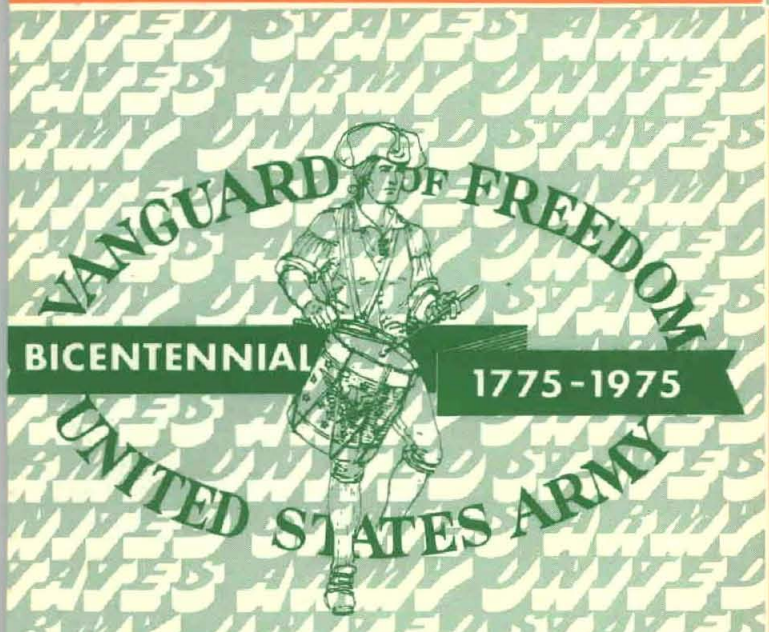
U.S. Army Air Mobility
R&D Laboratory . . . Page 16



U.S. Military Posture Statements, RDT&E Presentations to Congress

Inside front cover

ARMY RESEARCH AND DEVELOPMENT

March-April 1974

SPEAKING ON . . .

Military Posture Statements, RDT&E Budget Presentations Advise Congress Regarding Views of Top Defense Leaders

Several hundreds of pages of prepared statement presentations to the Committee on Armed Services of the United States in recent weeks have detailed the views of all the highest officials in the National Defense Establishment regarding the critical considerations to support their FY 1975 budgetary proposals.

Speakers have included Secretary of Defense James R. Schlesinger, Chairman of the Joint Chiefs of Staff Admiral Thomas H. Moorer, Army Chief of Staff GEN Creighton W. Abrams, Director of Defense Research and Engineering Dr. Malcolm R. Currie, Secretary of the Army Howard H. Callaway, Assistant Secretary of the Army (R&D) Norman R. Augustine, Chief of Army Research and Development LTG John R. Deane Jr., and many others.

Members of the Army Research and Development community, currently in the throes of widespread changes—some announced in February and March and others said to be forthcoming in the near future—would find each of these statements well worth reading as an exposition of the State-of-the-Nation defenses vis-a-vis the potential enemy. Within the limited space available, the editors of the Army Research and Development Newsmagazine *attempt here to provide some insight into what Congress considers in defense allocations.*

Dr. Currie's voluminous presentation was released too late for inclusion and must be reported in our next edition.

SECRETARY OF DEFENSE Schlesinger's FY 1975 Defense Budget and the FY 1974 Supplemental Budget Request to the House Committee on Appropriations and selected excerpts from his subsequently released "Annual Defense Department Report FY 1975" follow.

Mr. Chairman, Members of the Committee:

It is my privilege to present to you the FY 1975 Defense Program and Budget. This is the first budget in a decade or more that does not provide for the support of U.S. forces in combat. At the same time, it is a budget that must carry us, through maintenance of a military equilibrium, on the passage from the cold war toward a period of enduring peace.

In such a difficult period of transition, I have a special duty to review with you the fundamental strategic issues that we face and the basis on which we are developing what we consider to be our minimum peacetime defense and deterrence posture. As the Psalmist tells us, "Where there is no vision, the people perish."

As in the past, the Chairman of the Joint Chiefs of Staff, Admiral Thomas H. Moorer, will give you his report on our military posture. He will discuss, in more detail than I shall here, the current and developing balance of military power.

The International Situation and the Defense Establishment. The first issue we must face in our planning is how, at any given time, the international situation should affect the shape of the U.S. defense establishment. It is a well-worn truism that our forces exist to support our foreign policy, but what operationally does that mean? Are there specific elements in the external world that create the need for military capabilities, overseas deployments, military assistance, and continuing programs of research and development? When and how should changes in the international situation justify alterations in the size and composition of our force structure?

Interests. The divisions brought on by our involvement in Southeast Asia have left an understandable desire on the part of many Americans for some respite from foreign troubles and responsibilities. But recent events in the Middle East have sharply reminded us that the United States still has very large and important moral, political and economic interests outside its borders, and that these interests may require military protection.

Recent events have also underlined the extent to which distant troubles can affect and even jeopardize the United States itself unless our defenses are strong.

Opposing Capabilities. It is no secret that, in the past, certain nations have shown themselves hostile to the worldwide interests of the United States and have acquired the military capabilities to threaten them—and us. We live in the constant knowledge that the Soviet Union, at any time, could launch a nuclear attack—large or small—on the United States itself, and the Peoples' Republic of China (PRC) could well develop at least a modest capability for such an attack during the next decade.

It is generally agreed that some relationship must exist between these capabilities and the defense posture of the United States. Indeed, we consider it fundamental that at all times we must have available a sufficiency of ready strategic offensive forces to retaliate against a Soviet nuclear attack.

The Soviet Union (USSR), its partners in the Warsaw Pact, and the PRC also maintain large and ready general-purpose forces. These forces are in fact the most usable elements of their considerable and diversified power. It is noteworthy, however, that many Americans do not insist on a comparable availability and readiness for U.S. and Allied general-purpose forces, and even suggest that in a period of nuclear parity we should reduce them below their current levels.

It would be economically intolerable, inefficient and certainly undesirable for the United States by itself to develop a force structure that mirrors this entire range—the Soviet Union, the Warsaw Pact, and the PRC—of potential threats.

In any event, the Soviet Union is the only other superpower in the international political arena. Accordingly, it is primarily in light of Soviet capabilities that we must judge

James R. Schlesinger
Secretary of Defense

the adequacy of our own nuclear and nonnuclear deterrent forces.

Commitments, Contingencies and Objectives. Another factor shaping our over-all defense posture is the large number of formal commitments for mutual defense that the United States has accumulated since World War II. Not counting the collective security provisions of the United Nations Charter, we are allied to more than 40 nations in nine multilateral and bilateral treaties. In addition, we have informal but nonetheless real commitments to other nations that our defense programs must take into account.

These commitments are important to both our nuclear and our nonnuclear force planning. In varying degrees, they reflect an obligation to maintain military capabilities in support of our Allies. They give us insights about the types of contingencies that could arise and about the threats that require deterrence. They also enable us to share the burden of collective security with a number of other nations. In some instances they lead us to provide military assistance as a substitute for the maintenance of additional U.S. forces and deployment abroad.

Above all, when worldwide equilibrium and orderly change constitute basic U.S. objectives, commitments and contingencies tell us where points of potential pressure exist and where, for purposes of deterrence, specific balances of military power must be

(Continued on page 10)

ABOUT THE COVER . . .

Under the close cooperative relationship provided by agreement between the U.S. Army Air Mobility Research and Development Laboratory and the NASA-Ames Research Center, Moffett Field, CA, the basic cover design was prepared by a NARC staff artist and embellished a bit by our staff.

The USAAMRDL is comprised of four directorates, one at the NARC, one at the Army's Fort Eustis, VA, and the others at NASA's Langley Research Center, Hampton, VA, and Lewis Research Center, Cleveland, OH. This cooperative arrangement makes available to the Army facilities of NASA that would have cost the Army more than $100 million to construct.

Editor . . . . . Clarence T. Smith
Associate Editor . George J. Makuta
Editorial Assistant . Harvey Bleicher

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FEATURES

DEPARTMENTS

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Selective Scanner . . .

AMC Briefs ASA (R&D) on Weapons, Battery

Results from U.S. Army Materiel Command in-house laboratory efforts considered to have potential for application to high-priority military requirements are presented in recent reports.

Details were given in briefings delivered Mar. 13 to the Assistant Secretary of the Army (R&D) on Length and Weight Limits for Shoulder-Fired Antitank Weapons, James T. Torre, U.S. Army Human Engineering Laboratory, Aberdeen Proving Ground, MD; Thermally-Regulated Thermal Battery, Frank C. Krieger, Harry Diamond Laboratories; and Squad Automatic Weapon, Curt Johnson, Rock Island Arsenal, IL. Abstracts follow.

Length and Weight Limits for Shoulder-Fired Antitank Weapons has gained considerable attention, particularly as related to development of the Short-Range Man-Portable Antitank Weapon Technology (SMAWT).

A system was developed to measure key aspects of an infantryman's activities as influenced by different weights, lengths and bulks of experimental configurations. Specifically, a field study was conducted to determine the effect of weight and length of an antitank system on infantryman performance.

Utilizing a bipolar adjective rating technique, soldiers were asked to discriminate among various loads. Test results revealed a reduction in infantryman performance when 81mm antitank systems which are longer than 31 inches and heavier than 8 pounds are added to current combat loads.

Thermally Regulated Batteries are used extensively in rocket and mortar fuzes because of their superior shelf-life and wide ambient temperature range. However, their high operational temperatures and lack of adequate controls often cause short operating lifetimes and electrical noise and shorts.

Development of fusible heat reservoirs helped significantly to absorb excess heat during fusion and to maintain constant cell temperatures during cooling. Digital computer programs aided in design of this system and may ultimately make possible the use of thermal batteries in artillery shells.

EPA Unit to Monitor Alaska Pipeline Impact

Monitoring the environment impact of the 789-mile stretch of the Trans-Alaska Pipeline to carry oil from Alaska's North Slope deposits is a responsibility assigned to a newly established unit of the Environmental Protection Agency in Anchorage, AK.

Recoverable reserves at the Prudhoe fields are presently estimated at 10 billion barrels of crude oil and 26 trillion cubic feet of natural gas.

Working with the U.S. Department of the Interior, the EPA unit will become part of the agency's existing Alaska Operations Office. Their function is to insure that construction of the pipeline and related facilities complies with EPA's regulatory authorities in the areas of oil spill prevention, air and water pollution control, solid waste management and pesticides use.

Other environmental protection efforts, including the maintenance of timber, mineral, water, and wildlife resources on federal public lands crossed by the line, will be the responsibility of the Interior Department. Roughly three-fourths of the pipeline is expected to cross federal property.

The Interior Department is primarily responsible for reviewing the design and construction of the pipeline from engineering and environmental viewpoints. An "authorized officer" and his staff will represent the Department in Alaska.

Among EPA's duties regarding the pipeline will be:

- Insuring that builders of the pipeline system have on hand oil spill prevention procedures including control equipment, contingency plans and training programs.
- Reviewing an estimated 350 U.S. Army Corps of Engineers permits needed for pipeline stream crossings.
- Monitoring compliance of 12 pump stations and the pipeline's terminal facilities with air and water pollution control regulations.
- Providing policy liaison and technical assistance to other federal and Alaskan State agencies concerned with the line.
- Reviewing plans for solid-waste management at work sites and other communities.
- Insuring proper use of pesticides for rights of way clearance, insect control, or other uses.
- Investigating alleged violations of environmental statutes.

The EPA pipeline unit will be headed by Dr. Oscar E. Dickason, director of the Alaska Operations Office, which is under the supervision of EPA's regional administrator in Seattle, WA.

Legislation approving construction of the pipeline was signed by President Nixon Nov. 16, 1973. Construction camps for the line are now being made ready.

Army Continues 60mm Weapons Development

Continued development of a new lightweight 60mm weapon system at Watervliet (NY) Arsenal has been approved by the Department of the Army following progress reports on system management, weapon proper, firing control, ammunition, fuzing and testing.

Scheduled to replace the 81mm mortar in use at infantry company level, and intended for both Army and Marine Corps use, the new system is designed for improved firepower and mobility. It is expected to increase combat effectiveness of units where man-portability of weapons is a primary requirement.

The recent progress reports at a meeting chaired by John A. Purtell as systems manager disclosed that elimination of a fuze dustcap resulted in saving in excess of $1,000,000. Extensive operational and development testing at various proving grounds has been scheduled. The ultimate aim of the project is the production of significant quantities of the new mortar at Watervliet Arsenal.

Support for development of the system is provided by Frankford Arsenal, Philadelphia, PA, fire control; Picatinny Arsenal, Dover, NJ, ammunition; Harry Diamond Laboratories, Washington, DC, fuzing; U.S. Army Test and Evaluation Command, Aberdeen (MD) Research and Development Center; and HQ U.S. Army Training and Doctrine Command, Fort Monroe, VA.

MERDC Unveils Aircraft Runway Light Set

Aircraft visibility limitations encountered during night and certain daylight take-off and landing conditions may be lessened with an improved 1½ kilowatt runway light set.

Developed at the U.S. Army Mobility Equipment R&D Center (MERDC), Fort Belvoir, VA, the set's most significant improvement is replacement of a bulky, expensive 30/45 watt power isolation transformer with an economical, easily adaptable by-pass circuit assembly.

Additionally, the assembly housing serves as an excellent heat sink for the light's silicon control rectifiers, thus eliminating the need for costly commercial heat sinks.

Estimated cost for production quantities of 50 to 100 improved light sets is approximately $3,400. This is a $1,200 reduction from currently produced sets of equal quantity.

Japan Duck Deaths Laid to Botulism Poisoning

Identification of Type C botulism poisoning in Japan was reported for the first time at a recent meeting of the Toxic Microorganisms Panel of the United States-Japan Cooperation on Development and Utilization of Natural Resources.

Investigation that resulted in "the first time demonstration of Type C botulism poisoning of any kind in Japan" followed a mass outbreak of deaths of ducks, migratory and otherwise, on certain fresh water ponds and rivers in the Tokyo area and adjacent prefectures. Since these waters are contaminated with industrial waste products, Japanese investigators looked to this source of poisons for an explanation.

This action followed a report by a U.S. Army Director of Re-

search and Advanced Systems representative that the symptoms of poisoning "appeared to resemble in some respects those associated with epizootic outbreaks of Type C poisoning of wild birds on alkali lakes of the Western United States."

Subsequently, Dr. Kageaki Aibara, Department of Food Research, National Institute of Health, Tokyo, delivered data collected on the poisoning outbreaks among wild birds in Japan at a meeting in Washington, DC. His findings established Type C botulism as the cause of the outbreak of duck deaths.

Pulse Unit May Ease Tire Retread Decisions

Greater reliability in selecting tires for retreading, by using a Pulse Echo Ultrasonic Tire Inspection System now under development to detect hidden defects such as ply separations, is the goal of a research task in the Army Tank-Automotive Command.

David Gamache, special assistant to the chief of the Quality Engineering Division, Product Assurance Directorate, said the investigative effort, now in its second year, has resulted in fabrication of a successful breadboard model.

The model includes a manual scanning device mounted in a water tank, tire-handling equipment, and electronic signal generator. The tire is rotated about two revolutions a minute and the ultrasonic signals transmitted to the tire are echoed back to the scanner for display on a viewing screen. Defects are determined by interpretation of the echos.

Tests of the model at the Red River Army Depot, Texarkana, TX, have thus far indicated that background noises indicative of faults vary from one type of tire to another. Conversion of the breadboard model into several prototype models has been scheduled. The prototypes will have an automatic scanning device and built-in recording units.

Improved Field Fortification Concepts Studied

Methods of improving field fortifications for anticipated requirements of the battlefields of the future are receiving extensive consideration in MASSTER (Modern Army Selected Systems Test, Evaluation and Review) at Fort Hood, TX.

The MASSTER study is part of an Army-wide program involving a mix of research, conferences and evaluations to determine specific requirements for different situations. Army schools and centers are considering adequacy of standard field fortifications, designing new structures, and determining camouflage needs.

SOLDIERS from the 17th Engineering Battalion, 2d Armored Division stretch a wire-reinforced fabric over the metal frame of an underground bunker in MASSTER (Modern Army Selected SystemsTest,Evaluation,Review).

Studies include the use of new materials (fiberglass, aluminum and plastic) for protective structures, the manpower, equipment and time needed to build them, and the amount of training soldiers will require to build the structures correctly. New concepts also are being explored, including airlifting prefabricated modules that can be rapidly emplaced in the ground.

Results of the studies will be considered by a group of general officers at Fort Benning, GA, the Infantry Center, with a view to directing specific attention and testing to shelters and fortifications believed to show the best potential for future needs.

DoI, Air Force Initiate Energy Research Effort

Expansion of the thermal energy output of coal at reduced pollution levels is the purpose of a recently announced joint research effort between the U.S. Air Force and the U.S. Department of Interior's Office of Coal Research.

Participants in the project will utilize magnetohydrodynamics (MHD) technology, which involves extraction of electrical energy from a high-temperature gas and subsequent passage through a magnetic field. The process might be comparable to the flaming exhaust of a rocket of jet engine.

Announced by Secretary of Defense James R. Schlesinger and funded by the Office of Coal Research, the project will utilize Air Force facilities including a unique MHD generator at the Arnold Engineering Development Center, Tullahoma, TN. Initial tests will determine whether thermal energy extraction capabilities of the MHD generator are superior to those of conventional steam generating plants.

Previous research has indicated that efficiencies ranging from 50 to 60 percent may be possible in converting coal to electrical energy through MHD. This contrasts with 40 percent efficiencies of steam plants.

Congress Expands MAST Medical Program

Expansion of the Military Assistance to Safety and Traffic (MAST) program, designed to augment civilian emergency medical systems, was authorized recently by Congressional approval of Public Law 93–155 (Military Authorization Bill for FY 1974).

Initiated in July 1970, following recommendations of former Secretary of Defense Melvin R. Laird (see Dec. 1969 and Oct.-Nov. 1972 issues of *Army R&D Newsmagazine*), MAST has utilized Army and Air Force capabilities on a trial basis. Military vehicles have thus far accounted for more than 2,400 MAST missions and transportation for more than 2,700 patients.

Expansion of the program includes authorization for wider use of military helicopters and paramedical personnel and activation of nine additional MAST sites, including Fort Jackson, SC; Fort Benning, GA; Fort Sill, OK; Fort Hood, TX; Fort Bliss, TX; Fort Riley, KS; Fort Bragg, NC; Fort Ord, CA; and MacDill, AFB, FL.

ECOM Updates AN/TPQ-36 Radar System

Five engineering models of a new mortar locating radar, expected to replace the AN/TPQ-36 Army standard model used for 15 years, are being developed under an $8.6 million contract announced by HQ U.S. Army Electronics Command.

Technical direction for the new system has been assigned to the Product Manager Office, Mortar-Artillery Locating Radars.

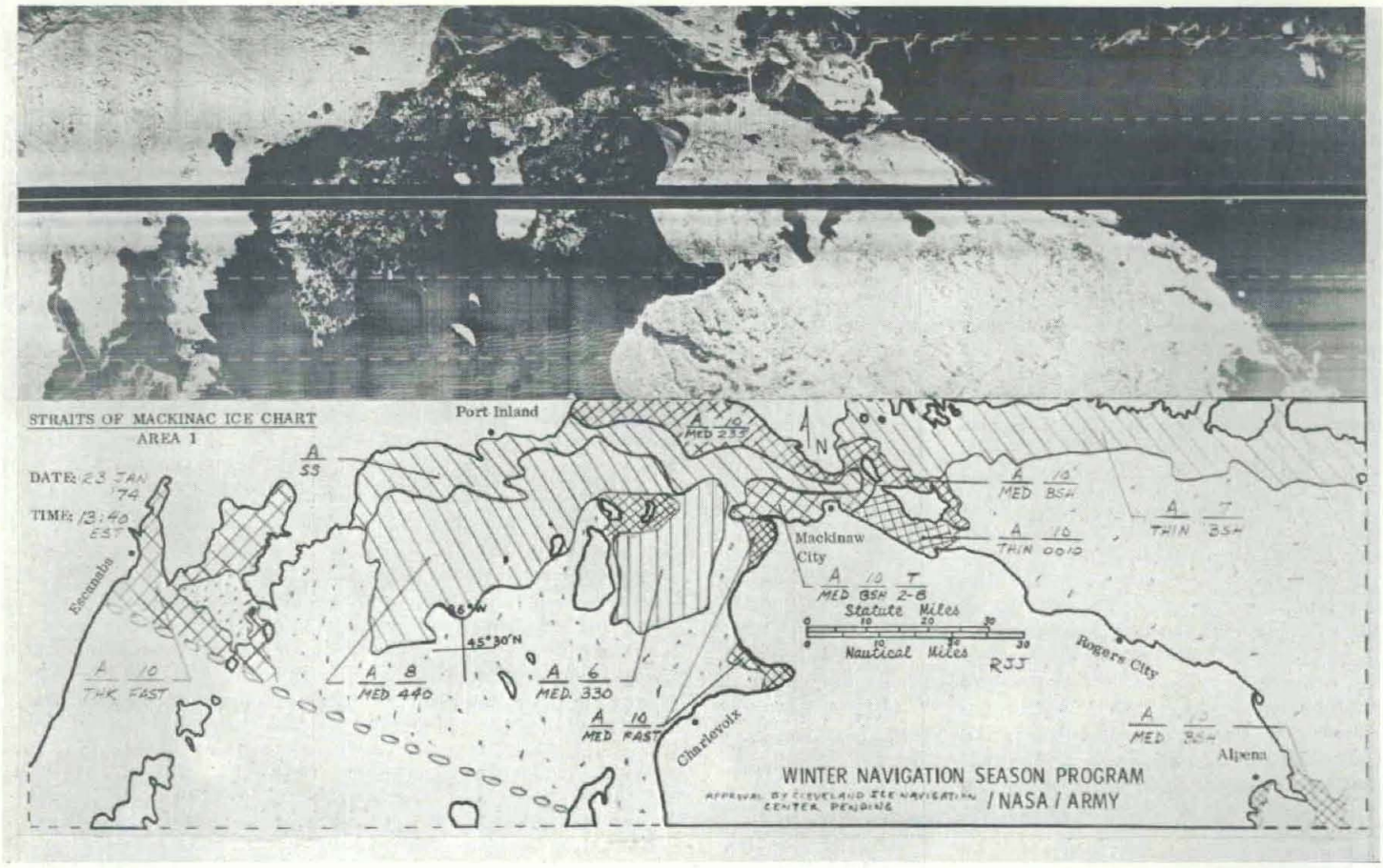
Performance capabilities specified for the new system include electronic scanning of a wide sector of any combat area, that it be highly automated, and that it will indicate the location of an enemy mortar by pin-pointing it with a spot of light on a rotating, cylindrical contour map.

A computer and a sophisticated signal processor will filter out much of the interference caused by birds, adverse weather, ground clutter and even insects. The new system also will be effective when several mortars are operating simultaneously.

MICOM Expands Simulation Center Facilities

Symbolizing transfer of the Electrical Optical Simulation Facility (EOSS) from industry to the Army and opening of the door to advanced missile technology, a key is turned over from Fred Payne, Martin Marietta's vice president of Technical Operations, to MG Vincent H. Ellis, commander of the U.S. Army Missile Command (MICOM), Redstone Arsenal, AL.

The EOSS is one of three test chambers in MICOM's Advanced Simulation Center (ASC) that will enable the Army to simulate, under one roof, environments that affect a missile in flight. Expected to be fully operational by 1975, the ASC also will house an Infrared Facility and a Radio Frequency Simulation System that will enable the Army to evaluate any missile known today or foreseen for the future.



SLAR scan of Straits of Mackinac is shown in upper half of the illustration, which indicates land masses, waterways and ice to trained interpreters. The black band with the white line running horizontally through the radar picture is the flight path of the aircraft. The lower portion of the illustration is the NASA interpretation of the scan, which indicates location, depth, character and even the age of ice formations obstructing shipping in the area.

R&D News . . .

SLAR Finds New Application as Scientific Research Tool

Side-looking Airborne Radar (SLAR) mounted on the OV-1D Mohawk aircraft—one of the dramatic developments to serve U.S. Army combat requirements—is linking research capabilities of the U.S. Army Electronic Proving Ground (AEPG), Fort Huachuca, AZ, to a Great Lakes navigation survey.

What can be done to keep the Great Lakes and the St. Lawrence Seaway open to shipping during the winter ice pack? Essentially, that is the question the Fort Huachuca unit is trying to help answer.

The action is in response to a request for assistance originally given to the National Aeronautics and Space Administration and its Lewis Research Laboratories. The need was for surveillance ideas to acquire a better understanding of the magnitude of the problem.

Through the U.S. Army Corps of Engineers, which has the responsibility of maintaining many areas of inland waterways, the AEPG was assigned the task of surveying the Great Lakes area.

Since Dec. 17, two specially equipped Mohawks and a C-47, based in Cleveland, OH, and Sault Ste. Marie, MI, have been working in the Great Lakes area, with daily reconnaissance flights over the waterways in specified patterns.

Results reportedly are almost unbelievable, even to the NASA experts accustomed to surveilling the Earth from the unlimited horizons of space. In spite of temperatures ranging from minus 34 degrees up, 30-knot winds, sleet and ice, the AEPG crews have produced a steady stream of data.

Bad weather conditions resulted in 90 "weather hours" (flying only on instruments) with no visual ground contact in a 35-day period—possibly an Army record.

The sophisticated navigation system built into the Mohawk has a great deal to do with its ability to map the ice movements. Pilots can plot a pair of points on the map, locate themselves and their aircraft exactly on one point, and fly in a straight line to the other point with less than 600 meters variation, even in zero visibility.

This capability makes it possible to scan, with the SLAR, a 25- to 50-mile strip—then come back an hour, a day, or a year later and scan the exact same area. This permits comparisons as time changes conditions.

Another advantage of the Mohawk is that the radar data can be electronically transmitted to ground stations and thereby be available almost instantly, in "real time."

Heavy weather does not obstruct the radar. The SLAR pierces cloud cover, snowstorms and other disturbances, and gives the observer a detailed picture of the ground surface.

More than 200 hours of "on target," that is, with the radar actually in operation on site, flying had been compiled as of Feb. 22 by the two Mohawks and their crews. Their data is transmitted to NASA interpreters on the ground, who produce ice maps similar to that shown in the lower half of the photo above. The top portion of the photo is the actual radar scan from the SLAR.

The experimental Winter Navigation Season Program so far has been an outstanding success, reports MAJ Richard E. Urick, chief of the AEPG Aviation Branch. "We are really opening up new fields of use for the Mohawk and the SLAR," he says. "They were originally developed for military surveillance purposes in combat. Now we are turning that same capability to scientific research, em-

ployed in the national interest."

Twelve members of the AEPG team have participated in the project. In addition to Urick, they are: CPT Richard P. Wolfe, mission commander and the second Mohawk pilot; CPT Rodney W. Callaway, ground operations commander and C-47 pilot; Eugene C. Paulsen and Carl A. Vanderpool, civilian C-47 pilots.

Also, crew chiefs; SFCs Bemis B. Allensworth, C-47, and Ottis C. Griffy, C-47 and OV-1D; SP5s David W. Little, C-47 and OV-1D, and Bobby L. Mahannah, OV-1D. Sensor specialists are SSG Michael S. Castro, SP5 Richard G. Miller and SP4 William D. Andrews.

Peacetime aircraft support challenges are greater even than those in wartime, Wolfe, the mission commander, believes. *But he points out that finding new applications for this sophisticated equipment also advances the military's tactical position, and keeps the expertise of the men who work with the Mohawk at a high level.*

"We are, in essence, carving out historical data building blocks in the Great Lakes project," he said. "We can go back anytime and duplicate any given run. Then investigators and interpreters can compare the previous data and the new data, and draw conclusions based on the changes they see—with accuracy."

The AEPG participation in the current program will continue through about the first of May, when the spring thaw arrives in the north country.

Until then, the Mohawk pilots and observers will continue to furnish the NASA experts and the scientific community with additional historical data "building blocks" on which to base an entirely new concept of navigation assistance.

Skylab 3 Astronauts Photograph New England Flood Damage Sites

Under sponsorship of the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL), Hanover, NH, and the New England Division of the Army Corps of Engineers in Waltham, MA, Skylab 3 astronauts photographed the New England area to study flood damage.

Astronauts William R. Pogue, Dr. Edward G. Gibson and LTC Gerald P. Carr, while orbiting the Earth in their 86-ton Skylab, photographed an area along Windsor, VT, and Canaan, Plymouth and Conway, NH. CRREL personnel photographed the Franklin Falls (NH) Reservoir from an altitude of 4,000 feet. NASA aircraft photographed the area from 60,000 feet.

The photographic imagery is being used for an evaluation of the damage to vegetation caused by the July 1973 floods, the second highest reported in the New England area since the early 1940s, and the December floods, rated as the fifth highest in history. Ice damage to vegetation following the December flood also is believed severe.

The photographic evaluation is part of a larger study being made of the New England Reservoir System, using the remote sensing images from Skylab and the Earth Resources Technology Satellite (ERTS). *(See cover and center spread feature story on ERTS in the August 1972 Army R&D Newsmagazine).*

MICOM Considering New Laser Guidance System

Plans for developing a unique system that conceivably could guide Army missiles as well as conventional artillery have been submitted to HQ U.S. Army Missile Command, Redstone Arsenal, AL, in proposals from two contractors.

The system is called Ground Laser Locator Designator (GLLD) and consists of a laser, rangefinder, day sight, tracking unit and tripod ground mount.

"We told contractors what we wanted. Now Philco-Ford and Hughes aircraft have told us how they would build it—right down to the last nut and bolt," said MAJ Phillip Williams, chief of MICOM's Precision Designator Management Office.

Williams said the Army will evaluate both proposals along with contractor prototypes that have undergone testing at Redstone and Fort Sill, OK, and that a contractor could be selected by spring to move into engineering development.

"We're the tri-service flashlight for a family of terminal homing weapons—both ground and airborne," he said. "Right now we're trying to cut costs as much as possible, emphasizing maximum commonality between the designator and rangefinder for both ground and air roles."

Both contractors responded to the question of interchangeable equipment in their engineering development proposals. Using the GLLD, it was explained, a designator operator could literally steer a terminal homing weapon to a target whether the weapon is a missile, a bomb or an artillery shell fitted with a laser seeker.

"We're not limited to one type weapon," Williams explained. "We can support laser-guided weapons like HELLFIRE or conventional artillery like a 155mm shell."

A "highly successful" test program demonstrating the value of lasers in a conventional artillery role was completed recently. Helbat IV (Human Engineering Laboratory Battalion Artillery Test) was conducted at Fort Sill, OK, by the Human Engineering Laboratories and the Fort Sill Artillery School personnel to improve accuracy of conventional artillery against moving targets.

In addition to supporting Army programs, Williams said GLLD has supported Air Force Maverick firings and is scheduled to support some Navy Bulldog tests later this month.

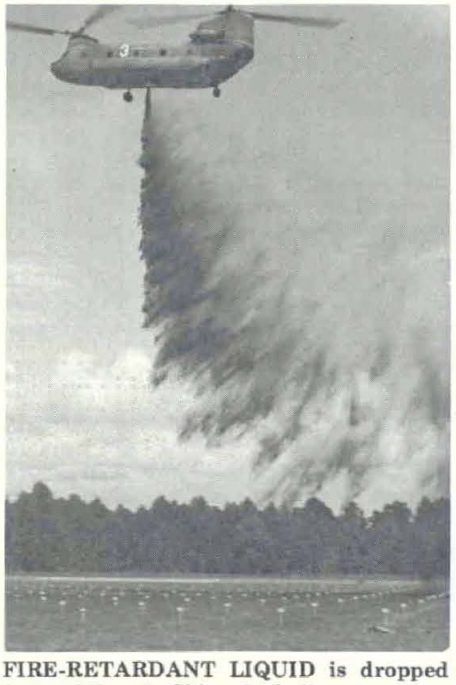
Army Assists in Helicopter Fire Fighter Evaluation

Evaluating methods of fighting forest fires is not in the normal routine of the U.S. Army Aviation Test Board, Fort Rucker, AL, but that type of technical assistance was provided recently at Apalachicola, FL.

The Northern Forest Fire Laboratory, Intermountain Forest and Range Experiment Station, U.S. Department of Agriculture, Forest Service, Missoula, MT, requested help in evaluating a large helicopter fire-retardant delivery system in comparison with that of a Lockheed C-130 airplane presently used.

The test involved 128 air drops, half of them using water to establish a baseline and the remainder using a fire-retardant mixture with iron oxide added for color to aid pilots in locating previous drops. The drops were made from heights of 75, 150 and 300 feet and airspeeds ranging from hover to 125 knots in 25-knot intervals. Flow rates from a slung bucket and internal distribution systems were also controlled.

Evaluated also were ground distribution patterns, aircraft stability and performance, and the effects of rotor downwash. U.S. Army Aviation Test Board preliminary determinations were that the drop characteristics of the helicopter were superior to those of the fixed-wing aircraft because of the inherent ability of the helicopter to maneuver at low speeds.



FIRE-RETARDANT LIQUID is dropped from CH-47C Chinook helicopter onto measuring grids at Apalachicola airport.

GRID SYSTEM used to measure quantity and quality of retardant included 1,600 "cups" that covered an area 2,000 feet by 400 feet to form the drop zone pattern.

INDIVIDUAL CUPS used to collect fire-retardant liquid during tests to determine effectiveness of helicopter delivery system.

Soaring Manpower Costs Impact . . .

Secretaries of Defense, Army Announce Major Realignments

Secretary of Defense James R. Schlesinger and Secretary of the Army Howard H. Callaway are effecting broad-scale realignments of functions and disestablishment of many major commands, principal Army staff agencies and subordinate units to offset soaring manpower costs.

The streamlining of organizational structures and relationships is termed the most sweeping change since the 1962 Army-wide reorganization, which created the Army Materiel Command as a consolidation of the materiel functions of six of the seven Technical Services. The reduction was explained in Secretary Schlesinger's Mar. 5 announcement, coincident to release of the annual Defense report to Congress:

"In this time of high personnel costs, it is more imperative than ever that we utilize our people in the most effective manner possible. Although substantial personnel savings have been made, I am persuaded that further economies are possible. We are presently studying ways to make further cuts in our headquarters establishments without adversely impacting combat force effectiveness."

Army actions being taken, as explained by Secretary Callaway, are designed to eliminate "duplicatory functions and unnecessary interfaces, establish broader and more realistic spans of control within internal staff sections, reduce administrative overhead, eliminate vertical layers in staff organizations, and more fully exploit the capabilities of the Army Forces Command, Army Training and Doctrine Command and the Army Materiel Command."

Over-all impact of the changes already directed or projected is estimated to reduce management headquarters strength by 10 percent from FY 1974 base levels. The Joint Chiefs of Staff force cut over FY 74-75 is planned at 15 percent. Actions under consideration for the Navy, Air Force and Marine Corps "will average 15 percent for each Service."

Since the FY 74 budget submission, the Army Staff and its support activities have been cut 23 percent (1,611 spaces—18.3% eliminations).

In announcing disestablishment of positions and agencies—Chief of R&D, Chief of Reserve Components, Assistant Chief of Staff for Force Development, Assistant Chief of Staff for Communications-Electronics, The Provost Marshal General—Secretary Callaway explained that the major thrust is to improve efficiency, effect substantial manpower savings, and more clearly delineate responsibilities in Army management.

Replacing the Chief of R&D will be a Deputy Chief of Staff for Research, Development and Acquisition, with responsibility for all phases of staff management of the Army's systems acquisition policy. He also will be charged with procurement and production of all major items of Army equipment.

Certain functions of the Assistant Chief of Staff for Communications-Electronics and the Assistant Chief of Staff for Force Development also will be transferred to the Deputy Chief of Staff for R&D and Acquisition.

Remaining ACSFOR functions will be assigned to the offices of the Deputy Chief of Staff for Plans and Operation, and the Deputy Chief of Staff Personnel. Similarly, ACSC-E remaining functions will go to the Deputy Chief of Staff for Plans and Operations. Responsibility of the Office of the Provost Marshal for military law and order will be vested in the Office of the DCS for Personnel.

Secretary Callaway's actions were further explained: "In this reorganization, the Army will move a long way toward its goal of fixing clear responsibilities in the major areas of budget, manpower management, plans and operations, materiel acquisition and logistics." Additional objectives are improved alignment of programing and budgeting functions with elements of the staff that discharge associated policy-making functions, and more coherent development of management information systems.

A new Director of the Army Staff will consolidate the functions of the Assistant Vice Chief of Staff and the Secretary of the General Staff.

OTHER ACTIONS: Newspaper reports of plans for other major changes within Army, Navy and Air Force functions were officially unconfirmed at press time. Similarly, many detailed impacts of the Army realignment were unannounced.

Announced in February were plans to phase out in the coming months six commands: U.S. Army Alaska; U.S. Army Forces, Southern Command; U.S. Army, Pacific; Theater Army Support Command, Europe; Engineer Command, Europe; and U.S. Army Intelligence Command, Fort Meade, MD. The Intelligence Command will be phased out by June 30 and the others during FY 1975.

Elimination of the U.S. Army Land Warfare Laboratory, and the Army Chemical and Coating Laboratory, both at Aberdeen Proving Ground, MD, and the U.S. Army Materiel Concepts Agency (AMCA), located in the Army Materiel Command Building, Alexandria, VA, also was announced in February. Actions will be completed by June 30.

MASSTER Evaluates FAAR Field Capabilities

FAAR (Forward Area Alerting Radar), a vehicle-mounted system for front-line troops to detect and monitor moving aircraft, was tested recently to its full range of field condition capabilities by MASSTER (Modern Army Selected Systems Test, Evaluation and Review) at Fort Hood, TX.

FAAR consists of a stable frequency radar from which information on either jet aircraft or helicopter gunships flying at or below treetop level is transmitted to individual Target Alert Data Display Sets (TADDS) operated by field gunnery units.

Each TADDS has a monitor screen containing a 49-grid display board that locates and plots aircraft, and can distinguish between enemy or friendly aircraft. The 49 grids, each representing an area of five square kilometers, have distinguishing green and orange indicator lights.

When an aircraft is spotted by FAAR, the proper light appears in the TADDS grid corresponding to the aircraft position. The orange light represents an aircraft tentatively unknown. The green light is activated by friendly aircraft equipped with a special unit that automatically responds to FAAR signals. The aircraft flight path is monitored by gunnery units through the TADDS activated lights "moving" from one grid to another. Once a unit's grid light is activated, air defense units must locate and identify the target before engaging it.

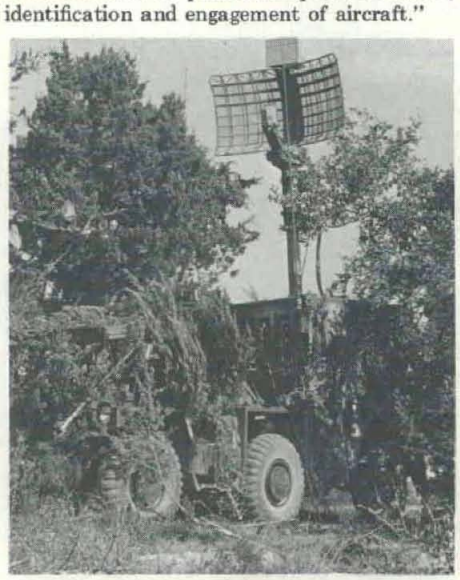
During the MASSTER test, FAAR personnel were required to denote the range at which each aircraft was visually identified, whether the aircraft was positively identified as friendly or hostile, and when engagement took place. Direction, altitude, and type of aircraft encountered were detailed for each engagement.

"What we are looking for most of all is the identification and engagement of aircraft," MAJ David L. McKee, FAAR project officer, stated, "but the key to success is the engagement. That is, how soon can proper engagement take place?"

The effect that enemy jamming will have on various portions of FAAR communications also was tested by jamming the radar and the links between the FAAR unit and the individual TADDS. Results of these tests indicate at which points FAAR is most vulnerable.

Half of the FAAR personnel conducted the test without the aid of TADDS—detecting, identifying and engaging the target by eyesight alone. Data collected will serve as a control for evaluating the true effectiveness of FAAR.

"With information from the test groups—those with and without FAAR—we will be able to determine if FAAR is indeed capable of alerting gunnery units before a hostile aircraft is sighted," MAJ McKee said. "Most important will be whether each unit has sufficient alert to permit adequate detection, identification and engagement of aircraft."



CAMOUFLAGED FAAR leaves only the radar antenna as evidence of its presence as it disperses information to individual Target Alert Data Display Sets (TADDS) operated by gunnery units in the field.

HDL Completes TEMPS Initial Deployment Tests

Initial deployment testing of the Defense Nuclear Agency's Transportable Electromagnetic Pulse Simulator (TEMPS), capable of releasing up to seven million volts of electrical energy in pulses lasting less than a millionth of a second, has been completed.

During the seven months of testing of the Defense Communications Center Autovon Switch Center near Polk City, FL, U.S. Army Harry Diamond Laboratories engineers pulsed the system about 2,700 times. More than 13,000 simulated electromagnetic pulse (EMP) measurements were made.

TEMPS is now relocated to HQ U.S. Army Communications Command, Fort Huachuca, AZ, where testing of another Defense Communications Center radio telephone facility is programed to extend into May. The next scheduled relocation is to Delta, UT, where a DCA Autovon Switch Center will be subjected to tests similar to those conducted near Polk City. A multiyear test program is planned at locations throughout the U.S.

Thousands of current and voltage versus time measurements made during the Florida testing have been forwarded to Stanford Research Institute, Menlo Park, CA, and to Boeing Aerospace Co., Seattle, WA, for analysis.

Described in detail in a feature article on pages 12–13 in the November-December 1973 edition of the *Army Research and Development Newsmagazine,* TEMPS is termed a "threat level" simulator, designed for the collection of data on methods of hardening critical electronic components for survivability against nuclear weapons effects.

The Department of Defense recognized the need for a transportable simulator system to conduct electromagnetic effects testing in the late 1960s. TEMPS was built by Physics International Co., San Leandro, CA, to specifications prepared by the Harry Diamond Laboratories and was first tested at HDL's Electromagnetic Effects Lab., Woodbridge, VA.

TEMPS as deployed for EMP testing at the AUTOVON switching center at Polk City, FL, extended over about 984 feet.

WSMR Automating Calibration Of Data Retrieval Equipment

Charged with a mission of making more than 36,000 calibrations annually, in-house or under contract, to assure the validity of instrument measurements in collecting missile launch data, White Sands (NM) Missile Range has successfully tested a new system.

The 8580B Automated Spectrum Analyzer, a computerized calibration system termed the first of its kind in the field, demonstrated two significant improvements compared to the previous methods.

System project leader H. F. Gonzales said the analyzer permits "complete calibration of a signal source in about 22 minutes," as opposed to 2.4 hours required to calibrate the same equipment using the manual methods.

Manual calibration procedures necessitate use of several different calibration standards and actual transcribing of data by the operating technician in line with tolerance limits.

The 8580B system permits automatic recording of calibration data; data storage in the computer; and automatically printed deviations, diagnostic messages, and test reports. WSMR performs about one-sixth of the Army Materiel Command's calibration workload.

Operator intervention is required only to answer a series of programed questions which establish test parameter criteria such as frequency, band widths, attenuation, power, pulse rate, pulse width, delay, and stability of the instruments being calibrated.

Calibration processes are completely controlled by the automated system which provides a predetermined value judgment, thus eliminating human indecision.

The calibration technician sits in front of a video terminal screen and responds to programed questions by pressing appropriate control keys on the console. Programed fail-safe factors prevent errors which might otherwise result from pressing incorrect control keys.

Following the calibration of a component it is either returned to the field or sent for repairs. Prior to development of the 8580B, the calibration/repair cycle required up to two weeks time. WSMR officials have estimated that use of the new system may reduce this time to an average of less than two days.

Officials note that the amount of equipment needing calibration will not diminish. However, more rapid calibration techniques will provide more frequent opportunities for calibration of equipment.

BECAMP Program Assists Munitions Community

What corrective action can be taken when artillery shells undergoing operational testing enter the ground, reemerge and travel downrange before detonating beyond target?

That was the challenging problem assigned to the U.S. Army Materiel Command's Picatinny Arsenal, located at Dover, NJ, as an element of the Armament Command headquartered at Rock Island (IL) Arsenal.

The problem developed during testing at the Army Artillery School and Center, Fort Sill, OK. The solution required, at the outset, a determination of the impact velocities and the angles of shell reemergence at which the phenomenon occurred. This determination could have required firing a large number of rounds over a period of many months, at a cost of hundreds of thousands of dollars.

BECAMP, a little-known Army Materiel Command program, provided the essential answers in a few weeks at a cost of only computer time and data processing—without any need for firing tests to make the right decision for corrective action. BECAMP denotes Ballistic Environmental Characterization and Measurements Program.

Under an approach fostered by Dr. J. V. R. Kaufman, Army Materiel Command deputy director, Plans, Research, Development and Engineering Directorate, BECAMP coordinators at principal laboratories and commodity centers review and coordinate work within their installations.

Over-all coordination responsibility is assigned to the Army Armament Command at Rock Island, IL, and the Ballistic Research Laboratories, Aberdeen (MD) Research and Development Center.

During the initial project reviews, it was found that fuze designers seemed to have the most critical needs for input data. Consequently, much of the program has been oriented to gathering information which is sufficiently defined for design engineering.

In particular, Picatinny Arsenal has, for several years, funded work at the AVCO Systems Division which has led to the ability to calculate "post impact trajectories"—the behavior of a projectile from the time it first contacts the ground until it either comes to rest, or "broaches." A 3-dimensional computer program is now operational at the arsenal for performing these computations. It has been used to assist Air Force and Navy designers as well as Picatinny engineers.

BECAMP has provided the ground work for the broad exchanges and extension of technical knowledge within the munitions community. In November 1972, at a joint government-industry symposium held at Picatinny, some 20 papers were presented on all aspects of munitions environmental characterization.

A steering committee has been established with experts from both the academic and private research communities serving to plan future symposia on a biennial basis.

Activities moved into a new phase of maturity in FY 1974 when the Army Research Office, Durham, NC, provided a grant for university-conducted research identified by Picatinny as fundamental to future interest in super-quick fuzing behavior.

One of the original BECAMP objectives was to establish a technological base that would permit a reduction in the number of tests without compromising test goals. Based upon Picatinny's experience in solving the problem discussed in this article, engineers believe this capability is being achieved.

AEC Realigns Reactor R&D Division

Accelerated development of the liquid metal fast breeder program and other advanced reactor concepts is a U.S. Atomic Energy Commission objective in a recent reorganization of its Division of Reactor Research and Development.

Key actions include provision for 10 assistant directors having specific program responsibilities, an assistant division director, and a special assistant to the director. COL William F. Reilly will remain the sole assistant director for Army Reactors.

Anticipated improvements include additional engineering and technical support for project managers; strengthened organizational R&D capabilities; a more cooperative effort among AEC facilities and segments of the nuclear industry; and an improvement in administrative and budgeting functions.

Interactive Computer Graphics in Materiel Acquisition

U.S. Army Materiel Command Director of Research, Development and Engineering MG Stewart C. Meyer presented the keynote address at a recent Defense Systems Management School seminar on Interactive Computer Graphics for Project Managers. His address, focused on achieving the potential of this new technology to effect dramatic savings in time and costs in Department of Defense materiel acquisition, follows.

* * *

It is a pleasure for me to be here and I am indeed complimented to be asked to address you on a subject that has such dynamic and far-reaching impact as does interactive computer graphics.

Anticipation of and the proper exploitation of the very rapid technological advances going on in this field can be an increasingly important factor in the success of our materiel project managers in the Department of Defense. GEN Scott has shown a good measure of vision to make interactive computer graphics the subject of this Defense Systems Management School symposium.

My purpose is to mention but a few of the many examples of work projects initiated or carried out in the area of computer graphics that bear directly on the programs being executed under the direction of our Army Materiel Command project managers.

All of our major commands and laboratories have a varying and expanding capability in interactive computer graphics tailored to suit their mission needs. I will illustrate some uses of the variety of equipment represented in these capabilities.

Additionally, I believe you will be interested in the efforts we have undertaken to solidify AMC's position on interactive computer graphics and develop a coordinated, standard approach to guide our new equipments acquisition and programing capabilities.

Computer graphics has a commanding role in the broad spectrum of computer-aided design and engineering. This is true to a degree that we must all resist the temptation to view, erroneously, computer graphics as being synonomous with Computer-assisted Design and Engineering (CAD-E).

This misconcept could result in neglect of the other very important applications of the computer to the design and engineering function—such as those of mathematical modeling, drafting design, and test simulation tasks—where graphics is not necessarily involved.

The "why" of computer graphics in CAD-E is to provide amplification to the value of scientific and engineering computing in the materiel process. It increases the band width and timeliness as well as the effectiveness of the computer in arriving at optimum and lowest cost designs.

Computer graphics output is viewed almost immediately by the engineer, as opposed to waiting for and then interpreting involved computer printouts. It has been observed that graphics is to CAD-E as TV is to radio in the communications medium. It is another means of input and output to the computer.

Man's visual capacities are by far the most powerful of his senses in absorbing and then utilizing communicated knowledge. When we introduce the man-in-the-loop concept to computer graphics, and make the process truly "interactive," we have taken a giant step in increasing the productive output per unit of computer interaction per dollar.

As CAD-E is called upon to address today's more complicated tasks with less people, interactive computer graphics (ICG) comes more to the fore. I can commend this field most highly to the attention of the assembled community of project managers as an abundant source of cost-effective, conceptual, engineering design and problem-solving techniques.

AMC's direct involvement in interactive graphics began in early 1971 with the investigation of an ICG terminal device at headquarters of the Electronics Command, Fort Monmouth, NJ. Monies were put into procurement of an interactive graphics terminal, associated minicomputer and applications programs.

Work on this project, termed MEDEA (for Multi-Discipline Engineering Design Evaluation and Analysis System), is continuing. The objective is to develop a design terminal concept, including hardware and software, whereby remote interactive graphics terminals are made available to the scientist or engineer *at his place of work* rather than clustered around the main computer.

The system consists principally of a 16-bit minicomputer, interactive graphics display, complete with light pen and keyboard, disk memory, teletype and printer-plotter. The system is connected to a distant central computer facility through voice grade communication circuits on a time-shared basis.

This MEDEA System is being put to use in support of the project manager for MALOR (Mortar Artillery Locating Radar). The particular problem addressed is how to simulate actions of the radar in searching for and acquiring for defensive interception incoming shells that present varying detection difficulties, based on angle of approach.

Identification of these critical rounds through simulation and application of ICG permits significant economies in the reduction of test range firing sessions. It is now possible for an artillery officer operating the display console to work out the most economical schedule of firings to meet the test condition and reliability criteria.

Use of ICG technology in the conceptual design stage is a major effort of the Preliminary Design Group at the Aviation Systems Command in St. Louis, MO. Last year, a simple on-line CALCOMP plotter was used to conduct extensive engine and configuration design trade-off studies for our Heavy Lift Helicopter (HLH) program manager. It has also been used to conduct parametric performance determinations in attack helicopter studies.

In our Armament Command, interactive graphics have been productively employed in arsenals to design fuzes and printed circuits, and to make finite stress analyses of structures subjected to operational environments. *The routine time to conduct a typical stress analysis on one artillery shell was reduced from two months to two hours.*

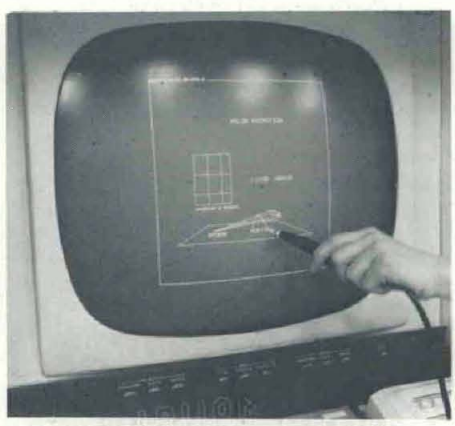
I don't need to tell a project manager what a reduction of two months in design, or in solving a development problem, saves in costs when a whole program is under way.

I would emphasize that interactive computer graphics is not just a research tool in a yet undeveloped, embryonic stage. In its various devices and mechanisms, ICG technology enables project managers to attack design tasks and solve real-world problems.

The rapid growth of this technology has raised an important question: How are we in AMC attempting to control the proliferation of available devices and equipments so that they and the supporting hardware and software are compatible and can be economically operated?

Recently, two significant steps were taken. The first was an Army Materiel Command

INTERACTIVE GRAPHIC DISPLAY SYSTEM showing (from left) graphics display with keyboard and light pen, teletype for input/output, data communication, and Varian 620-F11 Mini-computer. Included in the system (not shown) are an electrostatic printer-plotter, disc storage, and the paper-tape punch and card reader.



STATIC DISPLAY OF AN/MPQ-4 mortar-locating radar. The upper portion of the screen shows a readout to an MPQ-4 operator; the lower part is a scene of an animated simulation of an MPQ-4 intercept of an ammunition round in trajectory.

ICG symposium at Picatinny Arsenal. The second is the report of a working group on an AMC approach to ICG systems, chartered under the auspices of AMC's CAD-E Council on which I serve as chairman. What I say in drawing from both of these sources is not representative of a staffed AMC position. But at least you will know in what direction our best educated minds on this subject are pointing us.

The ICG problems confronting us might be summarily placed in three categories. Firstly, ICG technology is in such a rapid state of development that our automated data processing equipment procurement policy and procedures are not keeping pace in regard to the response time required. We have had another CAD-E Council working group looking at this set of problems. They are trying hard to get regulatory relief in the form of a more streamlined, decentralized authority and process for meeting scientific and engineering computer needs.

Secondly, we need greater in-house competence in areas critical to the technical support and implementation of ICG systems such as software, communications and central processor support functions.

We have taken steps to identify and form a cadre of expertise in defined technological areas of CAD-E that can coordinate and provide consultant or exchange of information and data services. The ICG working group is comprised of many of our best personnel in this field.

In addition, AMC sponsors a graduate program in CAD-E at the University of Michigan for bench-level engineers and a series of one-week seminars at the U.S. Military Academy for senior-level executives. We are also engaged in the formation of a CAD-E data bank to advance the storage, interchange and dissemination of CAD-E information throughout AMC.

Thirdly, the ICG field is deficient in standards, which restricts transportability of software and the implementation of interactive graphics in computer networks. This causes considerable duplication of effort, limited availability, unreliability and increased costs. The problem is one that should be of concern to all U.S. military services, and one to which the computer industry might address itself in the common interest.

It would appear that interchange of programs and data between graphic systems would be enhanced by adoption of two standards:

- The American standard code for information interchange (ASCII) for all data exchange.
- The use of FORTRAN IV callable subroutines for at least the near-term implementation of standard graphics functions.

In addressing the development of an AMC approach to standardizing ICG systems, we have had to recognize a number of salient conditions:

- A variety of interactive computer graphic systems are installed or being installed in AMC. These existing systems were not specified, acquired or installed with due consideration explicitly given to an AMC-wide approach.
- The inordinately long lead-time associated with computer-based systems, coupled with the increasing demand for their capability, makes it impractical to forestall acquisition of additional ICG systems pending adoption of an AMC-wide approach. We need an immediate near-term resolution that will accommodate long-range evolution in technology and future AMC requirements.

Properties the AMC preferred approach might well have include:

- It should accommodate all existing systems.
- It should apply over a wide range of equipments—relatively small, limited need, low-budget applications to extremely large, technically demanding, costly applications.
- It should allow for expansion in the number of users, types of applications and types of display devices.
- It should be capable of utilization in the context of a variety of approaches to providing computational support—for example, stand alone or use local time-sharing or computer networks.
- It should promote the exchange and utilization of applications software and application data banks.

This is a tall order. It is an extremely complicated and difficult task. It needs the understanding and support of project managers and other customers that the standard system would be designed to serve more effectively.

For that matter, I would hope that project managers would be receptive to the financial support of advancing interactive graphic techniques where they can be related to elements and tasks within their projects.

To our mutual benefit, I urge our Army project managers to contact the CAD-E Council for assistance or to lend their support. There is a principal or alternate council member in every command, arsenal and corporate laboratory.

It is a fact that this new technology of interactive graphics is being applied to a wide variety of AMC commodities. Included are aircraft preliminary design, munitions and communications gear—with demonstrable time saving and economic benefits.

In my mind, there is little question that ICG will be applied to essentially all aspects of the AMC materiel acquisition process—concept formulation, design and evaluation, performance simulation, component and subsystem modeling, drafting and numerical control.

I have outlined a number of the problems to be solved if ICG potential is to be realized. Interactive graphics merits and needs the support of project managers. This symposium will accomplish a useful purpose to the extent that it serves to stimulate the potential of recognition and implementation of ICG systems in project management.

EDITOR'S NOTE. Employment of interactive computer graphics in materiel acquisition, as discussed in this presentation by MG Stewart C. Meyer, is closely related to but, as he explains, is not to be considered synonymous with CAD-E (Computer Assisted Design and Engineering).

CAD-E was the subject of a feature article on U.S. Army Materiel Command activities in this relatively new area when it appeared in the January 1970 edition of the Army R&D Newsmagazine. Paul O. Langguth, a general engineer still assigned to the AMC Research, Development and Engineering effort as a CAD-E action officer, was concerned with the initial program development effort.

Night Vision Goggles May Provide Sight for the Blind

One of the paradoxes of war is that instruments contributory to combat wounds later may, in various applications of the technology involved, become instruments of mercy responsive to urgent human needs.

Pointing to this possibility is the recent announcement that U.S. Army-developed night goggles, designed to take the cover of darkness from the concealment advantage of the enemy, now hold the promise of giving sight tomorrow to many who are blind today.

Application of the technology of the Night Vision Goggles to aid those afflicted with the night blinding disease, Retinitis Pigmentosa (RP)—several thousand are estimated to be so affected throughout the United States—was reported at Fort Belvoir, VA, by the U.S. Army Night Vision Laboratory. The NVL is an element of the U.S. Army Electronics Command, Fort Monmouth, NJ.

RP victims using the NVGs can begin to do things during the hours of darkness which the disease previously prevented them from doing, according to the report. Some victims are blind under lighting conditions as high as normal street lighting; many cannot walk down the street after sunset.

"Goggles therapy" feasibility tests were conducted at the Massachusetts Eye and Ear Infirmary in Boston under the direction of Dr. Eliot Berson. His experiments proved that by using the NVGs, many patients with RP could become mobile at night.

Army Night Vision Laboratory scientists joined with Dr. Berson in 1972 by using the "second-generation" NVGs approach to RP therapy. Once the effectiveness of the equipment was determined, NVL representatives brought together representatives of industry to manufacture the systems for the Army.

AN/PVS/5 Night Vision Goggles

Consequently, through mutual endeavors a redesigned, lower-priced pair of NVGs may soon be available for sale to RP patients, NVL officials state.

Military applications require that NVGs meet rigid specifications to satisfy operational requirements under a variety of environmental conditions. RP sufferers do not need as rugged a device as the Army version. "Softening" NVGs for RP users is expected to lower their price tag considerably.

Working with the research, industrial and medical community to fight RP is the National Retinitis Pigmentosa Foundation, which maintains a registry of RP sufferers. Further information on RP may be obtained by contacting the foundation at Rolling Park Bldg., 8331 Mindale Circle, Baltimore, MD 21207.

SPEAKING ON . . .

(Continued from inside front cover)

maintained. On that score, I believe that we must keep a visible strategic nuclear balance, contribute to a number of regional balances—in Europe and Asia—and help to ensure the freedom of the seas, as has been the long tradition of the United States.

Planning the Forces. In light of these factors, we can arrive at the specific nuclear and nonnuclear forces required for a particular contingency. But those factors do not automatically dictate what over-all force structure the United States should maintain in this period of transition. Not only does the final calculus depend on a number of additional considerations, including various perceptions of the key military balances; it also turns on our assessment of the international environment and the degree of menance that it poses to our essential interests.

All through the previous decade—quite apart from our special buildup for Southeast Asia—my predecessors interpreted these factors to mean that we should maintain Active and Reserve forces (nuclear and nonnuclear) sufficient to deter hostilities by:

- Giving us counterforce and damage-limiting options, as well as the ability to retaliate with devastating power against cities, even after a surprise nuclear attack by the USSR;
- Coping simultaneously with two major contingencies (one in Europe and one in Asia) and one minor contingency;
- Maintaining superiority in a war at sea and control the sea lines of communication necessary to the support of our forces and allies overseas.

Admittedly, the assessment of the international situation during that decade was more pessimistic than our current estimate. But it also is noteworthy that the large active forces then at our disposal were intended, in most contingencies, to operate in conjunction with Allies and to receive early reinforcement from our reserves and the draft.

Indeed, despite a peacetime military establishment of 2.7 million men and women, we added another 900,000 (starting in 1965) both to strengthen our forces in Southeast Asia and to maintain our capability to deal with other contingencies. Only in 1969, with the advent of this Administration, did a significant reduction in the force begin to take place.

The Current Forces and Their Costs. Since that time, estimates of the international situation have become more optimistic, in large measure because of initiatives taken by the United States. To the extent that we now consider the political environment less threatening, it is largely because President Nixon terminated the U.S. Military involvement in Vietnam, made successful diplomatic overtures to Peking and Moscow, achieved agreements in the Strategic Arms Limitation Talks (with the Antiballistic Missile Treaty and the Interim Offensive Agreement), and began the negotiations on mutual force reductions in Central Europe.

As you know, U.S. force levels have declined substantially in the wake of these initiatives. Not only has the general-purpose force structure now fallen well below the peak levels of 1968; it is actually smaller than it was in 1964.

In other words, we maintain a much more modest defense establishment in 1974 than was considered necessary in peacetime only a decade ago. It is equally noteworthy, however, that the considerations which affect our defense planning are no less demanding.

The sheer physical threats, as measured by the military capabilities of potential adversaries, have actually increased during the last 10 years. At the same time, so have our foreign interests, with expanded external investments, a large volume of international trade, and growing dependence on raw materials from sources overseas. Meanwhile, our political commitments remain essentially constant, as do the capabilities of our Allies.

To underline these developments, and particularly the decline in the U.S. defense posture, is not to imply disapproval of previous initiatives, although some of the force cuts may have gone too deep. Nor is it to pretend that, in real terms, we now have a small defense budget as a result of the reductions in our force structure.

It is true, of course, that defense outlays are consuming a decreasing fraction of our gross national product (now less than 6 percent) and federal revenues. It is also true that in constant FY 1975 prices, we are spending $8 billion less than in FY 1964, the last pre-Vietnam budget year. Nevertheless, by any measure, $85.8 billion is a large outlay.

The nation should understand, however, that the total looks so large—and is so large—compared with the $50.8 billion we were paying for defense in FY 1964 primarily because of four factors:

	In FY 1975 (billions of current dollars)
—the remaining costs of Southeast Asia related support	$ 1.8
—the increase in military retired pay since FY 1964	4.8
—the growth in military and civil service pay and allowances since FY 1964	21.1
—the effects of inflation on the purchase of goods and services since FY 1964	14.4
Total cost growth	$42.1

Were it not for these factors, we could be maintaining our baseline force structure—the posture we design for long-term, steady-state, peacetime purposes—for about $43.7 billion. However, inflation and real pay increases (not cost-of-living increases) granted prior to the end of the draft have been substantial since 1964.

Because our society decided on grounds of equity to make military and civil service pay comparable to remuneration in the private sector of the economy, the bill for defense has gone up by a large amount. Despite the resulting burden, I doubt that we would want to reverse earlier decisions and implicitly tax our military personnel for service to the country—with or without the draft.

Instead, I believe we will want to accept the fact that, because of truly national decisions in favor of equity—shared in by the executive and legislative branches alike—a unit of defense is now more expensive than it was 10 years ago. Whether we can bring these unit costs down, and whether we should consider reviving the draft at some future date, are separable issues that I shall discuss later in more detail.

The Baseline Requirement. Because defense spending appears so high compared with the past, and because the international environment is less hostile, we have faced and will continue to undergo pressures to reduce our defense posture still further, to cut back unilaterally on our strategic offensive forces, and to thin out baseline deployments overseas.

Despite these pressures, I believe that we have already overshot the mark in previous reductions, and that, to the extent that we can expand the combat structure (particularly where the general-purpose forces are concerned) without adding real costs, we should be authorized to do so. I have several grounds for this view.

This is the first peacetime defense budget in many years. Nevertheless, I would be remiss if I pretended that our need for military strength is substantially less than it was a decade ago, before our major deployments to Southeast Asia. It is true that our relationships with the USSR and the PRC have improved since then; Sino-Soviet differences are more visible; and we no longer think it so important to insure against simultaneous conflicts in Europe and Asia.

But, as I have already indicated, the military capabilities of those nations in a position to threaten our interests have not declined; they have increased. There is, in fact, no evidence whatsoever that unilateral reductions induce reciprocity on their part.

Considering the cuts we have already made, further reductions should now be dependent upon international agreement with potential adversaries. And, with SALT and MBFR (Mutual Balanced Force Reduction), we have created the mechanisms for just such hoped-for reductions. While we await their results, growth in the force structure brought about by increased military efficiency should not be denied us, especially since estimates of our baseline requirements are not precise to the last detail.

As I hardly need remind you, to move from a state of cold war through a condition of detente and improved diplomatic communication to an era of greater mutual trust and cooperation between East and West is an involved and lengthy process. It is particularly difficult when our negotiating partners in the enterprise are closed societies.

As recent events in the Middle East have

demonstrated, tests of will and resolution may be with us for some time to come, and military strength appropriately displayed will play a meaningful role in their resolution.

Furthermore, unlike the role circumstances and disposition allowed us to play prior to World War II, we now unavoidably have the leading part in the defense arrangements of the Free World. There is no substitute among the other industrialized democracies for the power of the United States.

Whereas prior to World War II the United States could serve as the arsenal of democracy and its great reserve force, now we constitute democracy's first line of defense. There is no longer any large and friendly shield of defenses behind which we can take two or more years to mobilize our forces. It is our own ready defenses that constitute so much of the deterrent shield.

Nor is that all. We must also recognize that large and abrupt changes in our posture and deployments could well produce major effects in the world—not only on the calculations of the USSR and the PRC, but also on the perspectives of our Allies and on such long-term trends as nuclear proliferation. We are not the policeman of the world, but we are the backbone of Free World collective security.

To summarize, this is not only the first defense budget of the post-Vietnam era; it is also the first defense budget for what President Eisenhower once called the long haul. Short of a sudden and dramatic improvement in the international environment, this means that we must provide offsetting power to multiple capabilities of potential foes.

Deterrence must operate across the entire spectrum of possible contingencies; we cannot afford gaps in its coverage that might invite probes and tests. As far as we can see, a triad of strategic nuclear, tactical nuclear and conventional forces will be required.

In such circumstances, the force structure we propose for FY 1975 and the years that follow must rest on the concepts and methods that I have alluded to here. That is to say, U.S. interests, the potential threats to them, our commitments, the range of contingencies that might arise, allied capabilities, and our conception of the role we should play in world affairs, must continue to shape the defense posture and budget of the U.S.

Resources and Programs: FY 1974 Supplemental and FY 1975 Budget. The President's budget proposal . . . was developed within this over-all context, and includes requests for both FY 1974 Supplementals—the result of pay and price increases and necessary readiness improvements—and the FY 1975 budget.

The FY 1974 Supplemental requests total $6.2 billion in addition to the amounts already appropriated by the Congress, raising the proposed FY 1974 total obligation authority (TOA) to $87.1 billion. Of this Supplemental amount, $3.4 billion is required for pay and rate increases. The balance of $2.8 billion is required to maintain the desired readiness level of U.S. forces.

This "readiness supplemental" is largely the result of our recent Middle East experiences and includes fuel price increases in the amount of $480 million. Also included are the extra costs of our arms supply to Israel, consisting of increased operations and maintenance costs and the additional costs for replacing in U.S. inventories the material provided to Israel. These extra costs amount to $231 million.

The Supplemental request also reflects the most urgent deficiencies in the condition of our forces that were made apparent by the Middle East hostilities. With these things in mind, I have included $1,397 million to improve the readiness of our forces, $169 million to increase our airlift capability, and $516 million to buy certain high-value weapons and equipment which are now in short supply in our Services.

The readiness improvements include adding to our ammunition stocks, reducing the maintenance backlog on our ships and equipment, making sure prepositioned equipment is ready for use, improving our defense suppression capabilities, and purchasing short-supply items important for over-all readiness.

The airlift improvements I recommend are modest first steps in a more fundamental examination of our airlift capabilities which I believe is necessary. These first steps include buying additional C-5 and C-141 spare parts, developing a stretched version of the C-141, and examining the possibilities for relatively inexpensive improvements to civil airlift to permit them to carry military cargoes in an emergency.

The FY 1975 budget request in TOA is $92.6 billion, an increase of $5.5 billion over FY 1974, and outlays for FY 1975 are estimated at $85.8 billion. This request is a substantial one, but I offer no apologies for it. It bears directly on whether or not the United States will continue to fulfill the responsibilities it has around the world.

In real terms, moreover, it means doing no more than holding our own as compared to FY 1974, for the $5.5 billion increase is wholly consumed by pay and price increases. In fact, the FY 1975 budget in constant dollars is smaller than the FY 1964 budget of a decade ago. Similarly, the FY 1975 budget outlays continue for the second year to claim less than six percent of the gross national product —the lowest allocation of resources to Defense since FY 1950—and continue also the declining trend of Defense spending as a percent of the total federal budget, at 27.2 percent for FY 1975.

We do propose in the FY 1975 budget certain new emphases which are meant to insure that we have the ability to maintain in the future a worldwide equilibrium of military force. This requires that there be a stable balance of strategic forces, of general-purpose forces—particularly in central Europe—and of maritime forces.

. . . ***The FY 1975 program reflects these significant trends in our forces:***

• We will continue to maintain the triad of ICBM (Intercontinental Ballistic Missiles), SLBM (Submarine-Launched Ballistic Missiles) and bombers in our strategic forces, improving them and replacing them as appropriate, within the confines of the SALT I agreements.

• We will proceed with several strategic systems research and development programs which might serve either as replacements for existing allowed systems or as hedges against the uncertain results of SALT II.

• We will decrease our active Air Defense of the Continental United States, reducing the number of air defense fighter squadrons and SAM (Surface to Air Missile) batteries. Without an effective antimissile defense, precluded to both the U.S. and USSR by the ABM Treaty of 1972, a defense against Soviet bombers is of little practical value. We will, however, retain the capability to protect the sovereignty of our airspace and to defend against limited threats.

• We will continue improvements in our strategic command and control systems. In our general-purpose force structure, we will halt, and in some areas reverse, the steady reductions that have occurred since 1968.

—We will increase the number of active Army divisions, from 13 to 13⅓, add new battalions, and convert certain Reserve component infantry units into armored and mechanized units. We will do this within manpower authorizations, by making reductions in headquarters and support establishments.

—For the first time in many years, we will be adding more new ships to the fleet than we will be retiring from the fleet, thus reversing the trend that brought us from 979 general-purpose ships in 1968 to 526 ships at the end of FY 1974.

• We will apply the lessons of the recent Middle East War, by giving high priority to programs such as modern antitank weapons; tanks; air defense of land forces and its opposite, defense suppression; improved munitions and more substantial stocks, aircraft shelters, and the like.

• We will improve our readiness by accelerating aircraft modifications and reworks, restoring ship overhaul schedules, and other maintenance.

• We will increase our total airlift and sealift capability, as far as possible, through the use of existing resources, commercial as well as military, Allied as well as our own, in order to be able to deploy divisions even more rapidly to Europe in an emergency.

Chief procurement programs for strategic forces involve continuation of production of Minuteman III missiles at the minimum rate, completing SSBN (Submarine Nuclear Ballistic) conversion to POSEIDON, and the continuation of the TRIDENT SSBN and air-launched missile programs.

In addition, there are several research and development programs under way as replacements for existing systems allowed under SALT I or as hedges against the uncertainty of SALT II and the lapsing of the Interim Agreement.

These R&D initiatives include continued development of the B-1 (bomber), Advanced ICBM technology, the cruise missiles, advanced ballistic missile reentry systems and technology (ABRES), and a new, smaller SSBN. No production decisions on these systems have been taken or are required this year.

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SPEAKING ON . . .

(Continued from page 11)

In addition, we will complete deployment of Safeguard (Ballistic Missile Defense System) at Grand Forks, and continue our ABM technology development. We will not go ahead with antiballistic missile defense of the National Capital Area at the present time.

Despite the enormous importance of strategic programs, TOA for FY 1975 comes to $7.6 billion, or only 8.4 percent of the total budget, as compared to a TOA in 1964 of $8.5 billion (16.7 percent of the budget).

The major land force procurement and development programs involve tank/antitank, air defense, surface-to-surface missiles and mobility systems. The principal procurement programs are the M60 tanks and TOW and Dragon antitank missiles on an accelerated schedule, the Sea-Cobra and Cobra-TOW attack helicopters, the improved Hawk surface-to-air missile system, and the Pershing and Lance surface-to-surface missile systems.

The major development programs are for a new main battle tank, a Mechanized Infantry Combat Vehicle (MICV), and Advanced Attack Helicopter (AAH), testing of alternative mobile, short-range air-defense systems, and the continued development of a tactical transport and Heavy Lift Helicopter (HLH).

In order to maintain naval forces of adequate size and capabilities for the future, in the face of obvious budgetary limitations, we are giving great emphasis in our FY 1975 programs to the high/low mix concept for our surface fleet.

Accordingly, we look to the Sea Control Ship and Patrol Frigate to take on tasks in lower threat areas previously undertaken by aircraft carriers and destroyers. We are also continuing in 1975 our emphasis on ASW (Antisubmarine Warfare) capabilities, on acquiring an antiship missile (the HARPOON), and in pursuing new technology for the 1980s.

The chief procurement programs are a continuation of the DD-963 destroyer program, and the DLGN-38 nuclear frigates; the design and procurement of the Sea Control Ship, the patrol frigate, carrier and land-based ASW aircraft and helicopters, antiship missiles, attack submarines, amphibious assault ships, and a number of supporting systems. For the longer term, we are exploring surface effect technology and its implication for our surface fleet.

Tactical air forces programs this year reflect the application of the high/low mix concept. Major aircraft procurement programs include the F-14A and F-15, which will replace a portion of the long-service, F-4 tactical fighter. There will also be more of the latest versions of several Navy attack aircraft —the A-4M, A-6E and A-7E.

We have included in the FY 1975 budget the initial procurement funds for the A-10 close-air-support aircraft, and development funds for new lightweight fighters, both examples of low-cost but capable systems tailored to particular missions against limited threats.

We also include funds for the initial procurement of 12 tactical AWACS (Airborne Warning and Control Systems) which are expected to improve in significant measure our ability to control tactical air operations and to provide long-range airborne surveillance and warning for our tactical air forces.

Finally, we are giving greater emphasis in our FY 1975 procurement and development programs to systems that will locate, identify and suppress ground air defenses. In this regard, we will continue procurement of the EA-6B tactical jamming aircraft as well as a number of new development efforts.

We are not proposing new procurement programs for our mobility forces in FY 1975. Instead, we propose to make our existing forces more ready and capable of more extensive operations, by higher crew ratio and more certain availability of spare parts and the like.

We also propose to modify all of the existing C-141 cargo aircraft to increase their capacity by about 30 percent. We are studying ways to identify and mobilize necessary shipping early in a crisis.

We are working with our Allies to insure greater cooperation and availability of Allied sealift resources in an emergency. We are also proposing in the FY 1975 budget to modify civilian aircraft in cooperation with U.S. commercial airlines in order that they might have the necessary capacity to meet the military cargoes requirements and be available in time of need. This, of course, is a much less expensive alternative than buying and maintaining our own larger airlift fleets. Our over-all aim, underlined by the Middle East hostilities, is to improve substantially our strategic airlift capacity to deploy forces overseas swiftly in time of crisis.

Personnel for Defense. One side, and traditionally the less publicized side, of the Defense programs is the weapon systems and equipment programs I just discussed. The other and now more costly side is manpower. In FY 1975 we are aiming to maintain a peacetime deterrent force structure of sufficient size, quality and readiness by using our manpower more efficiently, with particular emphasis on getting more combat capability by reducing the headquarters and support structure. And we will continue programs to improve the quality of life in the military services.

These are formidable tasks. First, our force structure is much smaller than it has been in more than two decades, and smaller by almost 40 percent from the 1968 Vietnam peak. We cannot prudently allow it to shrink further. Moreover, we must take steps to increase our readiness and to continue to overcome nagging deficiencies.

Second, FY 1975 will complete the transition to the All-Volunteer Force; and, despite our smaller active force, we still must recruit one of every three eligible and available men to man the force adequately. We will increase also recruiting of young women. Attracting and retaining a sufficient number of qualified individuals will perhaps be our most significant personnel test in FY 1975. We obviously will have to use our personnel resources more efficiently.

Third, we must improve the organization and readiness of the Reserve and National Guard so that they can assume their increasingly important role in our total security posture. And finally, we must do all of this at as low a cost as is possible, since manpower already consumes approximately 55 percent of the Defense Budget and further increases would jeopardize both needed improvement in readiness and weapons development programs.

It is clear not only that the best efforts of the Defense Department will be required to succeed, but also that we must have the active support of the Congress and the American people as well.

Secretary of Defense Schlesinger—at this point in his statement to the House Committee on Appropriations to expound and justify the Department of Defense budget—launched into a discussion of "the first full year of operation" of the Volunteer Services Concept, then turned to "New Directions" in maintaining the "delicate balance of deterrence," and closed with praise of the Armed Forces, saying:

"The men and women of the Department of Defense are without peers as servants of the Nation. It does not follow, however, that patriotism can proceed without respect. We must give them the respect, dignity and support that are their due. Equal opportunity will continue to be a DoD watchword."

SECRETARY SCHLESINGER'S "POSTURE STATEMENT," following the general pattern of this annual document as presented by his predecessors, actually is titled "Annual Defense Department Report —FY 1975." Released for public dissemination Mar. 4, only a couple of days before this edition of the *Army Research and Development Newsmagazine* was submitted to the printer, the report is a 237-page publication. Within the space that could be made available by late changes in make-up, it was possible only to excerpt from the report as follows:

"*The Strategic Nuclear Balance.* There have been two aspects in the development of Soviet strategic forces, one long-term and the other, more recent, that affect our present strategic forces planning and the deterrent value of our strategic systems. The long-term and quite well-known factor is that over many years the Soviet have been steadily closing the gap in nuclear capabilities between them and us. . . .

". . . The Soviet Union now has the capability in its missile forces to undertake selective attacks against targets other than cities. This poses for us an obligation, if we are to ensure the credibility of our strategic deterrent, to be certain that we have a comparable capability in our strategic systems and in our targeting doctrine, and to be certain that the USSR has no misunderstanding on this point. . . .

"During the past year alone, the Soviets have tested four new ICBMs (the SS-X-16,

SS-X-17, SS-X-18 and SS-X-19) and have developed their first MRV (Multiple Reentry Vehicle) submarine-launched missile. The new ICBMs are of special interest. Three of the four have been flown with MIRVs (Multiple Interceptor Reentry Vehicles), and all of them are being designed for increased accuracy.

"The very large SS-X-18 will have about 30 percent more throw-weight than the currently deployed SS-9. The SS-X-17 and SS-19 are considered as successors to the relatively light SS-11. They will have from three to five times the throw-weight of the earlier model SS-11s, which now constitute the bulk of the Soviet ICBM force.

"If all three new and heavier missiles are deployed, Soviet throw-weight in their ICBM force will increase from the current 6–7 million pounds to an impressive 10–12 million pounds.

"This throw-weight, combined with increased accuracy and MIRVs, could give the Soviets on the order of 7,000 one-to-two megaton warheads in their ICBM force alone. They would then possess a major one-sided counterforce capability against the United States ICBM force.

"This is impermissible from our point of view. There must be essential equivalence between the strategic forces of the United States and the USSR—an equivalence perceived not only by ourselves, but by the Soviet Union and third forces as well. This was the essence of the SALT I agreements.

"*The NATO-Warsaw Pact Balance.* There are some who feel that the United States entered indiscriminately into security commitments in the post-World War II period, and that it is now time to review those commitments. I agree that we ought to review our commitments. But the worst thing of all would be if the United States, in reviewing those commitments . . . were to abandon these commitments indiscriminately—because many of these commitments are vital to our security, and to the place and role of the United States in the world today. . . ."

Secretary Schlesinger then compared his views of the combat capabilities of the NATO Forces with those of the USSR, concluding with: ". . . If the NATO countries do not falter in their defense programs, and if we can concert our defense efforts more effectively, there is no reason why NATO should not be able to achieve and sustain an adequate defense posture for the long haul. . . .

"The second major objective I have pursued with our European Allies is the achievement of an equitable adjustment of the defense burden. In fairness, we should acknowledge at the outset that NATO defense has been far from a single-handed effort by the United States.

"Of the peacetime forces deployed in the European area, our Allies contribute approximately 90 percent of NATO's ground forces, 80 percent of the ships, and 75 percent of the aircraft. In the critical central region of Europe, the United States contributes only 23 percent of NATO's manpower—compared, for example, with the Soviet Union's share of 46 percent of Warsaw Pact manpower.

"*Middle East Lessons.* Soviet actions during the October 1973 Middle East War show that detente is not the only, and in certain circumstances not the primary, policy of the USSR. The immediate Soviet arms shipment to Egypt and Syria at the outset of hostilities, the deployment of nuclear-capable SCUD missile launchers, the peremptory Soviet note to the United States Government imploying the possibility of direct Soviet military intervention with ground and air forces, and the forward deployment of sizeable Soviet naval forces—over 90 Soviet ships in the Mediterranean at the height of the hostilities and smaller naval forces in the Indian Ocean—provided another lesson in Soviet willingness to take risks with world peace. . . ."

JOINT CHIEFS OF STAFF STATEMENT before the Defense Appropriations Subcommittee of the House Committee on Appropriations. JCS Chairman (Admiral, USN) Thomas H. Moorer, in making his fourth annual "United States Military Posture" statement to Congress, a 92-page document, used 15 charts to depict comparatively the capabilities of the United States and the USSR—based on intelligence reports and estimates.

The chart titles are: *Significant U.S. and USSR Initiatives, Strategic Offensive Systems. Comparison of U.S. and USSR Intercontinental Ballistic Missiles (ICBMs). New USSR ICBMs. U.S. and USSR ICBM Launchers. Comparison of U.S. and USSR Submarine-Launched Ballistic Missiles (SLBMs). U.S. and USSR SLBMs. U.S. and USSR Intercontinental Bombers. U.S. and USSR Operational Strategic Offensive Delivery Vehicles.*

Also: Significant U.S. and USSR Initiatives, Strategic Defensive Systems. U.S. and USSR Strategic Defensive Forces. Significant U.S. and USSR Initiatives, General-Purpose Forces Systems. Ground Forces, Major Weapons and Equipment. Tactical Aircraft. Major Operational Combat Surface Ships. Cruise Missile and Attack Submarines.

Admiral Thomas H. Moorer
Chairman of Joint Chiefs of Staff

"In my opinion," Adm Moorer stated at the outset, "no task assigned senior military leaders is more important than the duty of keeping Congress and the American people fully informed on military matters. In the final analysis, our military posture and our national security can be no stronger than the determination of the American people to defend our Nation and its freedoms. . . .

"The military posture of the United States can be judged meaningfully only by relating our military forces—both strategic and general-purpose—to those of our most powerful potential adversary, the Soviet Union.

"In this regard, the negotiation and signing of the Treaty of the Limitation of Anti-Ballistic Missile Systems (ABM Treaty) and the Interim Agreement on Certain Measures with Respect to the Limitation of Strategic Offensive Arms (Interim Agreement) constituted first steps in our effort to restrain the obvious and destabilizing momentum of the USSR strategic force buildup, and to establish some control over the deployment of significantly increased strategic forces by both the U.S. and the USSR.

"The force levels for the U.S. and the USSR established by the ABM Treaty are equivalent, but the numerical ICBM and SLBM force levels authorized for the Soviet Union by the Interim Agreement are larger than those authorized for the United States. . . .

". . . In the Joint Resolution authorizing the acceptance of these agreements, however, you will recall that the Congress specified that the President should seek a future agreement which 'would not limit the United States to levels of intercontinental strategic forces inferior to the limit provided for the Soviet Union.' Compliance with this Congressional mandate is a primary objective of the current follow-on negotiations to conclude a permanent agreement.

"I report to you today that aggressive modernization programs, which could place the United States in a position of strategic inferiority in the foreseeable years ahead, are now being taken by the Soviet Union. These programs, although aggressive, are within the terms of the Interim Agreement now in effect.

"If we are to maintain our relative position, we must continue the deployment of the strategic systems requested by the President, and must continue to insist upon the equivalence which the Congress so wisely has called for as an ultimate goal in our Strategic Arms Limitations negotiations.

"With regard to the general-purpose forces of the Soviet Union and the United States, I have noted with apprehension for the past several years that a major shift in the naval balance is taking place.

"The U.S. still has the edge with regard to the projection of our naval power as the result of the global reach of our fleets through our carrier and amphibious task forces. The USSR, however, is building a modern and increasingly powerful naval force capable of interdicting sea lines of communications and obstructing this projection of our military power across the ocean to assist our Allies.

"The exact role of the new Soviet carrier force is not clear, but we may be sure that it portends a new era in the projection of seapower by the USSR.

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SPEAKING ON . . .

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"The tactical air forces of the Soviet Union are in the midst of a major and significant modernization program. The program appears to be directed at overcoming the long-standing qualitative advantage held by U.S. tactical air forces in the ground attack role. The Soviet tactical air forces hold major quantitative and some qualitative advantages in the air superiority role. . . .

"The Soviet weapons and equipment observed in the Middle East (War), together with other evidence, clearly show that the large USSR ground forces also are being modernized with new tanks and new combat vehicles, as well as new and sophisticated combat support weapons and systems.

"Additionally, there are indications that the Soviet Union is developing airmobile units with ground attack helicopter support which, when combined with its tanks and combat vehicles, will increase the tactical mobility and firepower of its ground forces. . . ."

Adm Moorer then turned to a discussion of the strategic programs of the Peoples Republic of China as another potential enemy "continuing to increase its over-all military power," and to a detailed comparison of the U.S. and USSR development of strategic offensive systems.

The SALT I Agreement, he said, prohibits converting any of the "older" or "light" launchers into "heavy" launchers for ICBMs, but that SLBM launchers may be substituted for the older launchers, if desired. He explained:

"Under the terms of the Agreement, therefore, the U.S. could 'modernize' all of its 1,000 MINUTEMAN and its 54 TITAN II launchers to MINUTEMAN III or any other modern 'light' ICBMs; but it could not replace any of the TITAN II or MINUTEMAN launchers with modern 'heavy' ICBMs.

"Similarly, the USSR could 'modernize' all of its ICBMs, but only the 313 SS-9 associated launchers (288 operational SS-9s and 25 new silos under construction in SS-9 complexes at the time the Agreement was signed) can be converted to new 'heavy' ICBMs.

"All of the 1,030 SS-11 and SS-13 (Soviet) launchers, operational at the time the Agreement was signed, may be modernized for new 'light' ICBMs . . . (which) also may be installed in the 66 new silos, under construction at the time of the Agreement, provided the dimensions of the launchers are not increased by more than 10–15 percent. As I already have mentioned, the 209 'older' SS-7 and SS-8 launchers (and 54 U.S. TITAN II launchers) may be replaced by SLBM launchers."

In comparing U.S. and USSR intercontinental bombers, Adm Moorer continued:

"In terms of just *intercontinental* bombers, the U.S. now has, and most likely will continue to have, at least into the 1980s, a substantial quantitative lead over the USSR, even after considering the deployment of a portion of the BACKFIRES (under development by the USSR and described as weighing 2½ times as much as the U.S. FB-111 and about four-fifths as large as the U.S. B-1 (also under development) in an intercontinental role. . . ."

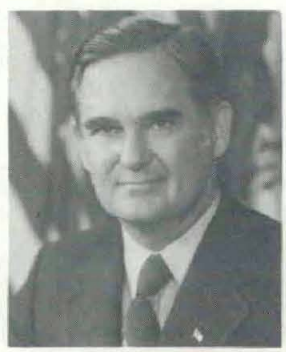
The B-1, he said, will begin flight tests late this year and a production decision will be made, after detailed evaluation of the four RDT&E aircraft, probably in late 1977. After describing the operational characteristics of the B-1, which is not expected to become operational until the 1980s, Adm Moorer continued:

"We also believe that it will have important qualitative advantages over the BACKFIRE in range, payload and penetration capabilities. The B-1 represents a major technological advance over the B-52 and the FB-111, and I strongly recommend your continued support of this extremely important program. . . ."

Much of the information presented by the Chairman of the Joint Chiefs of Staff during the remainder of his presentation to Congress explained, in precise detail, the intelligence views of U.S. and USSR current and anticipated strategic weapons systems capabilities, and the over-all strategic balance.

In different terms, this information is covered in the presentations by other Department of Defense leaders that will follow.

SECRETARY OF THE ARMY Howard H. Callaway's 40-page presentation to the House Committee on Armed Services on "The Posture of the Army" opened with a discussion of "Why an Army?" More so than in the recent past, he said, "we seem to be concerned with uncertainty about the Army's role and the continued allocation of resources to support our program. He perceived the question, "as at least three different questions posed by differing groups."



Howard H. Callaway
Secretary of the Army

In one case, he said, "Why an Army?", is actually asking why we have not found ways to resolve conflicts peacefully, and hence why we haven't abolished war. At that philosophical level, I really have no satisfactory answer. . . .

"From another group the question, 'Why an Army?', is really couched in relation to the current major policy goal summarized as 'Detente.' In effect, they are asking, 'Since our major policy is aimed at detente, and since we seem to be making some real progress, can we not now (or very soon) make substantial reductions in defense expenditures and divert those resources to other urgent national needs?'

"The answer to this question seems clear for those of us whose formative years span the period from World War II, through the Berlin Blockade, Korea, the Cuban Missile Crisis, Vietnam and to the recent conflict in the Mideast. With these events as background, we developed a set of assumptions and associated priorities which accepted as self-evident the need for the Army and other military forces.

"Those who now question these assumptions and ask, 'Why an Army?' need only glance at the history of warfare in this century to realize that military programs, if they are to be successful in deterring war, must be based on a realistic appraisal of the demonstrated capabilities of potential adversaries, and not on perception of their intentions. We must be ready to fight if we are to avoid war.

"Governments change, as do policies and intentions and perceptions of issues that warrant the use, or threatened use, of military force. It is rare in history that a power preferred the use of force to that of achieving the same ends through the threat of force. It is freedom from coercion, from the threat of force, which we gain by being ready to fight if necessary.

"In this light, I think you must agree that the most important ingredient leading toward successful detente is that we maintain an adequate and stable posture of military balance between the negotiating parties. Detente is most unlikely by negotiation if one of the parties believes it has an exploitable military superiority. The history of the 1930s demonstrates that detente is possible only when there is a balance of military force that stops would-be aggressors.

"As the Secretary of the Army, I support the President's policy of detente. This policy appears to have significant political and public support. We in the Army see the same hopeful signs that others see, but we see dangers as well. I believe that the Army can make its greatest contribution to detente by maintaining its readiness as part of our contribution to the essential military balance.

"A third group asking the question, 'Why an Army?', concedes that continued military strength and large defense expenditures are necessary but is really asking, 'Why must the Army of today be so much larger than the Army we had before World War II? Surely,' they say, 'there is not a threat of invasion of any part of the Western Hemisphere. So why not an Army like that of the 1930s, a base for mobilization rather than a large force in being?'

"I agree that there is no credible threat of military invasion of the United States or the

Western Hemisphere from any power or combination of powers at this time. The development of such a capability would require such an obvious and lengthy effort that our forces could mobilize to react to it.

"But I cannot accept the implied conclusion that defense of the United States from direct threat of invasion is the only viable threat to the national interest of the United States and, thus, the only valid basis for the allocation of resources or for design of the Army.

"This view rests not merely on a philosophical commitment to freedom as a political concept, nor on an automatic, unthinking desire to continue our role as leaders of the Free World. We grew into the mantle of world leadership. It was not attained as a result of a long-term national objective which was deliberately sought.

"Those are, of course, sound enough reasons, and either we believe in freedom and make commitments to this belief or we will see it lost. But I think it also true, and increasingly more evident, that the United States must prevent essentially hostile powers from denying peaceful access to critical resources.

"We do not, of course, desire or require satellite nations, and do not seek the degree of control such arrangements imply. We do require the reasonable degree of access that can be attained by negotiation between free people acting in their own self-interest.

"Finally, since we cannot yet guarantee that wars will not occur, we should commit ourselves to insuring that any which do occur, do not occur here and are terminated without the destruction of modern society, and without the loss of interests vital to us or our Allies.

"Even though a substantial fraction of our real military capabilities resides in our National Guard and Reserve forces and our general mobilization potential, the objectives I outlined above cannot be attained in today's world with an Army that is merely a cadre for expansion.

"To rely upon a cadre force is to court disaster should a major conflict erupt. A fundamental requirement for the success of such a concept is the time to mobilize. It is highly unlikely that in the future we, or our Allies, will enjoy the luxury of the time needed for extensive preparation and mobilization. The recent Middle East War, which lasted only 19 days, is a case in point. The speed and violence with which an aggressor can attack dictates that we have an Army ready to fight.

"We need not and should not and, of course, we do not carry the burden alone. In none of the wars of the twentieth century has the United States provided either the majority of the ground forces committed to combat or even the largest Army in the field. But we have, and we must continue, in concert with our Allies, to insure that the total military capability is adequate to Free World needs.

"The long-standing policy and practice of partnership is another of the fundamental elements of the President's foreign policy. To the extent our Allies cannot provide needed specialized and technical combat support, we are prepared to assist them. When compared with the threats, none of our Allies is self-sufficient in nuclear weapons. Many, accepting the United States promise to protect them from nuclear blackmail or to support them should nuclear war occur, have foregone development of their own capability.

"Our programs must be based on a realistic appraisal of the protracted capability of potential adversaries. Our major potential opponents have given, and still give, great emphasis to ready military forces. These forces continue to be improved and modernized. They stand poised as formidable war-waging threats to our Allies, and hence to our own vital interests. The size and technical sophistication of this threat is beyond the capacity of our Allies to match singly.

"The Soviets know, and their recent writings show, that their military posture in the 1930s was wrong, as was ours. Both the United States and the USSR underestimated the speed with which mechanized forces supported by tactical aircraft could achieve decisive results. They thought, as we did, that there would be sufficient time to mobilize and methodically prepare for war. They paid a vastly greater price for the miscalculation than we.

"A major tenet of Soviet military policy is that such a debacle will not be permitted to occur again. I can believe them when they say their intent is peaceful, as they see no inconsistency between a peaceful intent and readiness for war. I also see no such inconsistency in our case, and because they are ready we must be.

"We can believe and we can hope. But I cannot suggest that today's peaceful intent is unchangeable or that it will endure the many crises that surely will erupt before a lasting peace is achieved. Until then the United States must have an Army ready to fight, ready to meet each of its commitments, worldwide. . . ."

Secretary Callaway then turned to a discussion of "Today's Challenges" as pertinent to the role of the modern U.S. Army and the problems of recruiting, retaining and training "good people," saying:

"I want to assure you that we will continue to do our utmost to make the volunteer system work for the essential Army. We feel confident that opportunity for meaningful service to the Nation, in a well-trained and well-led Army which is concerned about the individual soldier and his contribution to mission accomplishment, will attract sufficient young men and women to maintain both the strength and the quality of the Army.

"Another aspect of this challenge is to maintain a competent civilian work force in support of the military. For every two men or women in uniform, we have one civilian who performs a vital support function. These civilians share fully the responsibility for mission accomplishment.

"For example, our largest single civilian group are scientists and engineers, who perform the majority of our research and development work. A large group is engaged in maintenance and repair facilities, especially in support of installations. Sixty-eight percent of our civilian employes are in white collar jobs and 32 percent are in the skilled and unskilled labor group.

"The civilian force has been declining as the uniformed force has been cut back, and every effort is being made to keep the civilian force at the maximum required for mission accomplishment. Reorganization and consolidations that have recently been carried out have reduced the civilian force, and planned consolidations in the future will result in additional reductions."

Secretary Callaway called the second major challenge to the U.S. Army that of "getting the most we can out of every budget dollar. This is the central goal of all our managing, programing and budgeting efforts. Additionally, certain aspects are getting particular emphasis as people and weapons costs go up and as we see the capability of our potential adversaries increasing.

"We are disciplining our equipment acquisition process—development time must be shortened and costs must be carefully controlled. Our procurement, carefully pruned for economy, emphasizes essential programs—directed at force readiness and modernization. Finally, our conservation efforts in the areas of energy and supply economy will enable us to realign operating and maintenance outlays to maximize their return.

"The third challenge is to make full use of the capability of our Reserve Component resources as a distinct but integral and essential part of the One Army—Our Total Force concept. We are aware of the need for a highest possible state of readiness in our Reserves. Today, Reserve forces must be ready to fight within two or three months or they may be too late to participate.

"However, on the scale now envisioned, this level of readiness has never before been achieved by the Reserve Components. This Nation owes a great debt of gratitude to the hardy Guardsmen and Reservists who, with limited time and resources for training, are striving to attain the readiness goals established. The Reserve Components have the added incentive that goes with a meaningful, important mission.

"These are the challenges confronting the Army. Our efforts to overcome them provide the very essence of the Army's budget philosophy of FY 1975. This basis for the budget request will become clear as I discuss our program makeup. . . ."

Secretary Callaway devoted the remainder of his presentation to budgetary, Volunteer Army, management, materiel acquisition, and research, development, test and evaluation objectives and problems, including conservation measures.

Many of the RDT&E and the materiel acquisition problems and goals he discussed are topics of attention of other Department of Defense leaders who submitted Military Posture Statements or proposed budget requests to Congress, particularly the Assistant Secretary of the Army (R&D) and the Chief of Research and Development, that will follow.

(Continued on page 20)

Army Air Mobility R&D Laboratory . . .

Focuses on Designing Superior Combat Aircraft

Positioning the U.S. Army Air Mobility Research and Development Laboratory in proper perspective within the Army-wide structure of in-house laboratory capabilities requires only due recognition of the criticality of designing superior aircraft for future U.S. Army needs.

The primary thrust of the laboratory is to develop the tools and techniques to design the best possible aircraft for the Army that will reliably meet their mission objectives. This effort ranges from the problems of today's aircraft through the advanced aircraft of tomorrow.

If you would imagine an aircraft that can fly up to 400 mph, one which can take off and land vertically, and transport combat troops and supplies to the battlefield, then your imagination would be running parallel to the advanced planning of USAAMRDL's highly professional staff.

"Today's dream is tomorrow's reality" is, to them, basic to goals for improved air mobility, surveillance employing advanced aerial sensor concepts, and aircraft firepower that helps to win battles.

Headquartered at the NASA-Ames Research Center, Moffett Field, CA, the USAAMRDL consists of the Ames Directorate, the Eustis Directorate at Fort Eustis, VA, the Langley Directorate at Langley Research Center, Hampton, VA, and the Lewis Directorate at the Lewis Research Center, Cleveland, OH.

The USAAMRDL—now the Army Materiel Command's Lead Laboratory for aircraft aeronautics, and the principal Department of Defense agency for small gas-turbine technology—had its beginning in 1965 when the Army signed a joint agreement with the National Aeronautics and Space Administration providing for mutual benefits in a cooperative working relationship.

Credited with a key role in the negotiations was the late LTG William B. Bunker, then deputy CG of the U.S. Army Materiel Command, and in 1948 the director of terminal operations during the Berlin Airlift. LTG Bunker later became chief of the U.S. Army Air Transport Division between Japan and Korea. Thus he was greatly concerned with improving aircraft capabilities.

TILT-ROTOR VTOL (Vertical Take-Off and Landing) aircraft (artist's concept) is being developed by Bell Helicopter Co., under a joint contract, for the U.S. Army Air Mobility R&D Laboratory and NASA. The scheduled prototype completion date is early 1976.

Charlie Zimmerman, then AMC Chief Engineer and earlier with NASA, along with Dr. Robert C. Seemans Jr. and Dr. Smith J. DeFrance of NASA, also were recognized for major contributions in working out the arrangement. The first commander of the Army Aeronautical Research Laboratory, as it was then known, was COL Cyril Stapleton, who resolved many of the difficult problems of making the joint effort successful despite differences in Army and NASA procedures.

Assigned responsibility as the Army's principal aeronautical research and development organization, and established in July 1970, under its present director, Paul F. Yaggy, the USAAMRDL prides itself as an outfit that produces full-value results for dollars expended.

Large-scale dollar savings were incorporated in the basic agreement with NASA in 1969 that provided for the use of NASA's complexes of aeronautical research facilities at Ames, Langley and Lewis Research Centers in exchange for sharing of research personnel. This pooling instead of duplication of resources has been estimated to have saved the U.S. Government as much as $100 million.

Although the directorates are located far apart, the USAAMRDL is *one laboratory under one command.* The U.S. Army Aviation Systems Command, headquartered in St. Louis, MO, is a commodity command of the U.S. Army Materiel Command, headquartered in Alexandria, VA.

The cooperative arrangement conserves the funding and manpower resources of both agencies in the performance of research of mutual interest. The Army derives the benefit of direct access to NASA facilities and NASA expertise for application to specific Army requirements.

Special effort, from the Army viewpoint, is placed on immediate and long-range research and development objectives for advanced aircraft. Interests include improvements in propulsion, flight testing, control systems, structures, composite materials, safety, higher speed, maneuverability, V/STOL (Vertical and Short Take-off and Landing) ability, maintainability and reliability.

Three-fourths of the USAAMRDL's 540 civilian employes and 40 military personnel are scientists, engineers, technicians and other professionals directly associated with aviation research. To provide the reader with some understanding of the nature and variety of current Army aviation R&D efforts, a brief review of some of the more important ongoing

DIRECTOR of the U.S. Army Air Mobility R&D Laboratory (USAAMRDL) Paul F. Yaggy (center) discusses ongoing projects with Ames Research Center, Moffett Field, CA, staff members (from left) Dr. Richard M. Carlson, chief of the Advanced Systems Research Office; Frederick H. Immen and John B. Wheatley, aerospace engineers; and COL Norman L. Robinson, USAAMRDL deputy director.

programs follows.

Tilt-Rotor Research Aircraft. Under specifications of a $26.4 million, 4-year contract, the Bell Helicopter Co. will build, and provide for government test, two twin-engine tilt-rotor research aircraft for use in a joint Army-NASA flight research program.

In addition to proving the tilt-rotor concept, the program will explore the operational flight envelope and assess the application of the technology to military and civil transport needs.

A tilt-rotor aircraft uses wing-tip rotors for direct vertical lift to take off like a helicopter. The rotors are then tilted gradually forward to provide propulsion for cruise flight. The concept has application for quiet, versatile VTOL (Vertical Take-off and Landing) operations, both military and civilian.

Advanced technology will be incorporated in basic configuration components. For example, the tilt-rotor concept will provide a VTOL aircraft with high-speed (300 to 400-knots) and other performance improvements. A cross-shafted transmission system will enable the aircraft to continue powered flight after one engine failure. Autorotational capability for an emergency landing also will be retained in event of complete power failure.

The developmental aircraft will include advanced flight control and communications-navigation systems to be evaluated for possible use in VTOL aircraft in a combat operational environment. For military use, a VTOL or tilt-rotor aircraft would combine the tactical utility of helicopters with advantages of longer-range, higher-speed, fixed-wing transport aircraft.

Analytical and experimental research has proved the feasibility of the tilt-rotor concept. Flight tests of the experimental aircraft currently are scheduled for 1976.

Rotor Systems Research Aircraft (RSRA). The RSRA Program is termed a "unique effort" to build a research aircraft testbed that will enable engineers to develop solutions to many helicopter technical problems. This approach by way of a single adequately instrumented aircraft contrasts with previous practices of modifying an existing vehicle or building a new one for every experimental development.

A joint study by the Army and the National Aeronautics and Space Administration resulted in a decision that a specially designed RSRA aircraft—fully instrumented and capable of operation over a wide range of test conditions, with flexibility of configuration to permit rotor systems testing—would be more effective, less expensive and faster than the methods now in use.

The negotiated contract with Sikorsky Aircraft Division of United Aircraft Corp. provides for design and construction of two RSRA aircraft that will have features such as:

- A removable wing that will allow testing as a pure helicopter (rotor only) or as a compound helicopter (rotor and fixed wing). A variable wing concept provides for effectively varying the weight by changing the lift, or vertical force, developed during flight.
- Removable auxiliary turbofan engines to provide additional thrust, or horizontal force, on the vehicle and a speed brake which can increase the drag if required. These devices will extend the operating envelope of the experimental aircraft as desired.
- An interchangeable rotor to permit testing of various rotors by making minor modifications to the vehicle. Interchangeability is to be achieved by using a transmission mounting system that can act as a wide-band vibration isolation system and a force measurement system to gauge rotor forces directly independent of other components.

The RSRA aircraft will permit testing over a broad envelope of current and future rotors to be developed during the 10-year operational life. The built-in safety system for the crew and the aircraft includes an escape device that gives the crew two options.

In case of rotor failure, the rotor blades can be jettisoned and the crew can fly the aircraft home as a fixed-wing aircraft. The second option is that in event of a failure that would preclude continued flight, the crew will be able to use a seat-escape system to reach ground safely.

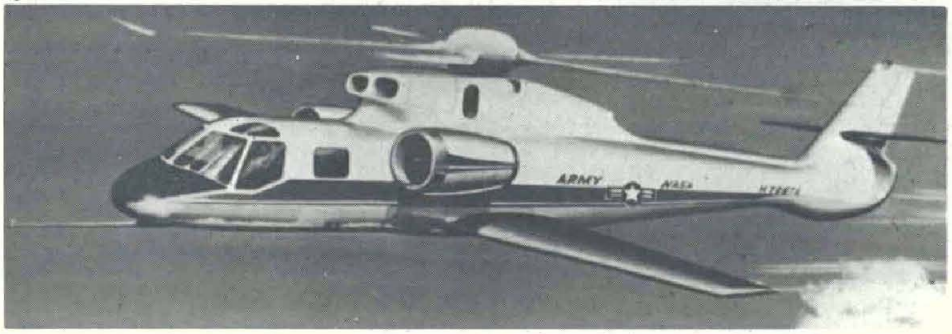
Specifications require that the RSRA will be capable of speeds up to 300 knots (345 mph) with a 2-man crew, plus the possibility of a third man to operate and monitor recording devices.

The planned test program for the RSRA

(Continued on page 18)

REPRESENTATIVE FY 73 ACCOMPLISHMENTS IDENTIFIED TO MAJOR THRUSTS

FY 73 Accomplishment	Major thrusts	Projected benefits and impacts
New analytical technique for crashworthy design	Safety & survivability	Will minimize need for experimental verification. Initial cost savings estimated at about $2 million per new aircraft design. Additional savings projected due to increased repairability potential and decreased personnel injuries and fatalities.
Armoring concepts evaluation	Safety & survivability	Established superiority of selective armoring concepts vs. integral armor for reconnaissance helicopter is expected to result in $0.5 to $2.0 million savings per helicopter.
New takeoff technique for heavily loaded helicopters	Safety & survivability	Comparable performance for UH-1 B/C using current techniques would require about 500 additional hp. This would represent about $15 million investment in the Army's current inventory. Additional savings attributed to aircraft and lives lost as a result of limitations of current technique.
Composites for ballistically tolerant control systems	Safety & survivability Reliability & maintainability Improved rotor & other systems	20-25% cost savings over conventional materials plus 75% reduction in vulnerability and better R&M.
Structural crack sensor	Reliability & maintainability Safety & survivability	Significantly earlier detection of cracks will improve flight safety and reduce aircraft losses due to structural failures.
Stall flutter suppression system	Safety & survivability Reliability & maintainability Improved rotor & other systems	40% reduction in peak control loads will permit significant expansion of helicopter operational envelope.
External payload stabilization system	Improved rotor & other systems Safety & survivability	Increased productivity resulting from increased flight speed capability and reduced time for accurate acquisition and placement of loads. Improved safety due to better flying qualities.
Tail-rotor deficiencies explained	Safety & survivability Improved rotor & other systems	Improved tail-rotor design will mean adequate directional control. Will reduce loss of aircraft due to loss of directional control, replacement costs due to operations above rated tail-rotor power limits, and modification costs for tail rotor changes. Extimated $15 million saving.
Small, high-temperature combustor	Propulsion system	Substantial savings resulting from efficient analytical design methods. More efficient combustor means lower weight and lower emissions.
Effects of turbine-blade coatings quantified	Propulsion system	Quantified mechanical degradation will permit more efficient and effective design and will minimize turbine blade replacements at overhaul. Projected savings about $15 million for fleet with 1000 engines.
New inspection schedule methodology	Reliability & maintainability	More effective scheduling promises to reduce MH/FH rate for the UH-1 by about 25% while decreasing the total "Not-Operationally-Ready-for-Maintenance" (NORM) time by over 45%.
Oscillating airfoil tests at actual helicopter-rotor Reynolds numbers.	Improved rotor & other systems Reliability & maintainability	Potential for significant expansion of flight envelope. Increased blade life and reduced control loads could result in $5 to $25 million savings based on current inventory.



Rotor Systems Research Aircraft (artist's concept).

(Continued from page 17)

Test of hingeless rotor with all-electronic feedback control system in wind tunnel.

aircraft is expected to advance knowledge of all areas of rotorcraft capabilities. The objective is knowledge essential to design of faster, quieter and more maneuverable helicopters—thereby increasing survivability of the vehicles in a combat area. The research contract is expected to be about $25 million.

Fan-in-Fin to Replace Tail Rotor. Feasibility of a fan-in-fin concept as a replacement for the tail rotor on rotary-wing aircraft is being explored under provisions of a 2-year contract with the Sikorsky Aircraft Division, UAC. As major subcontractor to Sikorsky, the UAC Hamilton Standard Division designed and built a variable-pitch, ducted, directional-control fan for the S-67 "Blackhawk" helicopter. Testing is in progress.

Substitution of a buried ducted fan for the conventional tail rotor is expected to result in greater reliability, reduced maintenance, and reduced hazards to ground personnel, along with decreased vulnerability to terrain or tree-contact damage. The concept also promises advantages for operation at high speed by being less susceptible to instabilities than a tail rotor.

Disadvantages of the fan-in-fin, as applied to the same helicopter, include increased weight and higher cost than the standard tail rotor. Current technology, however, indicates improvements in safety, vulnerability, reliability, maintenance and forward speed are expected to more than offset disadvantages.

Many of the major programs here described can be termed "dramatic developments." Many other USAAMRDL programs fall short of that description but are viewed as significantly important to the development of better aircraft.

Small Turbine Advanced Gas Generator (STAGG). This is an example of a less dramatic program that started with award of contracts to four engine manufacturers in December 1971. Envisioned was the establishment of a continuing gas generator developmental effort to provide the nucleus for demonstrator or developmental engines oriented toward future Army aircraft and auxiliary power units in the 200- to 800-horsepower range.

Current technical objectives of this effort include demonstration of a 20 to 30 percent reduction in specific fuel consumption and an increase of 35 to 45 percent in specific power relative to current production engines in this airflow range (1 to 5 seconds). The goal is a core gas generator that can satisfy a wide range of power in the spectrum for which the Army has the greatest requirements.

AIRCRAFT STRUCTURES. Structural designs and materials most suitable for rotary-wing aircraft comprise an area of R&D effort of prime concern to USAAMRDL scientists and engineers. Over the past four years the laboratory has initiated a rather comprehensive Rotary Wing Structures Program.

Much of the ongoing effort involves application of composite materials to primary air-frame structures such as rotor blades. One of the concepts being investigated is known as the multispar blade, providing sufficient structural redundancy to allow a helicopter to return safely despite major rotor damage.

USAAMRDL Director Paul F. Yaggy (right) receives American Helicopter Society's Dr. Alexander Klemin Award from Dr. Robert Loewy, dean of Engineering and Applied Sciences at Rochester Univ.

Other laboratory structural programs are concerned with ballistically tolerant control linkages and the application of composites to transmission and gear cases. If those applications are successful, considerable savings in cost and weight are envisioned.

ASSIGNED MISSION. As stated in its recent 1973 annual report, the mission responsibilities of the USAAMRDL are to:

- Plan, develop, manage and execute for the U.S. Army Aviation Systems Command the research and exploratory development programs and the advanced development program through demonstration of technology to provide a firm technical base for future development of superior airmobile systems.
- Manage and direct on a task basis, as assigned by the commander of USAAVSCOM, tasks in advanced and engineering development subsequent to demonstration of technology.
- Maintain cognizance of, and provide consultative support for, advanced development subsequent to demonstration of technology, engineering development, operational development and test for all Army airmobile systems.
- Provide technical consultation and independent risk assessment to the USAAVSCOM commander for systems and components under development.

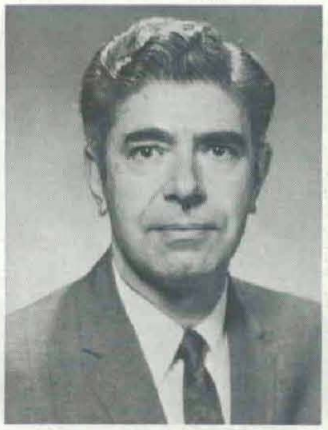
The USAAMRDL achieves its mission through in-house studies, utilization of the resources of academic institutions and commercial research organizations, close cooperation with other U.S. Government agencies, and the award of contracts to aerospace industrial firms, research institutes, and universities.

Despite the broad scope of the laboratory's mission, its budget has represented a relatively small percentage of the total Army research, development, test and evaluation program funding. The laboratory receives about $50 million annually, exclusive of support for aviation systems project managers.

Flexibility of management to accomplish the mission has been provided, since its inception in 1970, under Project REFLEX operational principles. The acronym denotes Resource Flexibility–Reconciliation of Workload, Funds and Manpower. Under an experimental program directed to long-term policy evaluation, the concept is applied currently to 13 Army laboratories.

The concept provides that each laboratory director and office chief has authority over

Dr. Irving C. Statler
Director
Ames Directorate



John Acurio
Director
Lewis Directorate

Larry M. Hewin
Acting Director
Eustis Directorate

Thomas L. Coleman
Director
Langley Directorate

his resources within a prescribed average grade and numerical guidance, based on funds.

USAAMRDL has prepared its second edition of the Army Aviation RDT&E Plan, which addresses objectives for the period FY 1974–95, with particular emphasis on the FY 74–80 time frame.

This plan groups laboratory activities according to the 13 scientific disciplines that make up the air vehicle technology—aerodynamics; structures and materials; propulsion and drive trains; dynamics; control; human factors; reliability and maintainability; safety and survivability; aircraft subsystems; mission subsystems; mission subsystems; avionics; ground support; and manufacturing methods and technology.

Distribution of the RDT&E USAAMRDL funding does not include monies allotted for avionics and weapons R&D programs, which are the responsibilities of the U.S. Army Electronics Command, the Armament Command, and the Aircraft Weaponization Management Office at HQ U.S. Army Aviation Systems Command, respectively.

The USAAMRDL had 346 active Army contracts at the conclusion of FY 1973, with a total value exceeding $102 million and 100 active contracts administered by the National Aeronautics and Space Administration with a total value of about $13 million.

Funding is derived by USAAMRDL through "non-AMC customers" such as the Naval Air Propulsion Test Center, the Naval Weapons Center, the Naval Air Systems Command and the Marine Corps. These four sources accounted for $326,000 in FY 1973 in supporting work of special interest.

Involvement of the laboratory in the high-priority Army Heavy Lift Helicopter development program is extensive, including the Advanced Technology Components activities.

Similarly, the laboratory has made major contributions in providing technical support to the UTTAS (Utility Tactical Transport Aircraft System), the Light Observation Helicopter (LOH) developmental effort and the Advanced Attack Helicopter (AAH).

An indication of the USAAMRDL technical effort was the publication of 136 technical reports in FY 1973. Seventy-five papers were authored all or in part by laboratory personnel and 61 published under contracts.

Professional personnel have been recognized by numerous honorary awards, the highest one going to USAAMRDL Director Paul F. Yaggy in May 1973 when he was presented the Dr. Alexander Klemin Award of the American Helicopter Society.

The society's highest award citation states: ". . . for notable achievement in the advancement of rotary-wing aircraft . . . his outstanding contribution to helicopter technology and his leadership of the U.S. Army Air Mobility Research and Development Laboratory. His foresight and dedication set the standards for the future of our industry."

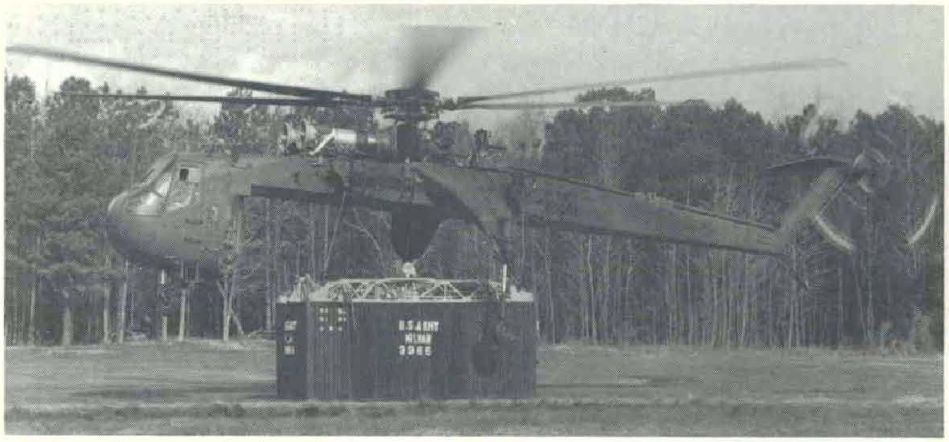
Watervliet Employes Issued Patents

Patents for improvements on a mortar control system and a gun testing process were issued recently to Gary M. Woods and Bruce B. Brown, recognizing inventions as U.S. Army employes at Watervliet (NY) Arsenal.

Physicist Woods' invention is titled "Automatic Elevation Recovery System for Cannons." This control system uses a fluidic sensor and amplifier to return a mortar tube to its original position after firing.

Brown's invention, "Multi-Ring Hydraulic Seal for Irregular Bore Surfaces," enables extremely high hydraulic fluid pressure testing to be performed on a gun tube without leakage even though the tube may have irregular bore surfaces due to erosion and heat checking damage.

New Device May Improve Shipping Container Transport Operations



Safer and more productive shipping container transport operations are anticipated by using a new top-lifting device tested with a specially equipped helicopter at the U.S. Army Air Mobility Research and Development Laboratory (USAAMRDL), Fort Eustis, VA.

Lift, transport and release of a 20-foot Mil-Van container by an Army CH-54 helicopter was accomplished without need of any ground crew assistance. Developed by the Boeing-Vertol Co., under contract with the USAAMRDL, the unit will be adaptable for use with the CH-47 helicopter and Heavy Lift Helicopter now under development.

Designed specifically for the transport of 8-foot by 8-foot by 20-foot commercial shipping containers weighing up to 57,000 pounds, the device is controlled automatically by instrumentation within the aircraft.

Capabilities of the system include direct pick up of containers from cells of a ship, tractor-trailer unit, a stacked position on the ground or a loading platform. Featured also are quick hook-up and release operations.

Aircrew Performance Conferees . . .
Examine Behavioral Science Research Applications

The vital role of behavioral science research in the future of Army aviation was the theme of the 3-day Conference on Aircrew Performance in Army Aviation sponsored by the Office of the Chief of Research and Development (OCRD) at the home of the Army Aviation Center and School, Fort Rucker, AL.

Key information provided by conferees—representatives from agencies Army-wide dealing with Army aviation—has recently been published by the Army Research Institute for the Behavioral and Social Sciences (ARI) in an Executive Summary and in the proceedings of the conference.

Conference host MG William J. Maddox Jr., AAC commander, set the stage for discussions. In any future war, he explained, the helicopter must cope with sophisticated antiaircraft offensive measures such as electronically controlled heat-seeking missiles. One of the best countermeasures, he said, is nap-of-the-earth (NOE) flight, an effective tactic using ground cover and concealment; NOE demands complex training and all the support behavioral science can provide.

MG Charles D. Daniels Jr., Director of Research and Advanced Systems, emphasized similarly, in the sponsor's charge, that the demands on the aviator will be met partly by new hardware, but primarily by timely human performance research that is responsive to the user's specific needs.

BG James H. Merryman, director of Army Aviation, Office of the Assistant Chief of Staff for Force Development (OACSFOR), keynoted the conference goals—to inform behavioral scientists of the Army's aviation needs; to recommend to the Army an integrated research program aimed at solving aircrew performance problems.

Dr. A. Louis Medin, assistant director, Environmental and Life Sciences, Office of Director of Defense Research and Engineering, emphasized the human role in new subsystems. He discussed, by way of example, how navigation subsystems place critical dependence on the pilot's senses and learned ability.

Conference chairman Dr. J. E. Uhlaner, chief psychologist of the U.S. Army and ARI technical director, summarized its purpose: To identify, on an Army-wide basis, aircrew performance research problems, assess their importance, and delineate requirements for research and development to solve them.

The objective, he said, is a well-balanced integrated research program, correlated to assist in developing combat concepts and doctrine, training, operations, and materiel development required for effective aircrew performance in Army aviation.

Aspects of Army aircrew performance examined in detail in four areas were:

Operational and Equipment Factors, Session I—Chairman, COL Robert O. Viterna, chief, Behavioral Sciences Office, OCRD; discussion leader, Clarence A. Fry, Army Human Engineering Laboratory. Major participants included MAJ Matthew R. Kambrod, OACSFOR; Stephen Moreland, Army Aviation Systems Command; and Marvin W. Buss,

(Continued on page 26)

SPEAKING ON . . .

(Continued from page 15)

ARMY CHIEF OF STAFF GEN Creighton W. Abrams' presentation to the House Committee on Armed Services was directed primarily to the international environment as it pertains to the combat readiness of Army forces to respond rapidly and effectively to changing situations affecting interests of the United States and its Free World Allies.

Creighton W. Abrams
Army Chief of Staff

"It is not easy to explain how the international environment affects the Army," he said, "because that environment itself is not easy to understand. At least I find it very, very complex. But there can be no doubt that the world situation, and our Nation's place in it, complicates our efforts to provide for the country's security. There are two sides to the picture—and both pose problems for the Army. First is the real, or actual, situation; second is the perceived environment.

"Perhaps there are more dangers in the perceived world than in the real one. Detente may last—but, on the other hand, it can fade overnight. It can easily lull us into a false sense of security. American strength made detente attainable, and it is hard to see it continuing unless we maintain that strength.

"No one needs to emphasize to this Committee the nature of the threat we face. You have heard witnesses before me give a clear and sobering assessment of Soviet capabilities, and you are aware that it is a global threat which is more than just tanks and ships or planes and missiles—though our relative strength in such an accounting gives little cause for satisfaction.

"It includes the momentum of growing military capabilities on the other side contrasted to declining military strength on ours. It includes the will to use power, which both sides have displayed in the past, but which some statesmen around the world now call into question—they wonder whether America will honor her future commitments.

"It includes the subtle array of economic, political, social and psychological pressures which the closed societies opposing us can concentrate so powerfully. Oil, for instance, may be only the first of many vital resources used as strategic weapons against us. The threat is multi-dimensional—and very real.

"*THE ROLE OF THE ARMY.* In this international arena, what is the role of the Army? Put another way, what does the United States wish to achieve with its Army. In very broad terms, it seems to me, the Army exists to serve just two ends. First is the Defense of our Land. That is an irreducible imperative. Second is the preservation of freedom of action, which might be defined as immunity from coercion.

"Ironically, 'Defense of our Land,' this clear-cut, unambiguous vital interest, has rarely been directly threatened. Instead, the conflicts in which the United States has been involved have begun, for the most part, as threats against our freedom of action.

"As you well know, debates raged from 1914 until our entry into World War I, from 1939 to Pearl Harbor, from 1950 to 1953, and from the Gulf of Tonkin Resolution in 1964 to the mining of Haiphong Harbor in 1973. The underlying question was not national survival, but whether or not American freedom of action was seriously enough threatened to warrant the use of military force.

"Over the years we have emphasized our war-fighting ability, which, when all is said and done, is our primary purpose for being. But we also have the peacetime mission of supporting national goals and implementing national policy.

"For instance, in today's world two of the more pressing aims of national strategy are to deter war and to preserve our freedom of action. Both, by definition, are peacetime roles. Putting the war-fighting and peacekeeping missions together, the Army sees itself with three distinct yet related functions: the prevention, control, and termination of conflict.

"In the first role, we seek to keep the peace without the direct use of military force. This function is based on the principles of deterring enemies and assuring our friends.

"Deterrence is the perception that a potential adversary derives from the sum of many things—strategic arms, theater and tactical nuclear systems, conventional forces, economic power, statesmanship, and national will. Assurance is a complementary dimension of deterrence. It is aimed at convincing our Allies that we remain a strong, dependable friend.

"In the event we are unable to prevent the outbreak of a war, we must have the ability to control it, that is, to limit its size, area and intensity in order to bring it to a negotiated settlement. Our ability to maintain a military balance in the Middle East last October through our resupply effort to Israel is a good case in point.

"Finally, if we are unable to control the conflict we must help apply sufficient force to end it under conditions advantageous to the United States."

Chief of Staff Abrams then turned to a discussion of "Force Structure," explaining that the Army budget proposal is based on 785,000 military men and women in a structure of 13⅓ divisions and their supporting echelons, and 8 Reserve Component divisions.

"In the years ahead," he said, "it is my hope to gradually build up the number of combat divisions as we trim down in other areas." He followed with an extensive discussion of what is "popularly known as the teeth-to-tail ratio, that is, the ratio of combat to support forces."

GEN Abrams explained that "without a sustaining capability, the fighting Army would rapidly wither. Yet the sustaining Army is all tail. The third part of the Army is not too often thought of, but it is a most important part.

"Regardless of whether today's Military Establishment is at war or standing ready for war, we cannot fail in our responsibility to pass on to the next generation of Americans a professional and able Army.

"Therefore, we must continue to attract good people who will develop into the leaders of the future. We must continue to operate our educational system; and we must continue to invest resources into research and development activities. And we must continue to do these things even though they will have no immediate pay-off if we are called upon to fight today. This future-oriented part of the Army is also all tail.

"Summing all of that up, we need forces ready to do whatever has to be done, other forces to sustain them while they are waiting to do it, and still others devoted to preparing for the future. In terms of teeth and tail, the only place you will find teeth is in a portion of the first part, the fighting Army.

"We must always strive to become more effective by removing 'fat,' but that is not the same as saying the Army can be made better merely by cutting its noncombat elements. The fact is, ill-considered cuts in the support forces are paid for with the lives of fighting men during early stages of a conflict."

GEN Abrams devoted the remainder of his presentation to a discussion of the organizational structure of the Army and the reasons therefore, as he views them; the Army's posture with respect to the current and anticipated world environment in the foreseeable future; and the role of the Active and Reserve Component forces, the "strategic reserve."

As Chief of Staff, he said, his concern is "to ensure that every appropriate unit in the United States is usable, that we can promptly send each one wherever it is needed, and can expect it to be able to function effectively once it gets there.

"A second concern is to achieve the optimum balance between forces deployed overseas and those based in the United States. That permits us to meet our overseas requirements while maintaining deployment flexibility.

"In sum, the Army's essential strategic requirements are two: establish and support overseas deployments wherever prescribed by national policy; and maintain a base in the United States capable of responding to such emergencies as may arise. That is how the Army is postured in peacetime to help deter war and to assist in retaining our freedom of action. That is why we need the structure I have described earlier; it is why we need an Army of 13⅓ divisions."

In concluding his statement, he addressed, in considerable detail, the areas of Readiness; Personnel Management; Logistics Management; and Modernization.

ASSISTANT SECRETARY OF THE ARMY (R&D) Norman R. Augustine, in making his first Research, Development, Test and Evaluation 38-page budget proposal to Congress, was followed by Chief of R&D LTG John R. Deane Jr. After an introductory statement, he continued:

Norman R. Augustine
Assistant Secretary of Army (R&D)

"Two questions surface frequently in discussions of the Army's RDT&E. Their answers provide, I believe, the guiding philosophy behind the Army's RDT&E Program. Question No. 1 is: 'Why, when the Soviets can field good, sturdy, effective battlefield machinery, must we develop systems which seem to be vastly more sophisticated, complicated and often more costly?'

"The answer in part is that, within the constraints of almost any foreseeable budget, on almost any conceivable battlefield of the future, our forces will be vastly outnumbered in manpower, firepower, airpower, air defense and combat vehicles. To prevail, or indeed, to survive, we must, therefore, be prepared to counter, destroy or neutralize these enemy advantages with an efficiency that requires better than the sturdy basic weapons which are equally available to all our potential future adversaries.

"Hence, we are developing systems whose ingenuity of design will maximize the effectiveness of the forces available to us. I use the word 'ingenuity' rather than 'sophistication' because the latter conjures images of complicated, delicate, hard-to-use equipment—a category of equipment which I strongly believe does not serve its user well.

"What we are striving for is the exact opposite. The TOW missile is one case in point. Its ingenuity of design relieves its user of the difficult task of steering the missile in flight; he need only keep the crosshairs on the target to obtain a hit. This feature makes the TOW system simpler to employ, easier to train on and vastly more accurate than its Soviet counterpart, the SAGGER.

"Another (example) is the use of a new phased-array radar technology in a number of our systems. In the case of SAM-D, for example, this technology permits a single type of radar to replace eight different types of radar in the predecessor HERCULES and HAWK systems.

"The weapons we require are, unfortunately, expensive; they require years to develop, and ofttimes, in attaining the required capabilities, we run into problems developing them. But they represent the edge that will be crucial to our Army's chances of success should war occur. I believe it is evident to all that there is no way we can, in the foreseeable future, match the Soviets tank for tank or gun for gun.

"The other question frequently raised is: 'Why are you spending so much on RDT&E and, in particular, on maintaining the technology base?' The answer is that we cannot afford not to. Breakthroughs in military-related technology are occurring at increasingly shorter intervals.

"Systems and counter-systems race neck and neck, each gaining temporary advantages which are then overcome by opposing technology—but which at any particular time can produce decisive results. Tank antitank, aircraft antiaircraft systems and electronic warfare are examples. We cannot lag, even for a little while, in developing and expanding our technology or we risk severe consequences.

"Turning now to our budget request for this year, we are asking for $1,986 million to fund our RDT&E programs. The chart shows that over the past 10 years, while our funding has increased at a rather steady but modest pace, our actual buying power, as a result of inflation, has already declined. In fact, in real buying power this year's request, if fully funded, would result in the smallest RDT&E budget the Army has had in 13 years.

"While the total Defense RDT&E budget request is up by about 15 percent in current dollars from FY 74, the Army's portion of that increase is less than one percent. We have tried to ask only for those things we truly consider to be important. Similarly, we have tried hard not to ask for those things which would, in future years, build up funding demands we are unlikely to be able to sustain.

"This is not to say that I do not expect that there are items in the budget which will be challenged—for indeed that will always be the case. But perhaps the best over-all summary I could give is that we have tried to tailor this budget to where the probability that additional reductions should be made is roughly equal to the probability that like increases should be incorporated.

"Our FY 1975 budget request, if discounted to the FY 74 level of purchasing power, would be about $1,860 million, or 6 percent less than last year's appropriation. I use the measure of constant purchasing power not to minimize the over-all amount of funding we are requesting, but rather because it is the true indication of how many people we can afford to pay in our Nation's (Army) laboratories and how much hardware we can afford to buy for testing.

"Some of our major programs show a substantial decline in requested funding relative to last year. Antiballistic missile research and development, for example, is down by about $42 million, funding for the Big Five (weapons systems) has declined this year by $110 million, and the technological base request is lower by $6.6 million. The first pie chart shows that the Army has requested 24 percent of the DoD FY 75 budget, and that 2 percent of the DoD budget request is for Army RDT&E.

"The second pie chart illustrates how we plan to use our FY75 appropriation. The Big Five, which I will treat individually later in my presentation, are generally progressing well. In combination with our other tactical development programs, they will provide us with the edge in combat to which I alluded earlier. The Big Five, plus the other tactical development efforts, account for 46 percent of our FY 75 RDT&E program.

"Strategic and joint programs account for 29 percent of our funding needs. We are fulfilling, in this area, our assigned mission in the strategic defense of the nation. The seesaw phenomenon of modern weapons systems is especially obvious in the field of strategic offensive and defensive weapons and tactics, and it is especially critical that we keep pace in this area.

"A defensive capability, either hardware or technology, must be maintained to counter the advances in offensive strategic weaponry. The 'unitary' threat of the early 1960s gave way to multiple reentry vehicles in recent years—MRVs which are now well on their way to being surpassed by Multiple Independently Targetable Reentry Vehicles (MIRVs), and even this latter threat eventually may be replaced by maneuverable reentry vehicles.

"Augmenting these systems are continuing advances in penetration techniques. Each succeeding advance in these technologies and tactics represents a very real threat to our strategic retaliatory capability, and hence to our survival as a nation and to our ability to avoid coercion by other nations. . . ."

ASA (R&D) Augustine at this point turned to a discussion of Lessons Learned in the recent Mid East War with respect to RDT&E planning for the future. Then he proceeded into a discussion of progress in major RDT&E programs, including SAM-D first-year full-scale development (FY 73), which he said was completed on schedule and within costs. Fully guided flights are scheduled to begin in July 1974.

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Other weapons systems he discussed in detail include the Advanced Attack Helicopter (AAH), its armament and night-vision systems for the pilot and copilot/gunner. The plan, he said, is to upgrade the present attack helicopter, the AH-1Q, by product improvement to provide an interim capability.

Four characteristics he described as AAH essentials that "will not be traded off without Army approval." These are a minimum cruise airspeed of 145 knots, a minimum armament load of 8 TOW missiles and 800 rounds of 30mm ammunition, a vertical flight performance of 450 feet per minute, and an endurance of just under two hours.

Design flexibility and the competitive nature of the AAH program, he said, coupled with new technology, "will assist in achieving an operationally acceptable aircraft at a cost equal to or less than the design-to-cost goal of $1.6 million recurring flyaway cost expressed in constant FY 72 dollars."

After describing the specified operational characteristics of the UTTAS aircraft—being developed to replace the UH-1 series in the assault helicopter air cavalry and aeromedical evacuation units—ASA (R&D) Augustine said the mock-up and critical design reviews have been completed. The competing airframe contractors are Boeing Co. and Vertol and Sikorsky Aircraft. Bench testing of dynamic components and whirl testing of main and tail rotors are scheduled in FY 74.

The General Electric T-700 engine, which will power both the AAH and the UTTAS, will have accumulated more than 2,000 hours of testing by the close of the fiscal year. Results to date are described as indicating "good mechanical operational characteristics and performance exceeding specified requirements by 64 shaft horsepower."

Another of the Big Five materiel items, the MICV (Mechanized Infantry Combat Vehicle), under development to replace the M113A1 Armored Personnel Carrier, was described as an $11.8 million program in FY 74, with testing slated in the final two quarters. Predicted unit procurement cost is $146,500 in FY 72 dollars.

Design-to-cost techniques being used in the XM-1 Tank Program are expected to insure that the vehicle will be "affordable as well as militarily effective." Special armor will make it twice as survivable on the battlefield as the M60A3. Stabilization and fire control will enable the new tank to fire twice as accurately when on the move. The contractors, Mr. Augustine said, believe the XM-1 can be built at the design-to-cost goal of $507,000 unit hardware cost in FY 1972 base-year dollars.

In discussing a number of other "high-priority systems," Mr. Augustine devoted four pages of his statement to ballistic missile defense, with the emphasis on accomplishments in and FY 75 programs for the SAFEGUARD, Site Defense, and Advanced BMD programs.

Installation and test of hardware at the Perimeter Acquisition Radar (PAR) and Missile Site Radar (MSR) facilities were reported as "essentially complete and subsystem testing is well along." Ten system tests are planned for FY 74; six had been completed as of late January, with five successful.

Mr. Augustine described the Site Defense Program as a prototype demonstration of a "hedge option to defend MINUTEMAN against advanced threats.

"The Advanced BMD technology program," he said, "appears to be faced with a critical decision this year. The effort devoted to this area has decreased gradually over the last six years until it, at present, is only about 68 percent of the funds appropriated in 1969. It is even less when measured in purchasing power.

"On the other hand, working within the SALT I limitations, the Soviets are proceeding with a very active program which threatens to erode the lead we presently hold in BMD technology. Even within the strict compliance we are maintaining with the agreements, there are continuing U.S. requirements in the BMD area. These include the avoidance of technological surprise, active assistance to the U.S. strategic offensive technology effort, and the need to continue exploration of new concepts should one day there be a need for the U.S. to develop a highly advanced BMD system."

"During the past year, Congressional reviews concluded that a 27 percent reduction in the over-all funds requested for BMD was appropriate, including a 39 percent reduction in the advanced BMD technology portion of that effort. To accommodate the latter reduction, the advanced technology program was rebalanced, with a resulting curtailment of research efforts in certain areas, including optical sensor development, future generation radar technology, and mitigation of nuclear effects."

These reductions, he explained, were taken after careful consideration of the alternatives. They represented a conscious effort to respond to the guidance of the Congress, and to preserve within the current limited program Army efforts to reduce still prevailing unknowns in designation and discrimination technology. This fiscal year, four ICBM flights have provided the Army with important data on two reentry vehicles, four decoys, two balloons, one chaff package, and a "large collection of assorted debris."

"Thus in the post-ABM Treaty environment," Mr. Augustine continued, "our strategic defensive efforts have undergone a significant change. The SALT agreement has made possible a decrease in BMD total funding from $1.4 billion in FY 72 to $440 million in the FY 75 request. The emphasis is no longer on deployment of an operational system, as was the case with SAFEGUARD.

"It is now directed toward a vigorous research and development effort with which we will attempt to maintain for the U.S. a strong visible competence in BMD. Today, we stand clearly at the crossroads. Unless we commit ourselves to a demonstration of that competence, we must stand ready to forsake our technological superiority in Ballistic Missile Defense."

SHORAD MISSILE SYSTEM. This was described by Mr. Augustine as "a considerable departure from other Army major systems acquisition in that leading contenders to fill the gap in our all-weather, short-range, air-defense system are three foreign-developed systems which are either in production, or about to enter production. This is, in part, a reflection of the significant progress being made elsewhere in the world in the development of military hardware, and in this case offers us the opportunity to acquire an important capability with relatively modest risk.

"We plan to produce all hardware for this program here in the U.S. We have the opportunity to capitalize on off-shore R&D expenditures, with a resultant savings to the U.S., and we have an excellent opportunity to contribute to standardization of NATO equipment.

"Since the Army has little experience in foreign acquisition of this magnitude, we are proceeding deliberately to insure that we obtain the needed performance at the least possible cost. Also, since we are just now in the process of initiating this effort, we will apply emphasis from the start in assuring that funding commitments are based on demonstrated system performance, as opposed to rigid adherence to some particular time schedule.

"I believe the SHORAD request for proposal is one of the first ones ever to simply list a set of sequential milestones to be met rather than prescribe a calendar-keyed program plan.

"The $2.5 million we received in FY 74 was used to prepare Requests for Proposals, establish the necessary simulations required to evaluate contractor responses, and the actual evaluation of these responses.

"We are requesting $35 million in FY 75 to start the initial fabrication of hardware for DT/OT II (Design Test/Operation Test) and order initial parts for equipment to be tested. Purchase of an operational system, as opposed to a complete development effort by the Army, will save approximately $300 million."

PERSHING II. Advanced development will begin in FY 75 on this missile system, Mr. Augustine said, with the new start objective of modernizing the current PERSHING with a highly accurate, low-yield capability for the future.

The Supreme Allied Commander in Europe was reported to have "expressed a specific need for a PERSHING II type system which will accomplish his military objectives with minimum damage to nonmilitary personnel and facilities.

"High accuracy and low-yield make this modular improvement to PERSHING more politically acceptable to our NATO Allies, and thus a better deterrent, while providing new and additional capabilities for employment in the event of tactical nuclear warfare. It maintains the advantages of the original PERSHING surface-to-surface system in prelaunch survivability and penetrability."

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During the remainder of his statement, Mr. Augustine discussed problem areas of the AH-1Q COBRA/TOW helicopter and a product improvement program, the Heavy Lift Helicopter Program (subject of a detailed feature article in the January-February 1974 edition of the *Army R&D Newsmagazine*), the High-Energy Laser Technology and Application Program, and Technology Achievements.

With respect to technology advances, he said, they are "seldom seen and often not fully appreciated . . . in support of major weapons systems . . . (because) work is done in literally thousands of diverse efforts, each with a small annual investment. It is difficult to assess the effort until it is concluded, perhaps 5 to 10 years after it starts. . . .

"Last year, in an effort to assess the benefits derived from the technology base, we identified four goals for Army Research and Development: technical superiority, cost savings, improved reliability and maintainability, and increased human effectiveness. These goals were the basis for developing a Corporate Report, which focused on tangible products from Army technology and also highlighted the returns on our technology investments in prior years.

"This year, we developed a second Corporate Report, using the previously stated goals in explaining the over-all objectives of our technology base. With the continuing emphasis on cost savings, as a particular target of interest, we have found that the Corporate Reports have done much to assist in understanding the contributions of the technology base, and increasing the awareness of the laboratories that they are being measured in terms of their 'return on investment.'

"One of the things that we have observed in our Corporate Reports is that the cost savings or cost avoidance resulting from technology base achievements exceed what we are spending each fiscal year on the technology base staff. This is in addition, of course, to substantial payoff in terms of militarily applicable technology." (Italics added.)

Four selected examples from Corporate Report II were cited to illustrate "our progress toward the four goals I mentioned a moment ago." Specifically, they are Elimination of Tetryl from Ammunitions; Viscous Damped Mount; Vehicle Armor; and Helicopter Seals.

Confronted with a requirement for modernization of the only tetryl production plant in the United States because of obsoleteness—in addition to "unacceptable levels of air and water pollution"—at an estimated cost of "several millions of dollars," he said Army R&D explosive specialists surveyed a number of alternative compositions during FY 73.

Following identification of a practical substitute made from other available explosives, the specialists demonstrated that tetryl can be replaced 'without decreasing reliability, effectiveness, availability, and maintainability. As a result, a Tri-Service agreement was reached, providing for elimination of tetryl from all munitions "during the next few years." The tetryl plant will be closed once an interim stockpile is established.

ASA (R&D) Augustine told the Congressional committee that "the minimum cost avoidance to be realized is about $6 million. The cost of the research which made this possible was $180,000." (Italics added.)

Developed by the Army Human Engineering Laboratory at Aberdeen (MD) Proving Ground, the Viscous Damped Mount was described as increasing the accuracy of aiming and firing antitank missiles, such as the DRAGON, that depend upon manual tracking by the gunner. With this mount, gunner tracking accuracy reportedly is improved "by 500 percent. . . . The gunner can now reliably track a moving target to one-tenth of a mil."

Adaptable to many uses, including the laser designator, TOW, and DRAGON, the new mount was described as providing "technical superiority and increased human effectiveness in weapon systems operation, as well as a reduction in the number of missiles needed for training."

In coordination of the Department of Defense materials program, Mr. Augustine said the lead in materials development taken by the Army, with close consideration of the requirements of the Air Force and Navy, has resulted in cost and weight reduction—without corresponding loss in protection.

Electro-slag Remelt (ESR), a "significant breakthrough" previously reported in two *Army R&D Newsmagazine* articles as an R&D result at the U.S. Army Materials Mechanics Research Center, Watertown, MA, was cited by Mr. Augustine as "producing armor steel that is both cheaper and better than current methods. . . . ESR steel is planned for use in the Armored Reconnaissance Scout Vehicle at a cost saving of $3,400 per vehicle."

Helicopter Seals Improvement by the U.S. Army Air Mobility R&D Laboratory (see center-spread feature article, page 16, this edition) was described by Mr. Augustine as a development for high-speed aircraft transmissions.

Not only was the previous seal costing the taxpayer $800,000 a year in maintenance costs, he said, it was causing the loss of 10 hours in flight time each time the seal had to be replaced.

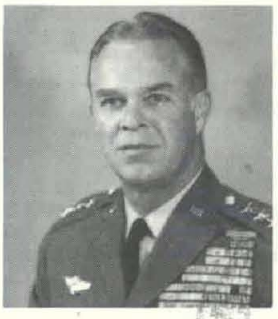
The improved technology is usable on existing helicopter transmissions without requiring special adaptation kits, and will be used on the UH-1, COBRA and UTTAS helicopters.

Other topics of budgetary consideration reported by Mr. Augustine included Face-to-Face Decision Making; Delegated Management; Cost Control; Requests for Proposals; Competitive Prototyping; Technical Risk Assessing Cost Estimate (TRACE); Red Team (a "Devil's Advocate" method of directing attention to potential weakness in developing the Concept Formulation Package for weapon systems); Independence in Testing; The Army Material Acquisition Review Committee (AMARC); and Management Toughness.

Secretary Augustine explained that, by management "toughness," he meant a steadfast adherence to well-recognized and effective management principles, even when the easier immediate solution is not to do so. This is, of course, he said, not a new nor innovative concept; it merely emphasizes a point that the Congress has indicated on a number of occasions—namely, that "had we merely adhered to our own prescribed rules, many of the problems we encountered in the past would not have occurred at all."

ARMY CHIEF OF R&D LTG John R. Deane Jr., in making his 49-page RDT&E budget proposal presentation before the Senate Committee on Armed Services, restated many of the major points made by earlier DoD and Army R&D leaders. He pointed particularly to the critical need of providing weapon systems superior to those of the potential enemy, and maintaining a technology base adequate to cope with any future exigency.

In addressing the objective areas selected for R&D emphasis in the FY 1975 RDT&E Budget Proposal, LTG Deane opened by discussing Improved Tank/Antitank Systems, stating:



LTG John R. Deane Jr.
Army Chief of R&D

"The war in the Middle East effectively dispelled the notion that the tank is an anachronism, a relic of past wars. Certainly its employment was limited in Vietnam; however, last fall, we witnessed the biggest tank clashes since the Battle of the Bulge (World War II). Soviet tactical thought is heavily armor-oriented.

"Within a few weeks of mobilization, Warsaw Pact forces are capable of assembling the largest armored force in the history of warfare. The Soviet antitank capability is equally formidable, and employs the tactic of massive use of rocket-propelled grenades, wire or radio-guided missiles, and tank-fired antitank projectiles.

"To counter the armor threat, we are developing the XM-1, a tank with the armor, firepower, mobility and survivability to defeat any known tank in the world today. Our ground and heliborne-launched TOW missile, which was phenomenally successful against Russian-made armor toward the end of our involvement in Vietnam, is in the

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field. The DRAGON, a medium antitank weapon, is almost ready for deployment.

"We are continuing work on the Advanced Attack Helicopter (AAH), which will be an effective antiarmor weapon, even under adverse weather conditions and at night. Two of the tank/antitank weapons, the AAH and XM-1, are part of our Big Five (weapons systems), and will be dealt with in more detail later in my presentation.

"The Warsaw Pact ground forces facing NATO in Europe are capable of fielding, in addition to the mammoth tank force previously mentioned, over one million men, many of them carried in thousands of modern light armored combat vehicles. These staggering figures reflect the premium that Soviet military planning places on high-speed mass armored assault on the enemy front.

"To counter a juggernaut of this size requires the capability to mass rapidly and deploy available forces and firepower to neutralize penetrations and exploit weaknesses. Four of our Big Five systems are designed to do precisely that. The UTTAS and MICV will enable the commander to rapidly shift infantry around the battlefield while the XM-1 and AAH will provide highly mobile heavy firepower. All, of course, must be supported by artillery, close air support and air-defense weapons.

"Improved Air Defense. The Army's air defense systems must be capable of coping with the threat posed by the numerical superiority of combat aircraft possessed by the Soviet Bloc, especially in Europe. The Warsaw Pact nations are capable of assembling, within a short period of time, a force of several thousand combat aircraft with advanced electronic countermeasures (ECM) capability.

"In order to protect and provide freedom of action for our ground forces and helicopters, and free our Air Force for offensive missions, we are developing SAM-D, a medium-to-high-altitude antiaircraft missile system with multiple engagement capabilities and high resistance to ECM.

"To fill the existing void in all-weather, low-altitude air defense, we plan to develop a mobile Short-Range Air Defense (SHORAD) missile system. STINGER, a highly reliable man-portable successor to the Redeye (missile), will complement SAM-D and deal with low-flying tactical aircraft and helicopters.

"Finally, a comprehensive, multifaceted effort is under way to define the best approach to upgrade our air-defense gun capabilities.

"The Middle East War demonstrated the ability of air defense to provide a relatively high degree of protection for ground units, even in the absence of friendly air cover, and established air defense as an integral component of offensive land forces. The salient factor in this success was the sheer volume of missiles fired, not just their quality."

LTG Deane summarized succinctly at this point some of the information submitted earlier by ASA (R&D) Norman R. Augustine. Then he turned to a consideration of artillery "directed toward coping with the numerical and range superiority of Soviet and Warsaw Pact artillery.

"We are continuing work on the XM-198, XM-204 and M110E2 howitzers, which will have improved range and reliability. We are also investigating both rocket-assisted projectiles and low-drag, unassisted projectiles to further enhance our range capabilities.

"Since the Soviets are reportedly developing extended-range rounds with similar technology, continued intense effort on our part in this area is clearly required to gain and maintain range superiority, especially in view of the 3-1 advantage in the number of artillery tubes available to them in Europe.

"Test firings of the 155mm Cannon-Launched Guided Projectiles are proceeding. This concept will provide our artillery with the capability of single-round neutralization of stationary or moving targets by employing terminally guided projectiles.

"Work on binary chemical munitions and improved conventional munitions is continuing. Artillery delivered antitank/antipersonnel mines, currently undergoing development, are designed to slow an enemy advance. After a selected period of time, they will neutralize themselves, allowing movement of friendly forces through the area and reducing the possibility of civilian casualties after hostilities have ceased.

"As a counter to the formidable Soviet artillery threat, work is continuing on the development of reliable automatic radar systems for detection and location of enemy mortars and artillery. A high percentage of Warsaw Pact (nations) exercises are conducted at night, and Soviet-equipped Arab armies demonstrated this capability during the October war.

"We possess strong night-vision technology and are proceeding with development of a variety of infrared detection and night-vision and sighting devices, which are being integrated into existing systems including TOW and DRAGON."

FY 75 BUDGET. LTG Deane said the FY 75 request for $1,985.9 million is a smaller figure than last year's request, but slightly larger than the amount received ($1,970.5 million). Category differences, with the FY 75 request shown last, are:

Military Sciences, $116.6 and $111.5 million; Aircraft, $296.0 and $270.0 million; Missiles, $821.3 and $706.4 million; Military Astronautics, $17.5 and $15.8 million; Ordnance, $255.0 and $263.9 million; Other Equipment, $401.6 and $562.5 million; Management and Support, $62.5 and $55.8 million.

A further budget breakout shows a comparison of FY 74 and proposed FY 75 funding (FY 75 last): AAH, $49.3 and $60.8 million; UTTAS, $102.7 and $54.1 million; SAM-D, $194.4 and $111.2 million; MICV, $11.8 and $7.8 million; XM-1 Tank, $54.0 and $68.8 million; Site Defense, $110.1 and $160.0 million.

The Military Sciences budget activity, LTG Deane explained, is a technology-oriented effort, with 65 percent of funds under the Technology Coordinating Paper (TCP) concept of the Department of Defense. An additional 15 percent is concerned with weapons technology and doctrinal studies not covered by the current TCP structure. Twenty percent is concerned, he said, "with what may be referred to as General Military Sciences . . . as relevant as possible to future Army technology-base goals and objectives."

About 40 percent of the Military Sciences budget, he explained, is used for such Applied Technologies as explosives, gun propellants, materials, rotary-wing aerodynamics, aircraft structure and propulsion, night-vision devices, military electronics, and ballistics research. Each of these technologies is "focused on some firm, timely, impact-producing goal."

Objectives include cheaper explosive fills; reduced gun tube temperatures and erosion; decreased aircraft fuel consumption; reduced cost and increased effectiveness of night-vision and electronics devices. Investigations in nuclear technology are directed toward better stability in nuclear effects. He said "a whole range of advancements in new electronic devices and microminiaturization has opened the door to new technologies in electronic warfare."

LTG Deane devoted the remainder of his statement to a further explanation of the breakout of the FY 75 budget proposal for: Soldier Support; General Military Sciences (which funds, among other things, the Army In-House Laboratory Independent Research and the Information Science Programs); Environment; Doctrine and Studies; Aircraft (UTTAS, HLH, AAH, Aerial Scout); Missiles (PERSHING II, BMD, STINGER, LOFAADS, SAM-D); Laser Designators; Cannon-Launched Guided Projectile (CLGP); Ordnance, Combat Vehicles and Related Equipment.

Other materiel items he detailed with respect to operational specifications and established performance characteristics, or state of developmental progress, included the new family of howitzers, the Lighweight Company Mortar System; MICV; Armored Reconnaissance Scout Vehicle, XM-1 Tank; and Other Equipment.

Program-wide Management and Support FY 75 funding is proposed at a level of $55.8 million. In summary, he concluded:

"My presentation has been designed to provide you with a description of the programs we will pursue in FY 75, and the reasons why we consider these programs necessary to the effectiveness of the Army.

"Throughout my presentation, I have made frequent reference to Soviet capabilities and the threat they pose. My intention, in this regard, is not to employ 'scare' tactics. I intend only to depict, as accurately and graphically as I can tell, the mass of armament and manpower our Army will face in the event of a future conflict. I believe the war in the Middle East is a warning we cannot ignore.

"Our RDT&E effort takes cognizance of this warning. It is designed to provide the American Soldier the tools he needs to meet the threat. . . ."

Conferences & Symposia . . .

Secretary of Defense and Army Staff Chiefs Brief ASAP

Secretary of Defense James R. Schlesinger, Secretary of the Army Howard H. Callaway, and Army Chief of Staff GEN Creighton W. Abrams addressed the Army Scientific Advisory Panel (ASAP) winter meeting at the Pentagon.

Programed to acquaint ASAP members with key officials and operations at Defense, Army Secretariat, and General Staff levels, the 2-day meeting brought together the most impressive gathering of Department of Defense and Army dignitaries in the panel's history. ASAP was established in 1954 as the Army staff senior scientific advisory group.

Secretary Schlesinger spoke mainly on the role of the Army Scientific Advisory Board, the return on investment in the Department of Defense, the Army laboratory structure, the research, development and materiel acquisition requirements process, and a planned Army staff reorganization.

On the role of advisory boards, he stressed criteria for critical assessments of Army needs, a hard-headed evaluation of ongoing programs, and an injection of industry and university viewpoints to assist in refining R&D policy and procurement mechanisms to produce top-value materiel at an affordable cost through design-to-cost policies.

Secretary Callaway discussed the current image of the Volunteer Army as viewed by Congress, the public, educational institutions, and industry. Army Chief of Staff GEN Abrams compared U.S. and Soviet equipment and systems, including human factors problems in training the soldier to effectively use improved and new equipment. Army Vice Chief of Staff GEN Fred C. Weyand attended this session but was not a speaker.

Deputy Under Secretary of the Army for Operations Research Dr. Wilbur B. Payne spoke on the techniques of reviewing and evaluating proposals for new military hardware. He was followed by Assistant Vice Chief of Staff LTG J. G. Kalergis, who also discussed the need for cost-effective policies in the materiel acquisition process.

Assistant Chief of Staff for Force Development LTG E. H. Almquist detailed the ROC (Required Operational Capability) Program, stressing the need for specifications to include environmental as well as operational testing. Assistant Chief of Staff (Communications-Electronics) MG T. M. Rienzi discussed the Army's new combat net radio program.

Assistant Secretary of the Army (R&D) Norman R. Augustine spoke on changes in the Army Materiel Acquisition Process and reviewed the current status of the "Big 5" and other major R&D programs. Chief of R&D LTG J. R. Deane Jr. followed with a discussion on OCRD relationships with other major commands in processing ROCs, from approval through the research, development, test and evaluation cycle to production.

Other principal briefings were presented by Dr. Howard L. Yudkin, Deputy Director (Systems), Office of the Director, Telecommunications and Command/Control Systems (OSD); Dr. Robert N. Parker, Principal Deputy to the Director of Defense Research and Engineering (DDR&E); Dr. Albert C. Hall, Assistant Secretary of Defense for Intelligence;

SECRETARY OF DEFENSE James R. Schlesinger, flanked by Secretary of the Army Howard H. Callaway and Army Scientific Advisory Panel (ASAP) Chairman Dr. Lawrence H. O'Neill, addressed the ASAP during its winter meeting. In the background is LTC Aubra N. Bone, ASAP executive secretary, credited with a major role in arranging the program that brought together top-level Defense Department and Army R&D leaders.

MG Harold R. Aaron, Assistant Chief of Staff for Intelligence; Arthur I. Mendolia, Assistant Secretary of Defense for Installations and Logistics (I&L); LTG Fred Kornet Jr., Deputy Chief of Staff for Logistics; and MG Thomas H. Tackaberry, Chief of Legislative Liaison.

In addition to panel members, dignitaries in attendance included Dr. Solomon J. Buchsbaum, Chairman of the Defense Science Board; Gordon Moe, National Security Council; Walter B. LaBerge, Assistant Secretary of the Air Force (R&D); and BG Herbert L. Wilkerson, Deputy Chief of Staff (Research, Development and Studies), Marine Corps.

The ASAP consists of members from industry, academic, and institutional sources, and works primarily through ad hoc groups (15 currently in operation). Areas of special study efforts and the chairmen are: Modern Volunteer Army, Prof. Williams; Equipping the Individual Soldier, Dr. Fried; Tactical Data Software, H. P. Gates; Behavioral and Social Sciences R&D, Dean Clark; and

Battlefield Effects, Dr. Gustavson; Foreign Systems, W. M. Hawkins; Non-Cooperative IFF, B. P. Brown; Product Improvement, Dr. Renier; Technical Readiness, Dr. Montgomery; SAM-D ECCM, Dr. O'Neill; SAM-D Communications, Dr. Yaru; Remotely Piloted Vehicles, C. W. Ellis; Intelligence, B. P. Brown; Logistics R&D, Dean Fadum; and Environmental Quality Research, Dr. Beaudet.

Computer Systems Command Marks 5th Anniversary

Without much more fanfare to break the normal work routine than a dinner dance sponsored by Commander (BG) Paul T. and Mrs. Smith, the U.S. Army Computer Systems Command, Fort Belvoir, VA, marked its fifth anniversary Mar. 31.

USACSC projects currently include the Army Tactical Data Systems (ARTADS) to support the Army Fire Direction System (TACFIRE), the Tactical Operations System (TOS), the Guided Missile Air Defense System (AN/TSQ-73), and the Air Traffic Management System (ATMS).

Other projects are Management Data Systems such as Standard Army Intermediate Level Supply (SAILS) System, the Standard Installation/Division Personnel System (SIDPERS), and the Vertical Army Authorization Document System (VTAADS).

Army in the Field concerns of the USACSC include the Combat Service Support System (CS3), the Division Logistics System (DLOGS), the Personnel Management and Accounting Card Processor System (PERMACAP), and the Automated Frequency and Call Sign Assignment System/Signal Operating Instructions (AFAC/SOI). Also, the Direct Support Unit/General Support Unit System (DSU/GSU), the Corps Support Command Management System (COSCOM) and the Standard Army Ammunition System (SAAS).

Overseas Systems projects of the command include Terminal Operations and Movements Management System (TOMMS), TASCOM Headquarters System (also the Support District System), Theater Army Support Command (Supply System known as TASCOM(S), the U.S. Army Europe Standard Depot System, the Standard Supply System (3S), and the Theater Army Support Command Transportation System (TRANSCOM).

Other command efforts are designed to serve the Army in Garrison, add-ons to Base Operations (BASOPS-II), and the Reserve and National Guard.

Aircrew Performance Conferees . . .
Examine Behavioral Science Research Applications

(Continued from page 19)

Army Materiel Command. Session II—Chairman, Dr. Vincent S. Haneman Jr., dean of Engineering, Auburn University; MAJ James A. Burke, Army Air Mobility R&D Laboratory; and Clarence A. Fry.

Environmental and Safety Factors, Session I—Chairman, COL Richard A. Rooth, commander, ARI; COL Lee M. Hand, Army Avionics Laboratory; Karl Stich and David Helm, Army Night Vision Laboratory; and CPT Richard G. Johnson, Defense Mapping Agency Topographic Center.

ESF, Session II—Chairman, Dr. Joseph Zeidner, director, Organizations and Systems Research Laboratory, ARI; discussion leader, MAJ Lawrence L. Grabhorn, Army Agency for Aviation Safety; COL Robert W. Bailey, Army Aeromedical Research Laboratory; and Darwin S. Ricketson, Army Agency for Aviation Safety.

Training and Simulation—Chairman, LTC Donald E. Youngpeter, chief, Army Aviation Human Research Unit; discussion leader, Dr. Paul W. Caro, HumRRO; MAJ Carl A. Weaver Jr. and MAJ Donald I. Saathoff, Aviation School (AAS); Dr. Wallace W. Prophet, HumRRO; and Dr. W. Guy Matheny, Life Sciences, Inc.

Performance Requirements and Assessment, Session I—Chairman, Dr. Charles O. Hopkins, assistant director, Aviation Psychology Laboratory, University of Illinois; discussion leader, COL Billy L. Odneal, Army Combat Developments Experimentation Command; Dr. John P. Farrell, ARI; and MAJ William E. Whitworth, Army Combat Developments Experimentation Command.

PRA, Session II—Chairman, LTC Richard D. Kavanaugh, Army Human Engineering Laboratory; John W. Senders, University of Toronto; Dr. Dora Dougherty Strother, Bell Helicopter Co.; Donald Vreuls, Canyon Research Group, Inc.; Richard W. Obermayer, Manned Systems Sciences, Inc.; and Ronald E. F. Lewis, Defence and Civil Institute of Environmental Medicine, Canada.

Conclusions of the conference, paraphrased from the Executive Summary, are:

1. A nap-of-the-earth capability is broadly recognized as a firm requirement of Army aviation in light of the projected antiaircraft weapon threat in any future conflict and is the basic justification for an intensified program of research on aircrew performance.

2. The research program should focus on nap-of-the-earth training to define and improve instructional content, procedures and devices.

3. The primary problem area in navigation —how to improve navigation training, equipment, maps and displays.

4. Nap-of-the-earth performance impacts heavily on crew workload, requiring methods to measure it and techniques to reduce it.

5. The need to reduce aircrew workloads leads directly to aircrew communication and teamwork, integrated cockpit design/layout, and control augmentation.

6. Nap-of-the-earth performance requirements are most demanding at night or with limited visibility, calling for improved night-vision devices and operational methods.

7. Flight test data continue to be required for quantitative assessment of basic capabilities of nap-of-the-earth crews.

8. Special skills needed in nap-of-the-earth flight warrant new studies of student/pilot selection procedures, and high-fidelity visual simulation techniques for training.

9. More specific statements of operational requirements are needed to provide direction for the research and a basis for interpreting the results; detailed task analysis data are needed for better structuring of aircrew performance requirements. Long-term interdisciplinary communication is necessary.

10. An interagency committee should be constituted and charged with integrating and coordinating the research of the various agencies concerned with future Army aviation.

Mathematicians Weigh Theories Of Finite Numerical Solutions

Mathematicians involved in development of a theory explaining recent successes (and occasional failures) of finite elements in the numerical solution of partial differential equations convened Apr. 1-3 at the Mathematics Research Center (MRC), University of Wisconsin.

Session chairmen for the Symposium on Mathematical Aspects of Finite Elements in Partial Differential Equations included Garrett Birkhoff, Harvard University; H. Rachford, Rice University; A. Schatz, Cornell University; R. S. Varga, Kent State University; and B. Wendroff, Los Alamos Scientific Laboratory.

Among the guest speakers were Ivo Babuska, University of Maryland; G. Baker, Harvard University; J. Bramble, Cornell University; P. Ciarlet, Universite de Paris VI; J. Douglas Jr., MRC and University of Chicago; T. Dupont, University of Chicago; and

H. O. Kreiss, MRC and University of Uppsala; J. Nitsche, MRC and Universitat Freiburg; P. A. Raviart, Universite de Paris VI; R. Scott, University of Chicago; B. Schwartz, Los Alamos Scientific Laboratory; V. Thomee, Chalmers University of Technology (Sweden); L. Wahlbin, University of Chicago; M. Wheeler, Rice University.

The speakers discussed such topics as the correctness, consistency, stability, convergence and convergence behavior of the discretizations of partial differential equations obtained through new methods; also, the relationship of these new methods to the long-established finite difference methods.

FY 75 Environmental Test Program Plans Reviewed

Environmental test program planning for FY 1975 was considered at a U.S. Army Test and Evaluation Command 3-day conference late in February at Aberdeen Proving Ground, MD, attended by about 75 participants.

Some of the major items and systems recommended for testing in the natural environments in the fiscal year beginning July 1 included the Armored Reconnaissance Scout Vehicle, Dragon Guided Missile System, Crew-Served Weapons Night Sight AN/TVS-5, Lightweight Company Mortar System and the Mechanized Infantry Combat Vehicle.

Representatives of the U.S. Army environmental test centers, Army Materiel Command and its subordinate commodity commands, in-house laboratories, project managers, and other military services and agencies with environmental testing requirements joined in the discussion of test programs.

COL Lowell H. Landre, HQ U.S. Army Alaska, was a featured speaker on test problems in the Auroral Environment. Briefings were given by representatives of the test centers and lists of materiel requirements for each proposed test were compiled. When approved, the lists will constitute the TECOM FY 1975 Environmental Test Program.

Chairmen of the ad hoc committees through which the conference functioned were COL David J. Schumacher, commander, U.S. Army Arctic Test Center, Fort Greely, AK; COL Arnold M. Sargeant, commander, U.S. Army Tropic Test Center in Panama; and William W. Snider, representing Yuma Proving Ground, AZ, where a desert test center is maintained.

COMMITTEE CHAIRMEN (left) COL Arnold M. Sargeant, COL David J. Schumacher, and William W. Snider (far right) meet with TECOM Commander MG Charles P. Brown (second from right) during Environmental Test Planning Conference at Aberdeen PG.

Herman R. Staudt
Under Secretary of Army

William P. Clements Jr.
Deputy Secretary of Defense

Malcolm R. Currie
Director of Defense R&E

Norman R. Augustine
Ass't Secretary of Army (R&D)

LTG John R. Deane Jr.
Army Chief of R&D

AMC Project Managers Annual Meeting Draws VIPs Array

Recognized importance of 39 Army Materiel Command Project Managers in the critical role of developing and procuring major weapon systems and equipment was attested by Department of Defense and Army top leaders who participated in the fourth annual PM Conference, Feb. 12-13, in Alexandria, VA.

Deputy Secretary of Defense William P. Clements Jr. gave the opening address after an introduction by AMC Commander GEN Henry A. Miley Jr., who also stressed the "hard work and overtime role of PMs" in his welcoming remarks. Under Secretary of the Army Herman R. Staudt was the opening speaker on the second day.

Luncheon speakers were Director of Defense Research and Engineering Dr. Malcolm R. Currie and Assistant Secretary of the Army (R&D) Norman R. Augustine. Army Chief of Staff GEN Creighton W. Abrams was the guest speaker at the formal dinner.

AMC Deputy Commander LTG Woodrow W. Vaughan introduced Dr. Currie and ASA (R&D) Augustine. AMC Deputy Commander for Materiel Acquisition MG George Sammet Jr. moderated a panel discussion on "Current Trends in Materiel Acquisition."

Panel members were Chief of R&D LTG John R. Deane Jr., Assistant Chief of Staff for Force Development LTG E. H. Almquist Jr. and MG Peter G. Olenchuk, director of Materiel Acquisition, Office of the Deputy Chief of Staff for Logistics.

Speakers included MG Robert C. McAlister, deputy chief of staff for Combat Developments, Training and Doctrine Command (TRADOC), "Materiel Development Current Trends Doctrine"; BG Leo D. Turner, PM for the Utility Tactical Transport Aircraft System (UTTAS), "Tracking Design to Unit Production Cost"; and MG E. R. Ochs, commander, U.S. Army Operations, Test and Evaluation Agency, "Operational Testing Current Trends/Doctrine."

"Contract Administration" was the topic of MG C. C. McKeen Jr., AMC director of Requirements and Procurement. COL Tenho R. Hukkla, commander, Mobility Equipment Research and Development Center, Fort Belvoir, VA, discussed "Camouflage."

DISCUSSION GROUP LEADERS and the topics included: Design to Unit Production Cost, John D. Blanchard, Office of the AMC Deputy Commander for Materiel Acquisition; Cost Analysis, BG L. R. Sears, AMC Comptroller; Procurement Strategy, Dr. Thomas J. Keenan, Army Aviation Systems Command; and Cost System Control Systems Criteria, LTC L. Marrella, AMC Requirements and Procurement Directorate.

Army Materiel Command commodity command leaders in attendance included MG Charles Brown, Test and Evaluation Command; MG Frank Hinrichs, Aviation Systems

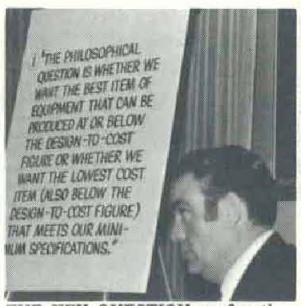
(Continued on page 28)

AMC PROJECT MANAGERS shown here, representative of a total of 39, are (l. to r.) LTC Joseph O. Lax, PM for the 1¼-ton truck; COL James H. Brill, HET (Heavy Equipment Transporter); COL Robert W. Noce, VRFWS (Vehicle Rapid Fire Weapon System); and COL Frank P. Ragano, 2.75-Inch Rocket System. Responsibilities of PMs involve AMC high-priority weapons systems, materiel and equipment acquisition programs.

PLACE ONE CHARMING WOMAN in a formal reception/dinner setting of more than 60 U.S. Army officers assigned to high-level responsibilities and you can be assured she will be in full focus. Ms Sally Clements, the Army Materiel Command's first woman to gain GS-15 rank, and currently assigned to command group duties with AMC Deputy for Materiel Acquisition MG George Sammet Jr., is shown with Army Chief of Staff GEN Creighton W. Abrams, AMC Deputy Commander LTG W. W. Vaughan (center) and AMC Commander GEN Henry A. Miley Jr.

SAM-D PM BG Charles Means responds to a question during the recent fourth annual Army Materiel Command Project Managers Conference. SAM-D is one of the Army's top developmental projects—one of the "Big Five" materiel systems.

PANEL DISCUSSION moderator MG George Sammet Jr. presides over consideration of "Current Trends in Materiel Acquisition." Seated (l. to r.) are LTG E. H. Almquist Jr., Assistant Chief of Staff for Force Development; Chief of R&D LTG John R. Deane Jr.; and MG Peter G. Olenchuk, director, Materiel Acquisition, Office of the Deputy Chief of Staff for Logistics.



THE KEY QUESTION confronting AMC project managers for major materiel acquisition programs is depicted here, and was discussed extensively at the PM Conference. Shown also is William Blanchard, special assistant to MG Sammet.

Army Science Conference Slated at Military Academy

Quality of Army in-house laboratory research, development, test and evaluation programs will be evidenced by 96 technical papers presented at the biennial U.S. Army Science Conference at the U.S. Military Academy, June 18–21.

Before an anticipated audience of about 500 invited participants, representative of high-level Department of Defense scientific leaders, foreign countries including the United Kingdom, Canada and Australia, and U.S. Army laboratories, authors and coauthors of the papers will be competing for honorary and monetary awards.

The most coveted will be the Dr. Paul A. Siple Memorial Medallion cast in silver, which has been awarded at the conference since 1970 as the most prestigious recognition the Army can give to one of its in-house scientists.

The medal honors the distinguished cold regions explorer and scientific adviser who died in 1968 while serving with the Director of Army Research. His career began as a Boy Scout selected in a nationwide competition to accompany Adm Byrd on his first Antarctic Expedition.

The U.S. Army Incentive Awards Program usually makes possible the presentation of $3,500 to $4,000 ($3,700 at the 1972 ASC) to the authors and coauthors of 10 to 15 papers selected by a panel of senior Army scientists.

In addition to the 96 papers programed for presentation, 24 papers have been selected as supplemental, meaning that they will be considered for presentation should any of the other papers be withdrawn. All 120 papers will be judged for awards.

Twenty-two authors of 8 papers in 1972 were presented with Army Research Office Crest Medallions cast in bronze and Certificates of Achievements signed by the Assistant Secretary of the Army (R&D) and the Chief of R&D.

Except for a decision from a top-level R&D leader invited to be the guest speaker at the banquet, and the toastmaster for that affair, arrangements for the conference were complete as this edition went to press.

Army Chief of R&D LTG John R. Deane Jr. is scheduled to give the keynote address and ASA (R&D) Norman R. Augustine will present the awards. LTG Bernard W. Rogers, deputy chief of staff for Personnel, will chair a panel discussion on "The Volunteer Army's Investment for the Future." Members will be representative of the Department of Defense, industry, academic institutions and other agencies.

Instead of the normal five concurrent sessions for presentation of papers in major disciplinary areas, four sessions, each divided into six subsessions, are programed this year.

Session chairmen are Dr. Craig M. Crenshaw, chief scientist, Army Materiel Command; Robert F. Jackson, Office of Research and Development, Army Chief of Engineers; COL Francis C. Cadigan Jr., director of Research, U.S. Army Medical R&D Command; and Dr. Herman R. Robl, chief scientist, Army Research Office, OCRD.

Subsession chairmen, all directors or high-level scientific leaders in Army labs, are:

A-I, Dr. Alvin E. Gorum; A-II, John Johnson; A-III, Dr. David C. Hardison; A-IV, Dr. Robert J. Eichelberger; A-V, Billy M. Horton; A-VI, COL Lee M. Sherman.

B-I, Dr. Louis R. Shaffer; B-II, COL E. Lyle Bowman; B-III, Dr. Dean R. Freitag; B-IV, Paul F. Yaggy; B-V, Clyde D. Hardin; B-VI, Lawrence A. Gambino.

C-I, COL Joseph F. Metzger; C-II, COL Tenho R. Hukkala; C-III, COL John E. Canham; C-IV, Dr. Benjamin L. Harris; C-V, Dr. Ernest N. Petrick; C-VI, COL W. L. Sheet. D-I, Dr. Eugene G. Sharkoff; D-II, Benjamin S. Goodwin; D-III, Dr. Jacob B. Gilstein; D-IV, Dr. John P. Hallowes; D-V, COL Richard A. Rooth; D-VI, Dr. Vitalij Garber.

Expanded National JSH Symposium Scheduled at MIT

Climaxing a year during which the 12-year-old U.S. Army Junior Science and Humanities Program was expanded to 36 regional student science fairs throughout the U.S., the National JSHS will be held May 15–18 at the Massachusetts Institute of Technology.

One student representative of each of the 36 regional fairs will evidence outstanding scientific research achievements by presenting technical papers on their experimentation. A significant change this year is that they will be judged by civilian and military scientists, instead of by their fellow students.

Five winners will be selected for what has proved in recent years a highly rewarding experience for other National JSHS winners—the opportunity to participate in the London International Youth Science Fortnight, July 31 to Aug. 14, under Army and industry joint sponsorship of the JSHS Program.

Three outstanding speakers had accepted invitations to address the MIT symposium at press time and acceptance by a fourth was awaited. Dr. Edward Teller, one of the nation's top nuclear scientists and a keynote speaker at the first National JSHS who has consistently supported the program, was unable to accept an invitation.

Definitely programed as guest lecturers are Dr. Robert Ogilvie, MIT professor of metallurgy, who will speak on "Understanding the Origin of Meteorites Through Metallurgy"; Harry Johnson of the Bureau of Mines, U.S. Department of the Interior, "Prototype Oil Shale Leasing Program of the Department of the Interior"; and Dr. Mary Mandell of the Army Natick Laboratories' internationally renowned husband-wife scientific team.

Dr. Mandell will speak on what has been termed—particularly in view of the nation's resources conservation and pollution control effort—one of the most significant achievements within the history of the Natick Labs. This is development of the technology to convert cellulose (waste paper of all types) into glucose products, such as sugar, syrup and even a clean-burning fuel (methane, ethanol).

One of the recent applications of this technology, involving the fine pelletizing of paper as a preliminary step, is now of growing interest as a potentially highly efficient method of removing major polluting oil spills from ocean drilling or from oil tankers. (A feature article, page 10 in the September 1972 edition of the Army R&D Newsmagazine, reported on this technology.)

Twelve panel discussions have been scheduled for the MIT symposium and the chairmen of many of them will be those selected to serve as judges of the student papers. Only four topics had been announced at press time: Food Preservation by Radiation; Taste Modification of Food (as preserved by various methods for long-term usability); Stress Psychology; and Frontiers in Engineering Technology.

Participants in the symposium will have a choice of visiting one or more of 15 MIT laboratories as well as the Natick Laboratories, Raytheon Co. labs, Polaroid labs, and the Bolt-Bernek-Newman Acoustical Engineering Labs.

Other attractions scheduled for them during their stay in the Boston area include a Boston Pops Concert conducted by Arthur Fiedler, a tour along the "Freedom Trail" of American history, and visits to the Boston Aquarium, the Museum of Fine Arts, Museum of Science, and the Peabody Museum.

JUDGES. Dr. Sidney Magram, working with National JSHS coordinator Don Rollins in arranging the program, announced that 16 judges had been selected as of press time and that others would be named.

They are U.S. Army Reservists MAJ Pritchard Burse, LTC Fred King, LTC Daniel Shimkus, CPT Larry Branch, MAJ Robert Anstey, MAJ Christols Mpelkas, LTC Samuel Horowitz and COL David Feldman. All are from Reserve units in the Boston area.

Other judges are Dr. L. David Minsk and Frederick Bilello, scientists with the U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, NH; Dr. Joseph W. Giffee and Dr. Frederick Parrish, Natick Labs; MAJ James Vick, Edgewood (MD) Arsenal; and Drs. Richard J. Weiss and Ralph Harrison, Army Materials and Mechanics Research Center, Watertown, MA. Two judges in the medical field will represent Walter Reed Army Institute of Research.

AMC Project Managers Fourth Annual Meeting Draws VIPs Array

(Continued from page 27)

Command; BG Henry Hill (acting commander), Electronics Command; and MG Vincent H. Ellis, Missile Command. Numerous AMC in-house laboratory commanders and technical directors also attended.

PROJECT MANAGERS who participated in the discussion of the critical problems with which they are dealing included:

MG Robert Baer, XM-1 Tank; BG A. B. Crawford Jr., ARTADS; BG Charles Means, SAM-D; BG George Turnmeyer, LANCE missile; COL James Brill, Heavy Equipment Transporter; COL Edward Browne, Advanced Scout Helicopter; COL Robert Cottey, Remotely Monitored Battlefield Sensor System; COL Raymond Cramer, Surface Containers;

Also, COL Earnest Deadwyler, HAWK Missile; COL John Dobbins, ATACS; COL Raymond Elwell, deputy PM, DCS (Army) SCS; COL Orlando Gonzales, COBRA Helicopter; COL John Hanby, HELLFIRE; COL William Harrison, Mortar Artillery Locating Radar; COL Robert Huntzinger, TOW Missile; COL K. E. Lockwood, Selected Ammunition;

Also, COL Henry Magill, SHORADS; COL Myles Mierswa, Training Devices; COL Robert Morrison, project officer, U.S. Army High Energy Laser Program; COL James McCluskey, Mechanized Infantry Combat Vehicle (MICV); COL Chester McDowell, NAVCON; COL Robert Noce, VRFWS; COL A. A. Nord, Safeguard System Munitons; BG Robert Malley, MPBME; BG Samuel Cockerham, AAH; COL John M. Shea, DRAGON; COL Elmer L. Birk, ARSV;

Also, COL Sterling Post, CAWS; COL Frank Ragano, 2.75-inch Rocket; COL Max Scheider, FAMECE; COL Stan Sheridan, M-60 Tank; COL Stewart Shirey, Aircraft Survivability Equipment; COL Samuel Skemp, PERSHING Missile; COL David Souser, STINGER; COL Carroll Strider, Mobil Electric Power; COL Leland Wamstad, Satellite Communications; BG Leo D. Turner, Utility Tactical Transport Aircraft System; LTC Joseph Lax, 1¼-Ton Truck.

Career Programs . . .

Army Selects 8 Civilian Employes To Attend Senior Service Schools

Eight Department of the Army civilian employes selected to attend three senior service colleges, commencing with the 1974–75 school year in August, have a total of more than 111 years of U.S. Civil Service.

Selectees were screened by the DA Executive and Professional Development Committee, composed of Deputy Assistant Secretaries of the Army for Manpower and Reserve Affairs, R&D, Installations and Logistics, and Financial Management; also, the director of Civilian Personnel and deputy director of Military Personnel Management.

NATIONAL WAR COLLEGE (NWC), Fort McNair, Washington, DC, is a graduate level interservice school for highly selected senior military and civilian career officials and State Department personnel. It provides training for those involved in high policy command and staff functions and national strategy planning.

Dr. R. J. Heaston

Dr. Robert J. Heaston, NWC selectee, is serving as chief, Office, Chief of Research and Development (OCRD). Backed by 17 years of federal service, he is responsible for monitoring all Army 6.1 basic research, 6.2 exploratory development, and 6.3 non-systems advanced development technology base efforts.

He has served assignments as a physical scientist, Chemical and Materiels Branch, OCRD; chemist, U.S. Army R&D Group, Frankfurt, Germany; and physical science administrator, Energy Conservation Branch and Technical Overview Team, OCRD.

Dr. Heaston has a BS degree (Cum Laude, 1952) and MS (1954) in chemical engineering from the University of Arkansas and a PhD from Ohio State University (1964). He is the recipient of a Meritorious Civilian Service Award and has authored numerous technical papers.

INDUSTRIAL COLLEGE OF THE ARMED FORCES (ICAF), Fort McNair, Washington, DC. The ICAF conducts graduate-level courses in national security, with primary emphasis on management of national resources. ICAF selectees include:

Neil R. Ginnetti

Neil R. Ginnetti, chief, Research and Methodology Branch, Cost Analysis Division, Comptroller, HQ U.S. Army Materiel Command (AMC). He is responsible for the development, implementation, and staff supervision of AMC plans and programs for cost analysis research, methodology and cost estimating policy.

Ginnetti has more than 13 years of federal service with 11 years experience in the comptroller field. His assignments have included management, review and analysis, program/budget, and cost analysis.

He earned a BS degree in education from Central Connecticut State College in 1957, an MBA degree in comptrollership from Syracuse University in 1967, and has attended the University of Connecticut, University of Maryland and George Washington U.

Lawrence R. Seggel

Lawrence R. Seggel has been employed since 1971 as chief, Systems Engineering Division, Lance Project Manager's Office, Redstone Arsenal, AL. His responsibilities include technical managerial control over all DA efforts and resources directed toward development, reliability, production, maintenance and value engineering functions of the Lance weapon system.

He has a total of 16 years federal service, earned a BS degree in industrial engineering from Lafayette College in 1957 and has served as a consultant on several key Army R&D programs.

Jay W. Jarrett

Jay William Jarrett is chief, Systems and Economic Analyses Division, Office of the Comptroller, HQ U.S. Army Communications Command (ACC), Fort Huachuca, AZ. He supervises systems and analyses programs for the ACC and serves as a principal adviser to his commander.

Graduated with a BA degree in economics from Washington State University in 1960, he has studied at the University of Richmond and the University of North Carolina. During six years of federal service he has authored or coauthored 11 economic and cost analysis publications.

James N. Hoge

James N. Hoge, chief, Staffing Division, Office, Deputy Chief of Staff for Personnel, Washington, DC, has served his entire 14 years of federal service in the Department of the Army civilian personnel administration. He is currently responsible for development of policy for hiring, placement, utilization, and separation.

Hoge has a BS degree in business administration from the University of Kansas, has attended George Washington University, and was a 1970 recipient of the William H. Kushnick Award as the outstanding young manager in Army civilian personnel administration.

ARMY WAR COLLEGE (AWC), Carlisle Barracks, PA. The AWC offers a course to prepare graduates for senior command and staff positions throughout the defense establishment, and promotes understanding of the art and science of land warfare. The AWC selectees are:

Bill Pales

Bill G. Pales, who has served since 1970 as deputy chief, Foreign Science and Technology Division, Directorate of Research, Development and Engineering, HQ AMC, has 19 years in federal service. He has extensive experience in the foreign science and technology field with the U.S. Army Missile Command, the Central Intelligence Agency, and the U.S. Air Force.

Pales obtained a BA degree in political science (foreign affairs) from Oklahoma A&M College in 1953, an MA degree in public administration from Oklahoma University in 1970, and has done graduate work in history at Trinity University.

John A. Lockerd

John A. Lockerd, a federal service employe for nine years, is assigned as technical director, Combat and Combat Support Systems Directorate, U.S. Army Combined Arms Center, Fort Leavenworth, KS. Prior assignments have included scientific adviser, Combined Army Group and Institute of Combined Arms and Support, Fort Leavenworth, KS.

His academic credentials include a BS degree in business administration from Texas Technological College and an MBA degree in engineering management/quantitative analysis from Texas Christian U.

John G. Grimes

John G. Grimes is serving as deputy chief of staff for Plans, Operations and Automation, ACC, Fort Huachuca, AZ. He is the DA functional chief's representative for the Civilian Communications Career Program, and has 17 years service.

Grimes was deputy director, Communications Engineering Directorate, U.S. Army Communications-Electronics Engineering Installation Agency prior to his present assignment. He has an AA degree in management from Cochise College and is completing work on his BS degree in public administration at the U. of Arizona.

Women in Army Science . . .

Career Goal Changed But 'I Like My Job' . . .

Aerospace Engineer Finds MERDC Tasks Rewarding

Claire Orth

While Claire Orth was working toward a degree in aerospace engineering, supplemented by a year of study in nuclear science, she had her career sights set on working in the field of nuclear-powered spacecraft.

When she graduated in 1971 from Virginia Polytechnic Institute and State University at Blacksburg, VA, opportunities in her chosen field were temporarily at a standstill. She was recruited in the Department of the Army Career Intern Program and was assigned as a mechanical engineer to work on supply distribution vehicles and bulk transport containers.

In that area of effort, she is proving an appreciable asset as the only female engineer in the Materials Handling Equipment Branch, Mechanical Equipment Division, Mechanical Technology Department, Mobility Equipment R&D Center, Fort Belvoir, Va.

Work in the branch involves developmental effort and testing of prototype items. When the Army needs a new piece of materials handling equipment, specifications and contract packages are prepared. Supervisors have recognized her ability and have entrusted Miss Orth with extensive contract monitorship responsibilities to ensure that the developing companies satisfy performance specifications.

One of her assignments, for example, was that of monitoring development of the chassis adapter to transport Air Force aluminum cargo pallets on the MILVAN flatbed transport vehicle. Her other duties have involved participation in OSDOC II (Off-Shore Discharge of Containership), a joint Army-Navy series of exercises to test special materials handling equipment and procedural technology.

Another assignment that proved well suited to her capabilities was that of organizing and arranging for speakers at a data exchange conference between United States and West Germany experts on materials handling technology.

Currently she is looking forward to working on a computer program designed to predict the performance characteristics of heavy equipment operating in a beach environment, involving parameters such as tire type and dimensions, inflation pressure, vehicle and load weight, and axle loading.

"I like my job," she comments, very convincingly.

Venturing into new fields of endeavor for women came quite naturally for Miss Orth at an early age. Her father, Lawrence B. Orth, is an electrical engineer with an industrial firm in northern Virginia. As a young girl she was fond of science fiction. In high school she and another girl were the first females to enroll in an elective course in electronics. She was president of the Science Club, took advanced mathematics as a junior, and was a National Honor Society member.

While attending VPI she worked on the school newspaper staff and was a member of Angel Flight, an honorary service organization affiliated with the Air Force ROTC program.

Miss Orth is an associate of the American Institute of Aeronautics and Astronautics and the American Nuclear Society.

'Contented Coexistence' . . .

Works for Watervliet Physical Scientists

Watervliet Arsenal, NY, has numerous claims to distinction within capabilities of its personnel resources—such as two Dr. Grays, both physical scientists, who head for home as a happily married couple when work is done.

You might run into a problem, however, if you indulged in the American predilection for evaluating superiority in professional capabilities. Dr. Alma Marcus Gray, listed in "Who's Who of American Women," and currently chairman of the Brunswick Conservation Advisory Council, has a clearly established claim to distinction. But so does Dr. Donald M. Gray, to whom she was married in 1967, three years after she joined the arsenal staff.

Mrs. Gray, a native of the Netherlands, graduated with honors and BS and MS degrees in physics and mathematics from McGill University in Montreal, Can., and received her doctorate from Rensselaer Polytechnic Institute. She was a research assistant at McGill and with the National Research Council of Canada, then was a research engineer on semiconductors for five years with Sprague Electric Co., North Adams, MA.

Dr. Alma Marcus Gray

Highlights of her studies at McGill included being a classmate of Dr. John S. Foster Jr., who was later to serve 7¾ years as U.S. Director of Defense Research and Engineering; working for her MS in applied mathematics under the guidance of Prof. P. R. Wallace; a year (1953) as research assistant to Prof. Gerhard Herzberg, a recent Nobel Laureate in chemistry; and fellowships for two years at the University of Illinois, studying with Prof. F. Seitz, one of the initiators of the modern theory of solid-state physics.

Currently, she is engaged in first-principle studies of physical properties of materials, including calculations of electronic band structure and development of sophisticated empirical models for predicting specific and unusual properties. She also is participating in a recently initiated program to develop new superconducting materials.

Among recent publications reporting on her research results are:

- Physical Review 5B,253 (1972) "A Consistency Test for X-Ray Form Factors"; and "Forbidden Silicon (442) Structure Factors," presented in 1973 at an American Physical Society meeting.
- Physical Review, Metallic Cu X-Ray Form Factors," scheduled for publication in March 1974, and in collaboration with her husband, "Band Structure Shifts for fcc Metals under Shear by a Perturbation Method," presented to an American Physical Society meeting.

Aside from her conservation activities in the area in which she lives, including her preparation and presentation to the Town Board of a plan for preservation of open areas, as well as directing a water quality study financed by the Ford Foundation, Mrs. Gray also enjoys skiing, hiking, swimming, the theater, music and good literature.

One of her hikes, in November 1971, was 300 miles with her husband through the Himalayas to Mt. Everest, during a visit to Nepal.

TACOM Issues Female Employment Statistics

Mary E. Jennings

Jessie Foster

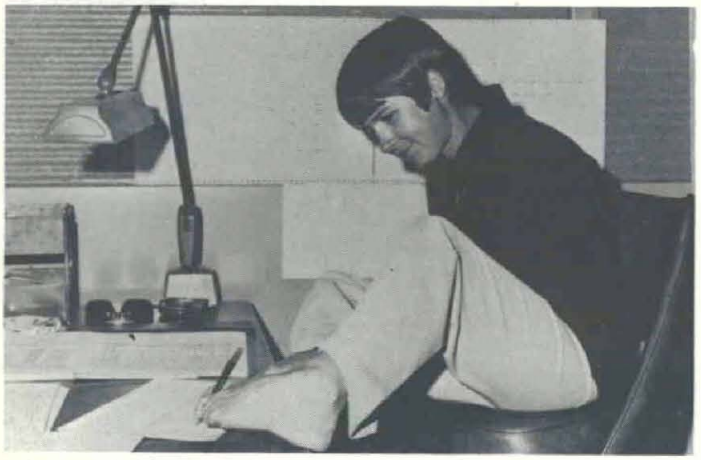
Statistics on employment of women announced recently by the U.S. Army Tank-Automotive Command (TACOM), Warren, MI, reveal that about 20 percent of the total of 1,928 are programed into GS-9 or above positions, including eight who hold GS-13 ratings.

Mary Archambault is a GS-13 mathematician in the Research, Development and Engineering Directorate and is concerned primarily with computations relating to tank automotive design. She has authored numerous technical papers and has an AB degree in science and math from Boston University.

Other GS-13s are Mary E. Jennings, supply systems analyst, Materiel Directorate; Jessie Foster and Palma Galante, program analysts, Project Manager's Office; Gertrude Levine, contract specialist, Procurement and Production Directorate; Annie Newell, operations research analyst, Comptroller; Ruth A. Edwards, management analyst, Comptroller; and Helen F. Cochran, labor management relations specialist, Civilian Personnel Office.

People in Perspective

Self-Reliance, Not Self-Pity . . . DA Handicapped EOY Sets Example



Anyone inclined to self-pity about real or imagined malevolent manipulation by the "fickle finger of fate" can do an abrupt about face, march right, after seeing in action the Department of the Army's petite (4'11") Handicapped Employe of the Year.

Selected also by the U.S. Civil Service Commission as one of 10 Outstanding Handicapped Federal Employes of the Year, Miss Cheryl Lee Maloney will be honored Apr. 3 at Department of the Army ceremonies in the Pentagon, and the following day by White House representatives at federal ceremonies.

Courage, almost to the degree of supremely confident cockiness about her capability to deal adequately with any adversity or any challenge, is ingrained in Miss Maloney, who was born armless 26 years ago and harbors no regrets.

Mr. and Mrs. Gerald C. Maloney of Honesdale, PA, never acted as though they considered their daughter handicapped. Instead, they let natural self-reliance work its wonders. Cheryl learned to do with what The Good Lord gave her—her feet and her teeth to serve in lieu of hands and arms. The dexterity and grace she exhibits in all her movements are incredible to most observers.

Cheryl is a computer programer with the U.S. Army Computer Systems Command Support Group, Fort Hood, TX, known to the Army research and development community as the home of MASSTER (Modern Army Selected Systems Test, Evaluation and Review).

After graduating from Rochester Business Institute (Business Administration and Data Processing), Cheryl entered federal service with the Army's Tobyhanna (PA) Depot. She served about four years as a computer card punch operator and as a remote site computer operator, earning several awards for outstanding performance.

In May 1972, she was one of 20 selected from more than 300 applicants to enter the USACSC Automatic Data Processing Intern Class at its Fort Belvoir headquarters. Promoted six months later for continued outstanding work, she elected to go to Fort Hood for the final 18 months of training. Supervisors there say she has exceeded all job requirements with ease and skill—and without assistance. Her computer technique is described as "flawless."

Coworkers say she has a most pleasant personality and sense of humor. She sets others at ease by disdaining assistance they might naturally expect to give a young lady without arms. For example, don't try to light her cigaret, open a door for her, or perform amenities.

When the time came to travel from Washington, DC, to Fort Hood, Cheryl decided to drive her 1972 Chevrolet Impala convertible. It has a floor disc steering mechanism and "3 on the floor" racing shift, both of which she controls as easily with her feet and toes as other drivers. She can flip the top down or up as easily as a male with hands might.

Friends say Cheryl moves with the grace of the born athlete at whatever she tries—and that includes bowling (ball drilled for her toes), skiing, swimming, miniature golf, and when she is home in Pennsylvania, zooming around in her own snowmobile.

Traveling to "See America First" is one of her hobbies and she prides herself on getting around to many states, including a trip to Hawaii.

'Courting the Stars . . . Redstone Man Enjoys Astronomical Avocation

Nights are never dull for Gert Schmitz; in fact, they seem to be growing more exciting the older he gets and the more experience he gains in pursuing his hobby, which does not qualify him for the Girl Watchers Society.

Schmitz' spare-time fascination is star-gazing, comet watching and studying the universe perhaps as much as 100 million miles away. This interest has tightened its hold during more than 16 years of observation that has yielded rewarding experiences.

During the daytime work schedule at Redstone Arsenal, AL, Schmitz is an aerospace engineer with the Safeguard System Command; but the nights "turn him on" as a member of the Von Braun Astronomical Society. He serves as chairman of publicity and is a former member of the board of directors, which qualifies him to use the 21-inch Casagranian telescope, the largest in the southeastern United States.

While U.S. planning for the space program was still in its infancy, Schmitz took pictures of possible moon landing sites for the Army Ballistic Missile Agency, later to become part of MICOM. Then in 1961 he became the first person in the world to photograph the hard impact of Ranger VI on the moon.

Hesitation following that feat cost him a substantial amount of money. When a publisher offered $5,000 per picture and $10,000 a column for the story, Schmitz delayed a decision to take time to evaluate the pictures. The magazine editor then withdrew the offer.

Cooperation in some international space research projects has added to his "memory bank," such as participation in Operation Moon Blink, a study of a Russian-reported reddish cloud rising from one of the Moon craters. Results added to knowledge for the space program.

Recently, Schmitz was a member of the U.S. team that followed the progress of Comet Kohoutek. Combining his knowledge of astronomy and photography, he produced some "outstanding pictures" of the comet as it passed within 75 million miles of the Earth. He also has photographed moon eclipses, the Orion Nebular, and other planets. Now he is anticipating the early appearance of Comet Inke. The Comet Kohoutek venture spawned a dream, an ambition that promises to keep him even more busily engaged in his hobby. In addition to using electronic photography to take pictures of planets and nearby stars, he hopes to emulate Kohoutek—to discover a comet that will perpetuate his name. Comet Schmitz? The impossible dream? Not in his mind!

ARMY AVIATORS LTC Daniel C. Dugan (right) and MAJ James A. Burke supported the National Aeronautics and Space Administration (NASA) by participating in high-altitude scientific flights observing Comet Kohoutek from an advantage position over the NASA-Ames Research Center, Moffett Field, CA. The pilots were flying astronomers in NASA's Lear Jet (shown above), a 600-mph research aircraft equipped with a 12-inch infrared telescope to make astronomical observations above 45,000 feet. This flight assignment is an outgrowth of NASA-Army activities in which personnel assigned to the U.S. Army Air Mobility R&D Laboratory (USA AMRDL), located at the Ames Research Center, are invited to participate in its research-support missions.

ISEF Winners Return from Japan Science Awards, Nobel Prize Ceremonies

Participation in the 17th Japan Student Science Awards (JSSA) in Tokyo, and Nobel Prize award ceremonies in Stockholm, Sweden, enriched the experience of five young American scientists as winners of top awards at the 24th International Science and Engineering Fair (ISEF) at San Diego, CA.

Administered by Science Service, a nonprofit organization supported by major professional scientific societies, U.S. Government agencies and industrial organizations, the ISEF is designed to popularize science in high schools and to stimulate gifted students to decide on scientific research careers. More than 400 winners in state, regional and other competitive science fairs qualify for ISEF each year.

Termed "Operation Cherry Blossom," the Japan trip was initiated in 1963 under the auspices of the Army, Navy and Air Force. Presently, the U.S. Army and General Motors Corp. (GMC) sponsor one student each for the trip. The Army, Navy and Air Force have joined since 1972 in sending one student representative each to the annual Nobel Prize ceremonies in Stockholm.

This year's Operation Cherry Blossom winners, June Anne Vayo (Army) and John C. MacGuire (GM), were greeted by Their Imperial Highnesses Prince and Princess Hitachi at the JSSA commendation ceremonies. The JSSA portion of the trip is sponsored by the *Yomiuri Shimbun,* one of Japan's leading newspapers.

The American students also met with Hiromi Onomura and Takayuki Nagashima, JSSA winners who will represent Japan at the 25th ISEF scheduled for May 1974 at Notre Dame University, South Bend, IN.

June Anne had an opportunity to visit Sagamihara City, her birthplace, about 40 miles from Tokyo, where her father was stationed while serving with the U.S. Navy. MacGuire was able to visit the Sugamo Prison site where his father had been held as a Prisoner of War in 1945.

Army officials attending the JSSA ceremonies included BG Ross R. Condit Jr., chief of staff, U.S. Army Japan, and COL John D. Marshall Jr., commander of the U.S. Army R&D Group, Far East. Escorting the students on both trips was Mrs. Dorothy Schriver, assistant director of Science Service. Mrs. Bertha H. Cory, U.S. Army Research Institute for the Behavioral and Social Sciences, Office of the Chief of R&D (OCRD), was the Army escort for the trip to Japan.

OPERATION CHERRY BLOSSOM (OCB) winners and escorts during visit to Camp Zama. From left are Mrs. Dorothy Schriver, John MacGuire, June Anne Vayo, Mrs. Bertha Cory, and BG Ross R. Condit Jr., chief of staff, for the United States Army Japan.

THEIR IMPERIAL HIGHNESSES Prince and Princess Hitachi and Mitsuo Mutai, president of the *Yomiuri Shimbun* newspaper greeted Japan Student Science Awards, OCB winners.

The itinerary included visits with Scientific Attache Myron Kratzer and members of his staff at the American Embassy in Tokyo, and a trip to Camp Zama where they met with COL Elwood Odom, commander of the U.S. Army Hospital. They also toured the Fuchu Plant of the Nippon Electric Co., the Yomiuri Newspaper Plant, and, by special arrangement, visited the Katsura Detached Palace, normally not open to the public.

June Anne, now a freshman at Harvard University, was selected for the trip as a result of her ISEF research project, "Mental Retardation and Eidetic Imagery: A Correlative Study." MacGuire was selected for "Slats as High-Lift Devices." (See July-August 1973 issue of *Army R&D Newsmagazine*, p. 24, for further information on the 24th ISEF.)

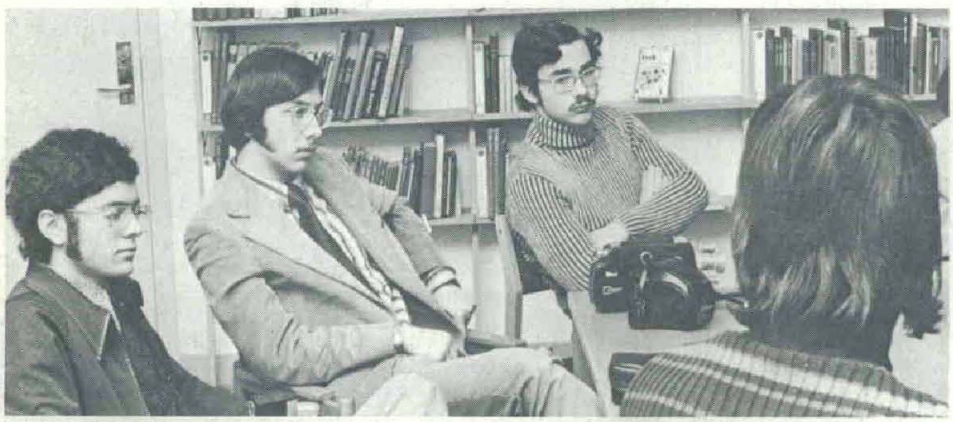
Nobel Prize award ceremonies in Stockholm, Sweden, were viewed this year by Robert Silverman (Army), Marvin Slepian (Navy), and Glenn Greene (AF). On their way to Stockholm, the students and escorts stopped in London to tour Westminster Abbey, the British Museum of Art, and Buckingham Palace where they saw the Changing of the Guard.

The visitors held a panel discussion with scientists from U.S. Army, Navy, and Air Force Branches of the U.S. Research Office in London, and also visited the American Embassy. Students had an opportunity to take independent trips to scientific institutes engaged in their specific fields of interest.

In Stockholm, the ISEF winners met with American Nobel laureates Prof. Ivir Giaever and Dr. Leo Esaki, who shared a prize in physics with a British scientist, and attended a press conference of Prof. Wassily Leontif, economics prize winner.

They also met with Dr. Uno Holmgren of Brannkyrka Gymnasium, visited the Carolinska Institute, and were escorted on walking tours by Swedish students including Ulf Thornberg, the Swedish science fair winner they had met at the 24th ISEF.

Silverman represented the Army in Stockholm for his exhibit "The Biochemical Process of Genetic Change," which depicts how chromosomal genetic aberrations are induced by irradiation. Slepian's award-winning exhibit was titled, "Bacteriophage T5 Pseudovirions," and Greene's display was "Fusion Containment Using Plasma Shock Waves."



WINNERS of trip to Sweden for Nobel Prize award ceremonies (from left), Glenn Greene, Marvin Slepian and Robert Silverman, during visit to Brannkyrka Gymnasium. Escort Arleen Plecenik, assistant public information officer, Office of Naval Research, is at right.

Army Plans CY 1974 Final In-Process Review Of Portable Landing Light System Prototype

By Alvin E. Gates

Formal In-Process Review (IPR) of a new Portable Landing Light System (PLLS), tested at Modern Army Selectee System Test Evaluation and Review (MASSTER) with excellent results, is scheduled soon.

Developed in response to a Project ENSURE (Expedited, Non-Standard Urgent Requirement for Equipment), received by the U.S. Army Land Warfare Laboratory from American Forces in Vietnam, the PLLS prototype was produced by ELCO Corp. on contract.

In the combat zone the prototype system performed well enough to warrant recommendation for type classification "Standard A" with modifications to increase its versatility and visibility capabilities. Following these refinements, the U.S. Army Mobility Equipment Research and Development Center, Fort Belvoir, VA, conducted extensive operational testing, including extreme environmental conditions.

MERDC personnel determined that the improved PLLS offered great potential for combat aircraft requirements, and arranged for delivery of the system to MASSTER in late 1972 for User Evaluation Tests. Pending final IPR acceptance, the PLLS is tentatively scheduled for delivery to field units during FY 74-75.

The PLLS consists of high-intensity flashing lights (landing lights), relatively low-intensity steady-glow lights (marker lights), a remote control unit, a central power unit, mounting stakes, color filters, and cable and reel assemblies. Marker and landing lights can be interconnected by the cable assemblies and the system can be remotely controlled. The single remote control unit looks like a garden-variety flashlight and uses four "D" cell batteries (6 volts)

Each light is powered by an internal 6-volt battery (BA-200). However, for AC operation, a central power unit allows a string of connected marker lights to operate without internal batteries. This permits use in extreme cold weather without performance degradation (6-volt batteries are severely limited in power at temperatures below zero C).

The battery-powered landing lights provide a high-intensity flash of approximately 12,000 candlepower visible from 5 to 7 miles.

Each landing light is equipped with a control knob to provide independent, sequential or simultaneous flashing. Landing lights set in the simultaneous mode flash simultaneously with the preceding light; those in the sequence mode flash 0.2 seconds after the flash of the preceding light. Because of these features, many types of aircraft landing patterns are available.

Tests at MASSTER were conducted to "determine the extent to which the PLLS provides an improved capability over currently authorized equipment to establish and operate temporary or semi-permanent tactical landing zones in darkness and reduced visibility."

The portable landing light system in current use is commonly called the "bean bag" light set because each light sits on a ballast bag. The set contains 12 lights, each self-contained, battery-operated, and manually switched for steady or flashing light.

MASSTER results showed that the PLLS is much more effective than the present system. In addition, MASSTER reported that the PLLS has major advantages over the presently authorized 1½ KW Airfield Runway Light Set. In fact, the PLLS offers operational and cost advantages over existing Army aircraft light sets.

As a result of the MASSTER determinations, the Army Materiel Command is proposing that the PLLS undergo DT III (Initial Production Testing) and, if successful, that a Special In-Process Review be conducted to type classify the PLLS "Standard A."

ALVIN E. GATES JR. is employed as an electrical engineer with the Electrotechnology Department, Power Engineering Division, U.S. Army Mobility Equipment Research and Development Center (MERDC), Fort Belvoir, VA. He earned a BS degree in physics from West Virginia Wesleyan College and has done graduate work at American University in Washington, DC.

Gates has published MERDC Report 2064 on Improved Airfield Runway Light Set, Operational Area, Aircraft: 1½ kw, *and a U.S. Naval Weapons Laboratory Report on* Investigations of Electromagnetic Radiation Hazards to the Improved TARTAR Missile, Mark 15 Mod 1, on board the Dupeti Thours.

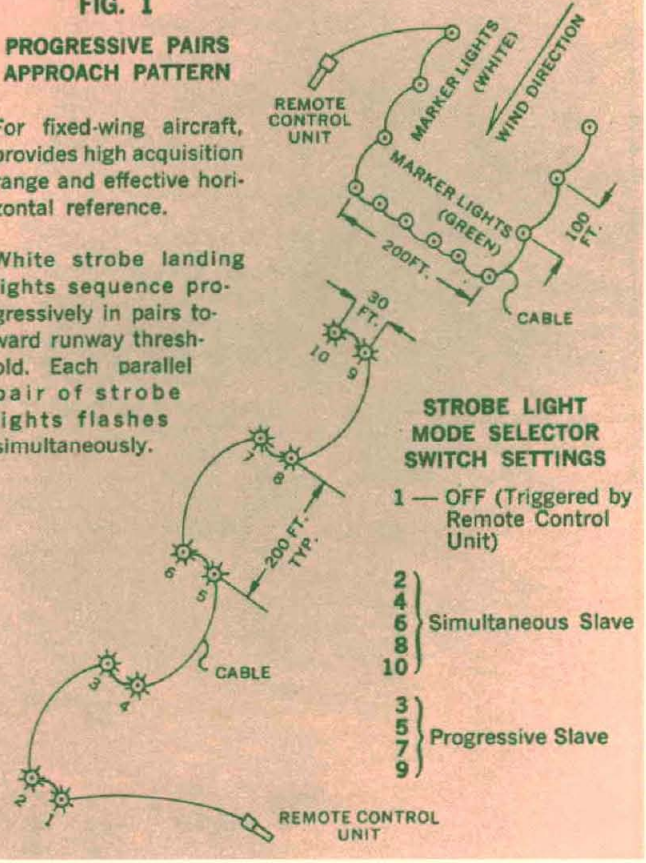
SYSTEM APPLICATIONS: Below are two typical integrated systems utilizing strobe landing lights and incandescent marker lights. Strobe lights in PROGRESSIVE SLAVE mode flash 0.2 seconds after the flash of the preceding light, or can flash simultaneously.

FIG. 1

PROGRESSIVE PAIRS APPROACH PATTERN

For fixed-wing aircraft, provides high acquisition range and effective horizontal reference.

White strobe landing lights sequence progressively in pairs toward runway threshold. Each parallel pair of strobe lights flashes simultaneously.



STROBE LIGHT MODE SELECTOR SWITCH SETTINGS

1 — OFF (Triggered by Remote Control Unit)

2, 4, 6, 8, 10 } Simultaneous Slave

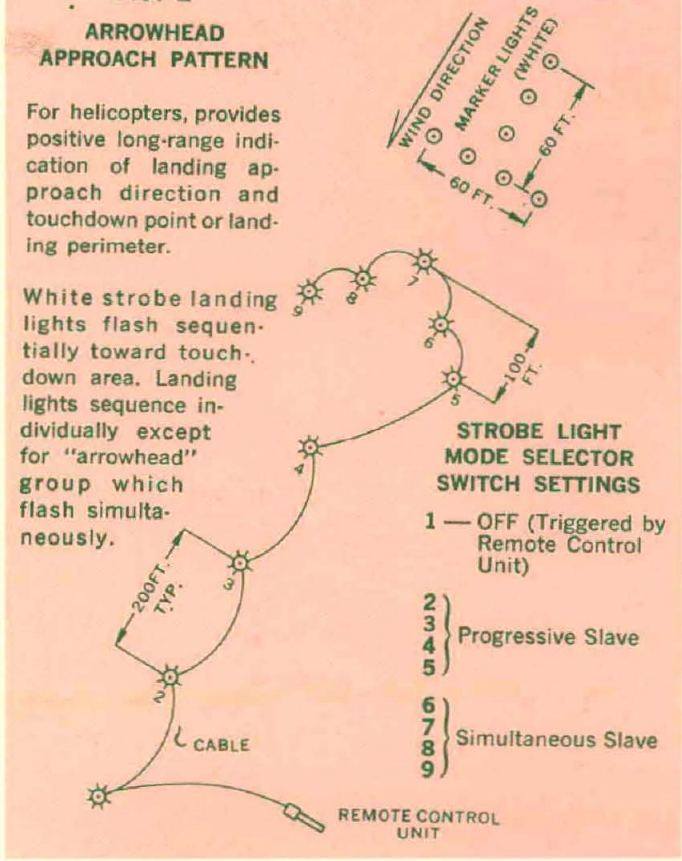
3, 5, 7, 9 } Progressive Slave

FIG. 2

ARROWHEAD APPROACH PATTERN

For helicopters, provides positive long-range indication of landing approach direction and touchdown point or landing perimeter.

White strobe landing lights flash sequentially toward touchdown area. Landing lights sequence individually except for "arrowhead" group which flash simultaneously.



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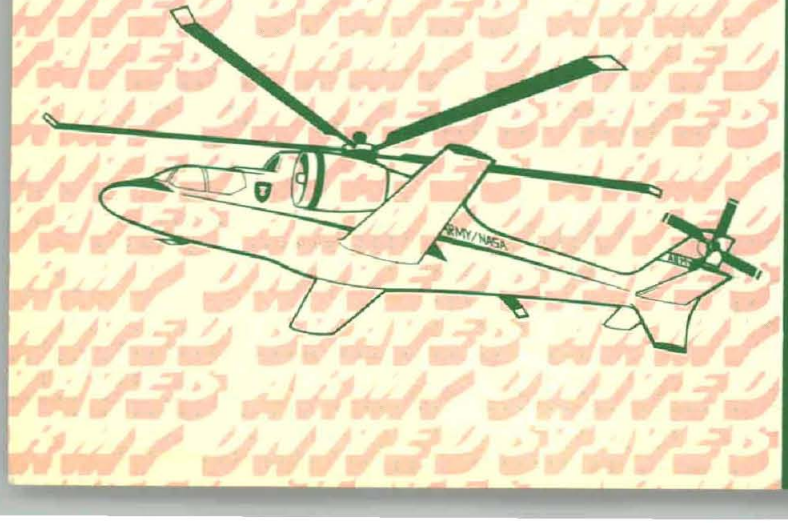
ARMY/NASA