek had the smile of good news spread broadly across his lean face. He had just been notified of approval of his request for a one-year extension of duty that evokes his full enthusiasm.

COL Lauris M. Eek Jr.

Considering that he is charged with management responsibility which in FY 1976 involved military materiel projects budgeted at $3.3 billion, that elation might be a bit difficult for some of our readers to comprehend—particularly when Congress is continually demanding maximum ROI (Return on Investment).

COL Eek, however, says he would not willingly change his job as chief, Office of Project Management, U.S. Army Materiel Development and Readiness Command, a position he has held since June 17, 1974—although he has enjoyed all of his continuous high-level assignments in R&D since August 1970.

Washington, DC, is to the nation at large the hub of the most excitingly important news. COL Eek terms project management of research, development, test and evaluation of military materiel the "most exciting, challenging and professionally demanding game in town...."

"In peacetime," he added, "I consider the responsibility of getting the utmost in effective results for the defense of the nation, for dollars expended, through dedicated performance of project management duties, the most important job a young general or colonel can hold."

The basis for that viewpoint, of course, is that *how well* DARCOM's 56 program/project/product managers perform *is the key* to how much of rugged, reliable, advanced or improved materiel the Army gets for the nations' defense, within whatever austerity restraints are imposed.

"LTG Sammet (DARCOM Deputy Commanding General for Materiel Development) believes that tremendous improvement has been made in administration of the Project Manager Program during the past four years," COL Eek said, speaking of his immediate superior. "Our goals for the future are to formalize the gains that have been achieved and to build solidly for the future—to ensure a corps of highly professional project managers on a continuing basis.

"This includes expansion of the educational opportunities for both military and civilian personnel in the PM Program, to use advanced automatic data processing and computer technology in administration, and to establish a Department of the Army Selection Board for PMs in grade of lieutenant colonel."

Only military personnel serve as program or project managers but civilians fill the deputy and four out of five of the other positions in project manager offices, COL Eek explained.

Graduated with a BS degree in military engineering from the U.S. Military Academy, COL Eek earned an MSE degree (mechanical engineering) from the University of Michigan. He completed basic and advanced courses in the Armor School and the weapons effects course in the Armed Forces Special Weapons Project. He also is a graduate from the Command and General Staff College, and the Army War College.

During the past 10 years he has served as chief, Armor and Combat Vehicles Test Division, U.S. Army Arctic Test Center, Fort Greely, AK; G-3, 1st Armored Division, Fort Hood, TX; commander, 2d Battalion, 13th Armor, 1st Armored Division, Fort Hood, TX, and commander, 1st Brigade, 2d Infantry Division, Korea.

When he returned from Korea in 1970, his first assignment was deputy chief, Combat Materiel Development, Office of the Chief of R&D, HQ DA. Then he became chief, Management and Evaluation Division, OCRD; assistant director and then director, Plans and Programs, OCRD.

COL Eek has two main hobbies. The first is to work on the family cars—how well is attested by a 1966 Buick whose speedometer shows 170,000 miles. He says it is "still running good." He has served on the audio systems committee of the Vienna (VA) Baptist Church for seven years and currently heads it. He also is a deacon of the church.

One of his family problems is that his wife makes it hard for him to keep "secrets." She is a parapsychology instructor at Northern Virginia Community College and a lecturer on ESP (extrasensory perception).

A son, Lauris Eek III, is a student at Wofford College, Spartanburg, SC; Donna is a student at Blue Mountain (MS) College and Jeanne is a junior at Madison High School, Vienna, VA.

Upward Mobility Goals. . .
Result in Rewarding Army Career for BG Paige

Opportunity to gain an education and achieve a better way of life by enlisting in the United States Army beckoned to BG Emmett Paige Jr., currently "wearing three hats" in major assignments, when he was 16 years old.

BG Emmett Paige Jr.

Queried as to how he entered the Army at that age, BG Paige smiled as he responded: "Well, I just *wanted* to get into military service."

In addition to serving as project manager of the DCS (Army) Communications Systems at Fort Monmouth, NJ, BG Paige is commander of the U.S. Army Communications Systems Agency, Fort Monmouth, NJ, and the Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, AZ.

Born Feb. 20, 1931, in Jacksonville, FL, he entered the Army in that city and completed basic training with the 9th Infantry Division, Fort Dix, NJ. Assigned to the 159th Field Artillery Battalion, 25th Infantry Division Artillery, in Nara, Japan, he remained there until November 1949. His next tour of duty was with the 17th Armored Engineer Battalion, 2d Armored Division at Fort Hood, TX.

Selected via the Signal Leaders Course at Fort Gordon, GA, for Officer Candidate School during an assignment with the 29th Heavy Tank Battalion, 2d Armored Division as communications chief, he graduated from the Signal OCS at Fort Monmouth, July 18, 1952.

Duty with the 41st Signal Battalion (Construction), Fort Bliss, TX, led to assignment with the Seventh Army in Worms, Germany, as a platoon leader, 315th Signal Battalion (Construction).

An assignment with the 40th Signal Battalion (Construction) in Karlsruhe, Germany, was followed by completion of the Infantry Officers Communications Course, Fort Benning, GA, in October 1957. His first 3-hat assignment came as company commander, Battalion S-3 and assistant signal officer with the 9th Infantry Division at Fort Carson, CO.

After assignment as officer-in-charge, Telephone Exchanges and Facilities Control, Youngsan, Seoul, Korea, with the Eighth U.S. Army and United Nations Command, BG Paige returned to Fort Monmouth as chief, Combat Developments Branch, Office of the G-3, Army Signal Training Command.

Another step along his Upward Mobility trail was selection for the Associate Signal Officers Advanced Course, Signal School, Fort Monmouth. In June 1962 he became secretary, General Staff, Electronics Command.

While assigned to the Defense Communications Agency, Southeast Asia at Clark AFB, Philippines as staff officer, Communications Systems, he was involved with initial planning for what became the largest communications system ever built for the U.S. Forces in a combat theater—the Integrated Wideband Communications System (IWCS).

BG Paige returned to Fort Monmouth in June 1965 as deputy project manager for procurement, engineering and installation of the IWCS at a cost of more than $400 million. Promoted to rank of lieutenant colonel in July 1967, he was assigned to Vietnam with the 1st Signal Brigade and later commanded the 361st Signal Battalion which operated and maintained a portion of the IWCS.

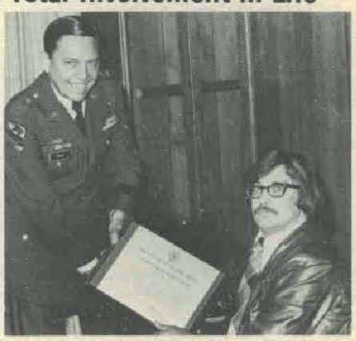
Assigned in January 1970 to the Defense Communications Agency, Arlington, VA, as staff officer on the worldwide Automatic Voice Network and the Automatic Secure Voice Network, he attended the University of Maryland and was graduated with a bachelor's degree in general studies.

Selection for the Army War College came in 1973 and promotion to colonel in July 1973. Then he received a master's degree in public administration from Pennsylvania State University.

Assigned as commander, 11th Signal Group, Army Communications Command, Fort Huachuca, he was promoted to rank of brigadier general Mar. 15, 1976, and concurrently given his present 3-hat assignment. He wears the Legion of Merit (2 OLCs), Bronze Star, Meritorious Service Medal, Joint Service Commendation Medal, and Army Commendation Medal.

Commitment to Others. . .
Leads Eustis Employe to Total Involvement in Life

Total involvement in life, as opposed to a disposition of many physically handicapped persons to withdraw from activities that tax their energy to the utmost, is a credo that has earned John A. Chappell Jr. exceptional esteem and affection among coworkers.



FORT EUSTIS Handicapped Employe of the Year Award is presented to John A. Chappell Jr. by MG Alton G. Post, commander, U.S. Army Transportation Center.

Folks with whom he associates at the U.S. Army Air Mobility R&D Laboratory's Fort Eustis (VA) Directorate had hoped that John might be selected as the U.S. Army's Handicapped Employe of the Year for 1976. It is hard for them to conceive of any one being more deserving.

Since that hope did not materialize, they believe he merits a place among "People in Perspective" who stimulate and inspire others by enjoyable companionship.

John is a GS-12 electronics engineer who has been confined to a wheelchair since he was nine years old—24 years ago. Adverse reaction to a series of rabies shots, required as the result of a dog bite, permanently paralyzed him from the waist down.

(Continued on page 26)

His deep commitment to other handicapped persons and total lack of sympathy for his own misfortune are evidenced by a life-style unmatched by many physically healthy people. Fostering activities to demonstrate skills and abilities of the handicapped gives him, as well as those he encourages, "real" happiness. "What limits the handicapped," he says, "is not their disabilities but their mental attitudes and those of their employers."

John is involved at Fort Eustis in almost every possible activity relating to the physically disabled. He is the first vice president and chairman of the board of Handicapped Unlimited, a social-civic organization which informs the public about problems of the handicapped and supports helpful legislation.

Among his most personally enjoyable activities are serving on the Virginia Lung Association Board of Directors, the Peninsula Advisory Committee on Transportation of the Elderly and Handicapped, the Peninsula Committee for Employment of the Handicapped, the Governor's Committee for Employment of the Handicapped, and the Advisory Committee of Disabled Individuals.

Indicative of his talents as an employe and his total dedication to his work is a long list of notable achievements. In 1976 he presented a paper, "Low Cost Digital Data Acquisition for Army Helicopter Tests," at the annual Instrumentation Society of America meeting in San Diego, CA.

Working independently, he designed "a complex electronic control panel to operate an automatic safety system for a ballistic test chamber, consisting of automatic door interlocks, sound warning device, flashing lights, and other intricate mechanisms that performed without flaw the first time operated."

As functional chief of the Electrical and Mechanical Instrumentation Area, Experimental Investigations Support Branch, Technical Support Division, he is concerned with design of various instrumentation systems. He also provides a point of contact within and outside of the Eustis Directorate for electronics instrumentation. The laboratory has recently been assigned additional responsibility for contractor data reduction requirements. Chappell serves as coordinator for this function.

John lives in his personally designed home which features long, low windows for easy escape in case of fire, a ramp from the garage to the house, a double-sided fireplace, and extra wide doors to facilitate moving about in a wheelchair.

His initiative to help others has resulted in numerous modifications to buildings and restaurants in the Newport News, VA, area. Several public buildings now have ramps and wider parking spaces.

Employed at Fort Eustis since 1965, John earned an associate degree in electronics technology from Old Dominion College and a 1970 BS degree in electrical engineering from the Florida Institute of Technology.

Conferences & Symposia . . .

Themes Announced for MRC, AMSC Spring Meetings

"Mathematical Software" and "Numerical Solution of Partial Differential Equations" are themes of the spring meeting of the Mathematics Research Center (MRC) and the Army Mathematics Steering Committee (AMSC), scheduled at the University of Wisconsin, Madison.

The MRC Symposium, Mar. 28-30, is concerned with development and analysis of mathematical algorithms, the behavior and comparative testing of computer programs for mathematical computation, and the systemization and dissemination of such programs.

The scope of the program extends from the theory of mathematical computation to the practicalities of getting useful data into the hands of working scientists. The relationship of the theme topics prompted joining of the two meetings. The symposium on mathematical software will feature 14 invited speakers. For further information, contact Prof. Carl de Boor, Mathematics Research Center, University of Wisconsin, Madison, WI 53706, or call 608-263-2661.

The AMSC Conference, Mar. 30-31, continues a series of meetings held annually since 1959 to provide a forum for exchange of information by scientific and technical staffs of Army computation centers.

Prof. Peter Lax, Courant Institute of Mathematical Sciences, will be the keynote speaker. Other invited addresses will be given by Dr. Tuncer Cebeci, California State University; Dr. James Ortega, Institute for Computer Applications in Science and Engineering; and Dr. David Fisher, Institute for Defense Analyses. Contributed papers also will be presented.

Although the AMSC meeting is intended primarily to reflect interests of members of Army computing establishments and their clients, representatives of other government agencies will be permitted to attend - within limitations imposed by seating capacity of the conference room.

Further information about the AMSC conference may be obtained through Dr. Paul T. Boggs, U.S. Army Research Office, P.O. Box 12211, Research Triangle Park, NC 27709, telephone: 919-549-0641, x253, or Autovon 935-3331, x253.

Army Mathematicians Slate May Meeting at AMRDL

Five invited addresses and about 60 technical papers will be presented at the 23d Conference of Army Mathematicians, May 11-13, at the Fort Eustis Directorate of the U.S. Army Air Mobility R&D Laboratory (AMRDL), Hampton, VA.

Sponsored by the U.S. Army Mathematics Steering Committee (AMSC), the meetings are intended to stimulate an interchange of ideas between Army mathematicians and scientists, and their counterparts from universities and industry.

Invited speakers and topics of lectures include: Prof. M.D. Kruskal, Princeton University, *Solitons, Nonlinear Wave Propagation;* Prof. D.H. Sattinger, University of Minnesota, *Nonlinear Parabolic Elliptic Problems, Stability;*

Prof. Mike Crandall, Mathematics Research Center (MRC), University of Wisconsin, *Evolution Equations;* Prof. H.O. Kreiss, Uppsala University, Sweden, *Hyperbolic-Parabolic Systems;* and Prof. Edward Kamen, Georgia Institute of Technology, *Algebraic System Theory.*

Robert L. Tomaine, AMRDL, local arrangements chairman, will issue formal invitations in April, along with copies of the agenda and pertinent information. Details may be gained by writing or calling Dr. Jagdish Chandra, U.S. Army Research Office, P.O. Box 12211, Research Triangle Park, NC 27709; Phone: 919-549-0641, x254; Autovon 935-3331, x254.

Conferees Examine Usefulness of Federal Reports

How useful are, or might be, training, instructional and miscellaneous informational reports generated by military and other federal agencies in helping those who produce similar materials for use in schools, industry and other civilian community organizations?

That question was explored in recent discussion at a week-long work shop conference cosponsored by the National Institute of Education and the U.S. Army Research Institute (ARI) for the Behavioral and Social Sciences.

Operating under the guidance of the Office of the Deputy Chief of Staff for Personnel, Department of the Army, ARI personnel participated in providing an evaluation that will be used in a report on the conference.

ARI representation included Dr. Stephen L. Goldberg, Dr. Marshall A. Narva, Dr. Zita M. Simutis, Dr. Joseph S. Ward, Dr. Leon H. Nawrocki and Dr. Milton S. Katz. Additional U.S. Army participants included Dr. Lawrence Brown, Training Management Institute, Fort Eustis, VA, and CPT Robert Begland, Combat Arms Training Board.

The conference was held at the Xerox Training Center, Leesburg, VA.

AMMRC Sponsoring Meet on Using Structural Foams

Potential military applications of engineering structural foams will be discussed in depth during a Materials Technology Transfer Conference sponsored by the Army Materials and Mechanics Research Center, May 10-11, in Boston, MA.

Programed for the Sheraton-Boston Hotel, the conference is intended to acquaint Army materiel personnel with the advantages of using structural foam and to provide industry with military structural foam requirements.

Specific areas of discussion relative to foam applications will include automotive, aircraft, missiles, troop support and materials handling. Planned also is an overview of foam materials, properties, processing and designs.

Additional information may be obtained from Stan Tozlowski, Conference Coordinator, AMMRC, Watertown, MA 02172, (617) 923-3620 or Jo Ayoub (617) 923-3150.

ECOM Calls For Wire, Cable Symposium Papers

A call for early submission of technical and scientific papers proposed for presentation at the 26th International Wire and Cable Symposium, Nov. 15-17, at Cherry Hill, NJ, has been issued by the U.S. Army Electronics Command.

Comprehensive summaries of papers should be submitted no later than Apr. 30 to: Elmer F. Godwin, chairman, International Wire and Cable Symposium, U.S. Army Electronics Command, ATTN: DRSEL-TL-ME, Fort Monmouth, NJ 07703.

Notifications of acceptance of papers will be mailed by June 4 with final manuscripts required by Sept. 30. Papers may not have been previously published or presented and must meet committee criteria of minimal commercial content.

Awards...

ARI Technical Director...

Gets Presidential Management Improvement Award

PRESIDENTIAL Management Improvement Award is presented to Dr. Julius E. Uhlaner by former Vice President Nelson Rockefeller.

Thirty years of distinguished service that earned Dr. Julius E. Uhlaner a long list of honors peaked recently when he received the Presidential Management Improvement Award as technical director, U.S. Army Research Institute for the Behavioral and Social Sciences, and U.S. Army chief psychologist.

Vice President Nelson Rockefeller presented the U.S. Government's highest civilian employe award to Dr. Uhlaner in a ceremony at the White House. The citation credits him with a "commanding role in the development and implementation of the U.S. Army Classification Battery and Aptitude Area System."

Results of the system in training and military assignment compatibility are estimated to have a value to the Army of "$80 million a year," according to the justification considered in selection for the award.

During World War II, prior to becoming an Army scientist in 1947, Dr. Uhlaner served as an aviation psychologist and was earlier employed in industry. Among his first outstanding achievements as an Army scientist was initiation and development of the Armed Forces Qualification Test.

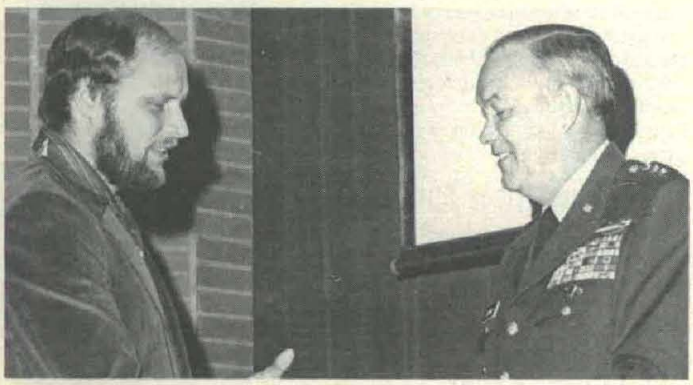
Presently he serves on the Technical Cooperation Panel, and as the principal U.S. Army member of the international group (U.S., United Kingdom, Australia and New Zealand) concerned with the Human Resources Program.

Other national and international groups with which he serves include the Armed Forces National Research Council Committee on Vision, and the Transportation Research Board of the National Academy of Sciences. He is a member of the Operations Research Society of America and the International Association of Applied Psychology. He also has served as president of the Division of Military Psychology of the APA (American Psychological Association), in which he is a Fellow in four divisions.

In 1960 he was honored with the Decoration for Meritorious Civilian Service; in 1969 with the Department of the Army Decoration for Exceptional Civilian Service; and in 1976 with the Washington Academy of Sciences Scientific Achievement Award in the Behavioral Sciences.

Improved Impact Switch Design. . .

Earns Award, $1,000 Honorarium for Engineer



Deputy Chief of Staff for Research, Development and Acquisition LTG Howard H. Cooksey presents Special Service Award to George K. Lucey Jr., during ceremonies at Harry Diamond Laboratories.

George K. Lucey Jr. has received a U.S. Army Special Act or Service Award and a $1,000 honorarium for developing a low-cost, electric, impact-sensing switch with improved inflight and impact reliabilities.

Currently in production for use in the M728 fuze, the switch is specified for the M732, XM734 and XM587 fuzes. From one to five million of these low-cost switches may be built into fuzes during the next five years, with resulting savings of $0.50 per switch, indicating its high cost-cutting potential and possibility of broad application.

In 1969, following assignments relating to the design and test of impact switches, Lucey conceived an improved design that he felt would reduce manufacturing cost and improve performance. Continuing his work, he managed by 1976 to develop the switch to a stage of production readiness.

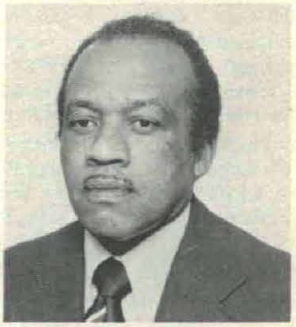
The switch is made of stamped or drawn stainless steel parts that have adequate contact and aging resistance without the need for gold plating. Additionally, it has a consistent directivity pattern and a smaller size than the designs it would replace.

Lucey is currently a supervisory mechanical engineer assigned to M732 IPF projects in the Commodity Management Branch (750), Harry Diamond Laboratories, Adelphi, MD. He is the recipient of five patents — Stress-Free Joint for Plastic to Metal Interfaces, November 1973, and jointly with members of his group, Crush Switch Design, in July 1971; Rain Impact Sensing Proximity Fuze, December 1975; Flight Simulator for Missiles, June 1976; and Protective Shield for Radomes, July 1976.

A native of New Orleans, LA, Lucey was born on Nov. 13, 1937. While his father was a TWA international navigator, he attended elementary school in Rome, Italy, and high school in Cairo, Egypt. He has bachelor's and master's degrees in engineering from the University of Maryland.

Ballistic Research Labs Name Kent Award Winner

The 1976 Kent Award of the U.S. Army Ballistic Research Laboratories, Aberdeen (MD) Proving Ground, has been presented to Orlando T. Johnson, chief of the Logistical and Tactical Targets Branch, Vulnerability/Lethality Division.



Orlando T. Johnson

Initiated in 1957, the annual award honors the late Robert Harrington Kent, and is regarded as the most prestigious award presented by BRL in recognition of outstanding performance in science or engineering.

A plaque, lapel pin and a Certificate of Achievement were awarded to Johnson in recognition of "leadership and technical excellence which resulted in improved and expanded vulnerability technology for aircraft systems." His most recent work is credited with providing essential vulnerability data on foreign aircraft and U.S. Army developmental 'copters.

Employed at BRL for 28 years, Johnson was cited for establishing procedures to generate damage threshold curves and blast contours for current application to important aerial targets.

He also has designed a simple mechanical method for measuring reflected impulse and an omni-directional gauge for measuring dynamic pressure behind a shock front.

Johnson has represented the Army and BRL on the International Technical Cooperation Program and Defense Exchange Agreements and has led BRL and Army Aviation Systems Command Vulnerability Analysis Team efforts in generating vulnerability data for the UTTAS and AAH aircraft.

Graduated from Virginia State College in 1947 with a BS degree in mathematics and physics, he has attended Tuskegee Institute, New York University and the University of Delaware. He served with the U.S. Army Air Force during World War II.

Army Engineers Present Environmental Awards

Winners of the first annual U.S. Army Corps of Engineers outstanding environmental achievement awards have been announced following review of nominations for Civil Works projects submitted by 11 Corps Divisions and five research laboratories.

Army Chief of Engineers LTG John W. Morris announced selection of the Portland (OR) Engineer District, North Pacific Division, to receive a merit award for preparation of a wetlands review for the Siletz, Alsea and Nehalem estuaries.

Honorable mention rewarded the Los Angeles Engineer District for expansion of the Whittier Narrows Nature Area, and for development of

Wildlife Lakes; also, the Waterways Experiment Station, Vicksburg, MS, for development of the Sensitive Wildlife Information System.

Other honorable mention awards were: Caesar's Creek (OH) Pioneer Village, Inc. for re-creation of a pioneer village; S. J. Cohen Construction Co., Blytheville, AR, for "providing without request for compensation heavy machinery and operators for the archeological investigations of the Zebree Homestead site, Mississippi County, AR."

Primary environmental objectives are: to preserve national ecological, aesthetic and cultural values; conserve natural resources; enhance, maintain and restore the natural and man-made environment; and to create opportunities for the American people to use and enjoy the environment.

1976 Defense Design Award Winners Announced

Winners of the 1976 Department of Defense Design Awards Program for military construction, including the "Secretary of Defense Blue Seal Award" for the most outstanding design, were honored recently at ceremonies in the Pentagon, Washington, DC.

Deputy Secretary of Defense William P. Clements Jr. and Assistant Secretary of Defense (Installations and Logistics) Frank Shrontz presented the awards.

Accepting the awards on behalf of the winners were LTG J. W. Morris, chief, U.S. Army Corps of Engineers; RAdm A. R. Marschall, commander, Naval Facilities Engineering Command; and MG Robert C. Thompson, director, Engineering and Services, U.S. Air Force.

All designs submitted for consideration were judged by a professional jury appointed by the American Institute of Architects, American Consulting Engineers Council, American Society of Landscape Architects and the National Endowment for the Arts. Competitors were judged on cost effectiveness, good design, environmental planning and innovativeness.

Blue Seal Award winner for best over-all design was the *Midshipmen Activities Facility* at the U.S. Naval Academy. Listed under the "Improvement Projects Category," it was designed by the Chesapeake Division, Naval Facilities Engineering Command, and drawn up by Ellerbe Architects-Engineers, Washington, DC.

In the "Medical Facilities" category, the winning entry was the *Dispensary/Headquarters Area,* Camp Pendelton, CA. The Naval Facilities Engineering Command Western Division was the design agency and Delawie, Macy and Henderson, AIA, San Diego, CA, was the architect.

"Family Housing" category honors went to a project titled *Rock Island Family Housing (40 units),* Rock Island, IL. Design work was done by the Army Corps of Engineers Omaha (NB) District and architecture by Gollehon-Schemmer and Associates Inc.

Bachelor Officers Quarters and Mess, Makalapa Crater Naval Station, won plaudits in the "Bachelor Housing" category. Pacific Division, Naval Facilities Engineering Command was the design agency and architects were Hogan, Chapman, Cobeen, Weitz and Associates Inc., Honolulu, HI.

The *Navy/Marine Corps Reserve Training Center,* Portland, OR, took top honors in the "Architectural Facilities" category. The design agency was Western Division, Naval Facilities Engineering and architectural work was done by Campbell Yost Grube, P.C., Portland, OR.

Top honors in the "Welfare and Recreational Facilities" category went to *Randolph-Brooks Federal Credit Union,* Randolph Air Force Base, TX. Base Civil Engineer, Randolph Air Force Base, TX, was the design agency and architectural work was performed by Robert Arburn, AIA and Associates, San Antonio, TX.

APG Retiree Gets Meritorious Service Award

Robert W. Warfel recently received the Department of the Army's second highest civilian honorary award, the Decoration for Meritorious Civilian Service, based on achievements prior to retirement after more than 35 years of federal employment.

He began his civil service career as a clerk with Aberdeen (MD) Proving Ground's Quartermaster Corps in 1941 and was assigned from 1972 until his retirement as chief of APG's Research and Development Division, Procurement Directorate.

Robert W. Warfel

Warfel was a key adviser on research and development contracting policies, procedures and regulations. He represented APG in official matters with industry and developed guides for purchase requests and contracts.

Career Programs . . .

Selected for MIT Alfred P. Sloan Fellowship

Feliciano Giordano

Selection of Feliciano Giordano for an Alfred P. Sloan Fellowship at the Massachusetts Institute of Technology, involving a year-long advanced study program leading to a master's degree in management, was announced recently by the Army Communications Command.

Giordano is technical director of the Communications-Electronics Engineering Installation Agency (CEEIA), an element of the ACC at Fort Huachuca, AZ, and is the first ACC employe selected for this training from a civilian-military workforce totaling nearly 29,000.

Initiated in 1931, the Sloan Fellowship Program provides mid-career executives with high development potential an opportunity to prepare for progressively higher level career assignments.

Selectees normally have 10 to 15 years of managerial experience and expectations of an additional 30 years of service with their organizations. About 50 selectees for the 1977-78 program will begin study in June.

Giordano immigrated to the U.S. from Italy in 1956 and earned a bachelor's degree in electrical engineering and a Reserve commission in the Army Signal Corps from Northeastern University in 1963. He also has a master's degree from Fairleigh Dickinson University.

During 1964-67 military service with the U.S. Army Strategic Communications Command (forerunner of ACC), he achieved the rank of captain and upon release from active duty resumed his civilian career at the Communications Systems Agency, Fort Monmouth, NJ.

Promoted to grade GS-14 while serving as chief of the Engineering Management Division, Office of the Deputy Project Manager for Integrated Communications System-Pacific, he joined the CEEIA in 1972.

Elevated to technical director in 1975, Giordano is the senior CEEIA employe responsible for developing guidance to chiefs of directorates and for overseeing the quality of CEEIA products.

His nomination for the Sloan Fellowship was approved by former CEEIA Commander MG Gerd Grombacher and later endorsed by former ACC Commander MG Jack A. Albright (Ret.).

Agreement Earns Recognition for 9 Army Skills

Recognition by industry and the civilian labor market of nine skilled trades taught to Army military personnel is provided for in a recent agreement between the U.S. Department of Labor and the U.S. Army Ordnance and Chemical Center and School. In conformance with the Department of the Army's Skill Recognition Program, the agreement was signed by Hugh C. Murphy of the USDL Bureau of Apprenticeship and Training and USAOCCS Commander BG Jere W. Sharp.

Army apprenticeship programs included in the agreement are: Small Weapons Repairman (Military Occupation Specialty-MOS 45B), Artillery Repairman (MOS 45L), Industrial Welder (MOS 44B), Machinist (MOS 44E), Automobile Body Repair and Painter (MOS 44B), Sewing Machine Repairman (MOS 63J), Truck Mechanic (MOS 63B,C,H), Automobile Mechanic (MOS 63B,C,H), Heavy Duty Equipment Mechanic (MOS 63C,H).

Soldiers completing these programs will receive Department of Labor certificates recognizing their qualifications as journeymen in their trades. Credit will be given toward requirements for status in national apprenticeship occupations.

Programs are administered at each installation by Education Services Officers (ESO).

NYU Announces April R&D Management Seminar

Programed to deal with problems faced by R&D managers in industrial, profit-oriented organizations, a 3-day Research and Development Management seminar will be conducted Apr. 25-27 at New York University's School of Continuing Education.

Experienced and inexperienced R&D managers will consider methods of generating new concepts for selection of projects, stimulating creative behavior, and justification of R&D to top management.

Subjects will be "dealt with on a practical, real-life basis" to provide participants the opportunity to present their management problems. Dr. Karakian Bedrosian will instruct the seminar.

IERW Training Revisions to Stress Simulators

Planned revision of the initial entry rotary-wing (IERW) training program for Army aviators, announced recently by the Department of the Army, has a goal of improved battlefield survivability and effectiveness.

Beginning in May, greater reliance will be placed on use of flight simulators for night and combat-skill related training. All training phases will feature a self-paced mode of instruction and about 25 percent of the students will be qualified as OH-58 aero-scout pilots.

The U.S. Army Training and Doctrine Command, headquartered at Fort Monroe, VA, is also establishing an aviator refresher course intended for pilots who have served three or more years in a non-flying assignment. Initiation of this course is scheduled in April.

Additionally, an aviation commander's readiness course has been designed to provide instruction on management and use of aviation resources. All courses will be conducted at the U.S. Army Aviation Center, Fort Rucker, AL.

Reader's Guide . . .

Acquisition Guidelines Publishes ADPA Address

LTG George Sammet Jr.'s keynote address to the American Defense Preparedness Association (Tank-Automotive Division) in Monterey, CA, is featured complete in the January 1977 edition of *Acquisition Guidelines*, an Army Materiel Development and Readiness Command publication.

The DARCOM deputy CG for Materiel Acquisition explained that normally he might not be expected to make a hard-line appeal to industry for complete cooperation in achieving reliability, availability and maintenance goals (RAM). But, he said, proper design and quality manufacturing standards are keys to his success in acquisition objectives.

LTG Sammet's address concluded with: "The more readiness we build into our vehicles, the more readiness we're able to achieve on the battlefield where it counts. I challenge you in industry and us in the military to work together to make readiness a reality and not just talk. I hope this meeting will be a step in that direction."

Copies of the January *Acquisition Guidelines* may be obtained by writing to or calling the editor, Robert Moore, HQ DARCOM, ATTN: DRCDMD-TG, 5001 Eisenhower Ave., Alexandria, VA 22333, or telephone (202) 274-8657 or 274-8692).

ARI Report Describes New Training Concepts

Development of New Training Concepts and Procedures for Unit Trainers is a publication recently issued by the U.S. Army Research Institute for the Behavioral and Social Sciences.

Research Report 1189 describes the development and testing of a 10-hour course of instruction designed to teach commissioned and non-commissioned officers how to conduct and manage performance-oriented training.

The initial three hours of instruction present principles and techniques of effective training and the remaining lessons provide practical exercises for small groups, as implemented by the Infantry Officer Basic Course.

UTRAIN has been adapted for NCO courses, as an instructor training course for service school faculty, for Reserve and National Guard instructors and for instructors of specialized element training.

Correspondence relative to this report may be addressed to: U.S. Army Research Institute for the Behavioral and Social Sciences, ATTN: PERI-P, 1300 Wilson Boulevard, Arlington, VA 22209.

Brochure Outlines Career Development Policies

Employee's Career Development Guide is the title of a new brochure outlining policies and programs relative to promotion opportunities for Civil Service non-career field employes (GS-9 and below) and wage-grade personnel.

A special task force initiated by Luther Adams, U.S. Army Missile Command Civilian personnel officer, and chaired by COL Robert W. Gruen, MICOM director of Plans and Analysis, prepared the brochure.

Programed for distribution through all primary organizational elements, the guide is intended to aid employes in making intelligent career decisions. Subjects include training, advancement and intern programs.

Planned also is the publication of a *Supervisor's Guide for Personnel Management and Affirmative Action.*

Personnel Actions . .

Brown Succeeds Rumsfeld as Defense Secretary

Dr. Harold Brown

Dr. Harold Brown, president of the California Institute of Technology since 1969 and a former Secretary of the Air Force (1965-1969), was sworn in Jan. 24 to succeed Donald H. Rumsfeld as Secretary of Defense.

Dr. Brown has bachelor's, master's and PhD degrees in physics from Columbia University. He holds honorary degrees in English, law and science from Stevens Institute of Technology, Long Island University, Gettysburg College, Occidental College, the University of California and University of Rochester.

Prior to joining the staff of the Lawrence Radiation Laboratory, Livermore, CA, in 1952, he lectured in physics at Columbia University and Stevens Institute of Technology. He also did post-doctoral research at Columbia, and was a research scientist at the University of California Radiation Laboratory, Berkeley, CA. From July 1960 until May 1961, he served as director of the Lawrence Livermore Lab. Then he became Director of Defense Research Development and Engineering, a position he held four years until he was appointed Secretary of the Air Force.

Dr. Brown was a delegate to Strategic Arms Limitations Talks in Helsinki, Finland, Vienna, Austria and Geneva, Switzerland. Additionally, he was senior science adviser at the Conference on the Discontinuance of Nuclear Tests in 1958-59; a consultant to and a member of the President's Science Advisory Committee (1958-61); and a member of the Air Force Scientific Advisory Board.

Selected as one of the 10 Outstanding Young Men of the Year by the U.S. Junior Chamber of Commerce in 1961, Dr. Brown has been honored with the Navy Distinguished Civilian Service Award, the Columbia University Medal of Excellence, the Air Force Decoration for Exceptional Civilian Service, and the Department of Defense Decoration for Exceptional Meritorious Civilian Service. He is a member of the National Academy of Engineering, The American Physical Society, The American Academy of Arts and Sciences, Phi Beta Kappa and Sigma Xi.

Duncan Chosen as Deputy Secretary of Defense

OATH OF OFFICE as Deputy Secretary of Defense is administered to Charles W. Duncan by Leonard Niederlehner, acting General Counsel, as Mrs. Duncan holds the Bible.

Nominated by President Carter Jan. 13 to succeed William P. Clements as Deputy Secretary of Defense, Charles W. Duncan Jr. was sworn in Jan. 31.

When nominated, Duncan was chairman and director, Rotan Mosle Financial Corp.; advisory director, Texas Commerce Bank Shares, Inc.; on the Advisory Council, Trust Co. of Georgia; and on the Board of Directors of A.P.S. Inc., Coca-Cola Co., Great Southern Corp., and Southern Railway System. He has also served as vice chairman, Board of Trustees, Rice University; on the Board of Trustees of Emory University, St. John's School, and the Texas Children's Hospital; and on the Board of Visitors, Cancer Foundation of the University of Texas.

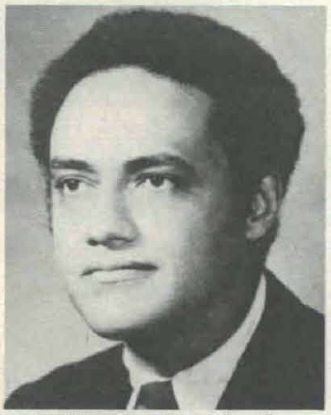
Graduated with a BS degree in chemical engineering from Rice University in 1947, Duncan worked initially with Humble Oil and Refining Co. He served during World War II with the U.S. Army Air Corps and com-

pleted two years of graduate study at the University of Texas.

He joined Duncan Coffee Co. in 1948 (predecessor of Duncan Foods Co.), was elected administrative vice president in 1957, and president in 1958. When Duncan Foods merged into the Coca-Cola Co. in 1964, he was elected to the board of directors.

Duncan later headed Coca-Cola European operations for three years prior to being named vice president and then president of the company.

Alexander Sworn In as Secretary of the Army



Clifford L. Alexander Jr.

Secretary of the Army Clifford L. Alexander Jr., a former high-level official with Presidents Kennedy and Johnson, was sworn in Feb. 14 as successor to Martin R. Hoffmann, incumbent since August 1975.

Graduated (cum laude) with an AB degree in American Government from Harvard University in 1955 and from Yale University Law School with an LLB degree in 1958, Alexander served six months of active duty in the Army (1958-59) after enlisting in the New York National Guard.

From 1959 to 1961, he was assistant district attorney for New York County. Then he was appointed executive director, Manhattanville Hamilton Grange Neighborhood Conservation Project, and later executive director of Harlem Youth Opportunities.

Selected in 1963 by President Kennedy as foreign affairs officer, National Security Council, he served successively with President Johnson as deputy special assistant, associate and then deputy special counsel.

Alexander was chairman of the Federal Equal Employment Opportunity Commission (1967-69), served with rank of ambassador as head of the U.S. Delegation marking the independence of the Kingdom of Swaziland in 1968, and was a consultant to President Johnson on civil rights matters.

Until 1975 he was a partner in the law firm of Arnold and Porter, then joined Verner, Liipfert, Bernhard, McPherson and Alexander. He also was a law professor at Howard University and Georgetown Law Center.

Guthrie Selected to Return as DARCOM Commander

LTG John R. Guthrie

GEN John R. Deane Jr. departed as the retired commander of the U.S. Army Materiel Development and Readiness Command, effective Jan. 31. LTG George Sammet Jr., deputy CG for Materiel Development, assumed command duty as successor pending arrival of LTG John R. Guthrie, tentatively in April.

Nominated for 4-star rank when he takes over, LTG Guthrie currently is commanding the IX Corps, U.S. Army Japan, a duty he assumed in March 1975.

Until October 1973 when he departed to become deputy chief of staff, U.S. Pacific Command, LTG Guthrie had served since Nov. 16, 1968 with the Army Materiel Command (renamed DARCOM in February 1975). Starting as deputy director, Development and Engineering, he was promoted to director Aug. 1, 1969 and to deputy CG for Materiel Acquisition in April 1971.

Included in his R&D experience is a 1966-67 assignment with the Office of the Chief of R&D (now the Office of the Deputy Chief of Staff for Research, Development, and Acquisition), HQ DA, and the Requirements and Development Division, J-5 Directorate Organization of the Joint Chiefs of Staff, Washington, DC.

During an initial 1956-58 R&D assignment with the Office of the Chief of R&D, HQ DA, he served with the Surface Missiles Division and later with the Missiles and Space Division - including Army staff project officer for Explorer I, the Free World's first artificial earth satellite.

Assigned to the Office of the Secretary of the Army as military assistant in July 1958, he became assistant executive Aug. 1, 1959, leaving in 1960 to attend the National War College, Fort McNair, Washington, DC. The remainder of his military career has been mainly in combat unit assignments in the U.S., Korea, Hawaii and Japan.

Other assignments were as staff officer, Joint Intelligence Center, Pacific Ocean areas, and special security representative to the Supreme Commander, Allied Forces, Japan. LTG Guthrie graduated from Blair Academy, Blairstown, NJ, from Princeton University (ROTC) with an AB degree in 1942, from Command and General Staff College in 1944, and from the National War College in 1961.

Simkus Succeeds Mittenthal as ARO Commander

COL Anthony P. Simkus

COL Anthony P. Simkus has assumed command of the Army Research Office, Research Triangle Park, NC, following service as director, Management Information Systems Directorate and chief, Command Systems Division, U.S. Army Combined Arms Center and Fort Leavenworth, KS.

COL Lothrop Mittenthal, who had commanded ARO since 1972 after serving as special assistant to the Director of Army Research, is the new commander of the U.S. Army Research and Standardization Group (Europe), London, England.

COL Simkus served as ARO executive officer during 1973, following assignments with HQ Military Assistance Command, Vietnam, as deputy to the associate director of Civil Operations Revolutionary Development Support for Research and Analysis, and contract administrator and alternate MACV ordering officer for goods and services.

During 1970-72 he was with the Office, Chief of Research and Development, Department of the Army, as an adviser to the Research Analysis Corp. He was branch chief and senior instructor, Operations and Training Branch, Army Chemical Center and School, 1966-68.

COL Simkus has a master's degree in business administration (operations research/systems analysis) from Tulane University and a bachelor's degree in general education (business management) from the University of Omaha. Among courses he has completed are the Army Command and General Staff College, Chemical Corps Officer Basic, Career and Senior Officer Refresher.

Stoner Assumes ECOM/Fort Monmouth Command

MG John K. Stoner Jr., former commander, 2d Support Command (Corps), U.S. Army Europe, is newly assigned as the seventh commander of the U.S. Army Electronics Command and Fort Monmouth, N.J.

A veteran of more than 25 years of active military service at age 47, MG Stoner served during 1973-74 as commander of the Kaiserslautern Army Depot, U.S. Army Materiel Management Agency, Europe; also, Edgewood (MD) Arsenal and Pine Bluff Arsenal, AR.

A chemical officer with the 1st Infantry Division in Vietnam during 1967, he has a BS degree in chemical engineering from Drexel Institute of Technology and a master's degree in business administration from Harvard University. MG Stoner wears the Legion of Merit with four Oak Leaf Clusters (OLC), Bronze Star Medal with "V" device and four OLC, Air Medal (four awards) and the Army Commendation Medal.

Lewis Follows Cheney as ECOM Deputy Commander

BG William D. Lewis

Deputy commander of the U.S. Army Electronics Command (ECOM) and Fort Monmouth, NJ, became the title of BG William D. Lewis in February when BG Robert A. Cheney retired from military service.

Formerly ECOM director of Procurement and Production, BG Lewis was assigned to ECOM in 1975 as special assistant to the project manager, Army Tactical Data Systems (ARTADS) and later served as PM for the Single Channel Ground and Radio Subsystem.

Other career assignments have included tours with the 7th Infantry Division in Korea; 3d Infantry Division, Europe; HQ Army Materiel Development and Readiness Command; and the 2d Armored Division, Fort Hood, TX.

BG Lewis graduated from Western Kentucky University in 1950 and was called to active military duty in 1952. During 1961, he attended the Signal Officer Advanced Course and was selected to study for a master's degree in business administration at Harvard University. He graduated from Command and General Staff College and Army War College.

Slocombe Designated Principal DASD (IS Affairs)

Designation of Walter B. Slocombe as Principal Deputy Assistant Secretary of Defense (International Security Affairs) and Director of the Department of Defense Strategic Arms Limitation Talks Task Force has been announced by Secretary of Defense Harold Brown.

Graduated with a BA degree from Princeton University in 1963, Slocombe was a Rhodes Scholar at Balliol College, Oxford University (1963-65) and received his LLB degree from Harvard University in 1968.

Prior to his DoD appointment, Slocombe was a partner in the Washington, DC, law firm of Caplin and Drysdale. Earlier he was a research associate, International Institute for Strategic Studies in London, England.

During 1969-70 he was a member of the Program Analysis Office of the National Security Council where he worked on subjects relative to strategic nuclear forces, SALT, naval forces and other intelligence matters.

Slocombe is a member of the Council on Foreign Relations, the Arms Control Association, the International Institute for Strategic Studies, American Civil Liberties Union and the American Bar Association. In 1975, he conducted a seminar on national defense, arms control and information policies at the University of Pennsylvania Law School.

White Chosen as PM for Navigation, Control Systems

COL LeRoy White

COL LeRoy White, a dual-rated Master Army Aviator with more than 20 years of flight experience, is the new project manager of Navigation and Control Systems (NAVCON), U.S. Army Electronics Command, Fort Monmouth, NJ.

A graduate of Tennessee Polytechnic Institute, COL White has a master's degree in business administration from George Washington University. He has completed the Defense Systems Management School, Command and General Staff College, and Signal Officer Course.

Formerly assigned as assistant project manager for Positioning and Navigation Systems, he has served duty tours with ECOM's Avionics Laboratory (1966-67) and with the Office, Assistant Chief of Staff for Communications-Electronics, HQ Department of the Army.

His military awards and decorations include the Legion of Merit, Bronze Star Medal with Oak Leaf Cluster (OLC), Army Commendation Medal with OLC and the Air Medal (four awards).

Gomez Becomes BRL Deputy Director/Commander

COL Robert M. Gomez

Deputy director and commander, U.S. Army Ballistic Research Laboratories, Aberdeen (MD) Proving Ground, recently became the title of COL Robert M. Gomez, following a 3-year tour as commander, U.S. Military Group, El Salvador, Central America.

Graduated from the U.S. Military Academy (USMA) in 1954, COL Gomez has a master's degree from the Georgia Institute of Technology. He also has completed the Armor Officer Basic and Advanced Courses, and Airborne and Ranger courses.

During 1971-72 he commanded the 2d Squadron, 1st Cavalry, 2d Armored Division, Fort Hood, TX, and early in 1973 was assigned as executive officer, 3d Brigade, 2d Armored Division during Exercise Reforger.

Other key assignments have included field representative, Joint U.S. Public Affairs Office, Vietnam; assistant professor of Automotive Engineering, USMA; and Scientific and Technical Division, Office, Assistant Chief of Staff, Intelligence, HQ Department of the Army.

Frymire Appointed to Reserve Forces Policy Board

MG Richard L. Frymire Jr., a member of the Air National Guard of the United States (ANGUS), has been appointed to a 3-year term on the Reserve Forces Policy Board, succeeding MG Frank A. Bailey.

Since 1971 he has been assigned as the adjutant general of Kentucky, commanding the Air National Guard, the Army National Guard and serving as director of the Division of Disaster Emergency Services. MG Frymire has an AB degree from Center College and a J.D. from the University of Kentucky Law School. He is a member of the National Guard Association of the U.S. and the Kentucky and American Bar Associations.

Acting through the Assistant Secretary of Defense (Manpower and Reserve Affairs), the Reserve Forces Policy Board is a statutory body serving as the principal policy adviser to the Secretary of Defense on matters relative to Reserve components.

Composed of 21 members, a majority of whom are general and flag rank officers, the RFP Board meets at the discretion of its chairman, currently John Slezak, a former Under Secretary of the Army.

Brill Succeeds Huntzinger as TOW Project Manager

COL James Brill

COL James Brill, former commander of the 593d Support Group, Fort Lewis, WA, has been named as new TOW project manager, stationed at Redstone (AL) Arsenal, following COL Robert Huntzinger's retirement.

TOW (Tube-launched, Optically-tracked, Wire-guided missile) is the Army's long-range tank killer designed for use against moving and stationary targets. It is mounted on a variety of combat vehicles.

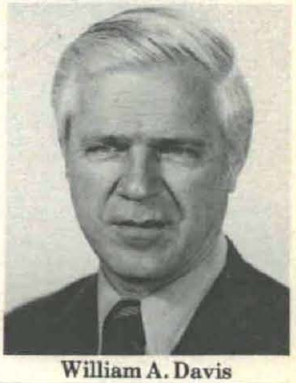
An honor graduate of Syracuse University (also named a Distinguished Military Graduate), COL Brill has a master's degree in general management from New Mexico State University and has completed the Command and General Staff College and National War College.

He has served as deputy and later commander, 3d Ordnance Battalion (AMMO), Vietnam; adviser to the Korean Army chief of Ordnance; operations officer, Nike Zeus; project officer, Shillelagh missile system R&D.

Pentagon assignments in the Office of the Deputy Chief of Staff for Logistics have included chief, Authorizations and Special Projects Branch and chief of Plans, Programs and Budget Division.

COL Brill wears the Legion of Merit with Oak Leaf Cluster (OLC), Bronze Star Medal with "V" device and two OLC, Meritorious Service Medal with OLC, and Army Commendation Medal with two OLC.

ABMD Program Manager Selects 2 Key Assistants



William A. Davis

Army Ballistic Missile Defense Program Manager BG John G. Jones recently named William A. Davis Jr. as his deputy. James D. Carlson has succeeded Davis as director of the Ballistic Missile Defense Advanced Technology Center.

Graduated from Vanderbilt University with a bachelor's degree in electronics, Davis has a master's degree (1967) from the Massachusetts Institute of Technology.

During 1969-71 he served as chief of the System and Threat Division of the U.S. Army Advanced Ballistic Missile Defense Agency (now BMDATC), where he was credited with pioneering work on Department of Defense high-power lasers.

Other achievements have included system design and synthesis of candidate systems for defense of the U.S. Minuteman Intercontinental Ballistic Missile network and initial work on the Hardsite Defense Program - later known as the Site Defense Prototype Demonstration Program, and now a part of BMD Systems Technology.

James D. Carlson

Carlson was until recently director of the BMDATC's Radar Directorate, following an assignment as an electronics engineer with ABMDA in Washington, DC, during 1972-74.

Employed as a section chief by the Hughes Aircraft Co., Fullerton, CA, from 1956 until he entered government service in 1972, Carlson worked in the radar and communications field during military service with the U.S. Air Force. Graduated from Chicago City College, he received a BS degree in electrical engineering from Long Beach State University, CA, in 1963. He served 4 years in the Air Force in radar and communications.

Carter Approved as Technical Director of HDL

Dr. William W. Carter

Dr. William W. Carter has been approved for PL-313 appointment as technical director of the U.S. Army Harry Diamond Laboratories, Adelphi, MD, after serving in an acting capacity since late 1974, following retirement of Billy M. Horton.

Chief scientist of the Army Missile Command for eight years (1959-67), Dr. Carter was assistant director for Nuclear Programs in the Office of the Director of Defense Research and Engineering prior to becoming an HDL associate TD in 1971.

Formerly a member of The Army Research Council (TARC), Office of the Chief of R&D, HQ DA, Dr. Carter has a 1943 BS degree from the Carnegie Institute of Technology and MS and PhD degrees in physics from California Institute of Technology.

He is a member of eight technical and honorary societies, has served on numerous advisory and review committees and in 1974 was selected for "the capstone" of federal training, the Federal Executive Institute.

WSMR Assigns Leishman as Installations Deputy

COL Carl A. Leishman was assigned in mid-February as deputy for Installation Operations at White Sands (NM) Missile Range, upon retirement of COL John E. Maier following 36 years of military service.

COL Leishman had commanded the U.S. Army's Computer Systems Command Support Group (Pacific), Fort Shafter, HI, since 1972.

Three of his tours of duty (a total of 6 years) have been at Fort Bliss, El Paso, TX. Listed among Army and Department of Defense career advancement training programs he has completed is the Army Command and General Staff College. A veteran of more than 26 years of active commissioned service, he has a BS degree in education from Utah State University.

ECOM Selects Coleman as Civilian Personnel Officer

Paul T. Coleman

Paul T. Coleman was recently promoted to civilian personel officer, HQ U.S. Army Electronics Command and Fort Monmouth, NJ, following service since 1973 as chief of ECOM's Management Relations Branch, Civilian Personnel Office.

A veteran of 24 years of government service, he was an enlisted man in the U.S. Army Infantry (1944-47) and later served for seven years as an investigator, examiner and inspector for the Civil Service Commission.

Other career assignments have included labor relations chief, U.S. Army, Vietnam; civilian personnal officer, Okinawa; with the Civilian Personnel Office, Department of the Army, Washington, DC; and Frankford Arsenal, PA. He has a BA degree in political science.

Oaks Takes Over as TARCOM Maintenance Director

LTC Clarence B. Oaks Jr. recently became director of Maintenance, U.S. Army Tank-Automotive Materiel Readiness Command, following service as assistant chief of staff, Materiel 2d Support Command, VII Corps, Stuttgart, Germany.

Graduated with an MS degree in mechanical engineering from New Mexico State University, LTC Oaks has a BS degree in chemistry from Jackson (AL) State University. He has completed the DoD Project Managers Course, Command and General SC, and Logistics Management.

LTC Clarence B. Oaks Jr.

Key assignments have included commander, 71st Maintenance Battalion, Nurnburg, Germany; ordnance adviser, Royal Thai Army Volunteer Forces to Vietnam; Military Assistance Command, Thailand; commander, 88th Heavy Equipment Maintenance Company; and materiel officer, 8th Maintenance Battalion, Germany.

Army R&D — 15 Years Ago

The Army R&D Newsmagazine reported on...

ASA (R&D) Reviews Materiel Production Problems

Assistant Secretary of the Army (R&D) Dr. Finn J. Larsen, in several recent major speeches to industry, has stressed the urgency of greatly expanded basic research and methods of reducing lead time to production.

Other areas of primary importance reviewed by ASA (R&D) included essentiality of getting utmost value for R&D expenditures, increased utility of military products, and measures to insure more effective utilization of scientists, engineers and technicians.

In one of his addresses, he stated, in part: ". . . As technological progress accelerated in the last 20 years, so did the emphasis on basic research. During World War II, we recognized that improved weapons, radar and the atomic bomb depended upon basic research conducted in the thirties and early forties. If American technology is to continue to expand and to accelerate, great emphasis must be . . . on basic research."

Army Reorganization Effects Changes in R&D

Based on recommendations of the Hoelscher Committee for broad reorganization of the U.S. Army, a plan carrying all necessary high-level approval is scheduled for implementation during an 18-month period.

Commanding generals of a new Materiel Development and Logistic Command, a new Combat Developments Command, and a U.S. Continental Army Command given vastly revised functions, are expected to be assigned. Each will have authority to select a planning group.

Traditional operational responsibilities of five of the seven Technical Services will be delegated largely to the new commands; however, the Corps of Engineers will retain its civil works responsibilities and The Surgeon General's functions will remain relatively unaffected.

"The primary purpose of this reorganization," stated Secretary of the Army Elvis J. Stahr, "is to develop an Army with the best possible command structure, management, training, doctrine, weapons, equipment and morale. I am certain national security will be strengthened . . . ."

CRD Urges Army-Industry Teamwork in NAM Address

Chief of R&D LTG Arthur G. Trudeau addressed the National Association of Manufacturers, making a stirring appeal for Army-industry teamwork and maximum effort. In his opening statements, LTG Trudeau said:

"Today, the basis of national security, in the military sphere, shifts - and almost momently - ever deeper into the area of scientific research and development. Today's weapon is tomorrow's relic! The nation which fails to see - or disregards - the emergent import of science and technology - no matter how varied and extensive its national resources - is doomed with sickening certainty to the path of decline and fall so well and terribly marked in the annuals of past civilizations . . . .

"Historically, characteristically, nations have underestimated the vast potential of science - the wide range and extent of its practical applications . . . . In this sense, contributions of American manufacturers to the muscular readiness of the United States and Free World forces must be all-encompassing - continually reflective of the great concept of Army-industry partnership which so long has marked out mutual dedication to the defense of this nation . . . ."

President's Federal Pay Panel Recommends Reform

Deep concern over "the inadequate compensation paid to federal civilian employes, especially to those bearing senior responsibility," was expressed by President Kennedy's special panel on the Federal pay system.

The panel made a preliminary report to the President saying that reform is particulary needed in grades GS-12 and above. Appointed late in December, the panel agreed at a meeting early in January that:

". . . The Federal Government should take steps promptly to insure that employes from lowest levels to the senior ranks should receive pay comparable to that of employes in non-government jobs doing like work."

DoD Contract Aims at Better Business Management

Studies directed toward improvement in Department of Defense business management are to be made by the recently established Logistics Management Institute, under a $600,000 contract announced by Secretary of Defense Robert S. McNamara. He stated, in part:

"The Logistics Management Institute is a nonprofit, fact-finding and research organization, guided by a group of trustees of national reputation . . . . . The Institute's objective will be to provide Defense decision- makers with alternative courses of action and supporting data needed for formulation and executing logistics policies and procedures . . . . "

Single Integrated Development Test Cycle Progress

TARGET after impact by Stinger DF-8 at WSMR. SIDTC savings were significant.

By George R. Thomson*

Significant reductions in materiel test time and costs have resulted from the Army's recent application of the Single Integrated Development Test Cycle (SIDTC) to the testing of proposed materiel.

Designed to preclude the Army from repeating contractor tests, the SIDTC recognizes that valid test data can be generated by many sources (contractor, laboratories, arsenals, proving grounds) and that all valid data, wherever generated, should be used in evaluating a test item or system.

The responsibility for conducting a large amount of materiel development testing rests with the U.S. Army Test and Evaluation Command (TECOM), which has been furnishing test and evaluation support for U.S. Army Materiel Development and Readiness Command (DARCOM) commodity commands, project managers, and other authorized customers for more than 14 years.

Two basic test categories for Army materiel are recognized under SIDTC:

- Development testing which is accomplished in factory, laboratory and proving ground environments to demonstrate that the engineering design and development process is complete; that design risks have been minimized; and that the test item will meet specifications.
- Operational testing is conducted to estimate a prospective system's military usefulness, operational effectiveness and suitability, and need for modifications. Conducted in as realistic an operational environment as possible, testing is accomplished by operational and support personnel of the type expected to use and maintain the system when deployed.

Coordination of testing between development and operational testers is a basic SIDTC policy. Necessary also are increased Army access to contractor data and maximum use of contractor test results; early user participation in the development cycle to insure compatibility of critical man-machine relationships; and more efficient test designs and program structures resulting from the new emphasis on independent evaluation.

Since the SIDTC method is in its second year, and results can be gauged for success, how does the report card read?

Despite some "growing pains," large dollar and materiel savings are being made in current development programs. Continuing refinements point for further gains. SIDTC also has closely united interested parties in a more coherent approach to testing that is streamlining materiel development and deployment.

Important under SIDTC, for example, is that the materiel developer, contractor, testers and logistical support personnel be involved in Test Integration Working Groups (TIWGs), chaired by the materiel developer to coordinate integration of valid requirements into cost-effective development testing.

Significant savings in the development testing program for the Stinger man-portable, shoulder-launched air-defense weapon system were achieved by a TIWG meeting among the project manager, TECOM engineers, and the Army Materiel Systems Analysis Activity.

The original plan called for firing 222 missiles. Adjustments to the contractor program, revision of the statistical bases for test quantities, and early TECOM participation in contract demonstration firings reduced to 135 the number of firings actually required.

Another example of SIDTC time and cost savings rewarded initial planning of testing

STINGER in SIDTC application at WSMR.

GEMMSS (Ground Emplaced Mine Scattering System). Three TIWG meetings were held to review contractor engineer design, and TECOM test programs, resulting in deletion of 1,078 mines from TECOM development test phases.

Development of the lightweight company Mortar System achieved a $169,000 saving by a reduction of 450 multioption fuzes through acceptance of engineer design test data.

All these are examples of test program reductions achieved on individual projects by normal TIWG procedures. SIDTC has also been applied successfully to two programs.

The first of these efforts involves the Army's effort to reduce the number of Hellfire antitank missiles in a test program associated with development of the Advanced Attack Helicopter (AAH) and the Advanced Scout Helicopter (ASH). Included is a competitive development of a target acquisition and designation system and a pilot night-vision system, both common to each helicopter.

A special task force reviewed these systems and devised an integrated coordinated test plan. Concurrent test phases, earlier operational testing, testing the Hellfire on a proven air frame, and a shorter test cycle resulted in earlier production decisions. Reduction of 90 Hellfire missiles in the SIDTC yielded total savings for all programs of $138 million, and an earlier operational date of about one year.

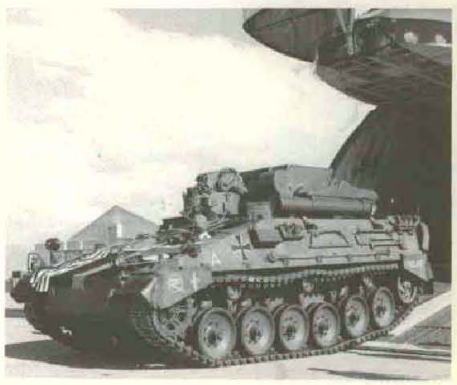
The other example involved a new area of weapon development: adopting a European weapon system - the Roland Surface-to-Air Missile - for U.S. testing and production. Emphasis was on increased cooperative testing with the French and Germans at European and U.S. test sites. The purpose was to obtain more usable data from European tests for tests to be conducted in the United States. - by using our telemetry on European missiles and providing U.S. high-performance aircraft targets.

A test review team including the U.S. contractors devised a cooperation test program that was negotiated successfully in principle with the partner countries. In this case, the price we have to pay includes additional front-end costs, but no increase in the over-all program. A formal set of agreements with the Europeans commits the United States to detailed procedures of design control and extensive testing support.

While the SIDTC program is returning savings in money and test time, it also places new demands on the development and test community. Contractor testing generates a large amount of data that must be reviewed and screened by the developer to identify that portion which may be appropriate, thereby reducing required TECOM-conducted development government verification testing for evaluation.

TECOM is currently having difficulty using some test data because of the lack of proper screening. This problem should be temporary - a result of the application of integrated testing procedures to ongoing development programs. When all testing is fully integrated from program inception, the problem should resolve itself. Meanwhile, TECOM is devoting excessive amounts of time to selection of usable test data generated by external sources.

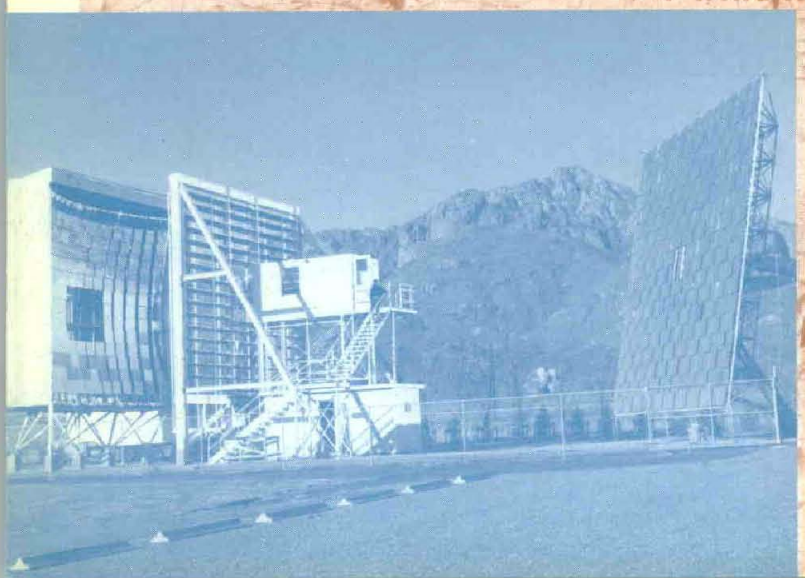
Another area of concern deals with preparation of the Request for Proposals. In order for TECOM to improve its role in the SIDTC process and reduce government testing, increased emphasis must be placed in insuring that TECOM review RFPs and proposed contractor testing. When contractor test data is to be used for evaluation, RFPs should include TECOM test operations and specifications. The RFP should specify the degree of TECOM test monitoring and participation if required.



SPORTING American, German and French flags, a fire unit of French-German-developed Roland Air Defense Missile System is unloaded from a C-5A aircraft at WSMR. Increased cooperative testing of this system with French and Germans at both European and U.S. sites reduced test time and cost.

George R. Thomson is an engineer in the Test Policy Division of the U.S. Army Test and Evaluation Command, a graduate of the University of Colorado, with 20 years federal Civil Service.


GREEN RIVER
TEST COMPLEX
ABRES AREA 1
Pershing
ABRES AREA 2
BLANDING LAUNCH AREA
UTAH
ARIZONA
COLORADO
NEW MEXICO



FT. WINGATE
EXCLUSIVE USE
CO-USE
NON-USE (WSMR)
WSMR RANGE EXTENSION
AEROBEE 350 AREA
WHITE SANDS MISSILE RANGE
ABRES AREA 4
McGREGOR RANGE