ARMY RESEARCH AND DEVELOPMENT

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ASA (R&D) Reviews Problems in Major Policy Addresses

AOMC Reorganizes for Management Economies

Reorganization of the Army Ordnance Missile Command at Redstone Arsenal, Huntsville, Ala., to achieve management economies and effect maximum utilization of personnel was announced last month.

Functions within the AOMC Headquarters are now consolidated through discontinuance of the Army Ballistics Missile Agency (ABMA) and the Army Rocket and Guided Missile Agency (ARGMA).

Major organizational elements of the new AOMC, as announced Dec. 12, include: Office of the Vice Commanding General, headed by Maj Gen Francis J. McMorrow, who became Deputy CG of AOMC July 17, 1961; Office of the Deputy CG for Ballistic Missiles, headed by Brig Gen John G. Zierdt, formerly CG of ARGMA; Office of the Deputy CG for Ballistic Missiles, headed by Brig Gen Richard M. Hurst, formerly CG of ABMA.

Under the change three new staff offices are established, namely: Plans and Programs, Management Services, and Missile Systems

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Assistant Secretary of the Army (R&D) Dr. Finn J. Larsen impressed important audiences as a practical, hard-hitting scientific administrator in several policy addresses this past month on problems related to military materiel production.

Among problems he discussed in blunt, plain-spoken language are the urgency of greatly expanded basic research, methods of reducing lead time from research to production, essentiality of getting utmost value for R&D expenditures, increased utility of military products, and measures to insure more effective utilization of scientists, engineers and technicians.

Speaking on the "Army-Industry Approach to Research" in Minneap-

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Well Pumps Chemical Waste 2 Miles Into Earth

A well that will pump neither oil nor water but reaches two miles into the earth has attracted the attention of both pertoleum and commercial chemical interests.

Located at Rocky Mountain Arsenal, Colo., the well is being drilled for the U.S. Army Chemical Corps to dispose of chemical wastes stemming from manufacturing processes at the Arsenal.

The shaft, deepest ever sunk in Eastern Colorado, will probably plunge through oil bearing sands, geologists said, and for this reason oil men have watched the drilling with interest. Petroleum interests have been permitted to inspect drilling samples and cores and other re-

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Reliability Parley Papers Invited

The Department of the Army is participating in the Seventh Military-Industry Missile and Space Reliability Symposium scheduled June 18-21, 1962, at the Naval Air Station, North Island, San Diego, Calif.

Technical and scientific papers are invited from all Army Technical Services, other Government agencies and industry in any of the following areas: Reliability in Action; Human Factors and Reliability; Reliability Design Techniques; Cost of Unreliability; and Reliability in Space.

Details for submission of papers may be obtained from Sumner Meisselman, Reliability Engineer, Management Analysis Division, OCRD, DA, Oxford 56525, Washington, D.C.

Experimental 85-lb. Portable X-Ray Scheduled for Field Testing

Delivery of a prototype of the Army's new portable, 85-pound field X-ray is scheduled early this month for use in a field testing program preliminary to evaluation for production.

The new unit can be carried on the back of a soldier and is designed to perform most of the more important functions of the present field X-ray weighing approximately 1,000 pounds.

Attendees at the 1961 meeting of the Association of the U.S. Army in Washington, D.C., viewed the experimental unit in its first major public demonstration early in September. But a more practical demonstration had been given the previous month

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FEXITRON, the Army's new portable, lightweight field X-ray unit, is self-powered and can be operated by one man during combat conditions.

Army R&D Newsmagazine

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CRD Urges Army-Industry Teamwork in NAM Address

(Lt Gen Arthur G. Trudeau, Chief of Research and Development, addressed the National Association of Manufacturers in the Waldorf-Astoria Hotel, New York City, on Dec. 7. He made a stirring appeal for Army-industry teamwork and maximum effort. The following is an excerpt from that speech.)

"Today, the basis of national security, in the military sphere, shifts—and almost momently—ever deeper into the area of scientific research and development. Today's weapon is tomorrow's relic! The nation which fails to see—or disregards—the emergent import of science and technology—no matter how varied and extensive its national resources—is doomed with sickening certainty to the path of decline and fall so well and terribly marked in the annals of past civilizations. . . .

"Historically, characteristically, nations have underestimated the vast potential of science—the wide range and extent of its practical applications. . . .

"In this sense, contributions of American manufacturers to the muscular readiness of United States and Free World forces must be all encompassing—continually reflective of the great concept of Army-industry partnership which so long has marked our mutual dedication to the defense of this Nation. . . .

"In the Free World military sphere it is essential that this Nation and our Allies enjoy unqualified superiority in weapons, equipment, and trained troops. Somehow, as the President emphasized, this must be done within a sound, safe budget framework—designed within our national economy to be adequate for the task at hand. . . .

"On the industrial front, much needs to be done in modernizing our industrial base. The exploitation of new materials, the use of great extremes of temperatures and pressures, the requirements for fine tolerances and great reliability, pose problems that can only be efficiently and economically resolved by new machine tools and automated equipment. While military production demands these advances today, commercial production demands them for tomorrow.

"In this highly competitive world, nothing less will keep us on top in the '70s. Hand in hand is the need for concurrent adjustment and implementation of enlightened employment policies.

"The application of more efficient and austere management policies is likewise a challenge to both Government and industry. Cost reductions and greater application of Value Analysis is essential. We can afford to defend ourselves, whatever the cost, but we can't afford to waste any dollars doing so. . . ."

AOMC Reorganizes for Management Economies

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Safety. Chiefs of these offices, and of the Office of the Chief Engineer, had not been assigned as the *Newsmagazine* went to press.

Established also is a Missile Intelligence Office and three operational elements designated as: Research and Development, Field Support, and Industrial Liaison.

Project offices established under control of the Deputy CG for Guided Missiles include: Nike Zeus, the Field Army Ballistic Missile Defense System, Mauler-Red Eye, Hawk-NATO, Antitank and Field Artillery Weapon Systems, Nike Hercules-Ajax and Target Missiles. An office as yet unnamed will handle projects managed by the AOMC for the National Aeronautics and Space Administration, and the Advanced Research Projects Agency.

Project offices established under control of the Deputy CG for Ballistic Missiles include: Pershing Missile, Sergeant Missile, Small Rockets, Missile "B," Honest John, Little John, and Redstone-Corporal.

Maj Gen August Schomberg, Commanding General, AOMC, stated that assignment of personnel to new staff agencies and project offices will be made by mid-spring.

Effective May 15, 1962, the AOMC will separate 820 of its 5,692 civilian employees and employ approximately 170 employees in other skills categories to provide a balanced work force compatible with the new organization structure.

Notice of intended termination was given Dec. 1 to affected employees. The Department of the Army is seeking to place as many of them as possible with the Marshall Space Flight Center, which is employing additional personnel during the next few months.

Coordination likewise is being established with other Ordnance and Department of the Army activities, the U.S. Civil Service Commission, U.S. Employment Service, other Federal agencies, and with public and private employers, to minimize such personnel and economic impacts as might otherwise result from the AOMC consolidation.

ASA (R&D) Reviews Problems in Major Policy Addresses

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olis, he was sharply critical of R&D practices he believes are retarding progress, wasting highly skilled manpower of which the Nation is critically in need, and unduly increasing production costs of military materiel.

In Minneapolis, where he was Vice President in Charge of Research for the Minneapolis Honeywell Regulator Co. until he resigned to accept his Defense post in July, Dr. Larsen addressed the Vehicular Communications Group, Institute of Radio Engineers. In part, he stated:

". . . In the not too distant past, the primary objective of our research efforts were a rising standard of living for mankind and a prolongation of human life. Today, in addition to these, rising threats of aggression have forced us to broaden the objectives to include security of the Free World and the exploration of outer space. . . . The Communists consider this struggle between themselves and us as a matter of life or death—and the time has come when we must think likewise. . . .

"As technological progress accelerated in the last 20 years, so did the emphasis on basic research. During World War II, we recognized that improved weapons, radar and the atomic bomb depended upon basic research conducted in the thirties and early forties. If American technology is to continue to expand and to accelerate, great emphasis must be maintained on basic research.

"Basic research penetrates the expanding boundaries of science to provide the ever-growing requirements for improved technology. Without this necessary ingredient, technology is limited to product improvement. And, as you all know, any business dependent only upon product improvement is doomed to be short-lived. . . ."

Calling attention to the Army separation of R&D into two categories, in-house laboratories and basic research grants to nonprofit basic research organizations or contracts to industrial firms, the Secretary said:

"An in-house capability pays high dividends in the form of creating and maintaining the Army's technical and administrative competence in the design, evaluation and direction of projects, but we also appreciate the necessity for maintaining a balance between our own competence and cost, and the competence and cost in private industry.

. "I feel that we now have a reasonable balance in funding between these two. However, we are initiating certain internal measures to improve the quality of our in-house capability without significant increases in funding. Let me assure you that we will continue to contract for the bulk of our research and development. For that reason, I should like to discuss some problem areas of mutual interest in which improvements are needed. . . .

That feeling of having hold of the tail of a tiger and not knowing how to let go has pestered Lt Col K. C. Emerson at times during his Army career. But he seems to have the situation well in control, as shown here during a recent visit to the Jungle Warfare Training Center zoo, Canal Zone. The Assistant for Research to Secretary of the Army (R&D) Dr. Finn J. Larsen was briefed on JWTC activities and the program of the Mid-America Research Unit.

"LEAD TIME. Concerted effort is required from both industrial and governmental decision-making agencies, if we are to shorten lead time. Our military departments have on occasion been criticized for administrative delays which in a few instances have equaled the actual development time. In other cases, decisions have been made swiftly and the administrative actions have not delayed the development program.

"Some of the organizational changes which are taking place in the Army will, in the very near future, affect our research and development organization. In every case, the changes are being made in such a manner that it will be easier to achieve responsible and prompt decisions.

There are, of course, many other problems in lead time—some resulting from initially unrealistic funding, some from frequent changes, some from lack of the required technology, and at times from an inadequate number of engineers and scientists being assigned to a project.

"COSTS. During the last decade, the cost of research and development work has doubled. Most of this has resulted from a direct increase in the salaries of all technical and scientific personnel. In some cases, we compound the increase in cost by administrative delay either in industry or in Government. In these cases, project costs continue at approximately the same rate during a delay as when these men are actively working on the project. . . .

"Overruns are of great concern to the Army and to the other military departments. These can be reduced by more accurate cost estimates and through the initiation of a minimum of changes in contracts after they have been let. Perhaps this can be accomplished by rewarding the company that delivers at lower than anticipated costs and penalizing the company that has appreciable overruns.

"I am convinced of the absolute necessity of radically improving industrial performance in the cost area. To some degree the Army has begun using incentive clauses in its contracts, and we will attempt to introduce them whenever possible.

"GREATER UTILITY OF PRODUCT. This important attribute can scarcely be overemphasized. The objective of any development is a better weapon, a better communication system, a more effective vehicle, or any similar improved tool for our fighting forces.

"Unfortunately, there are situations in which we are asked to spend money with little additional utility. Not long ago, I reviewed an Army project in which a special-purpose vehicle with extensive electronic equipment was proposed as an important addition to a weapons system. The development cost of the proposed special-purpose vehicle and equipment was approximately equal to that of the weapons system as previously planned.

"The weapons system accounted for 95 percent or more of the utility, and the special-purpose vehicle augmented the effectiveness of the weapons system. At times, of course, military requirements are stated in such a manner that it is easy for a manufacturer to conceive fringe improvements which contribute little to the Army's role, but which often cost a great deal.

"MANPOWER UTILIZATION. The demands for our engineers and scientists have grown steadily during the last few years. During some of the recent years, increased military spending has gone up at about the same percentage rate as the cost of research and development; this has been due largely to salary increases.

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WRAIR Initiates Series of Medical Seminars on New Techniques

Advances in medical science at Walter Reed Army Institute of Medical Research are being reported in a recently inaugurated series of seminars open to the medical public in the metropolitan area of Washington, D.C.

More than 200 medical personnel attended the introductory seminar in Sternberg Auditorium Nov. 30 to hear Maj Kevin G. Barry discuss "Acute Renal Failure in Humans: Its Prevention and Treatment by the Intravenous Infusion of Mannitol."

Lt Gen Leonard D. Heaton, the Army Surgeon General, and Col Conn L. Milburn, Director of WRAIR, participated in the inaugural ceremony, attended also by representatives of the Armed Forces, Veterans Administration, U.S. Public Health Service, and Washington area hospitals.

Future staff seminars are scheduled Jan. 25, Mar. 1, Mar. 22, and thereafter on the fourth Thursday of each month. Programs will be announced in invitations mailed to Washington area hospitals and medical personnel.

In his presentation Dr. Barry pointed out that, using conventional treatment of renal failure patients, those who survive go through long periods of suffering and expensive, tedious medical care before function of the kidney returns. Mannitol therapy, he said, not only decreases the suffering but has saved many patients from death.

Dr. Barry, Chief of the Department of Metabolism, WRAIR Division of Medicine, described a controlled study of 14 patients undergoing surgical removal of aneurysms (blood-filled sacs) from the main abdominal artery. A control group was compared with a group in which mannitol was used intravenously to prevent shutdown of the kidneys during surgery. Mannitol infusion, he said, proved effective in preventing renal shutdown.

In a related study, 24 patients already considered to be in a classic renal shutdown were given mannitol therapy, and 16 responded to treatment. The severe therapeutic restrictions and the above average 50 percent mortality rate associated with conventional therapy were circumvented, Dr. Barry reported.

Mannitol infusion is capable of preventing or interrupting acute functional renal failure and its progression to acute organic renal failure, Dr. Barry concluded. It was stated that this form of therapy is recommended as a potentially safe and effective method of decreasing the incidence of lethal kidney failure.

A general discussion of the subject followed Dr. Barry's presentation. Additional comments were made by Dr. Samuel R. Powers, Jr., Chief of the Department of Experimental Surgery, Albany Medical College, Union University, Albany, N.Y.; Lt Col Thomas J. Whalen, Chief of Peripheral Vascular Service and Assistant Chief of General Surgery Service, Walter Reed General Hospital; and Lt Col Paul E. Teschan, Chief of the Department of Surgical Physiology, Division of Basic Surgical Research, WRAIR.

AT INITIAL STAFF SEMINAR—From left, Col Conn L. Milburn, Jr., Director of Walter Reed Army Institute of Research; Lt Col Thomas J. Whalen, Assistant Chief of General Surgery Service and Chief of Peripheral Vascular Service, Walter Reed General Hospital; Lt Gen Leonard D. Heaton, U.S. Army Surgeon General; Maj Kevin G. Barry, Chief of the Department of Metabolism, Division of Medicine, WRAIR; Lt Col Paul E. Teschan, Chief of the Department of Surgical Physiology, Division of Basic Surgical Research, WRAIR; and Dr. Samuel R. Powers, Jr., Chief of the Department of Experimental Surgery, Albany Medical College, Union University, Albany, N.Y.

Tripartite Working Group Meets To Develop Joint Effort Plans

United States, British and Canadian Army members of the Tripartite Ad Hoc Working Group on Priority Standardization Effort met recently in Washington, D.C.

The purpose of the meeting was to develop proposals for priority standardization among the three Armies and to recommend sponsorship of particular projects in order to enhance the ABC standardization effort, eliminate duplication and effect savings in money and time.

Maj Gen Dwight E. Beach, Deputy Chief of Research and Development, Department of the Army, chairman and head of the U.S. Army delegation, was presiding chairman. Representing the British War Office was Maj Gen A. P. W. Hope. The Canadian Army was represented by Brig H. W. Love.

Well Pumps Chemical Waste 2 Miles Deep Into Earth

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ports on the well to determine if commercial quantities of oil may lie beneath the Denver area.

Safe disposal of waste has long been a problem for the chemical industry. By pumping the wastes, at a minimum rate of 400 gallons per minute, into a 1,000-foot-thick sandstone layer sandwiched between shale and precambrian era granite, pollution of water will be avoided as well as some of the handling problem of chemical waste.

To a depth of 125 feet the well was drilled 24 inches in diameter. The huge, 1425-hp. drilling rig then cut the shaft 17½ inches in diameter to the 2,000-foot level. The next 9,400 feet will be drilled at a diameter of 11 inches.

A waste treatment plant has been designed to be used in connection with the well to remove any solid material that might otherwise plug the shaft. The treatment plant will also sterilize the waste to prevent bacteria growth.

Waste material will be pumped through a 5½-inch diameter tube set inside the well. When it reaches the 10,000-foot level, the wastes will be sealed off into the sandstone.

Elaborate precautions will be taken against failures that would allow wastes to leak into useful strata of the earth's crust. The tubing should resist corrosion over a 50-year period, scientists believe, and the area between the shaft wall and the tubing will be pressurized. Changes in pressure and possible leaks will be shown by recording gauges.

The 3,000-foot-thick-layer of shale overlying the sandstone, which geologists say should absorb waste material in great quantities, also will prevent the wastes from entering other strata.

Nike Zeus Scores Impressive Test Firing Successes

In its most impressive test up to the time that this publication went to press, the Nike Zeus on Dec. 9 scored a "complete success" in a low-altitude flight down the Pacific Missile Range. All previous tests had been at high-altitude flights—easier to control with ground-based radar.

The 48-foot solid-fuel Nike Zeus is scheduled for firing against a small rocket called Speedball at Kwajalein in the near future and in coming months against Atlas missiles launched from Vandenberg Air Force Base, Calif.

Objectives of recent tests have included further evaluation of the missile's aerodynamics, propulsion system, guidance and control system, and control of the missile with the electronic brain on the ground. The "brain" collects data on oncoming targets and directs the Nike Zeus nuclear warhead to its intercept.

Army missile leaders have joined in stoutly rebutting claims of skeptics regarding capability of the Nike Zeus detection system to discriminate between an oncoming warhead missile and missile dummies (decoys) which might be fired by the enemy to confuse the defense.

Nike Zeus firings have been in progress since August 1959 at White Sands Missile Range though limitations of the 100-mile long range prevented full-range, high-altitude tests until the Pacific Missile Range was brought into action. Army missile leaders say test results at both ranges have helped to accelerate the Nike Zeus development.

The first-stage booster motor develops a thrust of 450,000 pounds, making it the most powerful single grain motor operational in the Free World. The sustainer motor takes the missile warhead to its target after the main stage drops free. If final maneuvers are required to bring the target within the lethal radius of the warhead, the third motor is fired.

Prime contractor for Nike Zeus is the Western Electric Co. Responsibility for system development is carried by Bell Telephone Laboratories. Douglas Aircraft Co. builds the missile. Development is under technical supervision of the Army Ordnance Missile Command, Redstone Arsenal.

NIKE ZEUS—Only antimissile missile system under active development by U.S. is designed for use against intercontinental ballistic missiles.

ARPA Funds Contributing To Fuel Cell Research

With funds obtained from the Advanced Research Projects Agency, the Army has awarded a $391,000 contract to the Esso Research and Enginering Co, of Linden, N.J., to proceed with research which promises to lead to a "breakthrough" in fuel cell development.

The projected Esso fuel cell system is designed to use methanol or ethylene glycol for fuel, air as the oxidant, and an electrolyte which rejects the products of reaction.

So far as is known, this is the first time that anybody will have put together a system which would operate at low temperatures and essentially atmospheric pressure, using carbonaceous fuel and air, and an electrolyte that does not require continuous replacement or regeneration—a significant combination from economy and logistics viewpoints.

The Esso research and development program is envisaged as requiring two or three years for completion.

Experimental 85-lb. Portable X-Ray Scheduled for Field Testing

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when the device was instrumental in saving a man's life at McMinneville, Ore., where it is being developed. (See page 16, September issue.)

Inventor of the new FEXITRON unit is Dr. W. P. Dyke, president, Field Emission Corp. of McMinneville. It is self-powered and can operate on rechargeable batteries, or any standard military vehicle battery—an important feature during combat or disaster conditions when conventional utilities are not available.

Research and development of the unit for field use was initiated under a contract supported by the U.S. Army Medical Service Research and Development Command.

Operating at such speed—1/1000 of a second—that films are not blurred by movement during chest radiography while the patient is breathing normally, the unit is designed for use in an ambulance, helicopter, or other vehicle in a combat area. This feature is important when the patient is dazed or unconscious and is not able to "hold his breath."

Army medical authorities have pointed out that, important as the new X-ray unit is for combat requirements, it has perhaps more widespread significance for civil defense purposes when quick use of X-ray can be a life-saving factor, particularly in isolated areas or devastated areas where larger conventional X-ray units would not be usable because of lack of power.

Similarly, the portable, self-powered X-ray could prove invaluable to physicians working under primitive conditions in underdeveloped areas of the world where adequate equipment is scarce and power sources are often nonexistent.

The unit occupies only one cubic foot of volume. The tube head of the FEXITRON is in the form of a pistol; to take the radiograph, the operator simply pulls the trigger.

Key to the unit is a new type high current X-ray tube which is made possible by a newly practical electron source, field emission, which is a cold, metallic needle emitting electrons into a vacuum when exposed to a high electric field. It is not necessary to heat this electron source, which avoids conventional heater supplies and accounts in part for the reduced weight of the unit.

Another useful property of the field emission electron source is its high current density; it gives a million times more current per unit than conventional heated cathodes. Since current density is proportional to the radiographic information rate, in lay terms this makes possible a very short exposure time (down to 0.03 microsecond in other FEXITRON equipments) and detailed sharpness in the photograph.

Army Orders Winter Kit For Mohawk AO-1 Plane

Installation in a Grumman Mohawk aircraft of a hand-start winterization kit powered by an 80 hp. Titan gas-turbine engine has been ordered by the U.S. Army.

The Model AO-1 Mohawk twin-engine, turbine-powered aircraft is currently in production by Grumman Aircraft and Engineering Corp. Developed to meet specific Army requirements, the aircraft is used for aerial observation and surveillance.

Installation of the lightweight turbine winterization unit will be performed by Grumman, and the complete aircraft will undergo testing and evaluation this winter by the U.S. Army Arctic Test Board at Fort Greely, Alaska.

The T-62T-14 kit will have a hand-start system and be able to deliver full output within a minute under arctic conditions. In addition to providing electrical power for main engine starting, the unit is equipped with a bleed port for cabin heating and windshield defrosting.

The new kit utilizes the same basic Solar T-62 turbine produced for the Army for installation in the HC-1B Chinook transport helicopter, the AC-1 Caribou STOL transport, and a prototype all-purpose aircraft service kit.

CmlC, HEW Studying Prevention of Contamination

Investigation of the vulnerability of commercial food and drugs to possible contamination from enemy biological agents is in progress as a joint effort of the U.S. Army Chemical Corps and the U.S. Food and Drug Administration, Department of Health, Education & Welfare (HEW).

Dr. Glen G. Slocum of HEW, Washington, D.C., and James A. Kime of the Army Chemical Corps Biological Laboratories, Fort Detrick, Md., are coordinating the research program. Civil Defense funds are providing partial support for the project. Technical information developed will be made available to CD authorities and the food and drug industries.

Impetus for the project was provided by a report of the Civil Defense Foods Advisory Committee of the National Academy of Sciences, National Research Council. The committee, composed of nationally prominent chemists, bacteriologists, and members of the food processing industry, concluded that:

"Under present conditions of food manufacture, packing and distribution, it would be possible to contaminate sufficient food with biological agents to impair the health or endanger the lives of large numbers of people scattered over wide areas in the United States."

Initial emphasis in the research project is being given to the study of what the persistence of pathogenic microrganisms might be in various food products. Such studies are expected to provide information indicating how food processing techniques can be adjusted to assure safe products and lead to the development of rapid and certain safety checks for finished food products.

Both civilian and military benefits are expected from the joint study. Information and processes developed to aid in the protection of civilian food supplies will be equally applicable to military food.

U.S., Canada Cooperating To Develop Mauler System

Cooperative development of the U.S. Army Mauler air defense missile system is being undertaken on a cost-sharing basis by the United States and Canadian governments in a $1.7 million contract awarded to DeHavilland Aircraft Corp. of Canada, Ltd., for work on an infrared acquisition unit.

Designed to destroy supersonic enemy aircraft, short-range ballistic missiles and rockets in the battlefield area, the Mauler is the U.S. Army's newest air defense missile system under development.

Overall responsibility for Mauler development is vested in the Army Rocket and Guided Missile Agency, which will provide technical supervision to DeHavilland. The contract coordination is through the Detroit Ordnance District.

Technical guidance will also be furnished by General Dynamics Corp. of Pomona, Calif., prime contractor.

Statistics Point Up Government Problem

Findings in surveys conducted by the U.S. Civil Service Commission and the U.S. Bureau of Labor Statistics may be used to support demands for higher salaries for Government R&D personnel when Congress reconvenes.

Top Government officials have been diligent in recent months in pointing to the increasingly difficult problem of retaining top quality scientists and engineers against competition from industry in the form of higher salaries and other incentives.

Bureau of Labor Statistics findings in 1960 were based on data collected from 1,606 business firms in 60 metropolitan communities. The comparison of salaries paid by the Government and industry for similar work by engineers, scientists, personnel managers, auditors, accountants and attorneys showed (first figure, Government; second figure, private business):

GS-12—$9,735 and $11,125; GS-13—$11,415 and $13,500; GS-14—$12,990 and $15,050; GS-15 — $14,705 and $20,175.

Similarly, the U.S. Civil Service Commission collected data on comparative salaries paid by Government and 21 large nationwide corporations to R&D directors, plant managers, finance directors, personnel directors and lawyers, as follows:

GS-16—$15,255 to $16,295 and $20,000 to $30,000; GS-17—$16,530 to $17,570 and $27,500 to $37,500; GS-18—$18,500 and $32,500 to $45,000.

Research Director Assures OSWAC on Coming Change

Impending reorganization of the Army research and development structure is expected to permit the Ordnance Special Weapons-Ammunition Command at Picatinny to "remain substantially as it now exists," the Director of Army Research stated during a recent visit to Picatinny Arsenal, Dover, N.J.

Maj Gen William J. Ely, in his discussion with Maj Gen W. K. Ghormley, Commanding General of OSWAC, stated that the future of Army research looks more promising than at any time in recent years.

Huachuca IRE Unit Considers Army Drive to Cut Lead Time

The Army's plan to speed up the research and development cycle by utilizing techniques outlined in AR 11-25 titled "Reduction in Lead Time" was discussed by James W. Virden at a recent dinner meeting of the Fort Huachuca Section of the Institute of Radio Engineers (IRE).

Mr. Virden pointed out that this new plan is designed to cut the lead-time cycle, from the time an idea is proposed until the finished product reaches the troops, by more than 50 percent.

An Operations Research Specialist at the U.S. Army Electronic Proving Ground at Fort Huachuca, Ariz., Virden is chairman of the local IRE.

Army Uses Permacrete As Building Material In Tests at Camp Tuto

Near Camp Tuto, Greenland, where steel fabrication materials have to be hauled by tractor train over the perilous conditions of the arctic ice-cap or brought in by air, a 500-gallon diesel oil tank has been built by Army Engineers with sand, gravel and frozen water.

Permacrete is a new polar building material which is a controlled version of permafrost — the permanently frozen ground under much of the polar regions.

In a 600-foot tunnel, one of several underground installations in the area, the Army is conducting studies of permacrete as an approach to the problem of construction in remote parts of the Arctic. Tables and chairs made of permacrete have been furnished for part of the interior of the permafrost tunnel. Anything made from this material must be protected from artificial heat and the summer sun, even in Greenland.

Permacrete studies include experiments to determine the ideal mixture of sand, gravel and water and the resultant structural properties. Properly made permacrete is said by Army engineers to be three to four times stronger than unreinforced concrete.

Some Army observers think that tanks such as the 500-gallon diesel-oil container, with walls ice-glazed by water spraying, will be the most economical solution to the storage of large quantities of fuel in the Far North.

Army Begins Cold Tests Of Pershing in Florida

Cold tests of the Army's Pershing missile began early this month at environmental test facilities at Eglin Air Force Base, Fla., to study how it will operate under cold weather conditions.

Field testing of the missile is scheduled for Yuma, Ariz., early this year. No missiles will be fired at Eglin or Yuma, but Pershing and its ground support equipment will be put through a series of exercises by Army personnel and technicians of the manufacturer.

The tests are part of an integrated development program aimed at having the Pershing fully ready for use by soldiers on schedule. Additional field test sites will be selected later.

The Martin Co. of Orlando, Fla., is prime contractor for the Pershing, under the technical direction of the Army Ordnance Missile Command.

AMAC Meets at Aberdeen PG, Jan. 16-17

Mutual interests and improved coordination in areas of possible integrated effort will be considered at the third meeting of the Army Materials Advisory Committee (AMAC), Jan. 16-17, at Aberdeen Proving Ground, Md.

Dr. Harry C. Allen, Chairman of the National Bureau of Standards Materials Research Committee, is on the agenda for the principal presentation. Executive Director Robert Crosier of the National Academy of Sciences Materials Advisory Board (MAB), will review the MAB 1962 program.

Among other leading speakers at the meeting will be Dr. Bernard B. Watson, Weapons Systems Evaluation Division, Research Analysis Corp., who will discuss the part that RAC can take in planning materials research programs, and Dr. E. T. Hayes of the U.S. Bureau of Mines.

Previous meetings of AMAC were held in September at the U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., and in mid-November at the U.S. Army Chemical Center, Md. Meetings are rotated among the Technical Services and other Army R&D activities to bring basic research, applied research and developmental personnel together with a view toward better coordination of effort.

Areas of cooperative activity and common concern between the Army and the National Aeronautics and Space Administration were discussed at the Army Chemical Center parley. Engineering materials development, applied materials research and fundamental research in the materials sciences came up for consideration.

Representatives of the Army's seven Technical Services and the Army Research Office-Durham reported on their activities in materials research in cooperation with or of interest to NASA. The Army, it was stated, is interested in many areas of NASA work on the protection of vehicles and personnel in space explorations for possible application to the Army's problems of armor and vehicular protection.

Dr. Peter Slagsvold, Chief, Defense Supply Materials Staff, Office of Barter and Stockpiling Manager, Foreign Agriculture Service, U.S. Department of Agriculture, discussed the potential of barter agreements for procurement of equipment, supplies and contract materials for research and development. The consensus of the meeting was that more incentives are needed to make the program attractive for R&D activities.

Dr. Sherwood Githens, Jr., Deputy Chief Scientist, Army Research Office-Durham, explained the recently inaugurated "Novel Research Projects Program." This is designed to stimulate creative research activity through grants to individual in-house researchers, with the grants ranging from $3,000 to $8,000.

Harold F. Weiler, Deputy Chief, Research Support Division, U.S. Army Research Office, OCRD, reviewed "Government Cost Sharing of Contractor Independent R&D Programs." Discussion which followed related to action that might be taken to exploit this program more fully, and the Research Support Division was asked to obtain more data.

In explaining the NASA materials research program, G. C. Deutsch said studies are centered on (a) materials and advanced technology and (b) materials development. Research is geared to requirements for specific vehicles.

About 85 percent of NASA materials research activities are conducted at in-house laboratories, Mr. Deutsch said, namely the Lewis Research Center, Cleveland, Ohio; Ames Research Center, Mountain View, Calif.; Marshall Space Flight Center, Huntsville, Ala.; and the Jet Propulsion Laboratory, Pasadena, Calif. Contract work is expected to grow during the next few years to about equal the in-house effort.

Army Engineers Directing Spacecraft Center Work

Architect-engineer design work on a major portion of a Manned Spacecraft Center, to be constructed near Houston, Tex., for the National Aeronautics and Space Administration by the Army Corps of Engineers, is called for in a $1,499,280 contract awarded to Brown and Root, Inc.

More than 150 firms submitted proposals for different phases of the design engineering for the Center. Completion of the initial engineering is expected to require about six months, though the first construction contract covering certain utilities is planned for February.

The initial contract covers general site development, master plans for the complete installation, design of the flight project facility, the equipment evaluation laboratory, the flight operations facility and various utilities. It does not include design engineering for the environmental testing laboratory.

ARO Official Seeks to Broaden Understanding of ASPR XV

What was described by an Assistant Secretary of Defense more than three years ago as "probably next to segregation . . . the most controversial subject in the U.S. at the moment" is now the subject of a series of orientation briefings given by a U.S. Army Research Office official.

Controversial though Section XV of the Armed Services Procurement Regulation is, Army and industrial leaders are in firm agreement on one aspect. They concur that it is probably as little understood as any Government regulatory procedure.

Harold F. Weiler, Special Assistant to the Deputy and Scientific Director of ARO, would be the last to profess that he is an authority on Section XV of ASPR, or that he is prepared to answer even a relatively small number of the questions that may be fired at him. But he is aiming to disperse a little of the confusion relating to the ASPR, Section XV, paragraph 205.35 pertaining to Government cost sharing of contractor independent research and development programs.

Any student of the complexities accountable for the perplexities regarding Section XV of ASPR will find an interesting glimpse into some of the historical background by reading "Transcript of Joint Department of Defense-Industry Conference on Comprehensive Cost Principles."

The transcript is a 104-page report on what transpired when top-ranking leaders of major industries and small business met with leaders of the Department of Defense and the three Services on Oct. 15, 1958. Objective: a possible solution to long-debated differences on contract cost principles mutually fair to the Government and industry.

Notables in attendance included: Perkins McGuire, Assistant Secretary of Defense (Supply and Logistics); W. J. McNeil, ASD (Comptroller); F. H. Higgins, Assistant Secretary of the Army (Logistics); Dudley C. Sharp, Assistant Secretary of the Air Force (Materiel); and William H. Holaday, Director of Guided Missiles.

Associate Chairmen of that historic conference were E. F. Leathem, National Association of Manufacturers, and Commander J. M. Malloy, U.S. Navy, Office of Assistant Secretary of Defense (Supply and Logistics). In attendance were 58 other distinguished Department of Defense officials, eight leaders in other Government agencies, and 31 representatives of industrial associations or major industries.

Most of the historic grievances and differences of opinion relative to equitable principles of cost determination were aired at that conference. Discussion centered on recommendations of the Hoover Commission in 1955 regarding Section XV of ASPR, as follows:

a. To establish a set of cost principles for cost reimbursement type contracts in keeping with recognized commercial accounting standards and;

b. These principles should be supplemented by guidelines for auditors in gathering cost information on fixed-price contracts, including terminated contracts.

The Hoover Commission fundamentals were embodied in the original objectives of the Department of Defense drafters of the proposed addition to the ASPR.

Up to that time, and until the ASPR Section XV was changed in July 1960, contract pricing included the allowance for contractor research and development expenses as part of his "incidental and necessary" expense of doing business.

In his orientation lectures, Mr. Weiler may be tempted to comment that contractor independent research and development efforts, "deserve recognition and better treatment than allowed by categorizing them with incidental items in contract pricing negotiations."

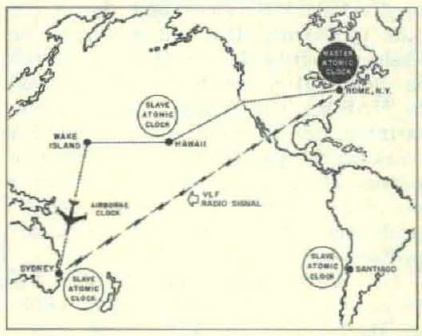
Likewise, Mr. Weiler is of the opinion that the present cost-sharing provisions of the ASPR allow a legitimate, reasonable and uniform cost allowance of independent research and development expenses of contractors performing work for more than one military department. It inherently tends toward improving contractor independent R&D activities—hopefully to the extent that it would reduce future 'crash project' conditions, reduce lead time and broaden the scientific and technical base of the Nation.

(The February issue of this publication will discuss the implementation aspects of ASPR XV 205.35 and the cooperative opportunities for scientific and technical talent in the Army to participate in the attainment of mutual advantages.)

Project WOSAC Completion Announced

Worldwide synchronization of atomic clocks to the precision of millionths of a second in a feasibility project termed Project WOSAC, as reported in the December 1960 introductory issue of this publication, was announced in a national news release to the public Dec. 1, 1961.

Completion of the third and main phase of Project WOSAC was described in detail in the *Newsmagazine* account a year earlier. The Dec. 1, 1961 release reported that testing had been continued, with additional "slave" clocks installed at Sydney, Australia, and Santiago, Chile.



TIME BRIDGE—How scientists synchronized atomic clocks within 3.5 millionths of a second of each other in ocean-spanning tests is shown by map. Project WOSAC was sponsored by the U.S. Army Signal Research and Development Laboratory, Fort Monmouth, N.J.

Tests between New York State, South America, Hawaii and Australia, the press release stated, revealed that the clocks were synchronized within an average of 3.5 millionths of a second during a 10-day experiment. About the only additional information not contained in the original *Newsmagazine* account was the statement that:

"Among other purposes, the close measure of time thus achieved will be of great value in tracking satellites and intercontinental ballistic missiles, for global communication systems and radio wave studies. . . .

"Intercontinental communications cables, even if they existed at all the points where they might eventually be needed, do not provide sufficiently stable transmission for attaining the degree of accuracy needed for global synchronization of atomic clocks.

"Full analysis of several hundred yards of data recorded during the tests has now been almost completed, and the U.S. Army Signal Laboratory scientists are confident that a global system of synchronized atomic clocks could be put on an operational basis within two years—and even greater accuracy attained. . . ."

Signal Corps Presents Honorary Awards to Four Key Civilians

High honorary awards to four key civilians of the U.S. Army Signal Corps—Harold Silverstein, Robert F. Brady, Thomas A. Kouchnerkavich and Robert L. Bennington—were presented recently by Maj Gen Earle F. Cook, Deputy Chief Signal Officer.

On behalf of Secretary of the Army Elvis J. Stahr, jr., General Cook awarded the Exceptional Civilian Service decoration to Mr. Silverstein for his "conception and development of automatic data processing systems for tactical operation and logistic functions . . . [which] have advanced the Army's R&D effort by many years."

Employed presently as Special Assistant to the Chief Signal Officer for Operations Research and Automatic Data Processing Systems, Mr. Silverstein has served with the Department of the Army for the past 22 years as a Federal Civil Service career employee.

Recently elected as a member of the Falls Church (Va.) City Council, Mr. Silverstein has a B.A. degree at New York University and an M.A. degree from American University, where he is also a part-time member of the faculty.

MR. BRADY was presented with a Certificate of Achievement prior to reassignment as Chief of the Electronics Section, Production and Logistics Division, International Staff, NATO. He had served as Chief of the Communications Branch, R&D Division, to earn a citation which stated in part:

". . . [His] knowledge, wisdom and technical superiority in the field of space communications and electronics contributed immeasurably to the COURIER delayed repeater and communications satellite and ADVENT, the 24-hour synchronous communication satellite. Because of his perseverence, meticulous planning and personal diplomacy as an advocate of UNICOM, the Signal Corps enjoys the unqualified support of the Department of Army Staff and Department of Defense elements in relation to the UNICOM program. . . ."

Maj Gen Earle F. Cook, Deputy Chief Signal Officer presenting an Outstanding Employee Rating to Mr. R. F. Brady, former Chief, Communications Branch, R&D Division, Office of the Chief Signal Officer, on the occasion of Mr. Brady's departure for a new assignment. Ceremony was held in Washington, D.C.

Graduated Cum Laude in 1932 with a Bachelor of Electrical Engineering degree from Catholic University, Washington, D.C., Mr. Brady continued his studies at the Columbus University School of Law, where he received Bachelor of Law and Master of Patent Law degrees.

MR. KOUCHNERKAVICH received a Meritorious Civilian Service Award for his work as Special Adviser, Signal Aviation Branch. He has 25 years of continuous Government service in aeronautical communications-electronics in the field of navigation, communications, air traffic control, surveillance, recognition and identification, and data processing.

For the past 12 years Mr. Kouchnerkavich has been active in national and international system component characteristics, and standardization, both military and civil. He has served on 10 U.S. delegations to international communications-electronic conferences for worldwide standardization and system implementation, and on national and international advisory councils. He has a B.S. degree in Electrical Engineering from the University of Michigan.

MR. BENNINGTON was recognized with a Meritorius Civilian Service Award for his work as an Occupational Analyst for The Adjutant General, Department of the Army. The citation stated in part that he "demonstrated superior foresight, initiative, efficiency and devotion to duty in the planning and execution of the Chief Signal Officer's Commercial and Industrial Activities Review Program. . . ." Before accepting Signal Corps employment in 1958, he served in the management field for the Aeronautical Chart and Information Center, U.S. Air Force. He is a graduate of the University of Maryland.

Harold Silverstein **Robert L. Bennington** **Thomas A. Kouchnerkavich**

DOD Contract Aims at Better Business Management Practices

Studies directed toward improvement in Department of Defense business management are to be made by the recently established Logistics Management Institute under a $600,000 contract announced by Secretary of Defense Robert S. McNamara. He stated, in part:

"The Logistics Management Institute is a nonprofit, fact-finding and research organization, guided by a group of trustees of national reputation. . . . The Institute's objective will be to provide Defense decision-makers with alternative courses of action and supporting data needed for formulatting and executing logistics policies and procedures. . . .

"I feel that the creation of the Institute will serve an important function of bringing to bear on the complex problem of Defense logistics the most experienced, capable and creative business management. While our top civilian and military logistics staffs are manned by capable people, these men are so occupied with critical day-to-day operations that they are unable to devote uninterrupted time to the detailed studies and analyses which are required.

"The Institute will have a working-level staff of 10 to 15 senior men with broad consulting and research experience in procurement and logistics. This staff will be responsible for the Institute's research efforts, including the supervision of studies subcontracted to universities and private consulting firms when their specialized talents are required."

Charles Kellstadt, Board Chairman of Sears Roebuck and Co., heads the Institute's trustees. Other trustees are: Maj Gen F. J. Dau (USAF-Ret.), Vice President of the Champion Paper & Fibre Co.; Peter Drucker of New York University's Graduate School of Business; Robert Nordstrom, Chairman of Mershon National Security Program at Ohio State University; Dr. Carlton Pederson, Associate Dean of Stanford University's Graduate School of Business; Dr. Stanley Teele, Dean of Harvard's Graduate School of Business Administration; and Charles E. Wilson, formerly President of General Electric Co.

Principal focus of the Institute's immediate efforts will be in the following areas:

- Requirements planning, where emphasis will be on: developing a system for rapid determination of procurement objectives, analysis of assets, evaluation of readiness; ways to reduce the initial procurement of spares and repair parts; means of cutting variety and cost of engineering and technical data acquired; and seeking methods by which effect of 'incremental funding' on cost and performance can be determined.
- Specifications, standards and designs, which involves developing a program to eliminate unnecessary specifications and excessive quality standards, and recommending improved methods to control engineering and design changes.
- Competition in Defense buying, by studying ways to increase competition in the purchase of production quantities of new military equipment and in the purchase of components and parts.
- Reducing cost of procurement practices, which will include appraisals of such problems as: evaluating contractor qualifications, reducing proposal costs, improving spare parts pricing, simplifying purchasing procedures, and awarding a 'fair proportion' of Defense contracts to small business.
- Control of contract performance, by developing a system to evaluate status of schedules, costs and technical performance, and exploring a means of making more effective use of contract incentives.
- Strengthening administrative and personnel practices, by proposing action plans for selecting and training top logistics personnel, establishing uniform contract administration procedures, and reviewing procurement operations by contracting personnel."

Huachuca Unveils Completely 'Blind' Landing System

A "blind" landing system that enables helicopters to fly to any area of a battlefield and land without the "talk-down" assistance of a ground operator has been successfully demonstrated at Fort Huachuca, Ariz.

Representatives of the Army, Navy and Air Force gathered at the U.S. Army Electronic Proving Ground for a recent day-long conference on a "blind" landing system. Following the conference the representatives and a Canadian Army observer viewed the landing, a first in military aviation, at Libby Army Airfield.

The system is nicknamed M W RAILS, a shortened version of its formal title, Microwave Remote Area Instrument Landing System.

To make the demonstration realistic, all lights on the airfield were turned off. Only the navigation lights of the H-34 helicopter were visible. After a short flight away from the field, the helicopter returned and landed within 100 feet of observers.

Fort Huachuca officials said it was the first time that a helicopter had made a completely blind landing without talk-down from the ground, with the exception of test program landings leading to the conference.

The M W RAILS is a product of Army-Navy cooperation through a program for improved instrumentation in aircraft. This program, known as ANIP (Army-Navy Instrumentation Program), has been underway for approximately six years. Its objective is to support research and development aimed at improved instrumentation for fixed and rotary-wing aircraft.

M. W. RAILS is expected to provide combat aviation with a greater potential for flight in conditions of poor visibility. It will find particular use in landings at night or under cover of poor weather behind enemy lines.

Lt Col Robert Gabardy (left) explains operation of Microwave Remote Area Instrument Landing System to Lt Col R. W. Kersey, U.S. Marine Corps, and Capt G. B. King, OSigO, Army.

Walter Reed Dentist Presented Order of Hope Award by ACS

The Order of Hope, the highest individual award of the American Cancer Society's Pennsylvania Division, has been awarded to Col Robert B. Shira, Chief of the Oral Surgery Section, Dental Service, Walter Reed General Hospital, Washington, D.C. The presentation marked the first time that the award had been given to a dentist. The citation stated:

"He has been a major force in developing the division's present professional education program in oral cancer. His contributions to the cause of control of oral cancer have been inestimable, as the hundreds of dentists and other medical professionals who have attended oral cancer institutes enthusiastically attest."

ATMC Symposium Weighs Army Aircraft Problems

Army and industry roles in the development, production and support of Army aircraft was the theme of a recent 5-day Aviation Logistics Symposium sponsored by the U.S. Army Transportation Materiel Command, St. Louis, Mo.

More than 200 Army and aviation industry representatives participated in considering problems of catalog and Federal stock numbers, maintenance in support of operations, overhaul and major rebuild, product improvement, tools and ground equipment.

Brig Gen Delk M. Oden, new Director of Army Aviation, made the principal address, other than the technical presentations, stressing that the Army pilot is expected to be and must be a "100 percent soldier and a 100 percent pilot."

Discussing long-range Army aviation goals, General Oden said:

"We are all dedicated to and believe that Army aviation offers the one great breakthrough in the mobility of the modern Army. The degree to which we can accomplish this goal depends on all of us understanding and solving the problems from the frontline back to the factory....

"Turning to the future, there seems to me to be one overwhelming requirement for Army aviation, and that is to move air mobility concepts from the realm of the possible to the practical and commonplace. We have demnostrated time and again the possibilities of air mobility, but I do not think we have convinced the average combat commander that air mobility should be his day-to-day means of moving people and things."

Representatives of Sikorsky Aircraft, Trans World Airlines, Grumman Aircraft Engineering Corp., Bell Helicopter Co., Lycoming Division of AVCO, the U.S. Army Maintenance Board, U.S. Continental Army Command, and the U.S. Army Aviation Board served as panel members.

Maj Gen William B. Bunker, Commanding General, U.S. Army Transportation Materiel Command, made welcoming and closing remarks.

Computer Expected to Provide Vital Link for Transportation

Installation of an IBM 7070/1401 computer at the U.S. Army Transportation Terminal Command, Atlantic, has been approved by the Department of Defense.

The computer is expected to be a vital link in the Integrated Transportation System planned to take transportation data from the shipper and move it ahead of the shipment to provide for rapid and more economical cargo movement. Installation of the computer should also provide assistance in the Department of Defense Uniform Priority System.

The latter part of 1962 has been set as the target date for installation. Installation of computers at the Gulf and the Pacific Terminal Commands is planned for early 1963.

Titanium Plates Utilized in Improved Armor Vest

Engineering development of an improved armored vest of titanium plates and ballistic-resistant nylon is being conducted at the Quartermaster R&E Center, Natick, Mass., in cooperation with the Chemical Corps, Ordnance Corps, The Surgeon General and the U.S. Marine Corps.

Designed to provide the combat soldier with greater protection against high-velocity fragments, the experimental Composite Armor Vest covers the entire upper torso with a flexible armor of overlapping titanium plates attached to the nylon material.

Studies involve two designs, one using nylon fabric, the other nylon batting, weighing respectively 8 pounds 15 ounces and 8 pounds 8 ounces.

QM researchers said the composite model insures a higher level of protection than the standard M1952A model used in Korea and also covers the neck with a 6-ply collar of ballistic-resistant fabric. New also is a shoulder section which pivots to provide more freedom-of-arm movement than permitted by the multilayered nylon vest.

Consideration is being given to use of larger titanium plates for body areas having slight movement. Thicker titanium plating protects vital areas.

When approved for production, the Composite Armor Vest will be issued to all Army ground and flight personnel in a combat zone to reduce injuries from battlefield fragments.

Experimental composite armor vest (outer covering removed). Titanium plates are fixed to ballistic nylon fabric. Above, vest with outer covering.

HumRRO Team Studies MAP Training in Far East

Information gathered by a team of Army human factors research leaders on a recent trip to the Far East is being evaluated with a view toward improving techniques of training foreign troops under the Military Assistance Program (MAP).

In addition to the exploratory study of MAP training methods, the team made observations on the U.S. Army Pacific Troop Motivation Program, special warfare training, and the language and cultural factors involved. Considered also was the possibility of implementing previous HumRRO research results in the allied forces training program.

Headed by Dr. Meredith P. Crawford, Director of the Human Resources Research Office, George Washington University, the 4-man team left Washington, D.C., Nov. 24 on a 4-week trip to Army installations at Taiwan, Okinawa, Korea, Japan and Hawaii.

In explaining the purpose of the study, a HumRRO announcement stated:

"Military observers have suggested that the efforts expended by U.S. Army personnel in advising on training troops of foreign nations, under the Military Assistance Program, yield higher dividends in free-world preparedness than equivalent additional U.S. expenditures in the training of our own troops.

"It is anticipated that MAP training and advising will increase in scope, complexity and recognized importance; this program merits examination of its unique problems of cross-cultural application of military systems and training methods.

"It may be appropriate to adapt previous HumRRO findings to applications in foreign armies as well as to study ways in which future training research can be so designed as to make products additionally applicable to foreign troops. . . ."

Under contract with the Department of the Army, and in accordance with guidance from the Chief of Research and Development, HumRRO conducts research and development in training, motivation, leadership and man-weapons systems analysis.

Other members of the fact-finding team are Dr. Charles D. Windle and Dr. George H. Brown of HumRRO and Lt Col Joffre L. Gueymard, Human Factors Research Division, Army Research Office, OCRD.

New Ordnance Materiel Since

By Mrs. Helen Reed
Army Ordnance Missile Command

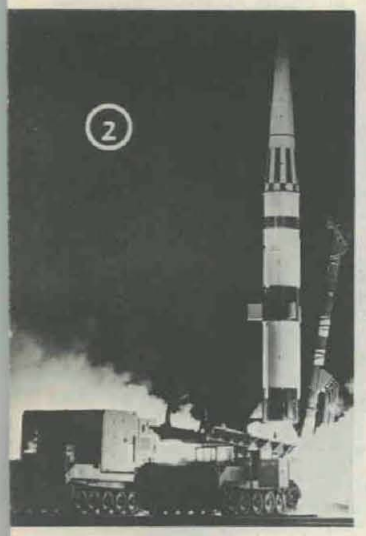
U.S. Army developments in weapons systems since the Korean conflict have given the foot soldier battlefield support and capabilities he has never before known. Extended firing ranges, lighter weight, greater cruising ranges, mobility and safety are features attesting to the rapid pace of Army science and technology.

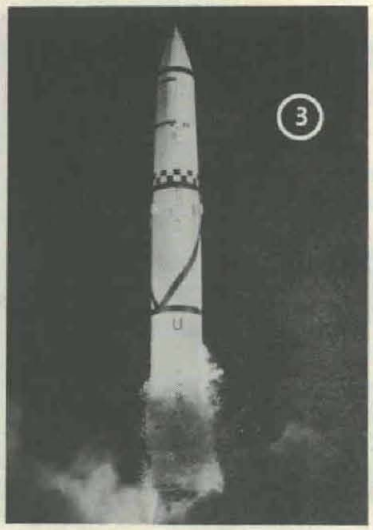
Development and improvement of conventional types of weapons are continuing as a major Army effort. Despite the vast expenditure of money and skill in the newer field of rockets and missiles, more than 30 individual weapons, artillery pieces, tanks, vehicles and trucks are either being produced, or are available for production, which weren't known or used in Korean combat.

It is not always appreciated that while guided missiles and rockets extend range, power and accuracy in the weapons field, in many cases they do not completely replace the proven types of weapons previously used.

Since Korea, the Army has not only deployed missiles with overseas troops, but has also developed and can produce, for instance, a new rifle, a new machinegun, a grenade launcher, a light antitank weapon, and an antipersonnel mine, to name a few.

The M14 rifle fires the 7.62 mm. NATO cartridge, one of the outstanding breakthroughs in modern ammunition development, and has a 20-round clip. Its predecessor, the M1 fires eight rounds. The new M60 machinegun is air-cooled and can be fired from either a tripod or the lighter bipod. A 90 mm. recoilless rifle,





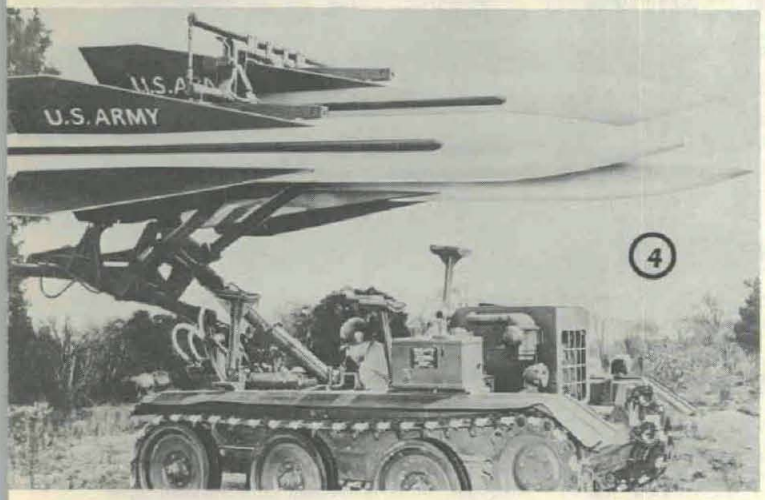


Fig. 1, the M60 machine gun, 7.62 mm., weight 23 lbs., rate of fire 550 r.p.m., which replaces the .30 cal. machine gun. Fig. 2, Pershing, 2-stage, solid propellant ballistic missile of selective range, designed for general support of the field Army. Fig. 3, Redstone, liquid-propelled missile played a major role in America's early space effort and is now being used in Mercury-Redstone "Man in Space" project. Fig. 4, Hawk, surface-to-air guided missile, 17 feet in length, for use against enemy aircraft at extremely low altitudes. Fig. 5, M110 self-propelled air-transportable 8-inch howitzer, takes rugged terrain in stride, can climb a 60 percent grade and has a range of 450 miles. Mechanical loading and ramming devices and hydraulically operated mounts require a gun crew of only five men. Fig. 6, Entac, a small, light, French Army developed guided missile, suitable for use by the Infantry, made available to the U.S. Army. Fig. 7, Davy Crockett will give Infantry and Armor troops a low-yield nuclear punch

Reflects Speed-up of Science

the M67, is an accurate antitank gun with greater range than the older bazooka type weapons.

Small, light, and simple to operate partially describes the M72, newest rocket grenade antitank weapon. Made of aluminum and plastic, it weighs only 4½ pounds, thus easing the soldier's load on the battlefield.

The Army's "ultimate weapon," the foot soldier, has another new combat weapon, the M79 grenade launcher with a range that bridges the gap between the distance the hand grenade can be thrown and the minimum range of the 81 mm. mortar.

The United States found an already developed antitank weapon in France, the SS10, and has purchased it and successive models, the SS11 and Entac, through the French government. All are guided missiles.

Other new weapons in the small arms are: the M73 machinegun, which uses 7.62 mm. ammo; the M85, .50-caliber machine gun; M26A2 hand grenade; and the M21 antitank mine. A 20 mm. automatic gun, the M61 (Vulcan), was developed by the Army for the Air Force.

The M18 Claymore antipersonnel mine is a device for defense against massed Infantry attacks, and for perimeter defense of isolated outposts. Projecting a fan-shaped spray of high velocity fragments parallel to the ground in a chosen direction from a remote position, this mine excels substitute items in both lethality and range. Also, its general performance is superior because of improved accessories.

Three new tanks for the Armored Division have been put into production since 1952—the M48, the M103 and the newer main battle tank, the M60. The latter

(Continued on page 14)

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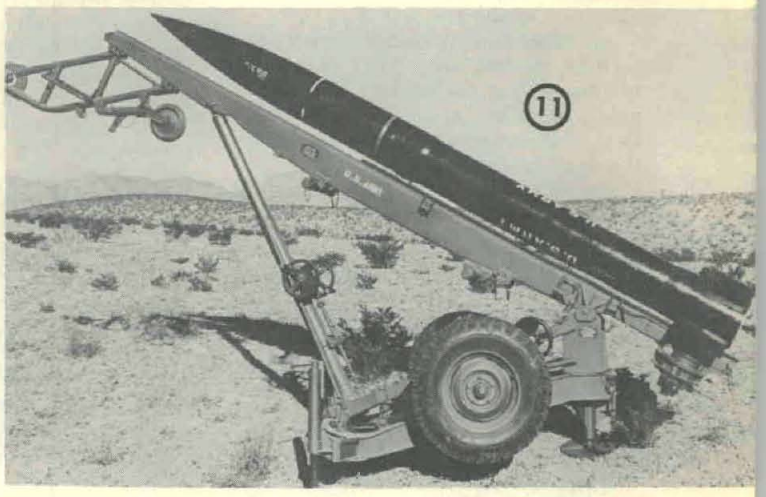
at close range. It packs an atomic warhead with a small enough effective radius so that using troops, nearby friendly troops, and civilian populations would not be endangered by blast. Fig. 8, the M151, provided with a new overhead valve engine and a new 4-speed forward transmission, gives increased performance in the lightweight class vehicles. Fig. 9, M116 is a new lightweight vehicle capable of crossing mud and snow and will replace the earlier Weasel and Otter cargo carriers. Fig. 10, Sergeant, a solid-propellant ballistic missile, will replace the operational Corporal. Fig. 11, Little John, a mobile, free-flight rocket packs explosive power of heavy operations. Fig. 12, M67, a 90 mm. recoilless rifle is designed to be carried into battle and employed by a team of two men. The gun's effective range, 500 yards, is more than twice that of the 3.5 bazooka of Korean War fame. Fig. 13, M56, Scorpion, is a 90 mm. self-propelled gun.



New Ordnance Materiel Reflects Science Speed-up

(Continued from page 13)

will replace the other two. The M60 carries a 105 mm. gun which gives it significantly greater firepower and artillery punch than the 90 mm. gun on the M48. Its diesel engine increases speed and maneuverability. The new infrared fire control provides for night fighting.

New trucks vary from the ¼-ton utility version M151—which resembles the World War II and Korean War Jeep, but can travel faster, cruise farther, and weighs less—to the heavier M35 series for transporting cargo and personnel. Included in this category are the Mechanical Mule, a ½-ton frontline transporter and the Mighty Mite, an Army development for the Marine Corps.

In this area, too, is the GOER, representing a new departure in design of military wheeled vehicles which comes in two versions, a cargo truck and a tanker. The GOER, with its "go anywhere" characteristics, permits movements of supplies and fuel to areas which are inaccessible to other types of military vehicles. It can "swim" fully loaded up to speeds of 3 m.p.h. Agility, mobility and floatability describe the GOER.

An armored personnel carrier (APC) dubbed the M113 is an improvement on the earlier M59. It is safer, lighter and ranges farther. Both, however, were developed since the Korean warfare.

Another APC now completing development, the T114, is a lightweight tracked vehicle for use in command and reconnaissance missions.

M72—Light antitank weapon designed for use of individual soldier. Firing tube also serves as shipping case and is discarded after firing.

Now entering production is a new amphibious cargo carrier, the M116, which can be used as a personnel carrier to accommodate 10 men in addition to the driver.

To retrieve tanks disabled on the battlefield, the Army has developed and is producing a tank recovery vehicle, the M88. It is designed to lift and recover the heaviest of armored tanks with comparative ease by the use of a giant "A" frame boom. This again is an improvement over earlier versions.

Two new howitzer weapons systems that are lighter, can cruise farther and fire ammunition of longer range are being developed. They are the T195E1 and T196E1, which will replace similar vehicles used during the Korean conflict. The T195E1 is a 105 mm. full-tracked, self-propelled light howitzer, and the T196E1 is the 155 mm. which utilizes the same chassis.

The artillery will be provided with two new self-propelled weapons which will permit down frontline support to the Infantry. The M110 8" self-propelled howitzer will replace the old M55. The M110 is lighter, faster and is air-transportable. The M107 packs the 175 mm. gun, yet weighs only 62,000 pounds compared with its predecessor, the M53, which weighed 100,000 pounds.

A self-propelled, full-tracked 81 mm. mortar, the T257, is under development. It is lightweight and is similar to the APC version of the M113.

The hard-hitting M56, 90 mm. self-propelled gun (Scorpion), was developed to provide airborne troops with a mobile antitank weapon that can move quickly to fire on its target.

For Infantry Battle Groups, the Army Ordnance is developing an atomic weapon system, the Davy Crockett, in two versions, a light and a heavy. Both versions fire projectiles that are larger in diameter than the gun tubes, and are fastened on pistons inserted in the gun tubes.

Disassembled, both versions can be carried by the gun crews. Both will also be mounted on various tactical vehicles. With a low-yield atomic warhead, the Davy Crockett will increase the firepower of the Infantry tremendously, enabling soldiers to combat numerically superior enemy forces.

There are eight operational missiles and rockets—Honest John, Little John, Jupiter (developed by the Army, but operational with the Air Force), Redstone, Corporal, Nike Ajax, Nike Hercules, Hawk and Lacrosse. The Sergeant, Redeye, Pershing, Nike Zeus, Shillelagh and the Mauler are all in the advanced development stage.

The Hawk engages low-flying aircraft. It's fired high in the air, then dives upon low-flying planes from above—just as a hawk attacks its prey. In the other extreme is the Nike Hercules with a nuclear warhead for air defense against high-flying aircraft.

Progress in weapons development is accelerated by the urgency of the threat posed by the competitive science and technology of the potential enemy. Impressive though the advances of the U.S. Army are in recent years, the problem of establishing and maintaining superiority in armaments is never-ending, with the tempo of the race ever increasing, to avoid falling victim to obsolescence.

Scientific Calendar

Second Conference of Military & Technical Directors on Management Problems of Military RDT&E, Quantico, Va., Jan. 8-9.

8th National Symposium on Reliability & Quality Control, sponsored by American Society Quality Control, IRE, AIEE, and Electronics Industries Association, Washington, D.C., Jan. 8-12.

2nd Symposium on Radioactive Isotopes in Clinical Medicine & Research, Bad Gasstein Austria Jan. 9-12.

Synoptic Meteorology Code Problems, Toronto, Canada, Jan. 9-19.

Data Processing Seminar, Washington, D.C., Jan. 10.

Optical Character Recognition Symposium, sponsored by ONR and Research Information Center of NBS, Washington, D.C., Jan. 15-17.

Instrument Society of America, Winter Conference & Exhibit, St. Louis, Mo., Jan. 17-19.

Tropical Cyclones, Inter-regional Seminar, Tokyo, Japan, Jan. 18-31.

National Plant Engineering & Maintenance Show & Conference, Philadelphia, Jan. 22-25.

Solid Propellant Rocket Conference, Waco, Tex., Jan. 24-25.

Thermophysical Properties Symposium, sponsored by ASME, Princeton, N.J., Jan. 24-26.

Western Electronic Week and Pacific Electronic Trade Show, Las Vegas and Los Angeles, Feb. 3-11.

Hughes Aircraft Company—Third Research Symposium, Los Angeles, Feb. 5-6.

Symposium on Redundancy Techniques for Computing Systems, sponsored by Office Naval Research, Washington, D.C., Feb. 6-7.

3rd Winter Convention on Military Electronics, sponsored by the Institute of Radio Engineers, Los Angeles, Feb. 7-9.

Solid State Circuits Conference, sponsored by AIEE and IRE, Philadelphia, Feb. 14-16.

30th Annual Symposium on Nondestructive Testing of Aircraft & Mssile Components, San Antonio, Tex., Feb. 27-Mar. 1.

Ultrasonic Sounding Techniques Used for Material Inspection

By Otto F. Gericke
Chief, Methods Development Section, Watertown Arsenal Laboratories

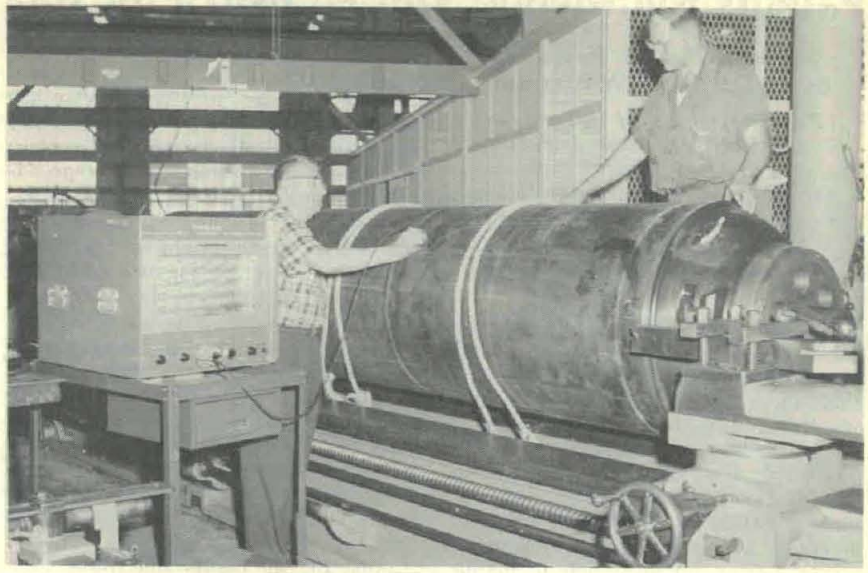
Space age and mobile warfare call for drastic reduction in weight of many Ordnance items. At the same time, however, it is imperative to attain the highest possible degree of reliability, since failure of even minor components can cause malfunction of an entire weapons system with possible loss of the weapon or crew.

The design engineer who has to observe weight restrictions can no longer ensure reliability through the use of liberal safety margins; he has to consider the ultimate performance limits of materials. Because the design tolerances are critical, it would be dangerous to judge the quality of a large lot according to the destructive test results of a small sample taken from the lot. Each individual item has to be examined to ensure that it does not contain defects that lower the theoretical performance limit. This 100 percent inspection of the production can only be carried out by applying nondestructive tests.

Aside from the more popular nondestructive test methods such as X-ray and magnetic particle inspection, a relatively new technique has evolved which utilizes ultrasonic waves to penetrate an object and obtain information on its internal condition. Ultrasonic waves are mechanical vibrations of frequencies beyond the hearing range of the human ear. These waves have the unique property of being reflected at discontinuities (flaws) encountered in their path through a solid body.

Sensitivity of the technique can be shown by the fact that a reflection is produced at the interface of two materials even if they are in intimate contact with each other. Hence, it is possible, for example, to determine ultrasonically the thickness of the steel alone in a missile motor case which is internally covered with a plastic liner. A test to do this mechanically would require that one arm of the calipers pierce the liner and possibly destroy its effectiveness.

Defects, such as laminations and inner surface corrosion which constitute a decrease of material thickness, can also be determined by the ultrasonic thickness test, the underlying principle of which is actually quite simple. As a piano string has a resonance frequency which depends on its length, a metal section possesses a resonance frequency which depends on its thickness.



Wall thickness of Sergeant missile motor case is checked ultrasonically.

To determine the frequency of a piece of metal, a calibrated ultrasonic generator is tuned until resonance is reached. The dial of the generator which indicates the resonance frequency can also be calibrated to show material thickness directly.

In the equipment shown in the illustration, the ultrasonic frequency is varied automatically and an indication appears on a cathode-ray-tube at resonance in the form of a vertical line. If a specially calibrated scale is mounted in front of the tube for each material to be tested, such as steel, aluminum, etc., thickness indications can be read directly in inches.

Beside the ultrasonic resonance method, a second procedure which has gained great importance is Pulse Echo Testing. In this method, which resembles the radar principle, a short ultrasonic pulse is transmitted into the test object by an ultrasonic search head which subsequently acts as a microphone to pick up echoes from internal defects. Cracks, cavities, inclusions, and various other flaws that reflect ultrasonic waves can thereby be determined.

The pulse echo test method can also be used to measure the absorption of ultrasonic energy in a material. The rate of absorption at various frequencies can be correlated to the material's microstructure and thus be used to determine, for example, the effect of heat treatment.

Research into new ultrasonic test principles and applications go hand in hand at Watertown Arsenal Laboratories. Extensive facilities are maintained to conduct fundamental investigations in the field of ultrasonics and also carry out applied research to develop improved test procedures. In addition, immediate inspection problems are solved through cooperation with the quality assurance group.

The goal of these efforts is to develop ultrasonic testing to a stage where it can be considered a reliable tool of nondestructive testing.

'Copter Seen as Aid in Target Range Triangulation

The idea of locating a target by mathematical triangulation from a helicopter is a relatively new approach to an age-old military problem of "How to hit a target when you can't see it."

The method is the brain-child of Joseph A. Prieto and Max Rosenberg, two mechanical engineers in the Picatinny Arsenal's Special Weapons Development Division.

Intended for use against targets undetectable by radar because of "ground clutter," the process is simple in theory and is closely related to triangulation used in land surveying or fixing the position of ships at sea.

The originators claim the new process of range estimation is 70 percent more accurate than optical range-finder methods used today which have as much as 10 percent error. The Ordnance Corps is investigating the prospect that, with the helicopter stabilized on an even keel, error could be reduced to less than 2 percent.

Patents Knowledge Viewed as Useful Tool for R&D Personnel

Part 2 of 3 Parts
By Lt Col G. F. Westerman

(The first section of this article in the December issue discussed the historical background of the Patents System, the Nature of Patent Rights, and What Can Be Patented. The final installment will appear next month.)

DESIGN PATENTS. With the advance of industry in this country, it was discovered that a pleasing appearance increased the consumer appeal of almost any item of merchandise. To protect and promote advances in this field, laws were enacted which provide for the granting of a special type of patent to any person who has invented a new, original and ornamental design for an article of manufacture.

A design patent protects only the appearance of an article, and not its structure or utilitarian features. The procedure for obtaining a design patent is substantially the same as that relating to other patents. A patent for a design may be issued for a term of 3½, 7 or 14 years, at the applicant's election, with a sliding scale of fees which increase with the lengthening of the term.

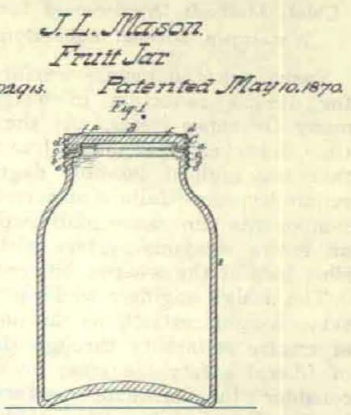
PLANT PATENTS. In order to promote new developments in the agricultural field, legislation was passed in 1930 to create another type of special patent. A plant patent may be granted to anyone who has invented or discovered an asexually reproduced, distinct and new variety of plant, other than a tuber-propagated plant.

Asexually propagated plants are those that are reproduced by means other than from seeds, such as by the rooting of cuttings, by layering, budding, grafting, etc. The law specifically excludes tuber-propagated plants. A tuber is a short, thickened section of an underground stem, as in the potato or the Jerusalem artichoke. This exception is made because this group alone, among asexually reproduced plants, is propagated by the same part of the plant that is sold as food.

Most of the plants that have been patented are new varieties of fruit, trees, bushes, vines and ornamental flowering plants.

SUBJECT MATTER LIMITATIONS. Interpretations of the statute by the courts have defined certain limitations in the field of patentable subject matter. Thus, it has been held that abstract ideas and mere mental theories or plans of action cannot be patented. It is that means, or thing by which they may be accomplished that is within the law.

The courts have also consistently held that the discovery of scientific principles or laws of nature or the inherent properties of matter may not be made the subject of a patent.



Patent on well-known "Mason Jar" was held invalid by the Supreme Court because Mr. Mason waited nearly nine years after his first jars had been sold before filing his application.

UTILITY. To be patentable an invention must be both new and useful. A useful device is one intended for a purpose that is neither frivolous nor contrary to the well-being and best interests of society.

A new gambling device or a new method for disguising adulteration in a food product would not be considered useful and therefore would not be patentable. Similarly, a court ruled that a new method for treating inferior tobacco leaf to give it the appearance of a better and more expensive leaf is not patentable.

The mere fact that the new device might be used for an improper purpose is not a bar to patentability, so long as the invention has also a legitimate and proper use. Thus, the revolver and machinegun, although often used antisocially, are patentable because of their value to the Army and various law enforcement agencies. Neither would a new game for the purpose of providing recreation and amusement be declared unpatentable merely because it might also be used for gambling.

The most spectacular example of this principle occurred when a new model Mauser automatic pistol was used to assassinate King Alexander of Yugoslavia on Oct. 9, 1934 and, five weeks later, United States Patent No. 1,980,874 on that same pistol was issued in the name of Josef Nickl, assigner to the Mauser Co. of Oberndorf, Germany.

The term "useful" also includes

Dr. Larsen Presents Gold Medal Award

Dr. Finn Larsen, Assistant Secretary of the Army (R&D), recently presented to Dr. Henry P. Kalmus, Associate Technical Director of the Diamond Ordnance Fuze Laboratories in Washington, D.C., the Army's Gold Medal Award for Exceptional Service.

Dr. Kalmus, an inventive genius with over 30 patents issued in his name, was cited for "his numerous inventions applicable to missiles, nuclear weapons, and radar and target detection systems [which] have contributed immeasurably to developments in modern weaponry."

A Fellow of the Institute of Radio Engineers and a member of the Washington Academy of Sciences, Dr. Kalmus received the Dipl. Ing. degree from the Technical University of Vienna in 1930 and his Doctorate from the same University in 1960. After an association of eight years with the Orion Radio Corp. in Europe, Dr. Kalmus came to the United States and was employed by the Emerson Radio Corp., New York City, and the Zenith Corp., Chicago, prior to joining the staff of the National Bureau of Standards in 1948.

Dr. Kalmus has published many scientific papers and articles. Among honors accorded him is the Department of Commerce Gold Medal for Exceptional Service (1954).

Dr. Finn J. Larsen presents Army Gold Medal Award for Exceptional Service to Dr. Henry P. Kalmus.

operativeness, that is, a machine which will not operate to perform the intended purpose would not be called useful. Alleged inventions of prepetual motion machines are commonly refused patents on this ground.

NOVELTY. Insofar as novelty is concerned, the statute provides that an invention cannot be patented if it was:

- Known or used by others in this country before the date of invention by the applicant; or
- Patented or described in any printed publication in this or any foreign country before the date of invention or more than one year prior to the filing of the patent application; or
- In public use or on sale in this country for more than one year prior to the filing of the application.

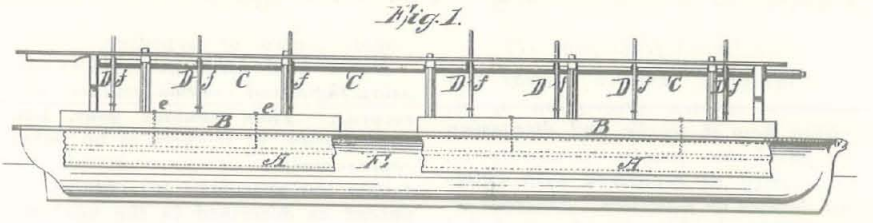
The reason for these requirements is clear. If the invention has been known or used in this country before the date of invention by the applicant, if it was previously patented or described in a printed publication, or if it had been an article of commerce or in commercial use for a considerable length of time before the filing of the application, there is a strong presumption that the invention would become a matter of common knowledge without the disclosure in the patent. Therefore, the Government would have little to gain by the granting of the patent.

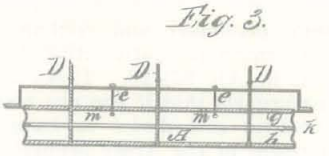
Thus, if the inventor (or anyone else) describes his invention in a printed publication or uses it publicly, or places it on sale, he must apply for a patent within one year; otherwise his right to a patent will be lost.

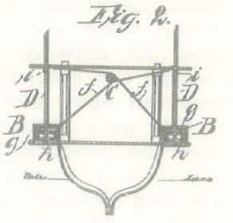
INVENTION. Even if the subject matter sought to be patented is not exactly shown by the prior art, and involves one or more differences over the most nearly similar thing alreay known, a patent may still be refused if the differences would be obvious. The subject matter sought to be patented must be sufficiently different from what has been used or described before it may be said to amount to invention over the prior art.

Small advances that would be obvious to a person having ordinary skill in the art are not considered inventions capable of being patented. For example, the substitution of one material for another, or changes in size, are ordinarily not patentable.

The courts have handed down innumerable other rules to determine the presence or absence of invention, an excellent discussion of which may be found in Chapter 3 of *Walker on Patents*, Deller's Edition, 1937.







On May 22, 1851, Abraham Lincoln, while Congressman from Illinois, received the above patent for "A Device for Buoying Vessels over Shoals." Lincoln's appreciation of inventions was later to be of great service to the Nation. John Ericson's Monitor, the ironclad which defeated the Merrimac, would never have been built except for Lincoln's insistence, nor would the Spencer repeating rifle have been adopted by the Department of the Army, records indicate.

WHY GET A PATENT? Ordinarily, when a man makes an invention, there are three courses of action he may take. He may (1) keep his invention secret, (2) make it available to the public by writing or any other suitable means, or (3) file a patent application. This raises the question that many people often ask: "Why bother getting a patent?"

Suppose the inventor elects to keep the secret——some other person may come along even at a later date and, having independently made the same invention, may patent it or make it public, and receive full credit.

The inventor who keeps his own secret can rarely establish that he thought of the idea first. It is obvious that today when so many thousands of researchers are on the hunt in all fields, secrecy offers poor protection.

The altruistic inventor may publish his invention, and one might think that sufficient. However, another independent inventor may file a patent application within a year of the publication, "swear back of the publication date" under the Rules of Practice of the United States Patent Office and obtain a patent. Another possibility is that a dishonest person may appropriate the invention and improperly obtain a patent.

In either case, the holder of the patent can keep the public, including our friend, the altruistic inventor, from practicing the invention for the period of the patent. Of course, the patent might be proven invalid, but normally this would be a very troublesome and expensive procedure.

The best protection is to have a patent application filed promptly, in the name of the first inventor, before publishing a description of the invention. So we see that the patent is a form of insurance preventing latecomers from appropriating an invention which the patent owner has previously put into use.

When the inventor is a Government employee, patenting protects the Government against unjustified payment of royalties. Every time such an application is filed, a potential lawsuit against the Government may be prevented. Therefore, it is a well-established policy of the Department of the Army to apply for patents on inventions made by its employees.

PROTECTION PRIOR TO PATENTING. Let's suppose that you have made an invention. What do you do now in order to protect your rights? Mailing yourself a registered letter containing your plans is not enough—despite a widespread belief to the contrary.

The law recognizes only the first inventor. Since it is not at all unusual for two or more persons to approach the solution of a problem simultaneously and independently make the same invention, it is very important to be able to prove you were first. Here, in brief, is the appropriate procedure:

- *To fix the time you conceived*

Patents Knowledge Viewed as Useful Tool for R&D Personnel

(Continued from page 17)

your invention, prepare a clear and complete written description of it, telling how it works and discussing its particular points of novelty or superiority as compared with existing devices or practices. Sketches or drawings should also be included where helpful.

• Get dated signatures of two or more competent witnesses on the description and the drawings. These should be honest and convincing persons you can call upon later to say under oath that on a particular day you described the invention to them in detail, that they clearly understood all you told them about it, that they recall the written record and that they signed and dated it.

• *Keep your records as you go along; later you won't be able to remember dates or details. In addition to the description, your records should also include shop notebooks, models, letters, sales slips showing when you bought materials or paid for labor, and any other corroborating papers.*

• **When you have actually built the device and operated it, show it to witnesses and have them sign a statement that they saw it work satisfactorily on a given date.**

These precautions do not guarantee that your invention cannot be developed and exploited by someone else, but they may be valuable evidence to the Patent Office, or to the courts, if some other inventor also attempts to patent the same invention at about the same time.

Some agencies have adopted a standard permanently bound laboratory invention notebook form with instructions for its use. Such record books are highly desirable since they provide space for written descriptions, sketches and witnesses' signatures, as well as avoiding possible loss of loose sheets. AR 70-12, Mar. 5, 1957, requires laboratory notebooks to be kept at each Army research and development laboratory.

If you have an invention that might be useful for national defense, the Army is definitely interested in having you submit it for consideration. The fact that you may not be a professional inventor makes no difference. Many amateur inventors also obtain patents. Some of the more famous of these are Abraham Lincoln, J. E. B. Stuart, P. G. T. Beauregard, Mark Twain and Hedy Lamar, who is coinventor of a secret communications systems useful in the remote control of torpedoes.

Don't hold back your ideas—develop them and provide yourself with records. Then contact your local patent man, or if there is no patent representative at your installation, follow the procedure for obtaining a patent as described in the next section.

OBTAINING A PATENT. The policy of the Department of the Army with respect to inventions made by military personnel and civilian employees under its jurisdiction is expressed in AR 825-20. These regulations provide that if you are a service inventor and desire to have the Department of the Army prepare and prosecute a patent application covering your invention, you should send drawings and a written description of the invention to the Chief of the Technical Service to which the invention relates.

In case of doubt as to the proper Technical Service, forward the invention disclosure to The Judge Advocate General, Department of the Army, Washington 25, D.C., ATTN: Chief, Patents Division.

Army patent lawyers will receive your invention and investigate its suitability and potential importance to the service. Once it is established that the invention might be used by the Government, trained patent searchers will make a novelty search of prior patents and publications relating to its subject matter. By making such a search, a patent lawyer is enabled to say whether, in his opinion, the situation warrants the filing of an application.

A novelty search is not an absolute requirement, but since more than three million patents have already been granted, the invention in question may well have been previously patented by another. The cost of filing an application will be saved if the search shows that the invention has already been patented.

When the search indicates that the invention is likely to be patentable, the material of the inventor is transformed into a technical description of the invention called the "specification." If the invention lends itself to illustration, a specially trained draftsman makes drawings and ties them to the specification by numerals appearing both on the drawing and in the specification.

At the end of the specification are a series of numbered paragraphs, called the "claims," which define the precise extent of the inventor's contribution. If these claims are expressed in terms broad enough to embrace what has been done before, they will be rejected by the Patent Office. If, by accident, a patent is granted with claims too broad, such claims will probably be found invalid in case of any test in court.

On the other hand, if the claims are drawn in too narrow terms, they will give the inventor no real protection against a competitor who can make slight changes and thereby avoid the coverage of the claims.

In a sense, these claims are equivalent to the metes and bounds set forth in a deed of land. In drawing claims, the use of the proper language may often make the difference between a valuable patent and a worthless piece of paper.

In addition to the drawings, specification, and claims, a patent application includes an oath signed by the inventor and a petition addressed to The Commissioner of Patents identifying the invention with a title and requesting that a patent be granted.

The Patent Office is divided into examining divisions, each staffed with experts handling one or more segments of industrial activity—chemical, electronics, mechanical devices, etc.

When an application is filed, it is assigned to the appropriate division for examination, although it may be examined by other divisions too if the invention falls within more than one technical field.

When he begins consideration of an application, the examiner to whom it has been assigned first makes certain that he understands it fully. Then he begins his own patent search to determine if the invention was anticipated by previous inventions.

The examiner may conclude that some of the claims listed by the inventor on the application are allowable, while others are not. If some are not allowable, he notifies the attorney, stating the reasons why. The attorney may then amend the application, seeking to overcome the examiner's objection. Any amendment must be submitted within six months from the date of the examiner's letter. This process is repeated until a final decision is reached to grant a patent or reject the application.

If the application is finally rejected, provision is made for appeal to a Board of Appeals in the Patent Office and ultimately to the Federal courts.

(To be continued next month)

Press Gives Top Play To Woman Among 100 Rocketry Experts

As the only woman among more than 100 of the Nation's top civilian and military scientists participating, an Army representative rated headlines and pictorial prominence in newspaper reports of the Dec. 5-6 Status of Meteorological Rocketry Conference at Texas Western College.

The *El Paso Times* and the *El Paso Herald Post* each carried a front page picture of Mrs. Frances Whedon, U.S. Army Research Office meteorologist, grouped with dignitaries and conference leaders. The *Times* also carried a Page 1 headline on one of its lead stories, "Top Woman Scientist Presides at Meeting." She presided at the session on Meteorological Rocket Vehicles.

No stranger to recognition among her male counterparts at national and international meteorological conferences, including NATO meetings in Paris, France, Mrs. Whedon has been widely acclaimed for her professional competence during 20 years as a Government career employee.

The U.S. Army Signal Missile Support Agency was one of the cosponsors of the TWC conference. Mrs. Whedon spent more than 15 years as a Signal Corps meteorologist and specialist in high atmosphere research before joining the U.S. Army Research Office staff in August 1959. She is currently the Army representative on a number of national and international committees concerned with meteorological research.

Willis B. Foster, Chief, Geophysical Sciences Division, Office of the Director of Defense Research and Engineering, was the top defense representative at the conference. Harold N. Murrow, Langley (Va.) Research Center, and John F. Spurling, Wallops Island Station, reported on the extensive program of meteorological rocket firings being conducted at Wallops Island by the National Aeronautics and Space Administration.

"The Status of Meteorological Rocketry in the Antarctic" was the subject of a presentation by Dr. Thomas O. Jones, National Science Foundation, Washington, D.C. The NSF currently is conducting extensive research in the Antarctic.

Reviews of rocketry meteorological research at the Atlantic Missile Range were made by Lt Col Peter E. Romo, at the Pacific Missile Range by Robert de Violini, at the White Sands

(Continued on page 21)

Miss Alice Lucille Graham watches Sp/4 John G. Adcock, system mathematician and statistical analyst, process data on Univac computer.

Woman Supervises Computing Section at WSMR

Women concerned with figures—usually their own—are a commonplace, but a woman concerned with mathematics is still news, and good news, at the Army's White Sands Missile Range, N. Mex.

The top-ranking female employee at the desert missile center is an altogether feminine mathematician, Miss Alice Lucille Graham, Chief of the Computing Section of the Data Reduction Division, South Range Branch of Integrated Range Mission.

Attractive, blue-eyed, prematurely gray, fast on the quip, Miss Graham is responsible for processing all raw missile data gathered by range instruments during firings. She supervises the programing and operating of Univac Scientific and Univac Solid State 80 computers in compiling reports on all missiles launched from, and covered by, South Range facilities.

"Sometimes," she said with a show of humor, "we feel that every object flying across the New Mexico sky is tracked and data from it sent to the section for processing . . . but maybe that's exaggerating a bit."

The Computing Section employs more than 30 people, military and civilian. It receives raw missile data in the form of magnetic tapes and cards. Tape data is run directly into the computer, where such information as position, velocity, acceleration and error-estimate is computed. Then the tape goes into the Solid State 80 for tabulation.

"Our Univac Scientific is in operation an average of 300 hours a month," noted Miss Graham. "To keep abreast of work and not have a backlog, unit employees work 8-hour shifts, 24 hours a day, five days a week."

Miss Graham has completed 10 years at WSMR since transferring from the Ordnance Corps Aberdeen Proving Ground, Md. A native of Webber, Kans., she was graduated with B.S. and M.S. degrees in mathematics from Kansas State University. Between 1930 and 1944 she taught mathematics in various Kansas high schools. During World War II she served in the WAVES, stationed at Lakehurst, N.J., and Washington, D.C.

In Las Cruces, N. Mex., where she lives with her sister, Miss Graham is an active member of the First Presbyterian Church and a member of its board of trustees. She helped to organize the Rio Grande Chapter of the Association of Computing Machine Operators, which includes members from Arizona, New Mexico and the El Paso area of Texas. She has served as chapter chairman and program chairman.

The mathematician-computer expert has a nonautomated hobby: "I'm just a knit-wit," she says. "I knit afhgans and bedspreads."

Siple Pays Tribute After Visiting New Zealand Byrd Memorial Site

A fine tribute to the man who helped to launch him on his highly successful scientific career 32 years ago comes from Dr. Paul Siple, Army Research Scientific Adviser. It was inspired by his recent visit to the site of the proposed monument to Rear Adm Richard E. Byrd, atop Mount Victoria overlooking Evans Bay in New Zealand.

Currently winding up a 4-month U.S. State Department cultural exchange tour to Australia, New Zealand and India, Dr. Siple began his scientific career when he was selected as the American Boy Scout to accompany Admiral Byrd on his first expedition to the Antarctic in 1929.

Dr. Siple's "Message to New Zealand" follows:

"While visiting Wellington . . . I was privileged to visit the site and see the plans for New Zealand's self-inspired memorial to the late Admiral Richard E. Byrd.

"Having accompanied all of Byrd's visits to New Zealand and Antarctica, as well as enjoying his close confidence, I knew his genuine affection and appreciation of New Zealand. He and his companions were a major source of United States consciousness of New Zealand during the period between 1928 and World War II. He was an ambassador of goodwill for both countries, which have much in common heritage and ideals.

"In this fast-moving age and the tendency to be self-absorbed, the present generation is prone to overlook the pioneers who fought great obstacles to achieve the basis for our present rapid progress. When Byrd met the challenge of little known Antarctica, there were few parts of Antarctica ever seen. He lived to see the continent unveiled through his own efforts and his inspiration to others.

"True, we must not overlook the other pioneers such as Cook, Bellinghausen, Wilkes, D'Urville, Ross, Scott, Shackleton, Amundsen, Mawson and Ellingsworth. Howeer, Byrd, more than any other single individual, served to bridge the gap between the past and the present. He introduced a new large-scale boldness as well as modern techniques. On the noble basis of the early pioneers, he launched the beginning of our present international exploration of the polar regions—a sturdy keystone of the in-between.

"I am personally moved by the remembrance and honor represented by New Zealand's memorial to Admiral Byrd, not so much alone for his explorations and goodwill towards New Zealand, but rather because it was inspired by his closest New Zealand friends in recognition of his stature as a world citizen and his remarkable influence upon the lives of those who knew him well, and even those who never met him personally.

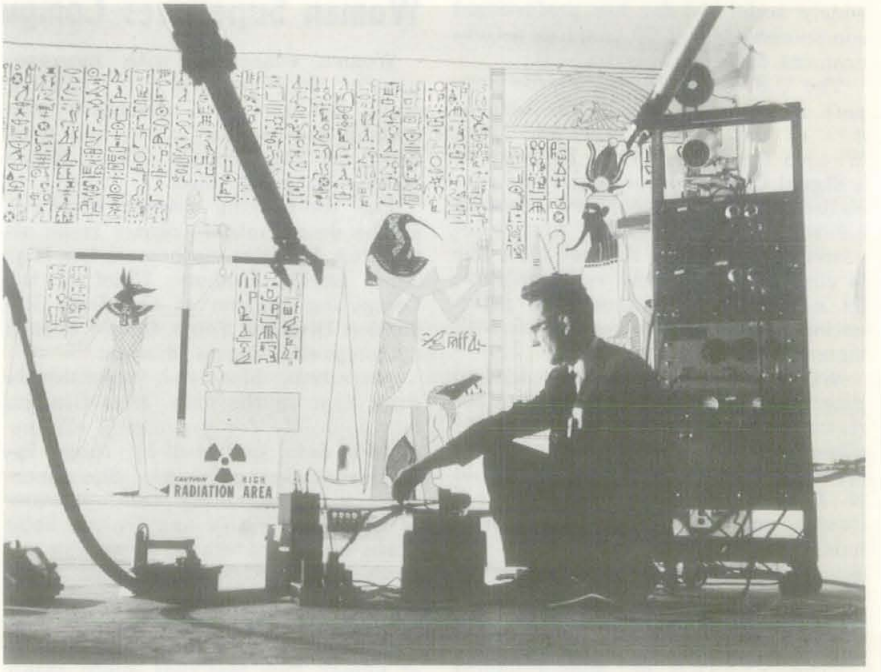
"Admiral Byrd devoted much more of his life to the problems of the freedom of man and international brotherhood than to exploration. He was a wise philosopher to those who knew him well. He would rather discuss the ideals of universal cooperation among men in the peaceful management of world government than he would discovery of the physical unknown. He was an explorer of minds and the cosmos rather than only a geographic explorer.

"Byrd had the combined qualities of greatness—imagination, wisdom, energy and the drive to satisfy his curiosity. He would have been a great personality in any generation. If he had lived earlier he would have been an Aristotle, a Columbus or a Leonardi de Vinci—had he lived later he would have been a pioneer of space and the universe.

"The memorial to Admiral Byrd on Mount Victoria in the Capital City will be a Mecca to visitors from every corner of the earth. The site of the memorial overlooking the city, the hills and the ocean was a spot that he had visited and that has inspired him personally. His memorial in such a significant place will inspire lesser men to use their talents boldly for the unselfish good of mankind.

"As insignificant and little as my voice can mean, I personally wish to give thanks and renew my respect for this New Zealand gesture which will help keep fresh in our memories one of the greatest men of the past generation."

Nuclear Physicist Applies Art to Radiation Room



Dr. Stanley Kronenberg, whose work as a nuclear physicist at the U.S. Army Signal Research and Development Laboratory at Fort Monmouth, N.J., has earned him the Army's Meritorious Civilian Service Award, allowed his imagination and archeological interest to guide his hand in decorating the Laboratory's new radiation source room.

Moved by a feeling that it resembled an Egyptian tomb he had seen, he set to work on his own time and copied on one of the room's 5-foot concrete walls an actual tomb painting, depicting the after-death trial of a queen.

During a thunderstorm at 3 o'clock one morning, Dr. Kronenberg decided it was time to put away his brushes when the prosecutor—the bird-headed figure above his hand—"turned around and looked me square in the eye."

Sciences Academy Elects ARO Man to Fellowship

Dr. Carl Lamanna, Deputy Chief, Life Sciences Division, U.S. Army Research Office, was elected a Fellow of the New York Academy of Sciences at the annual meeting in December.

Dr. Lamanna, who joined ARO in June 1961, was unanimously elected in recognition of his "achievements in science." He has been an annual active member of the Academy.

In a letter to Dr. Lamanna, Academy Executive Director Eunice Thomas Miner wrote, "Election to Fellowship is a distinguished honor, conferred on a limited number of members who, in the estimation of the Council, have done outstanding work toward the advancement of Science."

After earning B.S., M.S., and Ph.D. degrees at Cornell University, Ithaca, N.Y., Dr. Lamanna became an instructor at Washington State College, Pullman, Wash., in 1940. He was awarded the War Department Citation for Exceptionally Meritorious Civilian Service in 1946 while working as a consultant biologist and bacteriologist at Fort Detrick, Md. Prior to his present position Dr. Lamanna was Scientific Director, Naval Biological Laboratory, University of California, Berkeley, Calif.

Contract Let for Nike Zeus

A $1,800,000 letter contract was awarded Dec. 7 to Western Electric Co., Inc., for additional procurement of guidance and control equipment for the Nike Hercules guided missile system. Production is scheduled at the Western Electric plants in Greensboro and Winston-Salem, N.C. The New York Ordnance District will administer the contract.

GI Inventor Works on New Type Multiple Stage Rocket

Granted a patent on a device to slow the rate of descent of a spent booster case separated from a missile, an enlisted member of the Quartermaster Airborne Test Activity at Yuma Test Station, Ariz., has now focused his inventive ability in the opposite direction.

Sfc Adolphus Samms was recently awarded a patent for his "Booster Case Disposal Device," the principal objective of which is to lower a spent case to the ground gently to prevent possible bodily harm or property damage.

The invention consists of rotor blades pivoted to a rotating ring carried by a missile booster case and held in a folded position by wires until the case is separated from the missile. When separated, the wires are pulled automatically, permitting the blades to unfold and "parachute" the spent case slowly to the ground.

The sergeant gave the United States a royalty-free license to manufacture the device covered by his patent.

Currently Samms is working on a new type of multiple stage system for rockets which he believes will "greatly increase the payload of our rockets."

Sgt Samms has high hopes for his new system—among other things, he hopes it will be considered by the National Aeronautic and Space Administration for its "awards in excess of $100,000."

Dr. Gardner Takes DOD Post As Deputy Director (R&E)

Dr. James H. Gardner, who became vice president of the National Research Corp. early this year, has been named Deputy Director of Defense Research and Engineering (Engineering and Chemistry) and will be responsible for the Nation's R&D in these areas.

Dr. Gardner joined the NRC in 1951 and served as assistant director of the Pero-chemicals Department and of the Research Division. In 1959 he became the first general manager of the Metals Division.

Born in Salt Lake City on May 14, 1924, Dr. Gardner was graduated from the University of Utah, and received his Ph.D. in chemistry from Howard University. He was a paratroop infantry officer with the Office of Strategic Services in China during World War II.

Medics Claim 'Copter Mark For Texas-Alabama Trip

Army Medical Service personnel recently made a record nonstop helicopter flight from Hurst, Tex., to Mobile, Ala., in 4 hours and 28 minutes in an Army HU-1B Iroquois.

An average speed of 130.7 miles per hour was recorded for the 587-mile flight. Normally the flight takes from six to seven hours and requires a fuel stop at Alexandria, La. Capt J. N. Nichols piloted the ship. With him was Pfc Lyle E. Stone, crew chief. Both are from the Army Medical Aviation Detachment at Fort Sam Houston, Tex.

The HU-1B was equipped with a standard 165-gallon ferry tank and was flown to Brookley Air Force Base at Mobile for shipment to U.S. Army forces in Europe.

Bit of Fame Gains Dr. Wilson Poetical Tribute From Friend

Ever since the November issue of this publication, page 22, carried an article headlined "ARO Earth Sciences Chief Finally Gains Small Measure of Immortality," genial Dr. Leonard S. Wilson has been subject to a good deal of friendly fun-making from associates.

From Headquarters Third United States Army, Office of the Chief of Staff, Fort McPherson, Ga., came a comment by Dick Whitney, one of Dr. Wilson's cronies from World War II service in the Pacific Theater, as follows:

I've always bet since we first met
That you'd rise to the top of this bog
But it gets me down to think some clown
Hung your noble name on a frog.
When I think of the fame that eventually came
To "clods" like Fermi and Marconi
A better deal was deserved, I feel
By my Latin friend—Wilsoni.

Press Gives Top Play to Woman Among Rocketry Men

(Continued from page 19)

Missile Range by Kenneth R. Jenkins, at Fort Greely (Alaska) by Norman J. Beyers, and at the Tonopah Test Range (N. Mex.) by Lawrence B. Smith.

Warren Redpath reported on meteorological rocket firings at the Naval Ordnance Test Station, China Lake, Calif. Similar work at Eglin Air Force Base, Fla., was reviewed by Capt John Brown. "Status of the HASP Navy Meteorological Rockets" was the subject of a report by M. J. Parker, Naval Ordnance Laboratory, White Oak, Md.

The Air Force Cambridge Research Laboratory research in "The ARCAS Robin Program" was reviewed by Lt William J. Weppner. "Characteristics and Performance of Several Rocket Systems" were discussed by Hal T. Baber, NASA, Langley Research Center, Va. Spence T. Marks, U.S. Army Ordnance Ballistic Research Laboratories, Aberdeen Proving Ground, Md., spoke on "Feasibility Test of an Upper Atmosphere Gun Probe System."

White Sands Missile Range Signal Missile Support Agency speakers and their subjects included: Henry Rachele, "Surface Wind Model for Unguided Rockets Using Spectrum and Cross Spectrum Techniques"; Everett L. Walter, "A Model for Determining Wind Influence of Rockets"; Lloyd White and Gordon Dunaway, "Aerobee-Hi and ARCAS Rocket Impact Prediction"; Louis D. Duncan and Elmer J. Trawle, "Automatic Rocket Impact Predictor"; Robert N. Swanson, "Low Level Wind Measurements for Guided Missile Application"; Vertis C. Cochran, "Theoretical Performance of the ARCAS."

Distinguished scientists of several major industrial research laboratories and universities made presentations on meteorological rocketry explorations.

Maj C. E. Morrison, Chief of the Missile Meteorology Division, U.S. Army Signal Missile Support Agency, presided at the session on Meteorological Rocket Experience; Dr. Russell K. Sherbourne, Chief Scientists, White Sands Missile Range, at the session on Meteorological Rockets—A Survey; and Henry F. Thompson, Technical Director, U.S. Army Missile Support Agency, at the session on Meteorological Rocket Range Problems.

Principal speaker at the conference dinner was Dr. W. W. Kellogg, Director of Planetary Sciences, Rand Corp., and a member of the Space Science Board, National Academy of Sciences.

ASA (R&D) Reviews Problems in Major Policy Addresses

(Continued from page 3)

"In effect, this means that our military budgets have purchased no significant increase in scientific manpower, even though the budgets have risen steadily . . . I do not feel that engineering salaries and scientists' salaries have risen to levels which are excessive, but I strongly feel that they cannot continue to increase at these rates without serious implications to our country's defense operations.

"This is an especially serious situation, since the level of spending has increased in the three military services, and is being augmented by NASA spending which will be about 50 percent as great as the Department of Defense expenditures for basic research development.

If the demand for scientists and engineers under this pressure leads to an even more rapid acceleration of salaries, we will not be able to attain our objectives, since there will not be a proportionate increase in the number of men actually engaged in the technical areas.

"SELECTION OF CONTRACTORS. One of our greatest wastes of scientific manpower is in the present system of selecting successful bidders on military projects. Quite frequently, proposals submitted by 10 or a dozen contractors require as much engineering effort as the successful bidder utilizes to conduct the development project.

"In other words, the wasted engineering effort is often equal to the required engineering work. At the same time, since each of the companies bidding is most anxious to obtain a contract, each company usually puts its most creative engineers or scientists to work writing proposals, and the actual development work is done by men who are less skilled. This results not only in a waste of our best talent but fails to ensure the highest standards desired on vital projects.

"ENGINEERING CHANGES. Little need be said about this problem, since it is so well understood by both military project engineers and industrial engineers. One of the greatest causes of overruns and high costs of military equipment is the fact that changes are made after a design is established and while preliminary models are being built. . . .

"Of course, some contractors bid at prices which would be disastrously low if changes were not made. After the work has begun, they hope that the price can be increased to a point where a profit is possible, in addition to covering the cost of the change. Many of the changes will lead to refinements that are unnecessary, while others are vital. . . .

"Industrial engineers can assist us a great deal if they will take every opportunity to design functionally simple systems and if they will avoid the temptation of unnecessarily upgrading or refining a weapon or communication system.

"SPECIFICATIONS. Military specifications are required. . . . However, we have an obligation to make sure that unnecessary specifications are eliminated. This is primarily the responsibility of the engineer representing the military services, but it is appropriate for an industrial engineer to challenge specifications when they do not seem warranted.

TELESCOPIC "RADAR"—LASER light is tested for radar application by this dual-telescopic device designed at the U.S. Army Signal Research and Development Laboratory, Fort Monmouth, N.Y. A pencil-thin beam of ruby-red light is fired at a distant object from one of telescope tubes, and reflection is registered in the other. Light pulse round trip time indicates target's distance.

"REPORTING. In the basic research field all three military departments are letting either grants or contracts which require a minimum of reporting. For example, the Army Research Office operating from the Duke University campus requires only simple letter reports and prefers reprints of published articles to any other final report at the end of a basic research contract.

"In development work we frequently ask for more elaborate reports—so much so that costs are often increased. Upon termination of the contract, this involves specifications and formal sets of 'prints' which describe the system in great detail.

"After we have had one manufacturer develop and initiate a production run—during which time he uses his own set of prints—we ask him to prepare a set of drawings to Army specifications. We do this so we can ask for competitive bids. Frequently, a second manufacturer is the successful bidder. In some instances, the new manufacturer promptly redraws the prints according to his own set of standards and does not manufacture from the Government-furnished prints.

"In these cases it may be possible to save substantially, if we simply purchase the first manufacturer's prints, make sure that they are complete, and turn them over to the selected manufacturer for production. We are re-examining our requirements in this area to determine if changes in policy should be made.

"The problems discussed are obviously only a fraction of those existing in our military-industrial environment, but they are important. In addition, the very atmosphere and manner of approach to a problem are significant. I feel quite strongly that those of us in the Army are making a determined effort to build a vastly more effective Army.

"Our training techniques are improved, our handling of men is more efficient, and we have been procuring a considerably increased amount of equipment of all kinds in order to provide a more effective combat force.

"The morale and the fighting ability of our Army have been increased very rapidly and its effectiveness per man has never been higher. There is a new spirit—one in which our fighting forces are thoroughly caught up. They are determined and able.

"Our Army laboratories are imbued with an attitude of making as great a contribution in as short time as they can. I find my associates in the Pentagon sincerely dedicated to the idea of doing everything possible to increase the effectiveness of our Army. They want to make sure that each man gets the best of modern equipment and is as effective as he can be in every way.

"I should like to appeal to you as engineers in a great number of significant companies to share that same attitude; to try to concentrate on designing equipment that will be as simple and reliable as possible; to try to make sure that our soldiers get weapons and communications systems that help men, rather than entangle them in a mass of complexity; to try to make the equipment as functional as possible; and to try to make it producible at a low cost. If you do, I am sure that our country will be enormously strengthened by having the best-trained, best-led, best-equipped Army in the world."

By Dr. Ralph G. H. Siu
Technical Director, R&E, OQMG

FACILITATING CREATIVITY. Through the good graces of Maj Gen Webster Anderson, Maj Gen William Ely and Dr. Richard Weiss, I spent a week recently at Tahoe City listening to a group of psychologists talk about the creative person. Too much was said to attempt proper coverage in a T-Thought. There were three specific factors which were raised as being essential to maximizing creativity, however, which struck home as being particularly timely for Army R&D Management.

The first is the realization on the part of management that the birth of the creative process occurs when the individual formulates the problem in his own terms. The organization's assigned problem must be transformed into the person's own problem to ensure deep personal involvement on the part of the researcher. There must be a personal frame of reference. Frequently, a researcher is able to make this transformation himself. If not, it is essential that the research director do this with and/or for him and see that the personal commitment of the researcher is obtained.

The second is to ensure that the stated problem is not embedded in a functional fixedness that biases the researcher consciously or subconsciously to a less fertile approach. For example, the stated problem of getting a better gun involves a different functional fixedness from the stated problem of getting better firepower. Organizational fixedness of R&D in a materiel supplier context provides a different pattern of weighted influences on the researcher than in a materiel user context, a doctrine innovation context, a mission acquisition context, or a corporate growth context.

The subtle influence of functional fixedness is demonstrated by this simple experiment: Group A (provided with a tack, a small paper box, a candle, and a match) and Group B (provided with a tack inside a small paper box, a candle, and a match) were told to stand the candle against the wall and light it. Group A readily solved the problem by tacking the box sidewise against the wall, setting the candle in it, and lighting it. Group B had a difficult time arriving at the solution because the box with the tack in it was viewed in the functional context of a container. This functional fixedness subconsciously inhibited the idea of using the box as a stand for the candle.

The third essential is the avoidance of premature closure to approaches to a problem. There must be a sufficient incubation period, letting things stand in an ambiguous way long enough for the proper combination of facts and ideas to take place. This requires knowing just how long is long enough for various situations.

Army Awards VTOL Propulsion System Contract

A propulsion system to enable an airplane to take off and land vertically as well as fly forward at high speed will be developed as part of the Army's VTOL lift-fan flight research program.

The contract for the propulsion system is part of a $6.9 million initial contract that General Electric's Flight Program Laboratory received recently from the U.S. Army Transportation Research Command, Fort Eustis, Va.

Covering the first phase of a 2-part program expected to cost approximately $10.5 million, it calls for a VTOL flight research program during which the G.E. "lift-fan" propulsion system will be tested in two "fan-in-wing" aircraft to be designed and built by Ryan Aeronautical Co. under a subcontract. The first test flight is targeted for May 1963.

The lift-fan system is comprised of three major components: the G.E. J-85-5 jet engine, a gas diverter valve, and a tip turbine-driven fan. For vertical takeoff, the jet engine gases are directed through the diverter valve to tip turbines driving 6-foot diameter lift fans mounted in the wing structure. This propulsion method is designed to produce thrust approximately three times as great as that supplied by the jet engine alone.

Once aloft, the aircraft is accelerated from its hovering position to forward flight by use of vanes which direct the fan air flow partially rearward. Upon obtaining sufficient horizontal velocity to enable the wings to support the aircraft, the diverter valve is closed, allowing the exhaust to flow through the engine in the normal manner for conventional forward flight in speeds in excess of 450 kilometers.

The reverse of this operation permits transition from forward flight to hovering for landing. The Air Force is supplying the jet engines and diverter valves for the program.

As envisioned, each of the two research aircraft will be 2-place airplanes powered by two J-85-5 jet engines, each delivering in excess of 2,500 pounds of thrust. The wing span will be approximately 30 feet and the overall length will be about 45 feet. Louvered closures will be provided for the wing-mounted fans, providing a smooth aerodynamic surface when the aircraft is flying conventionally in forward flight. For safety, the exhaust from each jet engine will be divided so that the lift fans can be driven even when one engine is inoperative.

Lt Gen Arthur G. Trudeau, Army Chief of Research and Development, looks over a model of a unique solar reflector developed by Goodyear Tire and Rubber Co. scientists for collecting and using solar energy in a space satellite. Standing by is Russell DeYoung, Goodyear president, who escorted the General during a recent briefing on company research and development capabilities.

Top Agencies Join in Materials Research Parley at Watervliet

"Significance of Materials Research and Its Implications to the Army and the Other Armed Services" was the subject of Assistant Secretary of the Army (R&D) Dr. Finn J. Larsen's address to the Materials Science Conference at Watervliet Arsenal, Dec. 18-19.

Sponsored jointly by Watervliet Arsenal and Rensselaer Polytechnic Institute, Troy, N.Y., the conference had the cooperation of the Chief of Research and Development, Department of the Army, the Atomic Energy Commission and the Advanced Research Projects Agency.

Chief of Ordnance Lt Gen John H. Hinrichs introduced Dr. Larsen and joined with more than 150 scientists and research executives in considering problems related to expanding requirements and research activity in materials throughout the Defense establishment.

Director of Army Research Maj Gen William J. Ely made the keynote address, stressing the growing need for an interdisciplinary approach to the problems of materials research. He dwelt also on the need for integrated effort in this field among all Department of Defense and other Government agencies, and said that materials research calls for the blending of the talents of the scientist and the engineer.

Dr. R. E. Weigle, Director of Research, Watervliet Arsenal, opened the conference and introduced Dr. Richard G. Folsom, President of Rensselaer Polytechnic Institute, to make the address of welcome.

Dr. G. H. Lee, Chief Scientist, Office of the Chief of Ordnance, presided at the opening session, devoted to a "Review of Materials Research Programs." Dr. Peter Kosting, Director of Metallurgy and Ceramics Division, Army Research Office (Durham, N.C.); Dr. Charles Yost, Assistant Director for Materials Research, Advanced Research Projects Agency, and Dr. Donald Stevens, Assistant Director of Metallurgy and Program, Atomic Energy Commission, made presentations at this session.

Thirty-three original research papers were presented during the remaining three sessions. Chairmen included Prof. H. B. Huntington, Head of the Physics Department, RPI; George G. Deutsch, Chief, Materials Research Division, NASA; Dr. James L. Martin, Director of the Ordnance Materials Research Office; Harold Hessing, Materials Research Division, NASA; Dr. Fritz Lenel, Professor of Metallurgical Engneering, RPI; Dr. Walter H. Bauer, Dean, School of Science, RPI.

Examining filament-wound fiber glass honeycomb nose cone of a missile at Picatinny Arsenal are (left to right) Maj Gen W. K. Ghormley, Commanding General, Ordnance Special Weapons—Ammunition Command; Warren Reiner, Special Assistant to the Chief, SWD Division, OSWAC; Director of Army Research Maj Gen William J. Ely; Col R. R. Klanderman, Picatinny CO.

30 MAB Scientists Briefed on Activities at Picatinny

Thirty nationally prominent scientists and educators representing the Materials Advisory Board of the National Academy of Science made their first orientation visit Nov. 30 to Headquarters of the Ordnance Special Weapons—Ammunition Command at Picatinny Arsenal, Dover, N.J.

The group's major function is to advise the Department of Defense on materials research for maximum effectiveness.

Dr. E. G. Fubini, Director of Research for the Department of Defense, and Maj Gen William J. Ely, Director of Army Research, were among the distinguished visitors.

The group was briefed on the Arsenal's mission and activities before making a tour of the installation, including the Liquid Rocket Propulsion Laboratory, explosive research buildings and plastics facilities.

NG Units to Get Nike Hercules in Ajax Phase-out

Gradual phase-out of the Nike Ajax missile in Army Air Defense Command plans and arming of National Guard defense missile units with the much more powerful Nike Hercules, beginning late in 1962, was announced Dec. 7.

Lt Gen Robert J. Wood, Commanding General, U.S. Army Air Defense Command (ARADCOM), and a former Deputy Chief of Army Research and Development until July 1960, announced that an orderly transition over an extended period is planned. Seventy-six Army National Guard units are armed with Nike Ajax at present in ARADCOM.

Nike Ajax has continued to exceed design specifications in recent tests and is capable of destroying any known type of operational bomber. However, one battery of Nike Hercules missiles, carrying atomic warheads, insures the same level of defense provided by several Ajax batteries, Army leaders have stated.

The first tactical units armed with Nike Ajax moved on site in the Air Defense system in December, 1952, at which time the Army National Guardsmen took over antiaircraft artillery guns. In 1957, active Army missilemen began converting to Nike Hercules training. The National Guard then was changed from an augmentation force to a full partner in the Air Defense system, with around-the-clock operational responsibility of Nike Ajax sites.

Depending upon overall Army needs, the active Army personnel now mannng Nike Hercules sites selected for National Guard control will be reassigned within ARADCOM or will be made available for advanced missile systems as they are developed.